EU-MED Climate Summer School

D1.3 COLLECTION OF SCIENTIFIC PAPER PRESENTED IN THE FINAL CONFERENCE

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Abstract

The Deliverable provides collections of material and video presented during the Final roundtable of the First Edition of EU MED Summer School.

1 DESCRIPTION OF THE PROJECT

Today, the Mediterranean region is affected by significant environmental anthropogenic changes, which compromise future environmental and socio-economic sustainability, with serious repercussions also in term of human security. The main drivers of change include climate change, population growth, environmental pollution, biodiversity loss, and unsustainable land and sea use practices. In such a scenario, significantly efforts are needed to mitigate drivers of change, implement transformative adaptation, and increase socio-ecological resilience.

New opportunities arise from the EU's New Agenda for the Mediterranean, which identifying a range of actions along five key policy areas – human development, good governance and the rule of law; strengthen resilience, build prosperity and seize the digital transition; peace and security; migration and mobility; green transition: climate resilience, energy, and environment – aims to turn common challenges into opportunities, in a mutual interest approach.

In line with the EU's New Agenda for the Mediterranean key strategic priorities and consistent with the EU climate action and the UN's 2030 Agenda for Sustainable Development, the Roma Tre University (Dottorato in Filosofia Roma Tre/Tor Vergata; Master Studi dell'ambiente e del territorio – Environmental humanities), in collaboration with the Institute for Studies on the Mediterranean of the Italian National Research Council (CNR- ISMed), proposes the EU-MED CLIMATE Summer School.

1.1 Learning objectives and methods

The Summer School wants to be a laboratory where to test innovative teaching and learning models, contributing to the advancement in systemic knowledge to understand the complexity of the Mediterranean issues in the 21st century.

To achieve these objectives, the training course aims to 1) combine theoretical and practical knowledge, offering different kinds of learning activities (lectures, laboratories, and case study analyses); 2) develop a constructivist learning approach, encouraging the active participation of students in the knowledge process (interactive seminars, thematic dialogue tables); 3) re-imagine disciplinary boundaries, involving both academics, researchers and scholars with different disciplinary background, and non-academic actors; 4) strengthen the relationship between art and science, through the participation of artists and by utilizing the different forms of art as effective tools to make the learning process more successful and creative.

The so-designed proposal aims to achieve the following learning outcomes: 1) encourage students' holistic vision and systemic thinking without neglecting the scientific rigor of the individual disciplines; 2) stimulate students' critical thinking and creative potential, combining different ways of knowing – pre-conscious, intuitive and rational – using arts aside sciences to deepen the insight of questions traditionally approached only through scientific knowledge.

The ultimate objective of the Summer School is to provide a crucial integration to the current academic programs offered by the Roma Tre University. The training course hopes to shape a future-oriented academia curricula, nurturing the skills of a new generation of Mediterranean specialists in the fields of culture, arts, education, science, and policy-making, capable of envisioning a sustainable and just future for the region, in compliance with the new Mediterranean Strategy for Sustainable Development (MSSD) 2016-2025 core vision of ‘A prosperous and peaceful Mediterranean region in which people enjoy a high quality of life and where sustainable development takes place within the carrying capacity of healthy ecosystems’.

2 INTRODUCTION

2.1 Purpose and scope of this document

The Deliverable 1.3 Collection of scientific paper presented in the Final Conference', falls within the project task 1.3 focused on Implementation of the First Edition of the EU MED Summer school.
The Deliverable provides collection of Photovoice Laboratory presentations by Summer School participant and scientific publications produced by Consortium as well as paper presented during during for the final roundtable .

Roma Tre University, in collaboration with the Institute for Mediterranean Studies of the National Research Council (CNR- ISMed), organized the first edition of the EU-MED CLIMATE Summer School from September 12 to 23, 2022.

3. DOCUMENT STRUCTURE

The deliverable is structured into the following chapters:

Chapter 1 includes a description of the EU MED project;

Chapter 2 presents an introduction to the deliverable, detailing the document structure;

Chapter 3 describes and collects collection of Photovoice Laboratory presentations by Summer School participant and scientific publications produced by Consortium as well as paper presented during during for the final roundtable .

4. FINAL CONFERENCE

During the last day, a final workshop named **“Round table Mediterranean Sea, Migration and Humanities**” has been organized to foster dialogue and debate between students and scholars and experts on the main issues addressed during the course. Participants also presented their final works. At the end of the day It has been organized a ceremony during which students will receive the certificate of participation.

23rd September 2022 Aula Verra, Via Ostiense 234 Università Roma Tre	
Ore 14.00-16.00 *Round-table discussion: Mediterranean Sea, Migration and Humanities*	*Panelists:* *Halima Ouanada, (Università di Tunisi "El Manar")* *Laura Paulizzi (Università di Roma Tor Vergata)* *Paolo Quintili (Università di Roma Tor Vergata)* *Discussants: Daniela Angelucci (Università Roma Tre), Salvatore Capasso (ISMED – CNR), Antonio Cecere (Università di Roma Tor Vergata), Daniela De Gregorio (ISMed – CNR), Federica Giardini (Università Roma Tre), Desirée Quagliarotti (ISMed – CNR)*
Ore 16.00-18-00	Presentation Poster PHOTOVOICE Conclusion and delivery of certificate of attendance Participants Tiziana Bandini Nicoletta Banini Alessandro Belmonte Margherita Kay Boudillon Antonio Bufalari Alice Cascella Chiara Ferro Gilda Garofalo Giuseppe Meliti Alessandra Passeri Filippo Paterniti Flavia Petraccone Giulio Sassoli Gaia Sirchia Matilde Stivoli Elisa Viganò

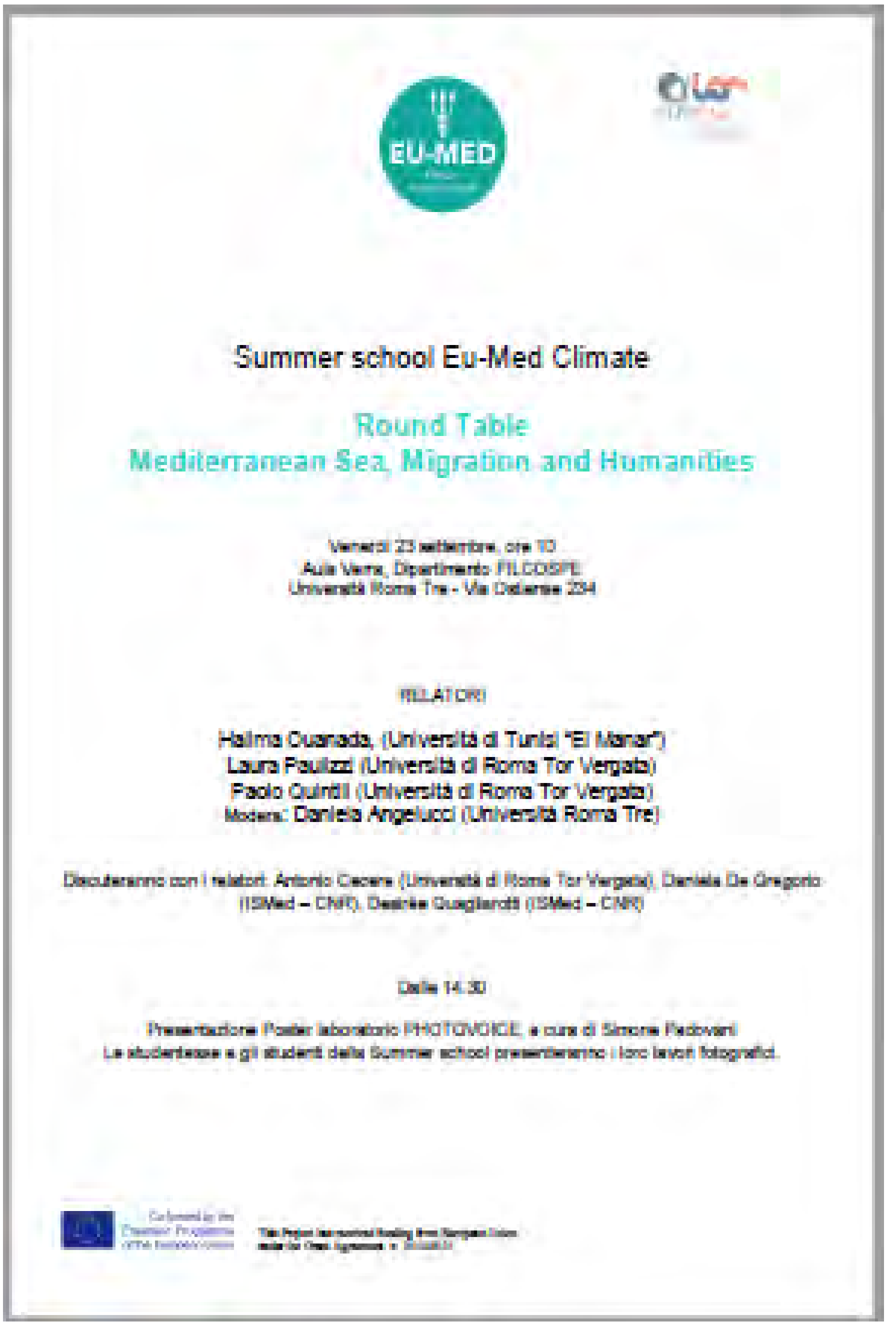

Fig. 1 Roundtable poster

5. CONCLUSIONS

This first edition of the EUMED Summers school was a laboratory where innovative models of teaching and learning, contributing to the advancement of systemic knowledge to understand the complexity of Mediterranean issues in the 21st century.

The training modules have:

1. combined theoretical and practical knowledge, offering different types of learning activities (lectures, labs and case study analysis);
2. developed a constructivist learning approach, encouraging students' active participation in the knowledge process (interactive seminars, thematic dialogue tables);
3. redefined disciplinary boundaries, involving both academics, researchers and scholars with

different disciplinary backgrounds, as well as non-academic actors;
4. strengthened the relationship between art and science, through the participation of artists and using different art forms as effective tools to make the learning process more effective and creative.
On the experience of this edition, the working group from early 2023 will begin the executive design of the second edition.

6. ACRONYMS

[EU]	[European Union]
[SDGs]	[Sustainable Development Goals]
[WP]	[Work Packages]

7. ANNEX

ROUNDTABLE SPEAKERS PRESENTATION

Roma, 23 settembre 2022

Mobilità e cittadinanza in uno spirito di mediterraneità

Halima OUANADA

Università di Tunisi El Manar

Questa riflessione è in realtà una continuazione del lavoro già iniziato qualche anno fa con ricercatori di entrambe le sponde del Mediterraneo che si sono riuniti per una presa di coscienza collettiva e un pensiero critico mediterraneo, sganciandosi da quell'altro pensiero che vede in questo spazio solo conflitti, opposizioni e cimiteri marini. Utopia e critica nel Mediterraneo, pubblicato da Jouvence nel maggio 2021 sotto la direzione di Antonio Cecere e Laura Paulizzi, è il primo libro nato da questo incontro amichevole e intellettuale, che si colloca fin dall'inizio nell'ambito dell'"anti-tradizionale" e del non convenzionale.

Riflettendo sull'ipotesi di un pensiero comune dei popoli mediterranei, ci siamo proposti, da parte nostra, di considerare l'ipotesi di un concetto di mediterraneità, più volte evocato ma mai francamente o definitivamente mantenuto, e che, a nostro avviso, trascende il concetto di "Mediterraneo". Questo concetto trascende quello di "Mediterraneo", poiché intende liberarsi dal paradigma spazio-movimento per un'accezione globale, senza dubbio utopica, ma che deve essere accettata da tutti come prospettiva aperta in un mare che deve essere più federativo, favorevole agli scambi che generatore di conflitti. Questo concetto di mediterraneità potrebbe infatti aprire un progetto di civiltà inclusivo, la cui pietra di paragone sarebbe un insieme di valori capaci di costruire un nuovo umanesimo.

In seguito, abbiamo ritenuto opportuno esaminare in questo documento altri due concetti, Cittadinanza e Mobilità, che sono, a nostro avviso, consustanziali al concetto di mediterraneità. In effetti, nonostante l'apparente divergenza tra questi tre concetti, essi ci sembrano fondamentalmente legati, a causa della relazione con l'altro che essi implicano, interrogano e richiedono, sia che si tratti dell'altro nel suo significato assoluto umano, culturale o di genere. Affrontando, o invocando, questi concetti, chiediamo un ripensamento diverso e sincero di questa relazione con le sue diverse e variegate dimensioni. Speriamo di costruire almeno, come dice Michel Foucault, "un modo di vivere in relativa mobilità e non un tentativo di immobilizzare la vita"[1]. Interrogare questi concetti, spesso eretti a entità immutabili, ci permetterà di ipotizzare un possibile rinnovamento, di abbattere le partizioni e di proporre altre prospettive di dialogo e convergenza nell'era di una globalizzazione che paradossalmente sembra essere "immobile"[2]. Questo dialogo non può avvenire senza il superamento delle differenze, dei paradossi e dei miti e senza una sincera apertura priva di qualsiasi volontà di stigmatizzazione, riduzione, esclusione o assimilazione, o addirittura di sfruttamento.

Nel titolo del nostro articolo abbiamo scelto di utilizzare il termine "mobilità", un termine con una forte valenza positiva, polisemico, aperto e persino accogliente, che va assolutamente distinto da quest'altra forma di movimento chiamata "migrazione", un termine che, a nostro avviso, è fortemente stigmatizzato, con una forte carica negativa e quindi respingente. E pensare che, secondo la classificazione di Kaufmann[3], il termine "migrazione", come "viaggio", era semplicemente una forma di mobilità spaziale. Tuttavia, è emerso che l'uso e la ricezione del termine non si presentano allo stesso modo a seconda che ci si trovi sulla sponda settentrionale o su quella meridionale del Mediterraneo, cioè a seconda che ci si trovi dalla parte di una presunta "cittadinanza da sogno" o di un sogno di cittadinanza.

[1] Michel Foucault, « La vie : l'expérience et la science », Dits et écrits, t.4, Paris, Gallimard, 1994, p.774-775.
[2] Daniel Cohen, La mondialisation et ses ennemis, Hachette, 2011.
[3] Caroline Gallez, Vincent Kaufmann. « Aux racines de la mobilité en sciences sociales: Contribution au cadre d'analyse socio-historique de la mobilité urbaine ». Mathieu Flonneau et Vincent Guigueno. De l'histoire des transports à l'histoire de la mobilité ?, Presses Universitaires de Rennes, pp.41-55, 2009, Histoire.

Sul versante meridionale, in particolare in Tunisia, Paese che continua a mantenere strette relazioni commerciali con i Paesi capitalisti, è proprio questo "sogno di cittadinanza" che sembra essere all'origine non solo della migrazione in tutte le sue forme, ma anche del fenomeno della fuga dei cervelli, che ha un enorme impatto sull'economia e sull'equilibrio della Tunisia. È importante ricordare che questa "fuga di cervelli" è fondamentalmente associata al "saccheggio di cervelli"[4].

Per ricordare che la Tunisia, che oggi fatica a trattenere i suoi giovani migranti verso le coste italiane, è stata tra l'Ottocento e il Novecento e persino nel Cinquecento una terra promessa e ha accolto clandestini dall'Italia e da Malta che arrivavano con le loro famiglie anche su semplici imbarcazioni, rischiando la vita. Furono più di 100.000[5] a sbarcare in Tunisia, in cerca di lavoro e mezzi di sussistenza e per sfuggire alla disperazione, esattamente come i nostri giovani di oggi. Prima dell'occupazione francese della Tunisia, l'Italia ha vissuto la più grande migrazione di massa dell'epoca contemporanea. Si chiamava diaspora italiana. Ciò ha indubbiamente favorito lo sviluppo di una forte identità italiana tra i tunisini, ancora oggi notevole. Se richiamo qui questi fatti storici noti, non è per giustificare il fenomeno, ma per richiamare l'attenzione sulle radici storiche della mobilità tra le due sponde del bacino del Mediterraneo.

In ogni caso, sul tema della fuga dei cervelli, si utilizzeranno alcuni esempi[6] di ritratti sociologici come riflessi di una storia sociale prodotta da una traiettoria complessa, che rimane combattuta tra la volontà di liberarsi e l'attaccamento alle proprie origini, tra l'impegno e il disimpegno, tra l'insediamento nella società ospitante e il ritorno al Paese d'origine. Il punto di convergenza tra questi ritratti, così come tra coloro che rischiano la vita, è la speranza di una cittadinanza, una cittadinanza mediterranea in particolare, che è certamente utopica, ma che è comunque concepita come un'alternativa possibile, motivata da una forte identificazione con questo spazio immaginato come "un orizzonte di attesa", come "la proiezione di un modello antico su un futuro da inventare, come un'utopia in totale, nel bene e nel male"[7].

L'obiettivo della nostra proposta è quindi quello di proporre il concetto di mediterraneità, con i suoi due pilastri e tutele, la cittadinanza e la mobilità, come spazio per attutire l'effetto della riconfigurazione dei confini e soprattutto della ridefinizione di una cittadinanza aperta, fluida e mobile in fase di era digitale e iperconnettività.

In questo contesto post-Covid, che ha rivelato i limiti dell'impegno per i diritti umani, è urgente oggi cogliere l'opportunità di convivenza che questo concetto di mediterraneità offre, ripensare il mondo in termini di “diversalità”[8] anziché di universalità e fare del riconoscimento della diversità una dinamica fondamentale dell'umanità. Infine, lavorare insieme, cittadini e cittadine di entrambe le sponde, non per la creazione di una "comunità di destino", ma al contrario per la "nascita giuridica di una cittadinanza mediterranea", o di "una cittadinanza di entrambe le sponde". Questo, una volta compreso e adottato dagli individui di entrambe le sponde, implicherebbe una serie di principi di base per istituire un'etica e dettare le regole di condotta per tutti i cittadini. A livello pratico, non resta che esaminare insieme i fattori facilitanti, "gli abilitatori", su come procedere insieme e sulla consapevolezza degli interessi condivisi e la pratica reale di questo sogno di cittadinanza mediterranea[9] nel rispetto di una serie di valori tra cui la

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[4] Pierre Jalée, Le pillage du Tiers Monde, Paris, Ed. Maspero (coll. « Cahiers libres »), 1965, 133 p. In: Tiers-Monde, tome 7, n°27, 1966. pp. 632-633.

[5] Henri De Montety. Les Italiens en Tunisie. In: Politique étrangère, n°5 - 1937 - 2ᵉannée. pp. 409-425.

[6] Lilia Othman Challougui en collaboration avec Radhia Mechken, Halima Ouanada et Hamida Trabelsi Bacha, Expériences migratoires et trajectoires personnelles des compétences tunisiennes Sous la direction de, Tunis, Simpact – 2019.

[7] Jean-Robert HENRY, « L'utopie d'une citoyenneté méditerranéenne In : La plurinationalité en Méditerranée occidentale : Politiques, pratiques et vécus » [en ligne]. Aix-en-Provence : Institut de recherches et d'études sur les mondes arabes et musulmans, 2016.

[8] Heidmann, Ute. « Différenciation, dialogisme, diversalité. Paradigmes pour un comparatisme différentiel et plurilingue », Revue de littérature comparée, vol. 376, no. 4, 2020, p. 487.

[9] Jean-Robert HENRY, « L'utopie d'une citoyenneté méditerranéenne In : La plurinationalité en Méditerranée occidentale : Politiques, pratiques et vécus » [en ligne]. Aix-en-Provence : Institut de recherches et d'études sur les mondes arabes et musulmans, 2016.

libertà, l'equità, la giustizia, il rispetto della dignità, lo sviluppo condiviso e, infine, la convivenza come garanzia di pace!

Daniela Angelucci

Idea di filosofia.

Se la pratica filosofica è l'attività di produrre concetti che parte da un evento, da un incontro che viene dall'esterno, l'evento più urgente, che dovrebbe costringerci a pensare, oggi riguarda le migrazioni che attraversano il mare intorno all'Europa. Nel 2016: più di 5000 migranti morti nel Mediterraneo. 2017: oltre 100.000 persone sbarcate in Italia, di cui circa 15.000 minori non accompagnati; 3 ottobre 2016: 366 persone morte a solo mezzo miglio da Lampedusa.

Nel trattare l'estetica, e intendere l'estetica non come filosofia dell'arte, ma come filosofia tout-court, che guarda al mondo dal punto di vista dell'esperienza sensibile, il mio primo passo nell'incontro con l'esterno del mare europeo, attraversato dalle migrazioni, è stato interrogarmi sul tipo di narrazione che sono legittimata a farne.

Cioè, la domanda è: come evitare un discorso oggettivo (quello che Lacan chiamava un discorso universitario), ma anche l'offesa di un'eccessiva familiarità con situazioni così diverse dalle nostre, come cittadini europei?

Discorso dell'università: Nel discorso dell'università, così come la conosciamo oggi, al posto di comando c'è il sapere (nello specifico il sapere della scienza), la cui verità è un significante-padrone ovvero, come dice Lacan: "*Continua. Avanti. Continua a sapere sempre di più*" (J. Lacan, *Le Séminaire, Livre XVII, L'envers de la psychanalyse*, Seuil, Paris, 1991, p. 120). La verità del discorso dell'università, quindi, non è un desiderio ma piuttosto un imperativo implicito: Continua! Lavora! Produci più sapere! La scienza, che ha invaso tutta l'università, ha trasformato il sapere in un bene di consumo, una merce da produrre (la Ricerca)… senza limite.

Eccessiva familiarità che finge una uguaglianza di posizione. Maria Lavajeva

Si può forse mettere in discussione la categoria di "intercessore" proposta da Deleuze e Guattari: diventare intercessore di qualcuno significa provare un continuo scambio di punti di vista, in un'adesione affettiva, politica e stilistica, invece di parlare al suo posto. Nella descrizione di questa indistinguibilità tra due punti di vista Deleuze riprende Pasolini che nel suo scritto *Cinema di poesia* (1965), a proposito dello stile di Godard, Antonioni e Bertolucci, parlava della possibilità nel cinema di una "soggettiva libera indiretta", ovvero di una contaminazione tra il punto di vista oggettivo e quello soggettivo a causa di un’immersione, di un’adesione affettiva dell’autore rispetto alle vicende dei suoi personaggi. Secondo Pasolini tale visione libera possibilità artistiche represse nella forma narrativa tradizionale e realizza la natura costitutivamente poetica e soggettiva del cinema, la sua finalità onirica, barbarica, visionaria. Pasolini parla di una libertà anomala e provocatoria. La soggettiva libera indiretta, e in generale il nuovo rapporto tra soggetto e oggetto che D. vede realizzato nel cinema moderno, abbiano a che fare direttamente con l’idea di intercessore: il “doppio divenire” che caratterizza il rapporto tra autore e personaggio nel cinema politico è propriamente questo scambio continuo di punti di vista, adesione affettiva, politica e stilistica.

Il senso teorico e politico di questo tema è tanto più importante quanto più si consideri con che forza Deleuze rifiuti la pretesa di alcuni di parlare per altri, attribuendosi il diritto o il dovere di rappresentarli: “Per noi, l’intellettuale teorico ha smesso di essere un soggetto, una coscienza rappresentante o rappresentativa, Quelli che agiscono e che lottano hanno smesso di essere rappresentati, foss’anche da un partito, un sindacato che si sarebbero arrogati a loro volta il diritto di essere la loro coscienza. Che parla e chi agisce? È sempre una molteplicità, anche nella persona che parla o che agisce”[10]. Questo è ciò che Deleuze e Guattari chiamano “concatenamento (*agencement*) di enunciazione collettiva”, ovvero la transizione continua tra individuale e politico. Il concatenamento, nel caso di Kafka, è anche quello, evidente, tra le tradizionali categorie di narratore e narrato: la lettera K designa nello stesso tempo lo scrittore e il personaggio, o meglio nessuno dei due, ma un “agente collettivo”.

Nel libro *Paesaggi migratori* Iain Chambers parla di pensare con le migrazioni, e sottolinea come pensare con le migrazioni e non sulle migrazioni significhi mettere in discussione la nostra posizione rispetto alla lingua, e alla propria formazione, aspirare allo spaesamento e promuovere un rapporto diverso, più inquietante, con il proprio background culturale. (p.8)

Così ho deciso consapevolmente di rinunciare ad un'argomentazione più consequenziale, più strutturata, di aderire proprio all'incertezza del titolo, di farmi catturare e modificare dall'esterno e di sfuggire al piacere dell'oggettivazione. Non voglio parlare per nessuno, né essere il rappresentante di qualcuno, ma l’unico modo per non rimanere a distanza senza fingere una familiarità eccessiva può essere quello di “aspirare allo spaesamento e a un rapporto diverso con la propria formazione culturale quando si parla di questi temi, mettersi un po’ a rischio. Vorrei che i concetti prodotti nell'incontro tra l'evento delle traversate in mare e la pratica filosofica producessero un riavvicinamento, un'area di indiscernibilità, un'intercessione. (E forse la narrazione artistica può aiutarci in questo approccio.)

[10] *Gli intellettuali e il potere. Conversazione con Michel Foucault*, in G. Deleuze, *La fine degli intellettuali*, Medusa, Milano, 2017, pp. 26-27.

Partendo da varie letture, filosofiche in senso lato, ma soprattutto letterarie, e anche visive, propongo tre caratteri del mare, che ci parlano della situazione contemporanea e allo stesso tempo della pratica filosofica e di un nuovo modo (diverso, inquietante, direbbe Chambers) di relazionarsi ad essa.

1. Pensare il mare come territorio, analogo ma molto diverso dalla terra: territorio mobile, è un ossimoro se seguiamo l'etimologia proposta da Sesto Pomponio; territorio deriva da terra ma anche da terrore che è diverso dalla paura: terrore è una paura indeterminata, senza oggetto, e dunque produce una fissazione, rimaniamo atterriti, fermi, congelato. Essere terrorizzati significa essere bloccati, chiusi in un territorio.

Ma il mare è da una parte una zona di soglia, un confine, dall'altra tuttavia è un confine mobile. Tremore è la caratteristica che vorrei utilizzare per esprimere in primo luogo la sua mobilità, fluidità.

Ho usato Edouard Glissant (scrittore e saggista nato in Martinica, nelle Antille, creolizzazione), che propone un "pensiero del tremore", tremito in francese è anche terremoto, qualcosa che ha a che fare con il territorio. Contro ogni dogmatismo Glissant si oppone al pensiero arcipelagico, che si declina come tremore, tremore, inteso in una doppia dimensione: Allo stesso tempo, per natura, tale pensiero non mira alla costituzione di griglie preconcette di interpretazione della realtà, ma si adatta ad una percezione fine e traballante del mondo nei suoi stessi cambiamenti; in campo etico, il tremore conserva, in campo etico, il desiderio e l'incertezza della scoperta dell'Altro".

Cito alcuni passi del libro della Glissant Pensée du tremblement: è un pensiero che "resiste all'irrigidimento dei pensieri sistemici e all'impeto dei sistemi di pensiero"; "apre l'identità al rapporto con l'Altro e al cambiamento originato dallo scambio", "è il pensiero sismico del mondo che trema dentro e fuori di noi". e poi: "siamo abbastanza nobili, magnifici e selvaggi (e abbastanza miserabili quando necessario) da considerare il nostro rapporto con l'Altro e con il Mondo come un enorme tremore".

Il tremore può essere utilizzato per indicare la fluidità dell'acqua e l'increspatura delle onde, ma anche il movimento delle vite, umane e animali, che la popolano e la attraversano. Il tremore descrive la vitalità del mare, la sua mobilità ma anche il suo essere pieno di esseri viventi, animali ed esseri umani. Il tremore qui è strettamente legato ad una poetica del rapporto: il tremore del pensiero tremante significa anche vivere l'apertura al mondo intero, a rischio di tremare, a rischio di incertezza.

2. Ci sono molti testi letterari sul mare che ne descrivono l'incertezza, l'impossibilità di vedere cosa si nasconde sotto la superficie, la possibilità di naufragare, di morire nell'attraversamento. Scrive Carl Schmitt nel suo Terra e mare che Melville rappresenta per gli oceani ciò che Omero ha rappresentato per il Mediterraneo. Ebbene, in entrambi i casi l'elemento che caratterizza il mare è quello della incertezza Nell'Odissea, che ho riletto recentemente, il mare con le sue onde e le tempeste distrugge ogni tentativo degli umani di seguire una rotta stabilita:

- incertezza delle sue condizioni: il movimento del mare cambia di continuo e improvvisamente;

- incertezza del riconoscimento: sulla superficie del mare è difficile distinguere le figure che appaiono, la balena bianca? le sirene? un gommone rovesciato?; La scrittrice Elena Stancanelli, nel libro *Venne alla spiaggia un assassino* racconta la sua esperienza nell'autunno del 2018 a bordo della nave Mare Jonio della flotta Mediterranea, armata per intervenire nell'avvistamento e nel salvataggio. Stancanelli descrive molto bene la incertezza dell'avvistamento, ma anche l'incertezza rispetto alla natura e alle intenzioni dell'altro che arriva dal mare. Descrive inoltre l'incertezza della sopravvivenza: il libro inizia dicendo: "Il mare Mediterraneo si sta riempiendo di morti", che rimanda a Melville: Il mare – oceano in questo caso – è una grande tomba.

- ma soprattutto incertezza della sopravvivenza: Moby Dick parla del fondo del mare come cimitero, e anche Ulisse nell'Odissea tra le tempeste scatenate da Poseidone lamenta spesso la paura di non tornare a casa: nel libro quinto, che racconta la partenza dall'isola di Calipso e il percorso in mare prima di arrivare dai Feaci, alla corte di Alcinoo, Ulisse nella tempesta rimpiange di non essere morto in guerra e di morire in mare senza degna sepoltura.: mare color del vino, infinito, oscuro, pieno di pesci, ma soprattutto cambia improvvisamente, è minaccioso.

Proprio il riconoscimento di questa incertezza detta però norme di comportamento adatte, la legge dell'ospitalità nei confronti di chi arriva dal mare: i racconti dell'ospitalità nei confronti dei naufraghi sono molti nell'Odissea, ma forse i versi più belli sono presenti nella Telemachia, all'inizio dell'Odissea, quando Telemaco va in cerca di Odisseo fino a Sparta alla reggia di Menelao: lo scudiero chiede a Menelao se debba ospitare o meno i due stranieri, e Menelao risponde sdegnato all'idea che vi possa anche solo essere un dubbio. Telemaco e il figlio di Nestore vengono lavati, avvolti in splendide vesti e fatti accomodare su due troni, poi nutriti e dissetati. Soltanto dopo vengono poste domande sulla loro identità.

3. Il terzo carattere che propongo, riprendendo Deleuze e Guattari, è quella della invenzione di un nuovo spazio e di un nuovo popolo. Intanto, l'idea dell'invenzione di un nuovo spazio va presa sul serio: l'esperienza di quei corpi che arrivano dall'Africa letteralmente crea un territorio, un percorso che prima non c'era. L'incertezza conduce infatti a cercare una via di fuga, che come scrive Henri Laborit in *Elogio della fuga*, non è soltanto a volte l'unica salvezza ma anche la possibilità di guadagnare "rive sconosciute".

L'invenzione di un nuovo popolo, minore, nomade, che manca, è un compito politico, artistico e filosofico per Deleuze e Guattari. Usando la lettura che ne fa Glissant, si tratta di inventare e non di creare, se per creare intendiamo un futuro già incluso nel presente: invece "questo popolo inventato è sempre un divenire popolo", è in continuo cambiamento. In arte, ma anche in filosofia e in politica l'invenzione di un popolo che manca può avvenire solo prendendo una posizione minore, rifiutando il canone maggiore. Nell'ottica dei due autori francesi, minoranza e maggioranza non si costituiscono come tali a livello quantitativo, bensì sulla base di una opposizione della prima al carattere maggioritario di gestione e organizzazione della società. Se la maggioranza si definisce attraverso la costanza, l'omogeneità, la centralità e l'unificazione, il carattere minoritario è invece l'elemento spiazzante, plastico e deterritorializzante del sistema. Divenire minore significa spostarsi continuamente alla ricerca di una prospettiva inedita, non centrale e non unificante: filosofia, arte.

Border di Waddington

Queste tre caratteristiche – tremore incertezza invenzione – emergono nel lavoro della video-artista Laura Waddington, Border, esempio di una invenzione e di una intercessione che rende visibili il tremore e l'incertezza. Non sono la prima a parlare di questo film, lo ha fatto Didi-Hubermann in *Come le lucciole*, e nel 2004 il film ha riscosso un grande successo al Festival di Locarno. Mi sembra particolarmente adatto a questa occasione proprio in riferimento ai caratteri del mare come confine di cui ho parlato finora

La videoartista inglese Laura Waddington ha una formazione letteraria, è stata lei stessa migrante illegale dall'Europa a New York, ha viaggiato in Kurdistan, Medio Oriente, Balcani.

Nel 2002 Laura Waddington ha vissuto per alcuni mesi nella campagna intorno al campo della Croce Rossa a Sangatte, una piccola città francese ubicata nella regione del Nord-Pas de Calais, rifiutandosi di entrare a fare parte degli apparati giornalistici autorizzati dal governo e collegati alla Croce Rossa. Lì ha seguito da vicino i rifugiati afghani e iracheni che tentavano di passare il tunnel sottomarino che collega la Francia al Regno Unito. Unitasi ai migranti con una piccola DV camera Waddington ne ha filmato la routine notturna, i tentativi di fuga, le corse in mezzo ai campi, le attese, gli interventi repressivi della polizia fino agli scontri avvenuti per la chiusura del campo.

Per venire ai temi di cui ho parlato finora:

Il mare qui è davvero un confine, anzi un muro da oltrepassare, un obiettivo oggetto del desiderio che tuttavia non si vede mai.

Quanto alla modalità di narrazione, Waddington propone una narrazione non oggettivante, partecipa e si mette a rischio, non intervista, ma corre, scappa con i rifugiati. Non si tratta dunque di un confronto corpo a corpo con il reale, bensì di un'adesione totale, trasparente, come se l'artista cercasse un annullamento visivo del suo sguardo soggettivo e diventasse parte di quei campi, di quei respiri affannati, di quei tentativi di corsa verso una nuova vita.

Il tremore: Le immagini, girate sempre al buio e in slow motion, sono sgranate, confuse, tremolanti. Il tremore della vita che pullula e si muove nel buio, evidenziato dal tremore e dai flash delle stesse immagini è notato anche da Georges Didi-Huberman nel suo libro *Survivance des lucioles*, Éditions de Minuit, Paris, 2009 (tr. it. Come le lucciole, Bollati Boringhieri, Torino, 2010), che cita Waddington insieme a Godard, Lanzmann tracciando le linee per una "politica della sopravvivenza". Le immagini di Waddington "come le lucciole" squarciano lievi il buio del vuoto etico in cui sembra essere sprofondata la società contemporanea.

L'incertezza. Il film racconta l'incertezza di queste vite: tentare una chance il più delle volte fallimentare; perdere le persone che viaggiano con te; rischiare la vita. Questa incertezza del mare, qui dell'esperienza del confine, è mostrata nell'effetto complessivo del video, potente e disorientante.

Invenzione. Differente di sicuro dal cinema convenzionale, ma ben oltre il formalismo del cinema sperimentale. Waddington gira e monta queste immagini cercando un nuovo modo, diverso, di raccontare questa esperienza.

Daniela Angelucci

Tremor, uncertainty, invention. Europe and the sea

Europe and its borders: it is an urgent theme of our present, which calls philosophy into question. The most urgent event today concerns the migrations that cross the sea around Europe, and it should force us, it should force philosophy to think. If philosophical practice is the activity of producing concepts that starts from an event, from an encounter that comes from outside, as I believe. In 2016: more than 5000 migrants died in the Mediterranean. In 2017: more than 100,000 people landed in Italy, including about 15,000 unaccompanied minors; I was near Lampedusa, the third October 2016, when 366 persons died just half a mile from the coast and the salvation.

I teach aesthetics, and I understand aesthetics not as a philosophy of art, but as a philosophy tout-court, which looks at the world from the point of view of sensitive experience, so my first step in the encounter with the outside of the European sea, crossed by migrations, will be to ask myself about the kind of narrative that I am legitimized to make of it.

That is, the question is: How can we avoid an objective discourse (what Lacan called the discourse of university), but also the offense of an excessive familiarity with situations so different from our situation, so harder than our situation, as European citizens?

To borrow a concept from Deleuze and Guattari, I call into question the category of "intercessor": becoming someone's intercessor means trying a continuous exchange of points of view, in an affective, political and stylistic adhesion, instead of speaking in his/her place. The theoretical and political sense of this concept –intercession – is that one of refuting the claim of the intellectual, of the philosopher to speak for others, attributing to himself the right or the duty to be their spokesperson. I quote Deleuze who asks: "Who speaks and who acts? It is always a multiplicity, even in the unique person who speaks or acts”. This multiplicity is what produces a stammering, an uncertainty, for Deleuze and Guattari, a becoming-minor of the language.

In the notable book *Migrancy, Culture , Identity*, Iain Chambers talks about thinking *with* migration, and emphasizes how thinking with migration and not about migration means questioning our position with respect to language, to our history and culture. Thinking with migrations promotes a different relationship, more disturbing, with our own philosophical background. (p.8)

So I consciously decided to give up a more consequential, more structured argumentation, to adhere precisely to the uncertainty of the title, to make myself be captured and modified from the outside and to escape the pleasure of objectification. I do not want to speak for anyone, nor to be someone's representative, but neither to remain at a distance: I would like the concepts produced in the encounter between the event of the sea crossings and the philosophical practice to produce a rapprochement, an area of indiscernibility, an intercession. And maybe the artistic narration can help us in this approach, it can help us to tell the sea and its contemporary situation without taking a distance and at the same time without showing an excessive familiarity.

Starting from various readings, philosophical in the broad sense, but above all literary, and also visual, I propose then three characters of the sea, which speak to us of the contemporary situation and at the same time of the philosophical practice and a new way (different, disturbing, Chambers would say) of relating to it.

1. Thinking of the sea as a territory, analogous but very different from the land, tremor, trembling is the characteristic that I would like to use to express in the first place its mobility, fluidity.

I borrowed a concept by Edouard Glissant (writer and essayist born in Martinique, in the Antilles, creolization), who proposeds a "trembling thinking", tremblement in French is also tremblement de terre, earthquake, something that not by chance has to do with the territory. Against every dogmatism Glissant opposes the archipelagic thinking, which is declined as a tremblement, tremor, understood in a double dimension: At the same time, such thinking does not aim at the constitution of preconceived grids of interpretation of reality, but adapts to an unstable perception of the world in its own changes; in the ethical field, the trembling preserves the desire and uncertainty of the discovery of the Other”.

I quote some passages from the book of Glissant *Pensée du tremblement*: it is a thinking that "resists the stiffening of systemic thoughts and the impetus of systems of thought"; "it opens the identity to the relationship with the Other and to the change originated by the exchange", "it is the seismic thinking of the world that trembles inside and outside of us". and then: "we are noble enough, magnificent and wild (and miserable enough when necessary) to consider our relationship to the Other and to the World as an enormous tremor".

Tremor can be used to indicate the fluidity of water and the rippling of waves, but also the movement of lives, both human and animal, that populate and cross the sea. The tremor describes the vitality of the sea, its mobility but also its being full of living beings, animals and humans. The tremor here is closely linked to a poetics of the relationship: the trembling thinking also means living the openness to the whole world, at risk of trembling, at risk of uncertainty.

2. There are many literary texts about the sea that describe its uncertainty, the impossibility of seeing what is hidden under the surface, the possibility of shipwreck, of dying while crossing. Carl Schmitt in his book *Land and Sea* writes that Melville with his Moby Dick represents for the oceans what Homer and Odyssey represented for the Mediterranean. Well, in both cases the element that characterizes the sea is that of uncertainty. In the Odyssey, the sea is of the color of wine, infinite, dark, full of fish, but above all, with its waves and storms, it destroys any attempt by humans to follow a route:

- uncertainty of its conditions: the movement of the sea changes continuously and suddenly;

- uncertainty of recognition: on the surface of the sea it is difficult to distinguish who arrives from the sea, the figures that appear: the white whale? the sirens? an overturned dinghy? or a boat full of humans beings? dead or alive?. The Italian writer Elena Stancanelli, in the book *Venne alla spiaggia un assassino* describes her experience in the autumn of 2018 aboard the ship Mare Jonio of the fleet Mediterranean, a fleet armed to intervene in the sighting and rescue of migrants. Stancanelli describes very well the uncertainty of the sighting, but also the uncertainty about the nature and intentions of the Other coming from the sea (are they people to rescue or dangerous people?), as well as the uncertainty of survival. At he beginning of the book she writes: "The Mediterranean Sea is filling up with deaths", which is a sort of quotation that refers to Melville: “The sea floor - ocean in this case - is a great cemetery”.

- but above all uncertainty of survival: in the Odyssey Ulysses, during the storms unleashed by Poseidon often complains of the fear of not returning home: in the fifth book, which tells the departure from the island of Calypso and the path into the sea before arriving from the Phoeacians, at the court of Alcinous, Ulysses during the storm is desperate, and regrets not to have died in war because dying at sea means not having burial, not having marked graves.

Precisely the recognition of this uncertainty, however, dictates appropriate rules of conduct, the law of hospitality towards castaways or those who come from the sea: the stories of hospitality towards shipwrecked people are many in the Odyssey, but perhaps the most beautiful verses are present in the Telemachy, at the beginning of the Odyssey, when Telemachus goes in search of Odysseus until Sparta at the palace of Menelaus: the squire asks Menelaus if he should accommodate or not the two foreigners, and Menelaus responds disdained to the idea that there may even be a doubt. Telemachus and Nestor's son are washed, wrapped in beautiful robes and seated on two thrones, then fed and quenched with water. Only then are questions asked about their identity.

3. the third character that I propose, referring to Deleuze and Guattari, is that of the invention of a new space and a new people. Meanwhile, the idea of the invention of a new space must be taken seriously: the experience of those bodies that come from Africa literally creates a territory, a path that was not there before. Uncertainty in fact leads to the search for an escape route, which, as Henri Laborit writes in L'*éloge de la fuite (1976),* is not only sometimes the only salvation, but also the possibility of gaining "unknown shores".

The invention of a new, minor, nomadic people, which is missing, is a political, artistic and philosophical task for Deleuze and Guattari. Using Glissant's reading of Deleuze and Guattari, we could say it is a matter of inventing and not creating, if by creating we mean a future already included in the present. Instead, "this invented people is always a becoming people", it is in continuous change. In art, but also in philosophy and politics, the invention of a people can only take place by taking a minor position, rejecting the greater canon. From the point of view of the two French authors, minority and majority do not constitute themselves as such on a quantitative level, but on the basis of an opposition of the former to the majority character of the management and organization of society. Majority is defined through constancy, homogeneity, centrality and unification, minority is instead the disorienting, plastic and deterritorializing element of the system.

Referring to the words of Iain Chambers, that I quoted before, who invites us to think *with* the event of migrations, I want to conlude this first part of my talk highlighting what the sea as a territory and as a border can teach to us philosophers. These three concepts – tremor uncertainty invention – that describe the sea as a boundary can also be proposed as characteristics of philosophical work, which should expose itself to risk, accept the possibilities offered by uncertainty, give space to invention.

****

I would like to conclude with an example of artistic invention, filmic, in which these three characteristics - tremor uncertainty invention - emerges clearly. It is the film of English video-artist Laura Waddington, *Border*, a great success at the Locarno Film Festival in 2004. The film seems to be a perfect example of an invention and an intercession that makes visible tremor and uncertainty. It seems to me to be particularly suitable for this occasion precisely because of the characteristics of the sea as a boundary, of which I have spoken so far.

Waddington has a literary background – and maybe this is signficant in respect of the kind of narrative that she choose, she travelled to Kurdistan, The Middle East, and the Balkans, researching refugee routes into Europe. In 2002 Laura Waddington lived for a few months in the countryside around the Red Cross camp in Sangatte, a small French town in the Nord-Pas de Calais region, refusing to join the government-authorised news media linked to the Red Cross. There she closely followed Afghan and Iraqi refugees who were trying to pass through the underwater tunnel linking France to the United Kingdom (It was some years before Brexit...) Joining the migrants with a small DV camera (similar to the webcam for PC), Waddington filmed their nightly routines, escape attempts, runs through the camps, waits, police repression and clashes over the closure of the camp.

To come to the issues I've talked about so far:

The sea here is really a border, or rather a wall to be crossed, an object of desire that is never seen, however.

As for the way of narration, Waddington proposes a non-objective narration, she participates and puts herself at risk, not interviewing, but running, running away with the refugees. It is not, therefore, a hand-to-hand confrontation with reality, but rather a total, transparent adhesion, as if the artist were seeking a visual cancellation of his subjective gaze and becoming part of those camps, and those attempts to race towards a new life.

The tremor: The images, always shot in the dark and in slow motion, are grainy, confused, flickering. The tremor of life that swarms and moves in the dark, highlighted by the tremor and flashes of the same images is also noticed by Georges Didi-Huberman in his book Survivance des lucioles, Éditions de Minuit, Paris, 2009, which cites Waddington with Godard, Lanzmann tracing the lines for a "survival policy". “Waddington's images "like fireflies" pierce slightly the darkness of the ethical void into which contemporary society seems to be plunged.”

Uncertainty. The film recounts the uncertainty of these lives: trying a chance that is often a failure; losing the people who travel with you; risking their lives. This uncertainty of the sea, here of the experience of the border, is shown in the overall effect of the video, powerful and disorienting.

Invention. Different from conventional cinema, but far beyond the formalism of experimental cinema. Waddington shoots and edits these images looking for a new, different way to tell the story of this experience.

Sustainable Development in the Mediterranean

Report 2021

Transformations to achieve the Sustainable Development Goals

SDSN Mediterranean

SANTA CHIARA LAB
Università di Siena 1240

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
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Co-authors are Simone Cresti (SDSN Mediterranean Network Manager and Santa Chiara Lab, University of Siena), Gianni Betti (University of Siena), Francesca Gagliardi (University of Siena), Emanuela Anna Riccelli (University of Siena) and Giovanni Stanghellini (University of Siena).

The Mediterranean Countries Edition is based on indices and indicators presented in the *Sustainable Development Report 2021* (Sachs et al. 2021) and partially replicates tables and figures with a specific focus on Mediterranean countries. Compared to the original document, it provides substantial integrations concerning the interpretation of results in the Med Area, their visualisation in the tables, and specific recommendations and policies for the implementation of Sustainable Development Goals (SDGs) in the Mediterranean region.

Scope of the report is to facilitate the reading of the *Sustainable Development Report 2021* with a focus on Mediterranean countries in order to share knowledge on current trends towards SDGs and provide a science-policy interface for institutions, policy makers and the private sector.

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Foreword

We are pleased to launch the third edition of the report on the Sustainable Development in the Mediterranean - Transformations to achieve the Sustainable Development Goals. It focuses on 24 Mediterranean countries hosting a population of over 550 million people to show the current level of achievement of the SDGs in the Mediterranean region.

The report builds on the Sustainable Development Report 2021 (Sachs et al., 2021).

The SDG index, the indices per each SDG and the entire set of indicators are taken from the Sustainable Development Report 2021. Tables (one per each indicator) and additional raw data (when relevant) have been specifically produced to facilitate the understanding of current trends and drive common action in the Mediterranean area. This initiative has been undertaken by the University of Siena - Santa Chiara Lab, hosting institution of the SDSN Mediterranean, together with SDSN, to raise awareness on the SDGs and foster the implementation of transformation strategies.

In particular, these strategies should follow the Six Transformations Framework presented by Sachs et al. (2019). Statistical data has been therefore aggregated and interpreted with the aim of showing the current state and progress per each transformation: 1. Education, Gender and Inequality; 2. Health, Wellbeing and Demography; 3. Energy Decarbonisation and Sustainable Industry; 4. Sustainable Food, Land, Water and Oceans; 5. "Sustainable Cities and Communities"; 6. Harnessing the Digital Revolution for Sustainable Development. Given the complexity and wide range of topics, highly interconnected to each other, the report proposes an innovative operational methodology, starting from the aggregation and visual representation of indicators, to the identification of main challenges and the definition of policies to inform action addressed to governments, businesses and other stakeholders.

This method makes the Mediterranean edition of the SDSN report more than a monitoring report, but rather a decision-support tool dealing with the six transformations and four geographical areas of the Mediterranean region: Western Europe, Eastern Europe, Middle East and North Africa.

The SDSN Sustainable Development Report 2021 dedicates a section to the impact of COVID-19 on key SDG indicators. Sachs and co-authors provide an overview of the impact of the pandemic on key SDG metrics where 2020 data are available. The COVID-19 pandemic has impacted all three dimensions of sustainable development: economic, social, and environmental. Besides its dramatic effects in terms of lives lost, the pandemic has had a negative impact on poverty rates, life expectancy, access to food and food insecurity, unemployment rate, educational systems, social and gender inequalities, functioning of political systems, the rule of law, and multilateralism, community building and international partnerships. Moreover, temporary gains observed over the past year related to sustainable production and consumption, climate action and biodiversity protection have been rapidly offset once restrictions were lifted and deforestation and plastic consumption are estimated to have increased.

The pandemic has affected countries and people in very different ways, making the SDG principle of Leaving No One Behind particularly relevant in COVID-19 emergency responses and recovery plans. However, there is a huge discrepancy in countries' abilities to leverage additional financial resources to support these actions.

The Mediterranean region in general presents high environmental, social and cultural challenges. Transnational partnerships, although complicated, are key to deal with them. To this aims, the SDGs analysis can be useful to identify common strategies and share best practices and policies, keeping in mind that gradual progress and policy changes are not enough and deep transformations are urgent. We have a very long way to go. Proactive behaviours by governments, businesses, citizens and all the stakeholders in the Mediterranean region to finally close the gap between rhetoric and action are needed. We hope that our focus on transformations supports such collective efforts.

Angelo Riccaboni
Sustainable Development Solutions Network Mediterranean Chair

Executive Summary

The 2021 Report, Sustainable Development in the Mediterranean, presents the SDG Index and Dashboards for the 24 countries of the Mediterranean area, a complex environment, shared by three continents, seriously affected by global warming, being the most vulnerable to climate change in the world, after the Artic (section 1). The scores, meant as general measures of the distance to SDG targets, have been reported per country and assessed in the four aggregated regions (values weighted by population) and in all the Mediterranean area (section 2).

As a result, given a general score of 75.1 of the Mediterranean area (meaning that SDG targets are achieved by 75.1%), the SDG index shows better performance in Europe West (79.8) and lower values in Europe East (75.6), North Africa (69.6) and Middle East (68.6). Nevertheless, the spillover index looks inversely proportional to the SDG index, since better performing countries tend to negatively impact on other countries (e.g. financial, trade, environmental issues), often compromising their efforts for improvements.

In order to unpack the SDG indices and properly understand results, this report presents a systematic methodology to represent and interpret any single indicator and provide a comprehensive current state picture of the Mediterranean area (section 3). To this regard, the Six Transformations proposed by Sachs et al. (2019) have been taken as the reference operative framework to inform and drive action. In particular, the SDSN indicators, made spatially explicit through dedicated tables, have been gathered based on their relevance for the monitoring and assessment of the six transformations and used to determine the main challenges to be faced per each transformation.

Once identified and briefly described, challenges became the basic reference for determining sets of policies addressed to various stakeholders to implement actions for improvement and increase the capacity of countries to accomplish the six transformations (section 4).

As for the Mediterranean overview, indices and disaggregated indicators provide a comprehensive information on the current state and trends towards the SDGs. In general, all the 24 Mediterranean countries are far from achieving the SDGs and must improve their performance.

Considering average incomes, over 60 million people (11%) in the Med area are at risk of #poverty, including 29 million Europeans.

#woman rights and opportunities for #woman emancipation must be improved, especially considering rates of scholarship, participation in labour force and policy (e.g. seats held by women in national parliaments: 38% in Europe; 18% in MENA).

The #job market looks stagnant. Unemployment rates are almost 12% in average in MED. The number of NEET (youth not in employment, education or training) is increasing in OECD countries involving about 18% of young people.

Wrong #food habits impact on health and the healthcare system. Obesity affects from 18 to 35% of the Mediterranean population (almost 95 million in total), namely 34 million people in Europe west, 33 million in North Africa and 25 million in the Middle East. #sustainable agriculture is among the most desirable practices to deploy with positive effects on social healthiness and the environment.

#water management is a crucial issue, also depending on the relevant effects of climate change in the Mediterranean area. Especially MENA countries, poor in water, risk to further compromise the access to basic drinking water and sanitation services, besides the risks for agriculture practices being farmers major users of water resources.

Regarding #water quality, basic services of wastewater treatment are performed in Europe West at 78%, in Middle East at 34.5%, in North Africa at 32.5% and in Eastern Europe only at 28%. This has also impacts on seawater quality, highlighted as a critical issue in the Mediterranean basin that needs to enlarge and enforce #environmental protection in marine and maritime areas.

#air quality in urban areas needs careful monitoring. In particular, the percentage of med population exposed to high rates of PM2.5 is high especially in the MENA countries. Values in Europe are lower but not negligible. Considering the high rate of urbanisation in Med (over 70% population leaves in cities) and the related respiratory diseases (higher vulnerability to the COVID-19), this represents an urgent problem to handle.

The share of renewable energy and the quantity of carbon emission per unit of electricity are promising factors in Europe, although improvements are still needed. Nevertheless, investments towards #sustainable energy systems in MENA countries need a consistent acceleration. This is even more important considering the high vulnerability of the Mediterranean area to climate change.

Quality of Higher Education University is medium-high in Europe west and Middle East, with lower performance in Europe east and North Africa. Nevertheless, investments in #R&I should consistently increase, especially looking at the expenditures of countries in research activities: 1.7% in Europe west, 0.3% in Europe east, 0.1% in Middle East and 0.6% in North Africa.

Regarding the protection of marine environment, capture #fisheries are often based on unsustainable practices and need more stringent regulations and monitoring. Moreover, aquaculture can be an alternative solution, provided that it is sustainably performed. #environmental protection through protected areas (including freshwater and lands) is still insufficient and needs to be further enlarged; seawater quality also needs constant monitoring in all MED countries.

Mainly focusing on urban areas, but without neglecting rural areas, #accessibility to services such as public transport and #waste management must be improved in all the Mediterranean region. #digital infrastructures should also guarantee higher accessibility rates to internet (83% in Europe and only 70% in MENA).

Among the forms of #crime, the perception of corruption is high in most of Mediterranean countries and #press freedom should be safeguarded in every country as essential factor of fairness and equality. High levels of inequality in #wealth distribution (family income) are recorded in all the Mediterranean area, with highest values in the Middle East. The #weapon market, especially concerning exports of conventional weapons, is prosperous in Europe west and need special attention.

The general overview on the Mediterranean area presented in this report is based on SDSN indices and indicators published in the Sustainable Development Report 2021 (Sachs et al. 2021) and, although wide and articulated enough, is anyhow partial and not exhaustive. In some cases, indicators have been coupled with raw data allowing for a better interpretation of results but many details still miss and, sometimes, due to the complexity of the Mediterranean environment, can bring to contradictions and statistical weaknesses.

The suggested framework looks useful to understand the current situations regarding the SDG targets and it demonstrated to be an effective method to share information and let a group of Mediterranean hubs cooperate for the identification of concrete strategies and policies to be promoted among governments, communities and other stakeholders. A general roadmap emerging from this cooperative analysis is finally reported (session 5).

1. Overview in the Mediterranean context

The Mediterranean Sea identifies a unique area shared by three different continents. The 24 countries analysed have been divided into four macro-areas Western Europe, Eastern Europe, Middle East, North Africa, as follows:

- Western Europe: France, Greece, Italy, Spain, Portugal, Malta;
- Eastern Europe: Albania, Bosnia and Herzegovina, Croatia, Cyprus, Montenegro, North Macedonia, Slovenia;
- Middle East: Israel, Jordan, Lebanon, Palestine, Syria, Turkey;
- North Africa: Algeria, Egypt, Libya, Morocco, Tunisia.

These countries show many differences from the cultural, religious, social and economic viewpoints. Countries have various spatial dimensions, their own history, traditions and peculiarities, and also different approaches in the global network; they are deeply interconnected through the sea, nowadays scene of socio-political compromises, human migrations, trade and energy exchanges.

In addition to the 21 countries directly facing the Mediterranean Sea, Portugal, North Macedonia and Jordan have been included considering their geo-political influence in the Mediterranean area. The population of the 24 countries has more than doubled since 1960 (+114%), and host nowadays more than 500 million people, with different growth trends in the four macro-areas: +33% in South Europe and +250% in the Middle East and North Africa (MENA). In the decade 2008-2018 the Mediterranean population has increased by 11%, with rates of over 2% in Western Europe, almost 18% in Middle East and 20% in North Africa, and a decrease of 3% in Eastern Europe. The population currently living in urban areas is on average 70%; this follows a growing depopulation of the rural areas. Urbanization has increased by 38% since 1990, while employment in the agricultural sector has decreased by 44% (World Bank data).

The Mediterranean area is a climate hotspot, where temperatures have already increased by 1.5 C°, while the world average increase is 1.1 C°. The warming effect in the Mediterranean is now more intense than in most of the world, with increasing risks associated to climate change (Cramer et al. 2018; MedECC 2019). Projections indicate that temperature could rice up to 2.2 C° in 2040 and 3.8 C° in 2100, besides a progressive reduction in precipitation (-10% in European countries and -30% in the Middle East and North Africa). At the same time, extreme rainfall events, heat waves and droughts may be 10-20% more intense and frequent, thus threatening water supply of millions of people.

Due to climate change and increased consumption, freshwater reserves are expected to decrease by 2% to 15% in the Mediterranean region. The risk of damaging water resources is among the highest in the world. The current situation of the Mediterranean population is classified as "poor in water" with less than 1,000 m3/year per capita; nevertheless, water availability in some locations, such as South-eastern Spain and North Africa, is further decreasing and could fall into a condition of "water scarcity" (below 500 m3/year per capita), affecting around 250 million people in 2040. Water availability is a crucial issue that risks to cause political instability, new conflicts, increased migration, and crisis in the agricultural sector (irrigation represents 50-90% of the demand for water in the Mediterranean countries).

The surface temperature of the Mediterranean has been increasing by 0.4 C ° every 10 years between 1985 and 2006 (+0.3 C ° in the western part and +0.5 C ° in the eastern part of the basin). Projections to 2100 indicate a possible increase from +1.8 to +3.5 C ° in seawater temperature compared to the 1961-1990 average, with a consequent rise in sea level which is already taking place in a progressive and worrying way: from 0.7 mm/year in 1945-2000, and 1.1 mm/year in 1970-2006, to 3 mm/year recorded in 2006-2019. This also affects marine currents with ecological decompensation. Risks due to sea level rise include the saline intrusion near the deltas of the most important Mediterranean river basins (Nile, Ebro, Rodano and Po) and the loss of important agricultural areas.

Food security and the internal production capacity, compared to imports, are directly influenced by increasing water scarcity and soil degradation, both medium-long term effects of climate change. Saladini et al. (2018) presented a comprehensive diagnosis of the Water-Energy-Food Nexus in the Mediterranean region and pointed attention to the alarming trends towards food imbalance (e.g. import of cereals), scarcity of water resources (70% of which is used for agriculture) and the increased demand for energy for the extraction, treatment and supply of water, especially in some MENA countries.

The Mediterranean Sea is subject to overfishing. Estimates indicate that only 50% of the current fish-stock will be available by 2050, while fishing activity will decrease by at least 20% on the southern Mediterranean coast in the coming years. Aquaculture is currently the source of 50% of commercialized fish and plays an important role in the economy of some coastal communities, with an increase of 112% by 2030 compared to 2010 values in European Mediterranean countries. (Riccaboni et Al. 2020, Sustainable Devleopment Report in the Mediterranean - Report 2020. Transformations to achieve the Sustainable Development Goals, 2020)

2. The SDG Index and Dashboards

The SDG Index tracks country performance towards the SDGs. All 17 goals are weighted equally in the Index and the score signifies a country's position between the worst (0) and the best or target (100) outcomes. Table 1 shows the SDG Index and world rank for 24 Mediterranean countries, classified according to region and income group. As a comprehensive system, hosting 550 million people, the Mediterranean region has an average index score of 70.2, hypothetically corresponding to the 71th position of the world rank. This suggests that the Mediterranean region is on average over 70% of the way to the fully achievement of the 17 SDGs comprehensively, , but in respect of 2020 (index score 73.5) it retreats of 21 positions in the ranking (50th in 2020).

Among the 24 Mediterranean Countries, most of European countries perform well on the Index score. Among the four Mediterranean regions, values of mean index (weighted by population) are variable, being 79.8 (ideally corresponding to the world rank 18) in Europe West, 75.6 in Europe East (world rank 34), 68.6 in the Middle East (world rank 82) and 69.6 in North Africa (world rank 79).

However, even European countries at the top of the list perform significantly below the maximum score of 100 and need significant improvements. Libya and Palestine are not included in the SDG index list being most of data unavailable; nevertheless, they are both included in the discussion concerning the indicators. Values of the Spillover Index have been also reported in the table.

They measure transboundary impacts generated by one country on others, which may in turn undermine the other countries' capacities to achieve the SDGs. The assessment refers to statistics on financial spillovers (e.g., financial secrecy, profit shifting), environmental and social impacts embodied into trade and consumption (e.g., imported CO2 emissions, imported biodiversity threats, accidents at work embodied into trade), and security/development cooperation (ODA, weapons exports).

Index score ranges from 0 (poor performance, i.e., significant negative spillovers) to 100 (good performance, i.e., no significant negative spillovers). It is clear how the spillover index scores are often inversely proportional to the SDG index. In other words, impacts of countries in Europe West, with higher income and negative spillover effects, are partially imposed upon other countries and risk to compromise their performance and chances for improvement.

Table 1 | SDG Index, Global rank and Spillover index (values of aggregated regions are weighted per population).

Countries & regions		Income group	Population	SDG INDEX score	Global rank	Spillover index
France	W-EU	HIC	68,084,217	81.7	8	55.9
Greece	W-EU	HIC	10,569,703	75.4	37	72.3
Italy	W-EU	HIC	62,390,364	78.8	26	71.2
Malta	W-EU	HIC	460,891	75.7	33	61.4
Portugal	W-EU	HIC	10,263,850	78.6	27	69.9
Spain	W-EU	HIC	47,260,584	79.5	20	64.8
Western EuroMed	**W-EU**	_	**199,029,609**	**79.8**	**18**	**64.4**
Albania	E-EU	UMIC	3,088,385	71.0	64	94.3
Bosnia and Herzegovina	E-EU	UMIC	3,824,782	73.7	47	95.8
Croatia	E-EU	HIC	4,208,973	80.4	14	84.8
Cyprus	E-EU	HIC	1,281,506	74.9	40	63.8
Montenegro	E-EU	UMIC	607,414	68.2	85	69.3
North Macedonia	E-EU	UMIC	2,128,262	72.5	54	93.9
Slovenia	E-EU	HIC	2,102,106	81.6	9	60.8
Eastern EuroMed	**E-EU**	_	**17,241,428**	**75.6**	**34**	**85.0**
EuroMed	**EU**	_	**216,271,037**	**79.4**	**20**	**66.1**
Israel	ME	HIC	8,787,045	75.0	38	69.6
Jordan	ME	UMIC	10,909,567	70.1	72	90.4
Lebanon	ME	UMIC	5,261,372	66.8	93	81.2
Palestine	ME	LIC	4,906,308	_	_	_
Syria	ME	LIC	20,384,316	58.0	127	98.3
Turkey	ME	UMIC	82,482,383	70.4	70	93.7
MIDDLE EAST	**ME**	_	**132,730,991**	**68.6**	**82**	**92.0**
Algeria	NA	LMIC	43,576,691	70.9	66	97.5
Egypt	NA	LMIC	106,437,241	68.6	82	98.7
Libya	NA	UMIC	7,017,224	_	_	_
Morocco	NA	LMIC	35,892,951	70.5	69	98.3
Tunisia	NA	LMIC	11,811,335	71.4	60	94.2
NORTH AFRICA	**NA**	_	**204,735,442**	**69.6**	**79**	**98.1**
ME & NA	**MENA**	_	**337,466,433**	**70.7**	**67**	**97.8**
MEDITERRANEAN AREA	**MED**	_	**553,737,470**	**75.1**	**38**	**86.4**

2.1 The SDG Dashboards

The SDG dashboards visually highlight strengths and weaknesses of each country on the 17 SDGs. The graphic representation is based on a four colours scale, from green to yellow, orange and red. The SDG indices are based on the set of indicators of each goal that are the same for all countries, except for a few additional data available for the OECD countries only. Nevertheless, colours represented in dashboards do not refer to an average but depends on the two worst indicators under each goal (this is the reason why traffic lights do not exactly match with index values).

The SDG Dashboards for the Mediterranean region have been composed by assembling the results per each of the 24 countries. Despite minor changes occurred in the set of indicators and assessment methods with respect to the 2020 edition, Figure 2 and 3 show both the 2020 and 2021 values, combined with the SDG index scores. For comparison, black arrows in the 2021 dashboard of Figure 2 show increased or decreased results compared to 2020.

The SDG indices, displayed in dashboards, show that the road to achieve the 17 goals of the 2030 Agenda is still long. In general, the dashboards allow for highlighting the magnitude of the challenges to be faced and help raise awareness on the urgent need for action. Nevertheless, since indices and dashboards result from aggregated parameters, they do not provide exhaustive information for making choices. Hotspots and needs cannot be easily determined based on the score of the SDG index and the indices per each goal. A backward disaggregation into source variables is necessary for a proper understanding of current dynamics. Moreover, specific thresholds should be set considering local instead of global conditions in order to provide more reliable and site-specific evaluations (for example, the poverty line should relate to each specific country instead of setting a world-based threshold).

Aiming at understanding the factors that can determine real changes in a country's performance, indices should be investigated through their component indicators and the data sources underlying the indicators. The desired outcome of monitoring the SDGs is to be able to indicate the road to take, anticipating possible actuation scenarios, estimating the effects of a series of possible actions and judging the degree of penetration these actions need to have in order to make progress towards the goal, namely, a transition from a red light situation to an orange, yellow then green light situation.

The following section provides a new representation of the SDG dashboard through a sequence of tables, one per each indicator, of 24 Mediterranean countries. Each indicator has been analysed and interpreted to determine the state of the art in the Mediterranean region and try to plan possible scenarios of improvement towards the achievement of the SDGs.

Figure 2 | Compared 2020-2021 SDG Dashboards for Mediterranean countries

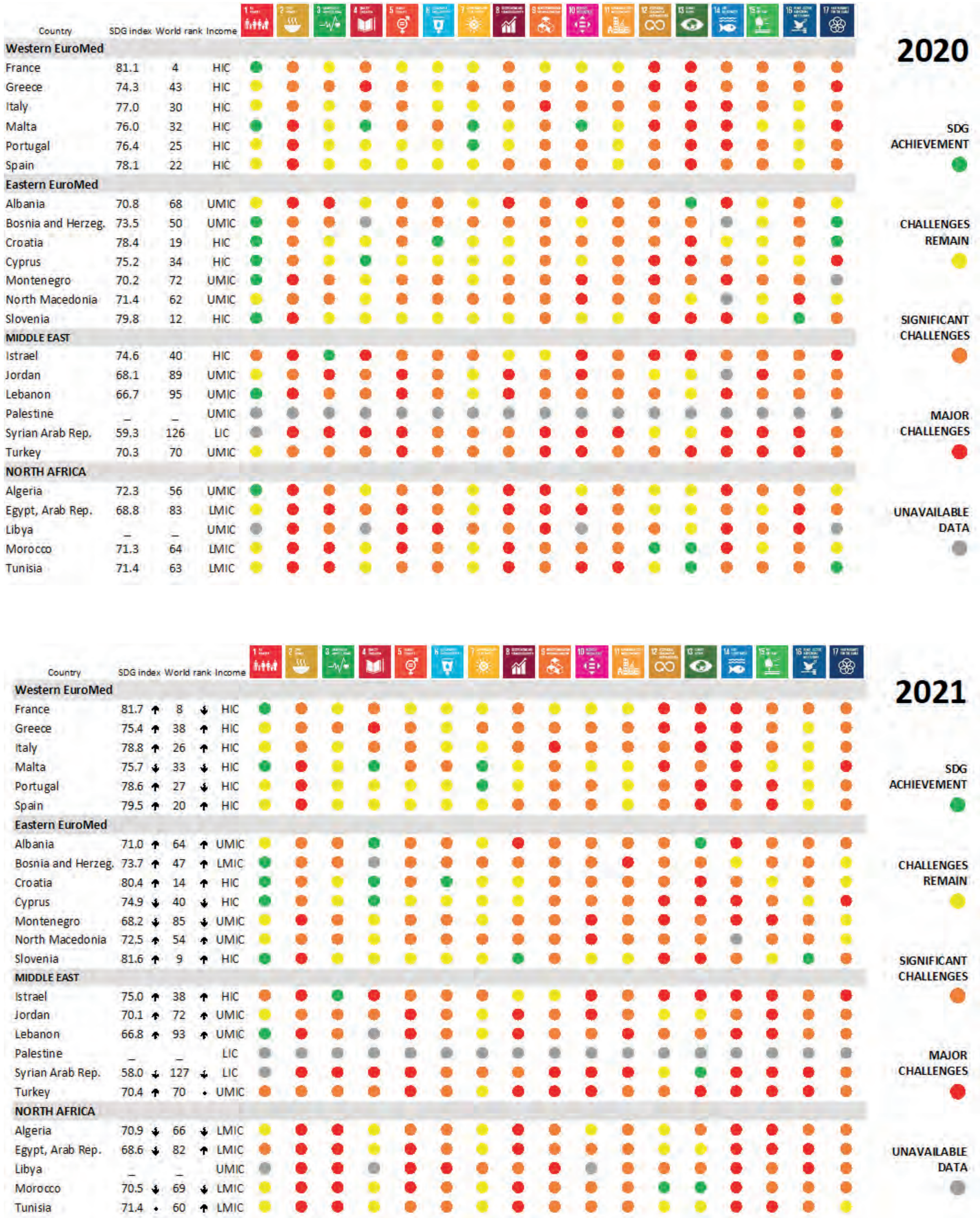
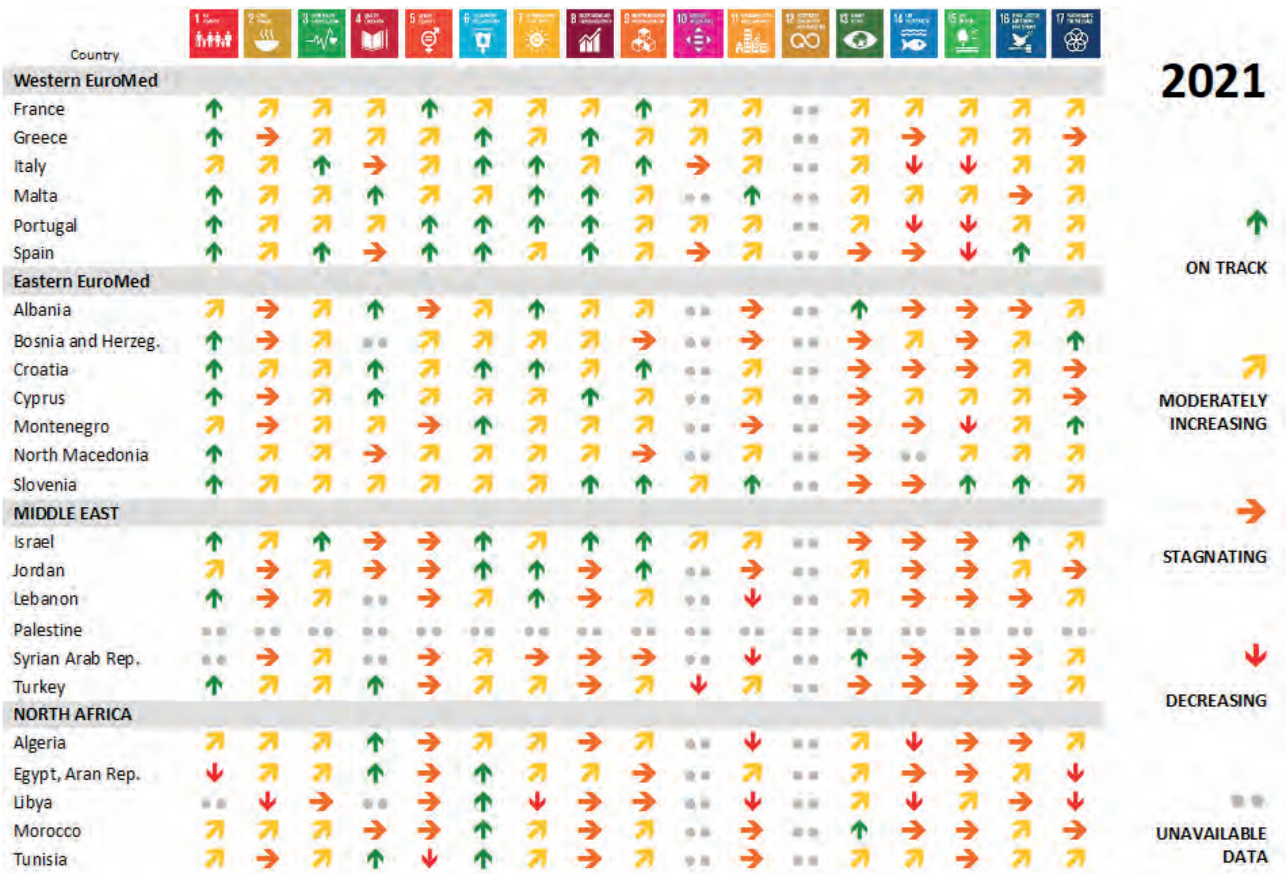


Figure 3 | Compared 2020-2021 SDG Trend Dashboards for Mediterranean countries towards 2030.



3. Six Transformations to achieve the SDGs and challenges

The 2030 Agenda is composed of 17 Sustainable Development Goals (SDGs) and represents the common international political program that the 193 UN member countries have set themselves to reach by 2030. It was officially adopted on September 25, 2015, at a UN Summit attended by over 150 heads of state. The 17 SDGs (Figure 4) are subdivided and better specified by 169 targets and the Agenda also includes recommendations on how nations should proceed in the implementation of the goals. It represents an international opportunity of transformation for humanity, a global vision for prosperity, people and the planet, which considers the three pillars of sustainable development: environmental protection, social inclusion and economic development.

With the 2030 Agenda and the Sustainable Development Goals countries have committed themselves to time-bound targets for Prosperity, People, Planet, Peace, and Partnership (United Nations 2015). They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection.
The Paris Agreement, which is part of the SDG framework, requires every country to achieve net zero greenhouse gas emissions by mid-century.

Figure 4 | 17 Sustainable Development Goals – SDGs

Aiming at identifying driving principles to share and make action, an operative framework to meet the 17 SDGs and the underlying 169 targets has been proposed by Sachs et al. (2019), organized into six broad Transformations. These are intended as sets of potential interventions to accomplish "deep, deliberate, long-term structural changes in resource use, infrastructure, institutions, technologies and social relations" to be undertaken in a short period of time. Any transformation would require guidelines adapted to any specific context, such as the Mediterranean region and its 24 countries, and interpreted according to site-specific social, environmental and economic backgrounds.

The benefit of the Transformations is that they group SDG interventions in ways that promote effective implementation strategies by governments, business, and civil society.

This section of the report is therefore structured into 6 paragraphs, one per each transformation. Significant indicators have been selected and, based on their interpretation, a set of the main challenges has been identified. Each challenge is shown in a dedicated record, including values of reference indicators and, when necessary, additional raw data for a clearer understanding of the observed phenomena. Moreover, each indicator has been represented in the form of tables, through the colour scale from green, to yellow, orange and red.

Tables provide a comprehensive at-a-glance view of the current state and any progress of Mediterranean countries towards the SDGs. The indicators are also grouped by geographic area: Western Europe (WE), Eastern Europe (EE), Middle East (ME) and North Africa (NA). Raw data helps to understand the relevance and magnitude of the phenomena monitored, for example in terms of the number of people affected. Tables provide a clear picture of current state and allow for determining priorities and most urgent actions to be shared by the 24 countries.

This systematic approach has a double role. First it aims at processing indices and dashboards and make them work as an effective decision support tool to achieve the SDGs in the Mediterranean area. Second, it constitutes an hexagonal operational framework to select crucial actors with which discuss about challenges and promote solutions for accelerating the achievement of the SDGs in the region.

Some policies are suggested ad examples for policy makers and other stakeholders to determine how to organize interventions – such as improved policies, public and private investments, and regulation – and also useful to promote participatory practices and perform cooperative decision processes, in line with the SDSN statement: "achieving the SDGs requires deep changes to policies, investments, and technologies. But success will not be possible without social activism that mobilizes stakeholders and changes norms to enable the SDG Transformations. Similarly, international diplomacy and international collaboration are critical underpinnings of achieving the SDGs, particularly to address international spillover effects, including international development finance where needed" (Sachs et al 2019).

3.1 Transformation 1. Education, gender and inequality

A set of indicators has been selected as the most relevant to report on the current state, highlight hotspots and track the progress towards the Transformation 1. This aims to expand and transform the educational systems of countries achieving universal standards of learning outcomes, to reduce inequalities through anti-discrimination measures and social safety nets and to definitely overcome gender inequalities (Sachs et al. 2019).

EDUCATION
GENDER
INEQUALITY
01

Figure 3.1 | Selected indicators and challenges in the transformation 1. Education, gender and inequality.

GOALS	INDICATORS	CHALLENGES
1. NO POVERTY	Poverty headcount ratio at $3.20/day People living below 50% of median income	Poverty
4. QUALITY EDUCATION	Net primary enrollment rate Pupil/teacher, primary Lower secondary completion rate Participation rate in pre-primary organized learning Tertiary educational attainment	Scholarship
	Literacy rate Underachievers in science Resilient students in science	Literacy
5. GENDER EQUALITY	Demand for family planning satisfied by modern methods Ratio of female to male mean years of education received	Women rights
	Ratio of female to male labor force participation rate Seats held by women in national parliaments Firms with F top manager Gender wage gap	Women emancipation
9. INDUSTRY, INNOVATION AND INFRASTRUCTURE	Female share of graduates from STEM fields at the tertiary level	
8. DECENT WORK AND ECONOMIC GROWTH	Unemployment rate Youth not in employment, education or training (NEET)	Job market
	Victims of modern slavery Wage and salaried workers Children involved in child labor	Labor rgihts
16. PEACE, JUSTICE AND STRONG ISTITUTIONS	Wage and salaried workers Children involved in child labor	
	Press Freedom Index	Press Freedom
10. REDUCED INEQUALITIES	Gini coefficient adjusted for top income	Wealth distribution
17. PARTNERSHIP FOR THE GOALS	Government spending on health and education	Domestic policy

Figure 3.1 shows the 21 representative indicators and the corresponding Goals, that allowed for identifying 10 main challenges to be faced to accomplish the transformation. The following records, one per each challenge, show values of the indicators and their representation into tables. Indicators in the tables are often coupled with the corresponding absolute values, such as the number of people involved, and, when useful, other additional data for their interpretation. References for all indicators and additional data (namely, Add.) are listed in captions.

3.1.1. Challenge: Poverty

Over 31 million people in the MENA area live with less than $ 3.20 per day. Almost 17 million people came in absolute poverty compared to 2020 (from 17 to 34), mainly in NA; considering the median income, there are almost 60 million people (11%) in the Med area at risk of poverty, including 29 million Europeans.

Countries and regions	Goal 1: Poverty headcount ratio at $3.20/day (1.2)		Goal 1: People living below 50% of median income	
	%	*mln*	%	*mln*
France	0.17	*0.12*	10.00	*6.76*
Greece	1.60	*0.17*	13.80	*1.47*
Italy	1.31	*0.82*	16.00	*9.96*
Malta	0.12	*0.00*	9.70	*0.04*
Portugal	0.46	*0.05*	11.50	*1.19*
Spain	0.98	*0.46*	15.70	*7.42*
Western EuroMed	**0.81**	**1.61**	**13.52**	**26.85**
Albania	8.50	*0.26*	12.00	*0.37*
Bosnia and Herzegovina	0.19	*0.01*	11.80	*0.45*
Croatia	1.02	*0.04*	11.50	*0.49*
Cyprus	0.05	*0.00*	7.50	*0.09*
Montenegro	5.68	*0.03*	18.90	*0.12*
North Macedonia	6.51	*0.14*	17.40	*0.37*
Slovenia	0.11	*0.00*	5.30	*0.11*
Eastern EuroMed	**2.83**	**0.49**	**11.60**	**2.00**
EuroMed	**0.97**	**2.10**	**13.37**	**28.85**
Israel	0.62	*0.05*	21.20	*1.81*
Jordan	4.75	*0.52*	7.50	*0.80*
Lebanon	0.90	*0.05*	10.70	*0.62*
Palestine	9.40	*0.46*	12.80	*0.60*
Syrian Arab Republic	-	-	-	-
Turkey	0.38	*0.31*	17.30	*14.12*
MIDDLE EAST	**1.05**	**1.39**	**13.82**	**17.96**
Algeria	2.89	*1.26*	6.30	*2.67*
Egypt, Arab Republic	24.77	*26.36*	5.20	*5.29*
Libya	-	-	-	-
Morocco	6.37	*2.29*	11.70	*4.12*
Tunisia	2.87	*0.34*	10.50	*1.22*
NORTH AFRICA	**14.77**	**30.25**	**6.73**	**13.30**
MIDDLE EAST & NORTH AFRICA	**9.38**	**31.64**	**9.54**	**31.26**
MEDITERRANEAN AREA	**6.09**	**33.75**	**11.06**	**60.11**

1.2 - Legend
- ≤ 2
- $2 < x \leq 7.5$
- $7.5 < x \leq 13$
- > 13
- *No data*

Data source [Source (Reference year)]:
1.2 – World data lab (2021)
1.2 Add: People living below 50 percent of median income – World Bank (2019)

3.1.2. Challenge: Scholarship

The primary school enrollment in the four areas of the Med and the pupil/teacher ratio shows differences. MENA countries should improve the lower secondary completion rate. Some OECD countries need pre-primary and tertiary educational improvements. Trends are positive compared to 2020.

Countries and regions	Goal 4				
		Net primary enrollment rate (4.1)	Pupil/teacher, primary		Lower secondary completion rate (4.2)
	-	%	%		
France		99.99	18.18		99.46
Greece		99.11	9.38		93.95
Italy		96.50	11.48		97.54
Malta		99.51	12.94		104.02
Portugal		99.64	12.35		93.60
Spain		97.20	13.13		97.64
Western EuroMed		**98.17**	**14.09**		**97.84**
Albania		96.16	17.57		92.70
Bosnia and Herzegovina		-	16.93		94.21
Croatia		97.81	13.51		100.98
Cyprus		99.49	12.04		98.10
Montenegro		99.93	-		86.69
North Macedonia		99.30	14.91		86.18
Slovenia		99.89	13.80		96.18
Eastern EuroMed		**76.42**	**14.61**		**94.87**
EuroMed		**96.43**	**14.13**		**97.60**
Israel		99.50	12.07		103.22
Jordan		79.92	18.54		66.36
Lebanon		-	12.48		-
Palestine		95.29	24.45		93.11
Syrian Arab Republic		72.39	25.33		53.81
Turkey		95.22	16.98		88.79
MIDDLE EAST		**86.90**	**17.99**		**79.18**
Algeria		99.82	24.32		82.92
Egypt, Arab Republic		99.27	23.68		88.42
Libya		-	-		-
Morocco		99.55	26.80		67.91
Tunisia		99.21	16.87		77.38
NORTH AFRICA		**96.03**	**23.17**		**79.95**
MIDDLE EAST & NORTH AFRICA		**92.43**	**21.10**		**79.65**
MEDITERRANEAN AREA		**94.01**	**18.31**		**86.72**

4.1 - Legend
- ≥ 97
- $97 > x \geq 88.5$
- $88.5 > x \geq 80$
- < 80
- *No data*

4.2 - Legend
- ≥ 90
- $90 > x \geq 82.5$
- $82.5 > x \geq 75$
- < 75
- *No data*

Data source [Source (Reference year)]:
4.1 – UNESCO (2020)
4.1 Add: Pupil-teacher ratio, primary – UNESCO (2018)
4.2 – UNESCO (2020)

Countries and regions	Goal 4: Participation rate in pre-primary organized learning (4.4)		Goal 4: Tertiary educational attainment (4.5)	
	%	mln people left	%	mln people left
France	99.92	0.00	49.45	4.02
Greece	96.66	0.01	43.69	0.66
Italy	91.54	0.14	28.86	4.88
Malta	x	x	x	x
Portugal	92.85	0.02	41.91	0.67
Spain	94.87	0.07	47.38	2.61
Western EuroMed	96.04	0.24	41.90	12.85
Albania	x	x	x	x
Bosnia and Herzegovina	x	x	x	x
Croatia	x	x	x	x
Cyprus	x	x	x	x
Montenegro	x	x	x	x
North Macedonia	x	x	x	x
Slovenia	91.58	0.01	45.43	0.13
Eastern EuroMed	-	-	-	-
EuroMed	-	-	-	-
Israel	99.76	0.00	47.26	0.63
Jordan	x	x	x	x
Lebanon	x	x	x	x
Palestine	x	x	x	x
Syrian Arab Republic	x	x	x	x
Turkey	75.91	0.90	35.33	8.06
MIDDLE EAST (6)	-	-	-	-
Algeria	x	x	x	x
Egypt, Arab Republic	x	x	x	x
Libya	x	x	x	x
Morocco	x	x	x	x
Tunisia	x	x	x	x
NORTH AFRICA	-	-	-	-
MIDDLE EAST & NORTH AFRICA	-	-	-	-
MEDITERRANEAN AREA	-	1.15	-	21.66

4.4 - Legend
- ≥ 90
- $90 > x \geq 80$
- $80 > x \geq 70$
- < 70
- *No data*
- *No OECD Country*

4.5 - Legend
- ≥ 40
- $40 > x \geq 25$
- $25 > x \geq 10$
- < 10
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
4.4 – OECD (2020)
4.5 – OECD (2020)

3.1.3. Challenge: Literacy

Over 2.9 million of youths in MENA do not show good literacy levels. Scientific skills of students should be much improved also in some OECD countries. Educational opportunities become available also for students from low-income families.

Countries and regions	Goal 4: Literacy rate (4.3)		Underachievers in science (4.8)	Resilient students in science (4.9)
	%	mln people left	%	
France	-	-	20.50	28.90
Greece	99.16	0.01	31.70	19.50
Italy	99.93	0.00	25.90	27.40
Malta	99.30	0.00	x	x
Portugal	99.66	0.00	19.60	41.10
Spain	99.62	0.02	21.30	37.30
Western EuroMed	61.21	0.03	22.95	30.57
Albania	99.33	0.00	x	x
Bosnia and Herzeg.	99.66	0.00	x	x
Croatia	99.72	0.00	x	x
Cyprus	99.82	0.00	x	x
Montenegro	99.11	0.00	x	x
North Macedonia	99.09	0.00	x	x
Slovenia	99.80	0.00	14.60	37.70
Eastern EuroMed	99.53	0.01	-	-
EuroMed	64.62	0.04	-	-
Israel	-	-	33.10	16.00
Jordan	99.34	0.01	x	x
Lebanon	99.75	0.00	x	x
Palestine	99.23	0.01	x	x
Syrian Arab Rep.	92.45	0.28	x	x
Turkey	99.91	0.01	25.20	48.20
MIDDLE EAST	92.35	0.32	-	-
Algeria	97.43	0.15	x	x
Egypt, Arab Rep.	88.19	2.21	x	x
Libya	99.60	0.00	x	x
Morocco	97.73	0.13	x	x
Tunisia	96.21	0.06	x	x
NORTH AFRICA	92.27	2.56	-	-
MIDDLE EAST & NORTH AFRICA	92.30	2.88	-	-
MEDITERRANEAN AREA	84.18	2.93	-	-

4.3 - Legend
- ≥ 95
- $95 > x \geq 90$
- $90 > x \geq 85$
- < 85
- *No data*

4.8 - Legend
- ≤ 15
- $15 < x \leq 22.5$
- $22.5 < x \leq 30$
- > 30
- *No data*
- *No OECD Country*

4.9 - Legend
- ≥ 38
- $38 > x \geq 29$
- $29 > x \geq 20$
- < 20
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
4.3 – UNESCO (2020)
4.8 – OECD (2018)
4.9 – OECD (2018)

3.1.4. Challenge: Woman Rights

Woman rights must be carefully monitored e.g. performances look good enough in terms of opportunities for family planning (except for low demands for assistance recorded in Eastern EuroMed and the Middle East) and rate of scholarship (with a few countries performing below 80%). Further improvements are desirable anyhow.

Countries and regions	Goal 5: Demand for family planning satisfied by modern methods (5.1)	Goal 5: Ratio of female to male mean years of education received (5.2
	%	
France	95.50	96.58
Greece	63.50	95.37
Italy	72.00	96.23
Malta	73.00	95.69
Portugal	77.60	103.30
Spain	83.50	99.03
Western EuroMed	**82.46**	**97.35**
Albania	6.30	91.51
Bosnia and Herzegovina	21.90	81.65
Croatia	61.40	90.98
Cyprus	-	98.37
Montenegro	32.90	88.62
North Macedonia	29.60	92.16
Slovenia	75.80	99.21
Eastern EuroMed	E-EU	**90.54**
EuroMed	**78.18**	**97.36**
Israel	68.30	100.77
Jordan	56.70	96.26
Lebanon	60.60	95.51
Palestine	64.60	94.68
Syrian Arab Republic	53.30	82.14
Turkey	60.10	81.11
MIDDLE EAST	**59.47**	**84.63**
Algeria	77.20	92.77
Egypt, Arab Republic	80.00	83.95
Libya	24.00	118.06
Morocco	72.00	71.21
Tunisia	62.70	81.25
NORTH AFRICA	**75.06**	**84.50**
MIDDLE EAST & NORTH AFRICA	**68.83**	**84.55**
MEDITERRANEAN AREA	**72.12**	**90.37**

5.1 - Legend

- ≥ 80
- $80 > x \geq 70$
- $70 > x \geq 60$
- < 60
- *No data*

5.2 - Legend

- ≥ 98
- $98 > x \geq 86.5$
- $86.5 > x \geq 75$
- < 75
- *No data*

Data source [Source (Reference year)]:
5.1 – UNDESA (2020)
5.2 – UNESCO (2019)

3.1.5. Challenge: Woman Emancipation

Opportunities for women should be further supported e.g. in terms of participation in labour force (almost 78.5% in Europe vs. almost 34% in MENA) and policy (e.g. seats held by women in national parliaments: 37.6% in Europe; 17.7% in MENA) and wage gaps in OECD countries. Rates of women in leading positions are very low in Western EuroMed and MENA. In general, all countries should promote significant cultural changes to enhance the position of women in society.

Countries and regions	Goal 5: Ratio of female to male labor force participation rate (5.3) %	Goal 5: Seats held by women in national parliaments (5.4) %
France	84.87	39.52
Greece	73.80	21.67
Italy	69.40	35.71
Malta	71.78	13.43
Portugal	84.88	40.00
Spain	82.12	44.00
Western EuroMed	**78.74**	**38.40**
Albania	77.14	29.51
Bosnia and Herzegovina	64.50	21.43
Croatia	77.96	31.13
Cyprus	83.65	19.64
Montenegro	75.16	22.22
North Macedonia	67.90	38.33
Slovenia	84.89	27.78
Eastern EuroMed	**74.74**	**28.00**
EuroMed	**78.42**	**37.57**
Israel	87.70	27.50
Jordan	22.84	15.39
Lebanon	32.03	4.69
Palestine	25.93	-
Syrian Arab Republic	19.79	11.20
Turkey	47.49	17.32
MIDDLE EAST	**42.67**	**15.77**
Algeria	25.10	25.80
Egypt, Arab Republic	25.90	15.10
Libya	52.10	16.00
Morocco	30.80	20.50
Tunisia	36.10	24.90
NORTH AFRICA	**28.10**	**18.94**
MIDDLE EAST & NORTH AFRICA	**33.88**	**17.69**
MEDITERRANEAN AREA	**51.57**	**25.52**

5.3 - Legend
- ≥ 70
- $70 > x \geq 60$
- $60 > x \geq 50$
- < 50
- *No data*

5.4 - Legend
- ≥ 40
- $40 > x \geq 30$
- $30 > x \geq 20$
- < 20
- *No data*

Data source [Source (Reference year)]:
5.3 – ILO (2019)
5.4 – IPU (2020)

Countries and regions	Goal 5		Goal 9
	Firms with F top manager	Gender wage gap (5.5)	Female share of graduates from STEM fields at the tertiary level (9.10)
	%	%	%
France	-	13.70	31.81
Greece	17.20	4.50	40.09
Italy	15.30	5.60	39.52
Malta	11.30	x	x
Portugal	14.00	9.60	37.76
Spain	-	11.50	29.56
Western EuroMed	**6.46**	**9.92**	**-**
Albania	18.10	x	x
Bosnia and Herzeg.	16.60	x	x
Croatia	27.00	x	x
Cyprus	8.20	x	x
Montenegro	15.00	x	x
North Macedonia	21.30	x	x
Slovenia	18.80	5.00	33.32
Eastern EuroMed	**19.59**	**-**	**-**
EuroMed	**7.51**	**-**	**-**
Israel	10.10	22.70	-
Jordan	3.10	x	x
Lebanon	5.90	x	x
Palestine	0.90	x	x
Syrian Arab Repub.	22.80	x	x
Turkey	3.90	6.90	34.69
MIDDLE EAST	**7.01**	**-**	**-**
Algeria	-	x	x
Egypt, Arab Repub.	6.30	x	x
Libya	-	x	x
Morocco	5.40	x	x
Tunisia	10.40	x	x
NORTH AFRICA	**4.82**	**-**	**-**
MIDDLE EAST & NORTH AFRICA	**5.68**	**-**	**-**
MEDITERRANEAN AREA	**6.40**	**-**	**-**

5.5 - Legend

- ≤ 8
- $8 < x \leq 14$
- $14 < x \leq 20$
- > 20
- *No data*
- *No OECD Country*

9.10 - Legend

- ≥ 33
- $33 > x \geq 29$
- $29 > x \geq 25$
- < 25
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
5.4 Add: Firms with female top manager – World Bank (2020)
5.5 – OECD (2019)
9.10 – World Bank (2018)

3.1.6. Challenge: Job Market

The job market looks stagnant. Unemployment rates are around 11.7% in average in MED, with alarming values in Western Europe (13.8 million) and MENA (26.2 million) and over 41 million in total. The NEET phenomenon is increasing in all OECD countries involving almost 8 million youths.

Countries and regions	Goal 8: Unemployment rate (8.4) mln	Goal 8: Unemployment rate (8.4) %	Goal 8: Youth not in employment, education or training (NEET) (8.7) mln	Goal 8: Youth not in employment, education or training (NEET) (8.7) %
France	8.62	3.58	15.03	1.21
Greece	16.85	1.13	18.75	0.21
Italy	9.31	3.75	23.46	1.41
Malta	4.09	0.01	x	x
Portugal	7.20	0.49	11.06	0.12
Spain	15.67	4.88	18.47	0.84
Western EuroMed	10.92	13.83	18.15	3.79
Albania	11.70	0.25	x	x
Bosnia and Herzegovina	16.85	0.46	x	x
Croatia	7.20	0.20	x	x
Cyprus	7.21	0.07	x	x
Montenegro	15.86	0.06	x	x
North Macedonia	18.40	0.27	x	x
Slovenia	5.17	0.07	9.07	0.02
Eastern EuroMed	9.60	1.37	-	-
EuroMed	10.81	15.21	-	-
Israel	4.61	0.25	13.99	0.19
Jordan	18.50	1.27	x	x
Lebanon	6.61	0.26	x	x
Palestine	27.35	0.77	x	x
Syrian Arab Republic	9.03	1.09	x	x
Turkey	13.92	7.80	28.77	3.69
MIDDLE EAST	13.14	11.43	-	-
Algeria	12.83	3.54	x	x
Egypt, Arab Republic	10.45	6.74	x	x
Libya	19.39	0.83	x	x
Morocco	10.15	2.38	x	x
Tunisia	16.69	1.29	x	x
NORTH AFRICA	11.59	14.78	-	-
MIDDLE EAST & NORTH AFRICA	12.22	26.21	-	-
MEDITERRANEAN AREA	11.67	41.42	-	7.69

8.4 - Legend

- ≤ 5
- $5 < x \leq 7.5$
- $7.5 < x \leq 10$
- > 10
- *No data*

8.7 - Legend

- ≤ 10
- $10 < x \leq 12.5$
- $12.5 < x \leq 15$
- > 15
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
8.4 – ILO (2020)
8.7 – OECD (2020)

3.1.7. Challenge: Labor Rights

Numbers show an unexpected scenario with almost 2 million workers overexploited or underpaid in the MED area, including European countries (almost 600,000). The exploitation of child labor involves 114 million children, 2.1 million of which in Europe. Rates of "regular" workers with proper contracts should be improved (67% in MENA).

Countries and regions		Goal 8			
			Victims of modern slavery (8.2)		Wage and salaried workers
			n./10^3	*n.*	%
France			2.01	*135,370.44*	87.87
Greece			7.91	*84,433.33*	68.10
Italy			2.43	*151,175.72*	77.26
Malta			-	-	84.30
Portugal			2.48	*25,689.87*	83.14
Spain			2.27	*107,141.95*	84.32
Western EuroMed			**2.54**	**503,811.30**	**82.32**
Albania			6.87	*21,055.20*	45.73
Bosnia and Herzegovina			3.42	*13,165.42*	75.10
Croatia			5.99	*25,595.09*	87.65
Cyprus			4.23	*5,228.69*	86.35
Montenegro			5.86	*3,599.38*	79.41
North Macedonia			8.66	*18,350.77*	78.92
Slovenia			2.17	*4,567.71*	86.33
Eastern EuroMed			**5.31**	**91,562.26**	**75.50**
EuroMed			**2.76**	**595,373.56**	**81.74**
Israel			3.86	*32,466.63*	87.69
Jordan			1.80	*18,865.86*	86.08
Lebanon			1.72	*10,463.23*	62.53
Palestine			-	-	71.44
Syrian Arab Republic			-	-	60.45
Turkey			6.50	*527,816.83*	68.46
MIDDLE EAST			**4.59**	**589,612.54**	**69.75**
Algeria			2.66	*110,549.88*	67.71
Egypt, Arab Republic			5.52	*548,628.14*	69.57
Libya			-	-	61.66
Morocco			2.45	*85,286.51*	51.44
Tunisia			2.18	*25,068.71*	74.84
NORTH AFRICA			**3.97**	**769,533.24**	**65.88**
MIDDLE EAST & NORTH AFRICA			**4.21**	**1,359,145.78**	**67.45**
MEDITERRANEAN AREA			**3.63**	**1,954,519.34**	**73.10**

8.2 - Legend
- ≤ 4
- $4 < x \leq 7$
- $7 < x \leq 10$
- > 10
- *No data*

Data source [Source (Reference year)]:
8.2 – Walk Free Foundation (2018)
8.2 Add: Wage and salaried workers – ILO (2019)

Countries and regions		Goal 16: Children involved in child labor (16.7)	
		%	mln
France		0.00	0.00
Greece		0.00	0.00
Italy		0.00	0.00
Malta		-	-
Portugal		0.00	0.00
Spain		0.00	0.00
Western EuroMed		0.00	0.00
Albania		2.80	0.97
Bosnia and Herzegovina		-	-
Croatia		-	-
Cyprus		-	-
Montenegro		7.70	0.57
North Macedonia		2.40	0.55
Slovenia		0.00	0.00
Eastern EuroMed		1.20	2.10
EuroMed		0.09	2.10
Israel		0.00	0.00
Jordan		1.20	2.88
Lebanon		-	-
Palestine		1.80	2.16
Syrian Arab Republic		-	-
Turkey		-	-
MIDDLE EAS		0.22	5.04
Algeria		3.72	29.87
Egypt, Arab Republic		3.58	73.89
Libya		-	-
Morocco		-	-
Tunisia		1.76	3.35
NORTH AFRICA		2.79	107.11
MIDDLE EAST & NORTH AFRICA		1.82	112.16
MEDITERRANEAN AREA		1.35	114.25

16.7 - Legend

- ≤ 2
- $2 < x \leq 6$
- $6 < x \leq 10$
- > 10
- *No data*

Data source [Source (Reference year)]:
16.7 – UNICEF (2019)

3.1.8. Challenge: Press Freedom

Based on a survey on the degree of freedom available to journalists, countries in the MENA area show the most critical limitations, with an average value of the index higher than 50. The average for Europe is almost 23 points. Initiatives to safeguard freedom of press as well as to increase professionalism of journalists are desirable.

Countries and regions	Goal 16 Press Freedom Index (16.9) %
France	22.60
Greece	29.01
Italy	23.39
Malta	30.46
Portugal	10.11
Spain	20.44
Western EuroMed	**22.05**
Albania	30.59
Bosnia and Herzegovina	28.34
Croatia	27.95
Cyprus	19.85
Montenegro	34.33
North Macedonia	31.67
Slovenia	23.10
Eastern EuroMed	**28.00**
EuroMed	**22.52**
Israel	30.90
Jordan	42.89
Lebanon	34.93
Palestine	43.18
Syrian Arab Republic	70.63
Turkey	49.79
MIDDLE EAST	**50.34**
Algeria	47.26
Egypt, Arab Republic	56.17
Libya	55.73
Morocco	43.94
Tunisia	29.53
NORTH AFRICA	**50.58**
MIDDLE EAST & NORTH AFRICA	**50.48**
MEDITERRANEAN AREA	**39.56**

16.9 - Legend

- ≤ 30
- $30 < x \leq 40$
- $40 < x \leq 50$
- > 50
- *No data*

Data source [Source (Reference year)]:
16.9 – Reporters sans frontières (2021)

3.1.9. Challenge: Wealth Distribution

Values are correlated to the GINI index measuring the level of inequality in family incomes. Inhomogeneity is recorded in all MED area with highest values in the Middle East. It is an alarming phenomenon also in Europe and with consequent risks of unfair economies and social instability.

Countries and regions	Goal 10 Gini coefficient adjusted for top income (10.1)
France	33.31
Greece	45.14
Italy	38.83
Malta	29.61
Portugal	42.14
Spain	38.55
Western EuroMed	**37.39**
Albania	41.68
Bosnia and Herzegovina	34.15
Croatia	36.58
Cyprus	33.95
Montenegro	40.50
North Macedonia	44.01
Slovenia	27.38
Eastern EuroMed	**36.68**
EuroMed	**37.33**
Israel	43.21
Jordan	41.06
Lebanon	36.17
Palestine	-
Syrian Arab Republic	46.47
Turkey	49.04
MIDDLE EAST	**45.29**
Algeria	31.52
Egypt, Arab Republic	49.60
Libya	-
Morocco	39.75
Tunisia	40.00
NORTH AFRICA	**41.66**
MIDDLE EAST & NORTH AFRICA	**43.12**
MEDITERRANEAN AREA	**40.78**

10.1 - Legend

- ≤ 30
- $30 < x \leq 35$
- $35 < x \leq 40$
- > 40
- *No data*

Data source [Source (Reference year)]:
10.1 – Chandy and Seidel (2017)

3.1.10. Challenge: Domestic Policy

Total general (local, regional and central) government expenditure on health and education ranges from 12% of GDP in Western EuroMed to around 7% in Eastern EuroMed and MENA. Much higher effort is needed to support and guarantee the provision of essential services in this fields.

Countries and regions	Goal 17 – Government spending on health and education (17.1) – % of GDP
France	13.71
Greece	7.97
Italy	10.45
Malta	10.52
Portugal	10.80
Spain	10.53
Western EuroMed	**11.74**
Albania	6.45
Bosnia and Herzegovina	-
Croatia	9.60
Cyprus	8.68
Montenegro	-
North Macedonia	7.07
Slovenia	10.79
Eastern EuroMed	**7.03**
EuroMed	**10.20**
Israel	10.96
Jordan	6.90
Lebanon	6.61
Palestine	-
Syrian Arab Republic	6.75
Turkey	5.94
MIDDLE EAST	**6.65**
Algeria	8.43
Egypt, Arab Republic	5.18
Libya	6.09
Morocco	7.40
Tunisia	10.78
NORTH AFRICA	**7.84**
MIDDLE EAST & NORTH AFRICA	**6.91**
MEDITERRANEAN AREA	**7.13**

17.1 - Legend

- ≥ 10
- $10 > x \geq 7.5$
- $7.5 > x \geq 5$
- < 5
- *No data*

Data source [Source (Reference year)]:
17.1 – UNESCO (2018)

3.2 Transformation 2. Health, Wellbeing and Demography

A set of indicators has been selected as the most relevant to report on the current state, highlight hotspots and track the progress towards the Transformation 2. This aims to promote initiatives and investments for health and wellbeing, starting from the principal output of a universal health coverage and publicly financed health systems that integrates prevention, therapeutic and palliative services, disease surveillance and control. Community health programs, including policies to raise the quality of life and promote healthy lifestyles, can improve health outcomes significantly (Sachs et al. 2019).

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Figure 3.2 | Selected indicators and challenges in the transformation 2. Health, Wellbeing and Demography.

GOALS	INDICATORS	CHALLENGES
2. ZERO HUNGER	Prevalence of undernourishment Prevalence of stunting in children under 5 years of age Prevalence of wasting in children under 5 years of age	**Malnutrition**
	Prevalence of obesity, BMI ≥ 30	**Food habits (diet)**
3. GOOD HEALTH AND WELLBEING	Maternal mortality rate Neonatal mortality rate Births attended by skilled health personnel Mortality rate, under-5 Surviving infants who received 2 WHO recommended Vaccines	**Healthcare**
	Incidence of tuberculosis New HIV infections Age-standardized death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations aged 30–70 years Daily smokers	**Healthy enviroment**
	Life expectancy Universal health coverage (UHC) service coverage index Subjective Wellbeing	**Wellbeing**
6. CLEAN WATER AND SANITATION	Population using at least basic drinking water services Population using at least basic sanitation services	**Water management**
7. AFFORDABLE AND CLEAN ENERGY	Population with access to electricity	**Energy suppply**
11. SUSTAINABLE CITIES AND COMMUNITIES	Annual mean concentration of particulate matter of less than 2.5 microns in diameter (PM 2.5) PM2.5 air pollution, population exposed	**Air quality**
16. PEACE, JUSTICE AND STRONG ISTITUTIONS	Exports of major conventional	**Weapons market**

Figure 3.2 shows the 21 representative indicators and the corresponding Goals, that allowed for identifying the 9 challenges to be faced to accomplish the transformation. The following records, one per each challenge, show values of the indicators. Indicators in the tables are often coupled with the corresponding absolute values, such as the number of people involved, and, when useful, other additional data for their interpretation. References for all indicators and additional data (namely, Add.) are listed in captions.

3.2.1. Challenge: Malnutrition

Precarious conditions of health induced by malnutrition require attention in the MENA area: almost 13 million people undernourished, 2 million children with wasting and almost 6 million children with stunted growth. Precarious conditions of health induced by malnutrition can have negative effects in the long run such as, besides healthiness, in terms of social wellness and economic costs. Interventions to avoid the insurgency of these problems would increase healthiness of next generation adult population.

Countries and regions		Goal 2 Prevalence of undernourishment (2.1)		
			%	mln
France			2.50	1.69
Greece			2.50	0.27
Italy			2.50	1.56
Malta			2.50	0.01
Portugal			2.50	0.26
Spain			2.50	1.18
Western EuroMed			2.50	4.96
Albania			3.90	0.12
Bosnia and Herzrgovina			2.50	0.10
Croatia			2.50	0.11
Cyprus			2.50	0.03
Montenegro			2.50	0.02
North Macedonia			2.70	0.06
Slovenia			2.50	0.05
Eastern EuroMed			2.77	0.48
EuroMed			2.52	5.44
Israel			2.50	0.21
Jordan			9.50	1.01
Lebanon			9.30	0.54
Palestine			-	-
Syrian Arab Republic			-	-
Turkey			2.50	2.04
MIDDLE EAST			2.93	3.81
Algeria			3.90	1.65
Egypt, Arab Republic			5.40	5.50
Libya			-	-
Morocco			4.20	1.48
Tunisia			3.00	0.35
NORTH AFRICA			4.54	8.97
MIDDLE EAST & NORTH AFRICA			3.90	12.78
MEDITERRANEAN AREA			3.35	18.23

2.1 - Legend
- ≤ 7.5
- $7.5 < x \leq 11.5$
- $11.5 < x \leq 15$
- > 15
- *No data*

Data source [Source (Reference year)]:
2.1 – FAO (2019)

Countries and regions		Goal 2					
		Prevalence of stunting in children under 5 years of age			Prevalence of wasting in children under 5 years of age		
		mln		%	mln		
France			2.58	0.11		0.70	0.03
Greece			2.58	0.01		0.70	0.00
Italy			2.58	0.07		0.70	0.02
Malta			2.58	0.00		0.70	0.00
Portugal			3.20	0.01		0.60	0.00
Spain			2.58	0.05		0.70	0.01
Western EuroMed			2.61	0.25		0.70	0.07
Albania			11.30	0.02		1.60	0.00
Bosnia and Herzrg.			8.90	0.01		2.30	0.00
Croatia			2.58	0.00		0.70	0.00
Cyprus			2.58	0.00		0.70	0.00
Montenegro			7.20	0.00		2.20	0.00
North Macedonia			4.30	0.00		3.40	0.00
Slovenia			2.58	0.00		0.70	0.00
Eastern EuroMed			6.18	0.05		1.63	0.01
EuroMed			2.90	0.31		0.77	0.08
Israel			2.58	0.02		0.70	0.01
Jordan			7.80	0.09		2.40	0.03
Lebanon			16.50	0.06		6.60	0.02
Palestine			8.70	0.05		1.30	0.01
Syrian Arab Rep.			27.90	0.64		11.50	0.27
Turkey			6.00	0.36		1.70	0.10
MIDDLE EAST			10.90	1.23		3.83	0.43
Algeria			9.80	0.43		2.70	0.12
Egypt, Arab Rep.			22.30	3.01		9.50	1.28
Libya			38.10	0.31		10.20	0.08
Morocco			15.10	0.48		2.60	0.08
Tunisia			8.40	0.08		2.10	0.02
NORTH AFRICA			18.85	4.31		6.94	1.59
MIDDLE EAST & NORTH AFRICA			16.22	5.54		5.91	2.02
MEDITERRANEAN AREA			13.07	5.84		4.70	2.10

2.2 - Legend

- ≤ 7.5
- $7.5 < x \leq 11.5$
- $11.5 < x \leq 15$
- > 15
- *No data*

2.3 - Legend

- ≤ 5
- $5 < x \leq 7.5$
- $7.5 < x \leq 10$
- > 10
- *No data*

Data source [Source (Reference year)]:
2.2 – UNICEF et al. (2020)
2.3 – UNICEF et al. (2020)

3.2.2. Challenge: Food Habits (Diet)

Obesity affects 22% of the population in Europe and 30% in MENA, namely almost 34 million people in Western EuroMed, 33 million in NA and 25 million in ME. Trend are emerging towards high-protein diets and progressive abandon of the Mediterranean diet.

Countries and regions		**Goal 2**		
			Prevalence of obesity, BMI ≥ 30	
			%	mln
France			21.60	10.89
Greece			24.90	2.14
Italy			19.90	10.05
Malta			28.90	0.10
Portugal			20.80	1.73
Spain			23.80	8.98
Western EuroMed			21.74	33.90
Albania			21.70	0.48
Bosnia and Herzegovina			17.90	0.56
Croatia			24.40	0.84
Cyprus			21.80	0.21
Montenegro			23.30	0.11
North Macedonia			22.40	0.36
Slovenia			20.20	0.34
Eastern EuroMed			21.47	2.91
EuroMed			21.72	36.80
Israel			26.10	1.37
Jordan			35.50	1.94
Lebanon			32.00	1.34
Palestine			-	-
Syrian Arab Republic			27.80	2.73
Turkey			32.10	17.19
MIDDLE EAST			30.55	24.56
Algeria			27.40	7.03
Egypt, Arab Republic			32.00	17.38
Libya			32.50	1.21
Morocco			26.10	5.63
Tunisia			26.90	2.07
NORTH AFRICA			29.50	33.33
MIDDLE EAST & NORTH AFRICA			29.93	57.89
MEDITERRANEAN AREA			26.10	94.69

2.4 - Legend

- ≤ 10
- $10 < x \leq 17.5$
- $17.5 < x \leq 25$
- > 25
- *No data*

3.2.3. Challenge: Healthcare

Relevant improvements are needed in NA countries in terms of equipment and medical assistance at birth and availability of skilled personnel (the lack of medical staff is especially relevant in Morocco with only 86.6% of properly assisted births).

Countries and regions		Goal 3: Maternal mortality rate (3.1)		Goal 3: Neonatal mortality rate (3.2)	
		n./10^5	*n. people*	n./10^5	*n. people*
France	W-EU	8.00	*5,370.09*	2.70	*1,825.90*
Greece	W-EU	3.00	*320.94*	2.30	*244.68*
Italy	W-EU	2.00	*1,241.66*	1.90	*1,183.14*
Malta	W-EU	6.00	*26.67*	4.70	*21.31*
Portugal	W-EU	8.00	*829.65*	2.00	*206.29*
Spain	W-EU	4.00	*1,889.28*	1.80	*850.94*
Western EuroMed		4.89	*9,678.29*	2.18	*4,332.26*
Albania	E-EU	15.00	*458.29*	7.50	*230.47*
Bosnia and Herzegovina	E-EU	10.00	*385.38*	4.20	*161.29*
Croatia	E-EU	8.00	*343.41*	2.90	*123.26*
Cyprus	E-EU	6.00	*73.32*	1.30	*16.29*
Montenegro	E-EU	6.00	*36.98*	1.30	*7.96*
North Macedonia	E-EU	7.00	*148.03*	3.90	*82.77*
Slovenia	E-EU	7.00	*147.10*	1.20	*25.23*
Eastern EuroMed		9.23	*1,592.51*	3.75	*647.27*
EuroMed		5.24	*11,270.79*	2.31	*4,979.54*
Israel	ME	3.00	*248.42*	1.90	*162.13*
Jordan	ME	46.00	*4,713.85*	9.20	*981.56*
Lebanon	ME	29.00	*1,804.92*	4.20	*245.32*
Palestine	ME	27.00	*1,226.20*	10.70	*505.55*
Syrian Arab Republic	ME	31.00	*5,413.59*	10.80	*2,007.15*
Turkey	ME	17.00	*13,737.37*	5.30	*4,326.29*
MIDDLE EAST		21.28	*27,144.36*	6.33	*8,227.99*
Algeria	NA	112.00	*45,866.59*	16.30	*6,895.81*
Egypt, Arab Republic	NA	37.00	*35,903.80*	11.10	*11,296.22*
Libya	NA	72.00	*4,667.81*	6.50	*439.27*
Morocco	NA	70.00	*24,157.15*	13.60	*4,789.56*
Tunisia	NA	43.00	*4,903.32*	11.90	*1,382.88*
NORTH AFRICA		60.67	*115,498.67*	12.55	*24,803.74*
MIDDLE EAST & NORTH AFRICA		44.86	*142,643.02*	10.08	*33,031.73*
MEDITERRANEAN AREA		28.87	*153,913.82*	6.99	*38,011.26*

3.1 - Legend
- ≤ 70
- $70 < x \leq 105$
- $105 < x \leq 140$
- > 140
- *No data*

3.2 - Legend
- ≤ 12
- $12 < x \leq 15$
- $15 < x \leq 18$
- > 18
- *No data*

Data source [Source (Reference year)]:
3.1 – WHO et al. (2017)
3.2 – UNICEF et al. (2019)

Countries and regions		Goal 3 Births attended by skilled health personnel (3.11) %	 *mln people left*
France	W-EU	98.10	*0.27*
Greece	W-EU	99.90	*0.00*
Italy	W-EU	99.90	*0.01*
Malta	W-EU	99.70	*0.00*
Portugal	W-EU	98.70	*0.03*
Spain	W-EU	-	-
Western EuroMed		74.93	*0.32*
Albania	E-EU	99.80	*0.00*
Bosnia and Herzegovina	E-EU	99.90	*0.00*
Croatia	E-EU	99.90	*0.00*
Cyprus	E-EU	98.30	*0.01*
Montenegro	E-EU	98.80	*0.00*
North Macedonia	E-EU	99.90	*0.00*
Slovenia	E-EU	99.80	*0.00*
Eastern EuroMed		99.71	*0.01*
EuroMed		77.08	*0.33*
Israel	ME	-	-
Jordan	ME	99.70	*0.01*
Lebanon	ME	98.20	*0.03*
Palestine	ME	99.60	*0.00*
Syrian Arab Republic	ME	96.20	*0.18*
Turkey	ME	98.00	*0.43*
MIDDLE EAST		92.17	*0.65*
Algeria	NA	96.60	*0.37*
Egypt, Arab Republic	NA	91.50	*2.16*
Libya	NA	99.90	*0.00*
Morocco	NA	86.60	*1.23*
Tunisia	NA	99.50	*0.01*
NORTH AFRICA		92.46	*3.77*
MIDDLE EAST & NORTH AFRICA		92.34	*4.42*
MEDITERRANEAN AREA		86.84	*4.75*

3.11 - Legend
- ≥ 98
- $98 > x \geq 94$
- $94 > x \geq 90$
- < 90
- *No data*

Data source [Source (Reference year)]:
3.11 – UNICEF (2018)

3.2.4. Challenge: Healthcare

Med child mortality rate (12%) is below the world optimal threshold (25%). Basic improvements are needed in NA (almost 21%) with almost 40,800 children affected. The national routine immunisation coverage of infants is estimated good in most of the MED area with deficits in some countries of Eastern Europe and MENA.

Countries and regions		Goal 3					
		Mortality rate, under-5 (3.3)			Surviving infants who received 2 WHO recommended Vaccines (3.12)		
			n./10^5	*n. people*		%	*mln people left*
France	W-EU	🟢	4.50	*3,043.17*	🟢	90.00	*0.10*
Greece	W-EU	🟢	3.80	*404.25*	🟢	97.00	*0.00*
Italy	W-EU	🟢	3.10	*1,930.39*	🟢	92.00	*0.05*
Malta	W-EU	🟢	7.00	*31.73*	🟢	95.00	*0.00*
Portugal	W-EU	🟢	3.70	*381.64*	🟢	99.00	*0.00*
Spain	W-EU	🟢	3.10	*1,465.51*	🟢	98.00	*0.01*
Western EuroMed			3.65	*7,256.70*		92.99	*0.17*
Albania	E-EU	🟢	9.70	*298.08*	🟢	95.00	*0.00*
Bosnia and Herzegovina	E-EU	🟢	5.90	*226.58*	🔴	68.00	*0.01*
Croatia	E-EU	🟢	4.80	*204.02*	🟢	93.00	*0.00*
Cyprus	E-EU	🟢	2.30	*28.81*	🟡	86.00	*0.00*
Montenegro	E-EU	🟢	2.30	*14.08*	🔴	24.00	*0.01*
North Macedonia	E-EU	🟢	6.10	*129.46*	🔴	75.00	*0.01*
Slovenia	E-EU	🟢	2.10	*44.15*	🟢	94.00	*0.00*
Eastern EuroMed			5.48	*945.18*		82.96	*0.04*
EuroMed			3.80	*8,201.88*		92.17	*0.21*
Israel	ME	🟢	3.70	*315.72*	🟢	98.00	*0.00*
Jordan	ME	🟢	15.60	*1,664.38*	🔴	76.00	*0.07*
Lebanon	ME	🟢	7.20	*420.55*	🔴	71.00	*0.02*
Palestine	ME	🟢	19.40	*916.60*	🟢	99.00	*0.00*
Syrian Arab Republic	ME	🟢	21.50	*3,995.71*	🔴	49.00	*0.29*
Turkey	ME	🟢	10.00	*8,162.81*	🟢	95.00	*0.08*
MIDDLE EAST			11.91	*15,475.78*		83.31	*0.47*
Algeria	NA	🟢	23.30	*9,857.20*	🟠	80.00	*0.22*
Egypt, Arab Republic	NA	🟢	20.30	*20,658.85*	🟢	94.00	*0.20*
Libya	NA	🟢	11.50	*777.17*	🔴	73.00	*0.05*
Morocco	NA	🟢	21.40	*7,536.51*	🟢	99.00	*0.01*
Tunisia	NA	🟢	16.90	*1,963.93*	🟢	92.00	*0.02*
NORTH AFRICA			20.64	*40,793.65*		91.18	*0.50*
MIDDLE EAST & NORTH AFRICA			17.17	*56,269.43*		88.58	*0.97*
MEDITERRANEAN AREA			11.86	*64,471.31*		86.39	*1.18*

3.3 - Legend

- 🟢 ≤ 25
- 🟡 $25 < x \leq 37.5$
- 🟠 $37.5 < x \leq 50$
- 🔴 > 50
- ⚪ *No data*

3.12 – Legend

- 🟢 ≥ 90
- 🟡 $90 > x \geq 85$
- 🟠 $85 > x \geq 80$
- 🔴 < 80
- ⚪ *No data*

Data source [Source (Reference year)]: 3.3 – UNICEF et al. (2019) / 3.12 – WHO and UNICEF (2020)

3.2.5. Challenge: Healthy Environment

Tubercolosis is still an illness affecting 120.000 people, with the great majority in African Med Countries but also with some cases in Euro-Med and Middle East countries. Whereas nex HIV infections affect mostly people from the northern shore of the Mediterranean than from the south one. These pictures shows that Mediterranean countries still have some gaps with healty and sanitary environment.

Countries and regions		Goal 3 — Incidence of tuberculosis (3.4)		New HIV infections (3.5)	
		n./10^5	*n. people*	n./10^3	*n. people*
France	W-EU	8.70	*5,883.46*	0.10	*6,762.60*
Greece	W-EU	4.30	*457.44*	-	-
Italy	W-EU	7.10	*4,421.21*	0.04	*2,490.82*
Malta	W-EU	14.00	*63.46*	-	-
Portugal	W-EU	19.00	*1,959.78*	-	-
Spain	W-EU	9.30	*4,396.54*	0.06	*2,836.48*
Western EuroMed		8.65	*17,181.90*	0.06	*12,089.90*
Albania	E-EU	16.00	*491.67*	0.03	*92.19*
Bosnia and Herzeg.	E-EU	27.00	*1,036.88*	-	-
Croatia	E-EU	8.00	*340.04*	0.02	*85.01*
Cyprus	E-EU	5.30	*66.39*	-	-
Montenegro	E-EU	15.00	*91.81*	0.05	*30.60*
North Macedonia	E-EU	12.00	*254.69*	-	-
Slovenia	E-EU	5.40	*113.53*	-	-
Eastern EuroMed		13.88	*2,395.00*	0.01	*207.80*
EuroMed		9.07	*19,576.91*	0.06	*12,297.70*
Israel	ME	2.90	*247.46*	-	-
Jordan	ME	5.50	*586.80*	-	-
Lebanon	ME	13.00	*759.33*	0.03	*175.23*
Palestine	ME	0.53	*25.04*	-	-
Syrian Arab Rep.	ME	19.00	*3,531.09*	0.00	*0.00*
Turkey	ME	16.00	*13,060.50*	-	-
MIDDLE EAST		14.01	*18,210.22*	0.00	*175.23*
Algeria	NA	61.00	*25,806.39*	0.05	*2,115.28*
Egypt, Arab Rep.	NA	12.00	*12,212.13*	0.05	*5,088.39*
Libya	NA	59.00	*3,987.20*	0.07	*473.06*
Morocco	NA	97.00	*34,160.84*	0.02	*704.35*
Tunisia	NA	35.00	*4,067.31*	0.05	*581.04*
NORTH AFRICA		40.59	*80,233.87*	0.05	*8,962.11*
MIDDLE EAST & NORTH AFRICA		30.05	*98,444.09*	0.03	*9,137.34*
MEDITERRANEAN AREA		21.72	*118,021.00*	0.04	*21,435.05*

3.4 – Legend
- ≤ 10
- $10 < x \leq 42.5$
- $42.5 < x \leq 75$
- > 75
- *No data*

3.5 – Legend
- ≤ 0.2
- $0.2 < x \leq 0.6$
- $0.6 < x \leq 1$
- > 1
- *No data*

Data source [Source (Reference year)]: 3.4 – WHO (2019) / 3.5 – UNAIDS (2019)

Countries and regions		Goal 3 Age-standardized death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations aged 30–70 years (3.6)		Daily smokers (3.17)	
		n./10^5	*n. people*	%	*mln*
France	W-EU	10.60	*3,637.73*	24.00	*13.29*
Greece	W-EU	12.40	*727.49*	24.90	*2.26*
Italy	W-EU	9.50	*3,336.51*	18.60	*10.03*
Malta	W-EU	10.80	*26.16*	x	*x*
Portugal	W-EU	11.10	*647.12*	14.20	*1.26*
Spain	W-EU	9.90	*2,689.50*	19.80	*7.97*
Western EuroMed		10.19	*11,064.51*	-	-
Albania	E-EU	17.00	*241.82*	x	*x*
Bosnia and Herzeg.	E-EU	17.80	*405.69*	x	*x*
Croatia	E-EU	16.70	*405.40*	x	*x*
Cyprus	E-EU	11.30	*74.33*	x	*x*
Montenegro	E-EU	20.60	*67.77*	x	*x*
North Macedonia	E-EU	20.30	*233.79*	x	*x*
Slovenia	E-EU	12.70	*153.97*	17.40	*0.31*
Eastern EuroMed		16.70	*1,582.76*	-	-
EuroMed		10.72	*12,647.28*	-	-
Israel	ME	9.60	*336.02*	16.40	*1.04*
Jordan	ME	19.20	*658.19*	x	*x*
Lebanon	ME	17.90	*507.55*	x	*x*
Palestine	ME	-		x	*x*
Syrian Arab Rep.	ME	21.80	*1,364.41*	x	*x*
Turkey	ME	16.10	*6,051.13*	28.00	*17.61*
MIDDLE EAST		5.22	*8,917.31*	-	-
Algeria	NA	14.20	*2,452.82*	x	*x*
Egypt, Arab Rep.	NA	27.70	*9,394.22*	x	*x*
Libya	NA	20.10	*514.46*	x	*x*
Morocco	NA	12.40	*1,809.13*	x	*x*
Tunisia	NA	16.10	*865.16*	x	*x*
NORTH AFRICA		20.40	*15,035.79*	-	-
MIDDLE EAST & NORTH AFRICA		13.92	*23,953.10*	-	-
MEDITERRANEAN AREA		14.84	*36,600.37*	-	-

3.6 – Legend
- ≤ 15
- $15 < x \leq 20$
- $20 < x \leq 25$
- > 25
- *No data*

3.17 – Legend
- ≤ 18
- $18 < x \leq 25$
- $25 < x \leq 32$
- > 35
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
3.6 – WHO (2016)
3.17 – OECD (2020)

3.2.6. Challenge: Wellbeing

Western EuroMed shows the best performances in terms of healthiness and wellbeing, that is indirectly correlated, albeit not exclusively, with food, land and water quality. Mediterranean diet can play a relevant role for improvements as it determines half the rate of cardiovascular mortality and the highest longevity.

Countries and regions		Goal 3: Life expectancy at birth (3.9)	Goal 3: Universal health coverage (UHC) service coverage index (3.13)	Goal 3: Subjective Wellbeing (3.14)
		years	-	-
France	W-EU	82.48	78.00	6.70
Greece	W-EU	81.10	75.00	5.80
Italy	W-EU	82.97	82.00	6.50
Malta	W-EU	81.89	82.00	6.20
Portugal	W-EU	81.57	82.00	5.80
Spain	W-EU	83.22	83.00	6.50
Western EuroMed		82.69	80.50	6.49
Albania	E-EU	78.00	59.00	5.40
Bosnia and Herzegovina	E-EU	76.75	61.00	6.00
Croatia	E-EU	78.64	71.00	6.50
Cyprus	E-EU	83.14	78.00	6.30
Montenegro	E-EU	75.88	68.00	5.40
North Macedonia	E-EU	74.82	72.00	5.00
Slovenia	E-EU	81.31	79.00	6.50
Eastern EuroMed		78.19	68.13	5.95
EuroMed		82.33	79.51	6.45
Israel	ME	82.62	82.00	7.30
Jordan	ME	77.87	76.00	4.10
Lebanon	ME	76.44	73.00	4.00
Palestine	ME	-	71.80	4.60
Syrian Arab Republic	ME	72.67	60.00	3.50
Turkey	ME	78.63	74.00	4.90
MIDDLE EAST		75.02	72.64	4.74
Algeria	NA	77.13	78.00	4.70
Egypt, Arab Republic	NA	71.82	68.00	4.50
Libya	NA	75.78	64.00	5.30
Morocco	NA	72.99	70.00	4.80
Tunisia	NA	77.04	70.00	4.70
NORTH AFRICA		73.61	70.50	4.63
MIDDLE EAST & NORTH AFRICA		74.17	71.36	4.68
MEDITERRANEAN AREA		77.41	74.65	5.37

3.9 – Legend
- ≥ 80
- $80 > x \geq 75$
- $75 > x \geq 70$
- < 70
- *No data*

3.13 – Legend
- ≥ 80
- $80 > x \geq 70$
- $70 > x \geq 60$
- < 60
- *No data*

3.14 – Legend
- ≥ 6
- $6 > x \geq 5.5$
- $5.5 > x \geq 5$
- < 5
- *No data*

Data source [Source (Reference year)]:
3.9 – WHO (2019)
3.13 – WHO (2017)
3.14 – Gallup (2020)

3.2.7. Challenge: Water Management

North Africa is the Med area that mostly suffers from lack of access at basic drinking water services (6.7 million people) and lack of basic sanitation services (14.2 million people), but trends are positive compared to the 2020 (respectively -2.1 and -1.7 million people).

Countries and regions		Goal 6: Population using at least basic drinking water services (6.1) %	*mln people left*	Population using at least basic sanitation services (6.2) %	*mln people left*
France	W-EU	100.00	*0.00*	98.65	*0.92*
Greece	W-EU	100.00	*0.00*	98.99	*0.11*
Italy	W-EU	99.92	*0.05*	99.89	*0.07*
Malta	W-EU	100.00	*0.00*	99.96	*0.00*
Portugal	W-EU	99.91	*0.01*	99.60	*0.04*
Spain	W-EU	99.93	*0.04*	99.90	*0.05*
Western EuroMed		99.95	*0.10*	99.41	*1.18*
Albania	E-EU	95.07	*0.15*	99.30	*0.02*
Bosnia and Herzeg.	E-EU	96.11	*0.15*	95.39	*0.18*
Croatia	E-EU	98.68	*0.06*	96.57	*0.15*
Cyprus	E-EU	99.77	*0.00*	99.40	*0.01*
Montenegro	E-EU	98.86	*0.01*	97.77	*0.01*
North Macedonia	E-EU	97.74	*0.05*	98.33	*0.04*
Slovenia	E-EU	99.50	*0.01*	98.10	*0.04*
Eastern EuroMed		97.54	*0.43*	97.45	*0.44*
EuroMed		99.76	*0.52*	99.25	*1.62*
Israel	ME	100.00	*0.00*	99.95	*0.00*
Jordan	ME	98.94	*0.11*	97.08	*0.32*
Lebanon	ME	92.60	*0.40*	99.20	*0.04*
Palestine	ME	97.88	*0.10*	98.58	*0.07*
Syrian Arab Rep.	ME	93.93	*1.18*	89.69	*2.00*
Turkey	ME	97.01	*2.45*	99.22	*0.64*
MIDDLE EAST		96.76	*4.25*	97.66	*3.07*
Algeria	NA	94.44	*2.39*	85.97	*6.03*
Egypt, Arab Rep.	NA	99.44	*0.58*	97.33	*2.78*
Libya	NA	99.89	*0.01*	92.11	*0.54*
Morocco	NA	90.40	*3.41*	87.25	*4.53*
Tunisia	NA	97.54	*0.29*	97.43	*0.30*
NORTH AFRICA		96.68	*6.68*	92.95	*14.19*
MIDDLE EAST & NORTH AFRICA		96.71	*10.93*	94.81	*17.26*
MEDITERRANEAN AREA		97.91	*11.45*	96.56	*18.88*

6.1 – Legend

- ≥ 98
- $98 > x \geq 89$
- $89 > x \geq 80$
- < 80
- *No data*

6.2 – Legend

- ≥ 95
- $95 > x \geq 85$
- $85 > x \geq 75$
- < 75
- *No data*

Data source [Source (Reference year)]:
6.1 – JMP (2020)
6.2 – JMP (2020)

3.2.8. Challenge: Energy Supply

Access to electricity is generally guaranteed to Mediterranean population. The objective to establish self-sufficiency of electricity systems in the Mediterranean is a possible scenario considering the availability of renewable energy sources with high potentials, such as sunlight and wind.

Countries and regions		Goal 7: Population with access to electricity (7.1) %	mln people left
France	W-EU	100.00	*0.00*
Greece	W-EU	100.00	*0.00*
Italy	W-EU	100.00	*0.00*
Malta	W-EU	100.00	*0.00*
Portugal	W-EU	100.00	*0.00*
Spain	W-EU	100.00	*0.00*
Western EuroMed		100.00	*0.00*
Albania	E-EU	100.00	*0.00*
Bosnia and Herzegovina	E-EU	100.00	*0.00*
Croatia	E-EU	100.00	*0.00*
Cyprus	E-EU	100.00	*0.00*
Montenegro	E-EU	100.00	*0.00*
North Macedonia	E-EU	100.00	*0.00*
Slovenia	E-EU	100.00	*0.00*
Eastern EuroMed		100.00	*0.00*
EuroMed		100.00	*0.00*
Israel	ME	100.00	*0.00*
Jordan	ME	100.00	*0.00*
Lebanon	ME	100.00	*0.00*
Palestine	ME	100.00	*0.00*
Syrian Arab Republic	ME	89.32	*1.98*
Turkey	ME	100.00	*0.00*
MIDDLE EAST		98.47	*1.98*
Algeria	NA	99.50	*0.21*
Egypt, Arab Republic	NA	100.00	*0.00*
Libya	NA	68.53	*2.13*
Morocco	NA	99.60	*0.14*
Tunisia	NA	100.00	*0.00*
NORTH AFRICA		98.75	*2.48*
MIDDLE EAST & NORTH AFRICA		98.64	*4.46*
MEDITERRANEAN AREA		99.18	*4.46*

7.1 – Legend
- ≥ 98
- $98 > x \geq 89$
- $89 > x \geq 80$
- < 80
- *No data*

Data source [Source (Reference year)]:
7.1 – SE4All (2019)

3.2.9. Challenge: Air Quality

MENA countries show high levels of exposition to PM 2.5 (50 µg/m3). Values in Europe are lower but not negligible (13 µg/m3) especially considering specific sites with high concentrations. The percentage of med population exposed at PM 2.5 is about 90%; even higher in MENA.

Countries and regions		Goal 11: Annual mean concentration of particulate matter of less than 2.5 microns in diameter (PM 2.5) (11.2)	Goal 11: PM2.5 air pollution, population exposed
		µg/m³	*%*
France	W-EU	11.19	*78.21*
Greece	W-EU	15.39	*100.00*
Italy	W-EU	15.82	*94.78*
Malta	W-EU	13.31	*100.00*
Portugal	W-EU	7.52	*16.01*
Spain	W-EU	9.36	*41.12*
Western EuroMed		11.63	*72.52*
Albania	E-EU	17.54	*100.00*
Bosnia and Herzegovina	E-EU	26.75	*99.96*
Croatia	E-EU	16.82	*99.78*
Cyprus	E-EU	16.59	*100.00*
Montenegro	E-EU	19.61	*100.00*
North Macedonia	E-EU	29.18	*100.00*
Slovenia	E-EU	15.37	*99.49*
Eastern EuroMed		20.42	*99.87*
EuroMed		12.77	*74.72*
Israel	ME	18.46	*100.00*
Jordan	ME	33.45	*100.00*
Lebanon	ME	30.60	*100.00*
Palestine	ME	-	*100.00*
Syrian Arab Republic	ME	46.16	*100.00*
Turkey	ME	45.21	*100.00*
MIDDLE EAST		43.73	*100.00*
Algeria	NA	41.26	*100.00*
Egypt, Arab Republic	NA	91.28	*100.00*
Libya	NA	55.52	*100.00*
Morocco	NA	33.42	*100.00*
Tunisia	NA	40.26	*100.00*
NORTH AFRICA		53.69	*100.00*
MIDDLE EAST & NORTH AFRICA		52.10	*100.00*
MEDITERRANEAN AREA		43.84	*89.79*

11.2 – Legend
- ≤ 10
- $10 < x \leq 17.5$
- $17.5 < x \leq 25$
- > 25
- *No data*

Data source [Source (Reference year)]:
11.2 – IHME (2019)
11.2 Add: PM2.5 air pollution, population exposed to levels exceeding WHO guideline value – Brauer, M. et al. (2017)

3.2.10. Challenge: Weapons Market

The volume of major conventional weapons exported, expressed in constant 1990 US$ millions per 100,000 people, is relevant in most OECD countries. Considering the delicate role of this economy that risks to nurture instability and wars, this sector requires a special attention and a comprehensive rethinking at international level. Western EuroMed is among the exporters of weapons and regulation and control systems need constant update and monitoring to avoid unfair behaviours and allow for full traceability.

Countries and regions		Goal 16 Exports of major conventional weapons (16.8) $/10⁵
France	W-EU	3.55
Greece	W-EU	0.29
Italy	W-EU	1.04
Malta	W-EU	1.14
Portugal	W-EU	0.47
Spain	W-EU	1.94
Western EuroMed		2.04
Albania	E-EU	0.00
Bosnia and Herzegovina	E-EU	0.00
Croatia	E-EU	0.07
Cyprus	E-EU	0.00
Montenegro	E-EU	0.00
North Macedonia	E-EU	0.00
Slovenia	E-EU	0.00
Eastern EuroMed		0.02
EuroMed		1.88
Israel	ME	10.17
Jordan	ME	0.40
Lebanon	ME	0.00
Palestine	ME	-
Syrian Arab Republic	ME	0.00
Turkey	ME	0.28
MIDDLE EAST		0.87
Algeria	NA	0.00
Egypt, Arab Republic	NA	0.01
Libya	NA	0.00
Morocco	NA	0.00
Tunisia	NA	0.00
NORTH AFRICA		0.01
MIDDLE EAST & NORTH AFRICA		0.35
MEDITERRANEAN AREA		0.96

16.8 – Legend

- ≤ 1
- $1 < x \leq 1.75$
- $1.75 < x \leq 2.5$
- > 2.5
- *No data*

Data source [Source (Reference year)]:
16.8 – Stockholm Peace Research Institute (2019)

3.3 Transformation Energy, Decarbonisation and Sustainable Industry

A set of indicators has been selected as the most relevant to report on the current state, highlight hotspots and track the progress towards the Transformation 3. This aims to ensure universal access to renewable energy sources, decarbonize the energy system in line with the Paris agreement and avoid or mitigate impacts of production processes in air, water and soil. Electricity generation and distribution, thermal energy, mobility and transport, industrial processes are among the targeted sectors, for example through lifecycle approaches and circular economy (Sachs et al. 2019).

Figure 3.3 | Selected indicators and challenges in the transformation 3. Energy, Decarbonisation and Sustainable Industry.

ENERGY
DECARBONISTASION
SUSTAINABLE
INDUSTRY
03

GOALS	INDICATORS	CHALLENGES
6 - Clean water and sanitation	Anthropogenic wastewater that receives treatment (%)	Water Quality
7 - Affordable and clean energy	CO_2 emissions from fuel combustion for electricity and heating per total electricity output ($MtCO_2/TWh$) OECD only: Share of renewable energy in total final energy supply (%)	Sustainable energy
8 - Decent work and economic growth	Adjusted GDP Growth (%)	Job market
	Fatal work-related accidents embodied in imports (deaths per 100,000)	Labor rights
9 - Industry, innovation and infrastructure	Logistics performance index: Quality of trade and transport-related infrastructures	Physical infrastructures
	The Times Higher Education Universities Ranking : Average score of top 3 universities Number of scientific and technical journal articles (per 1,000 population) Expenditure on research and development (% GDP) OECD only: Researchers (per 1,000 employed)	R&I
12 - Responsible production and consumption	Production-based SO_2 emissions (kg/capita) Production-based nitrogen emissions (kg/capita)	Environmental impact
13 - Climate action	CO_2 emissions from fossil fuel combustion and cement production (tCO_2/capita) CO_2 emissions embodied in imports (tCO_2/capita) CO_2 emissions embodied in fossil fuel exports (kg/capita) OECD only: Carbon Pricing Score at EUR60/tCO_2	Carbon emission
15 - Life on land	Permanent Deforestation (5 year average annual %)	Environmental protection

Figure 3.3 shows the 17 representative indicators and the corresponding Goal, that allowed for identifying the 9 challenges to be faced to accomplish the transformation. The following records, one per each challenge, show values of the indicators and their representation into tables. Indicators in the tables are often coupled with the corresponding absolute values, such as the number of people involved, and, when useful, other additional data for their interpretation. References for all indicators and additional data (namely, Add.) are listed in captions.

3.3.1. Challenge: Water Quality

Wastewater treatment is not a practice deployed enough. Besides EW (78%), MENA countries need consistent improvements (33% only). Some countries, in particular in Eastern EuroMed and MENA, show unsatisfactory performances and call for investments in wastewater infrastructures and management.

Countries and regions		Goal 6: Anthropogenic wastewater that receives treatment (6.4) %
France	W-EU	88.00
Greece	W-EU	81.66
Italy	W-EU	58.75
Malta	W-EU	100.00
Portugal	W-EU	54.98
Spain	W-EU	91.51
Western EuroMed		77.63
Albania	E-EU	2.67
Bosnia and Herzegovina	E-EU	1.13
Croatia	E-EU	51.71
Cyprus	E-EU	50.00
Montenegro	E-EU	8.37
North Macedonia	E-EU	0.94
Slovenia	E-EU	89.09
Eastern EuroMed		28.38
EuroMed		73.69
Israel	ME	81.70
Jordan	ME	18.63
Lebanon	ME	38.16
Palestine	ME	-
Syrian Arab Republic	ME	48.00
Turkey	ME	30.40
MIDDLE EAST		34.50
Algeria	NA	33.12
Egypt, Arab Republic	NA	41.96
Libya	NA	9.60
Morocco	NA	5.40
Tunisia	NA	43.04
NORTH AFRICA		32.45
MIDDLE EAST & NORTH AFRICA		33.27
MEDITERRANEAN AREA		49.46

6.4 – Legend
- ≥ 50
- $50 > x \geq 32.5$
- $32.5 > x \geq 15$
- < 15
- *No data*

Data source [Source (Reference year)]:
6.4 – EPI (2018)

3.3.2. Challenge: Sustainable Energy

CO2 emissions from fossil combustion per electricity output are lower in European countries, depending on good energy policies and, in some cases (France), on nuclear power plants (high risks for humans and ecosystems). Eastern EuroMed leads in terms of share of renewable energy. Improvements are needed in MENA countries.

Countries and regions		Goal 7: CO_2 emissions from fuel combustion for electricity and heating per total electricity output (7.3) MtCO2/ TWh	Goal 7: Share of renewable energy in total primary energy supply (7.4) %
France	W-EU	0.54	10.68
Greece	W-EU	1.22	12.83
Italy	W-EU	1.09	18.24
Malta	W-EU	0.83	x
Portugal	W-EU	0.88	23.16
Spain	W-EU	0.88	14.71
Western EuroMed		0.85	14.75
Albania	E-EU	0.51	x
Bosnia and Herzegovina	E-EU	1.22	x
Croatia	E-EU	1.16	x
Cyprus	E-EU	1.32	x
Montenegro	E-EU	0.68	x
North Macedonia	E-EU	1.29	x
Slovenia	E-EU	0.86	16.66
Eastern EuroMed		1.03	2.03
EuroMed		0.86	13.73
Israel	ME	0.92	2.87
Jordan	ME	1.19	x
Lebanon	ME	1.27	x
Palestine	ME	-	x
Syrian Arab Republic	ME	1.50	x
Turkey	ME	1.28	15.95
MIDDLE EAST		1.23	10.20
Algeria	NA	1.91	x
Egypt, Arab Republic	NA	1.21	x
Libya	NA	1.42	x
Morocco	NA	1.81	x
Tunisia	NA	1.34	x
NORTH AFRICA		1.48	x
MIDDLE EAST & NORTH AFRICA		1.38	4.05
MEDITERRANEAN AREA		1.18	7.89

7.3 – Legend
- ≤ 1
- $1 < x \leq 1.25$
- $1.25 < x \leq 1.5$
- > 1.5
- *No data*

7.4 – Legend
- ≥ 20
- $20 > x \geq 15$
- $15 > x \geq 10$
- < 10
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
7.3 – IEA (2019)
7.4 – OECD (2019)

3.3.3. Challenge: Job Market

In relation to national income levels, the growth rate of GDP does not show any improvement, except for Europe. The decreasing trends of national economies call for a consistent rethinking of the economic system at the international level.

Countries and regions		Goal 8 Adjusted GDP growth (8.1) %
France	W-EU	1.40
Greece	W-EU	0.16
Italy	W-EU	0.00
Malta	W-EU	1.60
Portugal	W-EU	1.29
Spain	W-EU	0.55
Western EuroMed		0.69
Albania	E-EU	0.23
Bosnia and Herzegovina	E-EU	1.32
Croatia	E-EU	2.44
Cyprus	E-EU	0.45
Montenegro	E-EU	3.92
North Macedonia	E-EU	0.22
Slovenia	E-EU	2.87
Eastern EuroMed		1.48
EuroMed		0.75
Israel	ME	-0.42
Jordan	ME	-3.14
Lebanon	ME	-6.67
Palestine	ME	-
Syrian Arab Republic	ME	-
Turkey	ME	-3.24
MIDDLE EAST		-2.62
Algeria	NA	-5.35
Egypt, Arab Republic	NA	-3.38
Libya	NA	6.03
Morocco	NA	-3.97
Tunisia	NA	-3.91
NORTH AFRICA		-3.61
MIDDLE EAST & NORTH AFRICA		-3.22
MEDITERRANEAN AREA		-1.64

8.1 – Legend
- ≥ 0
- $0 > x \geq -1.5$
- $-1.5 > x \geq -3$
- < -3
- *No data*

Data source [Source (Reference year)]:
8.1 – World Bank (2019)

3.3.4. Challenge: Labor Right

The number of fatal work-related accidents, associated with imported goods, is still high in Western EuroMed, accounting for 2.5 million workers. This indicator refers to the spillover effect due to imports of goods produced in places with lower safety standards at work.

Countries and regions		Goal 8 – Fatal work-related accidents embodied in imports (8.5) n./10^5	mln
France	W-EU	1.72	1.14
Greece	W-EU	0.89	0.10
Italy	W-EU	0.77	0.48
Malta	W-EU	1.23	0.01
Portugal	W-EU	0.83	0.09
Spain	W-EU	1.42	0.67
Western EuroMed		1.26	2.48
Albania	E-EU	0.19	0.01
Bosnia and Herzegovina	E-EU	0.13	0.01
Croatia	E-EU	0.49	0.02
Cyprus	E-EU	1.10	0.01
Montenegro	E-EU	1.31	0.01
North Macedonia	E-EU	0.18	0.00
Slovenia	E-EU	0.86	0.02
Eastern EuroMed		0.44	0.08
EuroMed		1.19	2.56
Israel	ME	0.57	0.05
Jordan	ME	0.33	0.03
Lebanon	ME	0.57	0.04
Palestine	ME	-	-
Syrian Arab Republic	ME	0.09	0.02
Turkey	ME	0.20	0.16
MIDDLE EAST		0.23	0.29
Algeria	NA	0.11	0.04
Egypt, Arab Republic	NA	0.08	0.07
Libya	NA	0.13	0.01
Morocco	NA	0.09	0.03
Tunisia	NA	0.26	0.03
NORTH AFRICA		0.10	0.18
MIDDLE EAST & NORTH AFRICA		0.15	0.47
MEDITERRANEAN AREA		0.58	3.02

8.5 – Legend
- ≤ 1
- $1 < x \leq 1.75$
- $1.75 < x \leq 2.5$
- > 2.5
- *No data*

Data source [Source (Reference year)]:
8.5 – Alsamawi et al. (2015)

3.3.5. Challenge: Physical Infrastructures

Quality assessments of public transport show highest levels (about 3) in Western EuroMed and ME. Numbers on passengers by train and plain confirm this result in Western EuroMed and ME. Levels in Eastern EuroMed and NA are lower and need to be much improved.

Countries and regions		Goal 9 Logistics performance index: Quality of trade and transport-related infrastructure (9.3)	Air passengers	Railway passengers
		-	mln	mln-km
France	W-EU	4.00	71.29	107,920.00
Greece	W-EU	3.17	16.12	1,104.00
Italy	W-EU	3.85	27.76	55,493.00
Malta	W-EU	2.90	2.25	-
Portugal	W-EU	3.25	18.67	4,487.00
Spain	W-EU	3.84	88.24	28,434.00
Western EuroMed		3.83	55.83	-
Albania	E-EU	2.29	0.31	2.70
Bosnia and Herzegovina	E-EU	2.42	0.01	30.00
Croatia	E-EU	3.01	2.11	756.00
Cyprus	E-EU	2.89	0.40	-
Montenegro	E-EU	2.58	0.60	60.00
North Macedonia	E-EU	2.47	0.09	64.00
Slovenia	E-EU	3.26	0.87	650.00
Eastern EuroMed		2.69	0.74	-
EuroMed		3.74	51.42	-
Israel	ME	3.33	6.66	3,031.76
Jordan	ME	2.72	3.48	503.54
Lebanon	ME	2.64	3.16	-
Palestine	ME	-	-	-
Syrian Arab Republic	ME	2.51	0.02	1,223.00
Turkey	ME	3.21	111.03	8,938.00
MIDDLE EAST		2.94	70.59	-
Algeria	NA	2.42	6.75	1,602.00
Egypt, Arab Republic	NA	2.82	12.96	40,837.00
Libya	NA	2.25	1.37	-
Morocco	NA	2.44	9.38	4,475.00

9.3 – Legend
- ≥ 3
- $3 > x \geq 2.5$
- $2.5 > x \geq 2$
- < 2
- *No data*

Data source [Source (Reference year)]:
9.3 – World Bank (2018)
9.3 Add1: Air transport, passengers carried – International Civil Aviation Organization (2019)
9.3 Add2: Railways, passengers carried – Internation Union of Railways (2018)

3.3.6. Challenge: R&I

Quality of Higher Education University is medium-high in Western EuroMed and ME, with lower performances in Eastern EuroMed and NA. National expenditure in R&D and number of researchers are crucial factors that need improvements in most of Mediterranean countries.

Countries and regions		Goal 9: The Times Higher Education Universities Ranking (9.4)	Goal 9: Scientific and technical journal articles (9.5)
		-	ratio
France	W-EU	66.80	1.02
Greece	W-EU	39.82	1.04
Italy	W-EU	55.97	1.18
Malta	W-EU	33.25	0.96
Portugal	W-EU	43.58	1.39
Spain	W-EU	55.77	1.17
Western EuroMed		49.20	1.13
Albania	E-EU	0.00	0.06
Bosnia and Herzegovina	E-EU	7.00	0.21
Croatia	E-EU	22.63	1.03
Cyprus	E-EU	37.47	1.05
Montenegro	E-EU	17.65	0.40
North Macedonia	E-EU	0.00	0.24
Slovenia	E-EU	22.63	1.54
Eastern EuroMed		15.34	0.62
EuroMed		30.97	1.09
Israel	ME	49.58	1.46
Jordan	ME	34.17	0.26
Lebanon	ME	33.98	0.26
Palestine	ME	-	0.08
Syrian Arab Republic	ME	0.00	0.02
Turkey	ME	40.45	0.41
MIDDLE EAST		31.64	0.39
Algeria	NA	27.77	0.12
Egypt, Arab Republic	NA	40.45	0.14
Libya	NA	0.00	0.02
Morocco	NA	20.97	0.14
Tunisia	NA	17.65	0.48
NORTH AFRICA		21.37	0.15
MIDDLE EAST & NORTH AFRICA		26.50	0.25
MEDITERRANEAN AREA		29.02	0.58

9.4 – Legend
- ≥ 30
- $30 > x \geq 15$
- $15 > x \geq 0$
- < 0
- *No data*

9.5 – Legend
- ≥ 0.5
- $0.5 > x \geq 0.275$
- $0.275 > x \geq 0.05$
- < 0.05
- *No data*

Data source [Source (Reference year)]:
9.4 – Times Higher Education (2021)
9.5 – National Science Foundation (2018)

Countries and regions		Goal 9 Expenditure on research and development (9.6) %	Goal 9 Researchers (9.7) n./10^3
France	W-EU	2.20	11.05
Greece	W-EU	1.18	8.56
Italy	W-EU	1.40	6.31
Malta	W-EU	0.57	x
Portugal	W-EU	1.37	10.13
Spain	W-EU	1.24	7.11
Western EuroMed		1.68	-
Albania	E-EU	0.15	x
Bosnia and Herzegovina	E-EU	0.20	x
Croatia	E-EU	0.97	x
Cyprus	E-EU	0.56	x
Montenegro	E-EU	0.37	x
North Macedonia	E-EU	0.36	x
Slovenia	E-EU	1.94	10.04
Eastern EuroMed		0.35	-
EuroMed		1.25	-
Israel	ME	4.95	-
Jordan	ME	0.71	x
Lebanon	ME	-	x
Palestine	ME	0.49	x
Syrian Arab Republic	ME	0.02	x
Turkey	ME	0.96	4.88
MIDDLE EAST		0.11	-
Algeria	NA	0.54	x
Egypt, Arab Republic	NA	0.72	x
Libya	NA	-	x
Morocco	NA	0.71	x
Tunisia	NA	0.60	x
NORTH AFRICA		0.58	-
MIDDLE EAST & NORTH AFRICA		0.21	-
MEDITERRANEAN AREA		0.28	-

9.6 – Legend
- ≥ 1.5
- $1.5 > x \geq 1.25$
- $1.25 > x \geq 1$
- < 1
- *No data*

9.7 – Legend
- ≥ 8
- $8 > x \geq 7.5$
- $7.5 > x \geq 7$
- < 7
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
9.6 – UNESCO (2018)
9.7 – OECD (2019)

3.3.7. Challenge: Environmental Impact

Environmental impacts of industrial production are higher in more industrialised countries, also depending on population density, but can also reveal insufficient measures of impact mitigation. Values would be much improved based on strategies of energy saving, renewability and circular economy.

Countries and regions		Goal 12					
			Production-based SO_2 emissions (12.3)			Production-based nitrogen emissions (12.5)	
			kg/capita	*tot Mt/year*		*kg/capita*	*tot Mt/year*
France	W-EU	🟢	26.48	*1.74*	🟠	42.08	*2.74*
Greece	W-EU	🔴	102.47	*1.13*	🔴	50.56	*0.56*
Italy	W-EU	🟡	38.70	*2.30*	🟠	37.30	*2.21*
Malta	W-EU	🔴	555.76	*0.23*	🟡	34.34	*0.01*
Portugal	W-EU	🟡	52.92	*0.56*	🟠	35.52	*0.38*
Spain	W-EU	🟡	37.20	*1.74*	🟠	45.03	*2.10*
Western EuroMed			39.73	*7.70*		41.44	*8.00*
Albania	E-EU	🟡	49.34	*0.14*	🟢	16.96	*0.05*
Bosnia and Herzegovina	E-EU	🟠	73.80	*0.27*	🟢	17.00	*0.06*
Croatia	E-EU	🟡	57.58	*0.25*	🟡	20.50	*0.09*
Cyprus	E-EU	🔴	193.09	*0.22*	🟡	27.32	*0.03*
Montenegro	E-EU	🟡	43.15	*0.03*	🟡	30.75	*0.02*
North Macedonia	E-EU	🔴	144.55	*0.30*	🟢	17.05	*0.04*
Slovenia	E-EU	🔴	126.16	*0.26*	🟡	29.22	*0.06*
Eastern EuroMed			87.65	*1.46*		20.58	*0.35*
EuroMed			43.52	*9.17*		39.77	*8.34*
Israel	ME	🔴	113.78	*0.90*	🔴	60.50	*0.46*
Jordan	ME	🟢	29.09	*0.24*	🟢	10.01	*0.07*
Lebanon	ME	🟡	55.53	*0.31*	🟢	15.08	*0.07*
Palestine	ME	⚪	-	-	⚪	-	-
Syrian Arab Republic	ME	🟢	24.90	*0.51*	🟢	10.40	*0.22*
Turkey	ME	🟢	28.72	*2.14*	🟡	25.49	*1.84*
MIDDLE EAST			33.96	*4.10*		22.80	*2.67*
Algeria	NA	🟢	5.32	*0.20*	🟢	9.94	*0.36*
Egypt, Arab Republic	NA	🟢	8.82	*0.76*	🟢	10.85	*0.90*
Libya	NA	🟡	42.45	*0.27*	🟢	19.72	*0.12*
Morocco	NA	🟢	12.78	*0.42*	🟢	10.29	*0.33*
Tunisia	NA	🟢	21.10	*0.23*	🟢	13.71	*0.15*
NORTH AFRICA			10.80	*1.88*		11.06	*1.86*
MIDDLE EAST & NORTH AFRICA			20.28	*5.98*		15.89	*4.53*
MEDITERRANEAN AREA			29.96	*15.14*		26.01	*12.87*

12.3 – Legend
- 🟢 ≤ 30
- 🟡 $30 < x \leq 65$
- 🟠 $65 < x \leq 100$
- 🔴 > 100
- ⚪ *No data*

12.5 – Legend
- 🟢 ≤ 20
- 🟡 $20 < x \leq 35$
- 🟠 $35 < x \leq 50$
- 🔴 > 50
- ⚪ *No data*

Data source [Source (Reference year)]:
12.3 – Lenzen et al. (2012)
12.5 – Oita et al. (2010)

3.3.8. Challenge: Carbon Emissions

CO2 emissions per capita depending on energy use and imports are highest in Europe mirroring carbon intensive lifestyles of citizens. Emissions associated to export of fossil fuels refer to intensive exploitation of non-renewable energy sources for economic return. Emissions related to local economies show low efficiencies in OECD countries.

Countries and regions		Goal 13					
		CO_2 emissions from fossil fuel combustion and cement production (13.1)			CO_2 emissions embodied in imports (13.2)		
			tCO_2/cap	*mln tCO_2*		*tCO_2/cap*	*mln tCO_2*
France	W-EU	🔴	4.97	*336.10*	🔴	1.86	*123.65*
Greece	W-EU	🔴	6.42	*68.30*	🔴	1.60	*17.36*
Italy	W-EU	🔴	5.57	*346.85*	🔴	1.33	*81.01*
Malta	W-EU	🟠	3.53	*1.60*	🔴	2.78	*1.24*
Portugal	W-EU	🔴	4.75	*48.99*	🔴	1.56	*16.17*
Spain	W-EU	🔴	5.41	*255.76*	🔴	1.34	*62.33*
Western EuroMed			5.33	*1,057.60*		1.54	*301.75*
Albania	E-EU	🟢	1.94	*5.96*	🟢	0.45	*1.28*
Bosnia and Herzegovina	E-EU	🔴	8.07	*30.99*	🟢	0.40	*1.37*
Croatia	E-EU	🔴	4.33	*18.40*	🔴	1.38	*5.82*
Cyprus	E-EU	🔴	6.10	*7.64*	🔴	2.51	*2.92*
Montenegro	E-EU	🟠	3.92	*2.40*	🟠	0.79	*0.49*
North Macedonia	E-EU	🟠	3.86	*8.19*	🟡	0.55	*1.15*
Slovenia	E-EU	🔴	6.59	*13.85*	🔴	2.64	*5.44*
Eastern EuroMed			5.07	*87.45*		1.12	*18.46*
EuroMed			5.31	*1,145.04*		1.51	*320.22*
Israel	ME	🔴	7.53	*64.25*	🔴	1.36	*11.38*
Jordan	ME	🟡	2.58	*27.53*	🟡	0.61	*5.64*
Lebanon	ME	🔴	4.11	*24.01*	🟠	0.89	*5.82*
Palestine	ME	🟢	0.66	*3.13*	🟢	0.50	*2.14*
Syrian Arab Republic	ME	🟢	1.58	*29.36*	🟢	0.19	*3.46*
Turkey	ME	🔴	4.86	*396.71*	🟢	0.47	*37.22*
MIDDLE EAST			4.19	*545.00*		0.53	*65.66*
Algeria	NA	🟠	4.00	*169.22*	🟢	0.24	*9.49*
Egypt, Arab Republic	NA	🟡	2.50	*254.42*	🟢	0.13	*11.56*
Libya	NA	🔴	6.90	*46.63*	🟢	0.37	*2.38*
Morocco	NA	🟢	2.00	*70.43*	🟢	0.20	*7.07*
Tunisia	NA	🟡	2.70	*31.38*	🟢	0.46	*5.13*
NORTH AFRICA			2.89	*572.08*		0.19	*35.63*
MIDDLE EAST & NORTH AFRICA			3.41	*1,117.08*		0.33	*101.29*
MEDITERRANEAN AREA			4.16	*2,262.12*		0.81	*421.51*

13.1 – Legend
- 🟢 ≤ 2
- 🟡 $2 < x \leq 3$
- 🟠 $3 < x \leq 4$
- 🔴 > 4
- ⚪ *No data*

13.2 – Legend
- 🟢 ≤ 0.5
- 🟡 $0.5 < x \leq 0.75$
- 🟠 $0.75 < x \leq 1$
- 🔴 > 1
- ⚪ *No data*

Data source [Source (Reference year)]:
13.1 – Gütschow et al. (2019) / 13.2 – Lenzen et al. (2015)

Countries and regions		Goal 13: CO_2 emissions embodied in fossil fuel exports (13.3)	kg/cap	tot Mt/year	Goal 13: Carbon Pricing Score at EUR60/tCO_2 (13.4)	€/t CO_2
France	W-EU	green	1.98	*0.13*	yellow	55.40
Greece	W-EU	green	53.04	*0.56*	orange	46.90
Italy	W-EU	green	42.80	*2.67*	yellow	51.09
Malta	W-EU	green	0.00	*0.00*	light blue	x
Portugal	W-EU	green	0.00	*0.00*	orange	44.46
Spain	W-EU	yellow	111.79	*5.28*	orange	46.09
Western EuroMed			43.50	*8.65*		-
Albania	E-EU	yellow	868.51	*2.68*	light blue	x
Bosnia and Herzegovina	E-EU	green	79.43	*0.30*	light blue	x
Croatia	E-EU	yellow	110.55	*0.47*	light blue	x
Cyprus	E-EU	green	0.00	*0.00*	light blue	x
Montenegro	E-EU	yellow	157.15	*0.10*	light blue	x
North Macedonia	E-EU	green	1.11	*0.00*	light blue	x
Slovenia	E-EU	green	13.41	*0.03*	yellow	57.14
Eastern EuroMed			207.22	*3.57*		-
EuroMed			56.57	*12.22*		-
Israel	ME	green	28.91	*0.25*	orange	35.51
Jordan	ME	green	1.03	*0.01*	light blue	x
Lebanon	ME	green	0.00	*0.00*	light blue	x
Palestine	ME	grey	-	-	light blue	x
Syrian Arab Republic	ME	grey	-	-	light blue	x
Turkey	ME	green	2.03	*0.17*	red	23.61
MIDDLE EAST			3.26	*0.43*		-
Algeria	NA	red	3,202.56	*137.56*	light blue	x
Egypt, Arab Republic	NA	yellow	226.49	*23.58*	light blue	x
Libya	NA	red	20,666.53	*142.41*	light blue	x
Morocco	NA	green	0.00	*0.00*	light blue	x
Tunisia	NA	yellow	355.24	*4.16*	light blue	x
NORTH AFRICA			1,480.59	*307.71*		-
MIDDLE EAST & NORTH AFRICA			897.65	*308.13*		-
MEDITERRANEAN AREA			566.31	*320.36*		-

13.3 – Legend
- green: ≤ 100
- yellow: $100 < x \leq 4050$
- orange: $4050 < x \leq 8000$
- red: > 8000
- grey: *No data*

13.4 – Legend
- green: ≥ 70
- yellow: $70 > x \geq 50$
- orange: $50 > x \geq 30$
- red: < 30
- grey: *No data*
- light blue: *No OECD Country*

Data source [Source (Reference year)]:
13.3 – UN Comtrade (2020)
13.4 – OECD (2018)

3.3.9. Challenge: Environmental Protection

Tree cover removal for urbanization, commodity production and small-scale agriculture (not including temporary forest loss due to the forestry sector or wildfires) tends to moderately increase. Differences in terms of forest area per country are relevant in the Mediterranean area due to climate zones.

Countries and regions		Goal 15: Permanent deforestation (15.4) %	Goal 15: Forest area %
France	W-EU	0.008	*31.51*
Greece	W-EU	0.001	*30.27*
Italy	W-EU	0.005	*32.13*
Malta	W-EU	-	*1.44*
Portugal	W-EU	0.019	*36.15*
Spain	W-EU	0.007	*37.17*
Western EuroMed		0.007	*33.60*
Albania	E-EU	0.001	*28.79*
Bosnia and Herzegovina	E-EU	0.001	*42.73*
Croatia	E-EU	0.001	*34.27*
Cyprus	E-EU	0.131	*18.67*
Montenegro	E-EU	0.000	*61.49*
North Macedonia	E-EU	0.000	*39.71*
Slovenia	E-EU	0.000	*61.47*
Eastern EuroMed		0.006	*39.34*
EuroMed		0.007	*34.35*
Israel	ME	0.005	*6.47*
Jordan	ME	-	*1.10*
Lebanon	ME	0.063	*14.01*
Palestine	ME	-	*1.68*
Syrian Arab Republic	ME	0.156	*2.84*
Turkey	ME	0.035	*28.87*
MIDDLE EAST		0.052	*21.59*
Algeria	NA	0.783	*0.82*
Egypt, Arab Republic	NA	0.005	*0.05*
Libya	NA	-	*0.12*
Morocco	NA	0.157	*12.87*
Tunisia	NA	0.545	*4.52*
NORTH AFRICA		0.353	*1.51*
MIDDLE EAST & NORTH AFRICA		0.305	*4.72*
MEDITERRANEAN AREA		0.242	*10.94*

15.4 – Legend
- ≤ 0.05
- $0.05 < x \leq 0.275$
- $0.275 < x \leq 0.5$
- > 0.5
- *No data*

Data source [Source (Reference year)]:
15.4 – Curtis et al. (2018)
15.4 Add: Forest area – FAO (2020)

3.4 Transformation Sustainable Food, Land, Water and Sea

A set of indicators has been selected as the most relevant to report on the current state, highlight hotspots and track the progress towards the Transformation 4. This aims to make food systems, land use and sea sustainable and healthy for people, safeguarding the integrity of ecosystems and biodiversity. Changes are particularly challenging considering that current land use and food systems lead to persistent hunger, malnutrition and obesity, provide environmental impacts in terms of greenhouse gas emissions, nutrient overload and eutrophication, water scarcity, overfishing, pollution and, moreover, are vulnerable to climate change and land degradation (Sachs et al. 2019).

Figure 3.3 | Selected indicators and challenges in the transformation 4. Sustainable Food, Land, Water and Sea

SUSTAINABLE
FOOD
LAND
WATER
OCEANS
04

GOALS	INDICATORS	CHALLENGES
2 - Zero Hunger	Prevalence of undernourishment (% population) Prevalence of stunting (low height-for-age) in children under 5 years of age (%) Prevalence of wasting in children under 5 years of age (%)	Malnutrition
	Prevalence of obesity, BMI = 30 (% adult population) Human Trophic Level (best 2 - 3 worst)	Food habits (diet)
	Cereal yield (t/ha) Sustainable Nitrogen Management Index	Sustainable agriculture
3 - Good health and wellbeing	Age-standardised death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years	Healthy environment
	Life Expectancy at birth (years) Subjective Wellbeing (average ladder score, 0-10)	Wellbeing
6 - Clean water and sanitation	Population using at least basic drinking water services (%) Freshwater withdrawal as % total renewable water resources	Water management
	Anthropogenic wastewater that receives treatment (%)	Water Quality
12 - Responsible production and consumption	Production-based nitrogen emissions (kg/capita)	Environmental impact
13- Climate action	CO2 emissions from fossil fuel combustion and cement production (tCO2/capita)	Carbon emission
14 - Life below water	Fish caught by trawling or dredging (%)	Fisheries
	Mean area that is protected in marine sites important to biodiversity (%) Ocean Health Index Goal - Clean Waters (0-100)	Environmental protection
15 - Life on land	Mean area that is protected in terrestrial sites important to biodiversity (%) Mean area that is protected in freshwater sites important to biodiversity (%) Permanent Deforestation (5 year average annual %)	

Figure 3.4 shows the 21 representative indicators and the corresponding Goal, that allowed for identifying the 11 challenges to be faced to accomplish the transformation. The following records, one per each challenge, show values of the indicators and their representation into tables. Indicators in the tables are often coupled with the corresponding absolute values, such as the number of people involved, and, when useful, other additional data for their interpretation. References for all indicators and additional data (namely, Add.) are listed in captions.

3.4.1. Challenge: Malnutrition

Precarious conditions of health induced by malnutrition require attention in the MENA area: almost 13 million people undernourished, 2 million children with wasting and almost 6 million children with stunted growth. Interventions to avoid the insurgency of these problems would also increase healthiness of next generation adult population.

Countries and regions		Goal 2: Prevalence of undernourishment (2.1)		Prevalence of stunting in children under 5 years of age (2.2)	
		%	*mln*	%	*mln*
France	W-EU	2.50	*1.69*	2.58	*0.11*
Greece	W-EU	2.50	*0.27*	2.58	*0.01*
Italy	W-EU	2.50	*1.56*	2.58	*0.07*
Malta	W-EU	2.50	*0.01*	2.58	*0.00*
Portugal	W-EU	2.50	*0.26*	3.20	*0.01*
Spain	W-EU	2.50	*1.18*	2.58	*0.05*
Western EuroMed		2.50	*4.96*	2.61	*0.25*
Albania	E-EU	3.90	*0.12*	11.30	*0.02*
Bosnia and Herzegovina	E-EU	2.50	*0.10*	8.90	*0.01*
Croatia	E-EU	2.50	*0.11*	2.58	*0.00*
Cyprus	E-EU	2.50	*0.03*	2.58	*0.00*
Montenegro	E-EU	2.50	*0.02*	7.20	*0.00*
North Macedonia	E-EU	2.70	*0.06*	4.30	*0.00*
Slovenia	E-EU	2.50	*0.05*	2.58	*0.00*
Eastern EuroMed		2.77	*0.48*	6.18	*0.05*
EuroMed		2.52	*5.44*	2.90	*0.31*
Israel	ME	2.50	*0.21*	2.58	*0.02*
Jordan	ME	9.50	*1.01*	7.80	*0.09*
Lebanon	ME	9.30	*0.54*	16.50	*0.06*
Palestine	ME	-	-	8.70	*0.05*
Syrian Arab Republic	ME	-	-	27.90	*0.64*
Turkey	ME	2.50	*2.04*	6.00	*0.36*
MIDDLE EAST		2.93	*3.81*	10.90	*1.23*
Algeria	NA	3.90	*1.65*	9.80	*0.43*
Egypt, Arab Republic	NA	5.40	*5.50*	22.30	*3.01*
Libya	NA	-	-	38.10	*0.31*
Morocco	NA	4.20	*1.48*	15.10	*0.48*
Tunisia	NA	3.00	*0.35*	8.40	*0.08*
NORTH AFRICA		4.54	*8.97*	18.85	*4.31*
MIDDLE EAST & NORTH AFRICA		3.90	*12.78*	16.22	*5.54*
MEDITERRANEAN AREA		3.35	*18.23*	13.07	*5.84*

2.1 - Legend
- ≤ 7.5
- $7.5 < x \leq 11.5$
- $11.5 < x \leq 15$
- > 15
- *No data*

2.2 - Legend
- ≤ 7.5
- $7.5 < x \leq 11.5$
- $11.5 < x \leq 15$
- > 15
- *No data*

Data source [Source (Reference year)]:
2.1 – FAO (2019)
2.2 – UNICEF et al. (2020)

Countries and regions		Goal 2 Prevalence of wasting in children under 5 years of age (2.3) %	 *mln*
France	W-EU	0.70	*0.03*
Greece	W-EU	0.70	*0.00*
Italy	W-EU	0.70	*0.02*
Malta	W-EU	0.70	*0.00*
Portugal	W-EU	0.60	*0.00*
Spain	W-EU	0.70	*0.01*
Western EuroMed		0.70	*0.07*
Albania	E-EU	1.60	*0.00*
Bosnia and Herzegovina	E-EU	2.30	*0.00*
Croatia	E-EU	0.70	*0.00*
Cyprus	E-EU	0.70	*0.00*
Montenegro	E-EU	2.20	*0.00*
North Macedonia	E-EU	3.40	*0.00*
Slovenia	E-EU	0.70	*0.00*
Eastern EuroMed		1.63	*0.01*
EuroMed		0.77	*0.08*
Israel	ME	0.70	*0.01*
Jordan	ME	2.40	*0.03*
Lebanon	ME	6.60	*0.02*
Palestine	ME	1.30	*0.01*
Syrian Arab Republic	ME	11.50	*0.27*
Turkey	ME	1.70	*0.10*
MIDDLE EAST		3.83	*0.43*
Algeria	NA	2.70	*0.12*
Egypt, Arab Republic	NA	9.50	*1.28*
Libya	NA	10.20	*0.08*
Morocco	NA	2.60	*0.08*
Tunisia	NA	2.10	*0.02*
NORTH AFRICA		6.94	*1.59*
MIDDLE EAST & NORTH AFRICA		5.91	*2.02*
MEDITERRANEAN AREA		4.70	*2.10*

2.3 - Legend

- ≤ 5
- $5 < x \leq 7.5$
- $7.5 < x \leq 10$
- > 10
- *No data*

Data source [Source (Reference year)]:
2.3 – UNICEF et al. (2020)

3.4.2. Challenge: Food Habits (Diets)

Obesity affects 22% of the population in Europe and 30% in MENA, namely almost 34 million people in Western EuroMed, 33 million in NA and 25 million in ME. Trends are emerging towards high-protein diets (highlighted by the human trophic level) and progressive abandon of the Mediterranean diet. The increasing spread of child and adult obesity is mostly due to incorrect eating habits.

Countries and regions		Goal 2: Prevalence of obesity, BMI ≥ 30 (2.4)		Goal 2: Human Trophic Level (2.5)
		%	*mln*	-
France	W-EU	21.60	*10.89*	2.48
Greece	W-EU	24.90	*2.14*	2.38
Italy	W-EU	19.90	*10.05*	2.42
Malta	W-EU	28.90	*0.10*	2.31
Portugal	W-EU	20.80	*1.73*	2.44
Spain	W-EU	23.80	*8.98*	2.42
Western EuroMed		21.74	*33.90*	2.44
Albania	E-EU	21.70	*0.48*	2.38
Bosnia and Herzegovina	E-EU	17.90	*0.56*	2.26
Croatia	E-EU	24.40	*0.84*	2.37
Cyprus	E-EU	21.80	*0.21*	2.38
Montenegro	E-EU	23.30	*0.11*	2.48
North Macedonia	E-EU	22.40	*0.36*	2.25
Slovenia	E-EU	20.20	*0.34*	2.40
Eastern EuroMed		21.47	*2.91*	2.34
EuroMed		21.72	*36.80*	2.43
Israel	ME	26.10	*1.37*	2.41
Jordan	ME	35.50	*1.94*	2.20
Lebanon	ME	32.00	*1.34*	2.18
Palestine	ME	-	-	-
Syrian Arab Republic	ME	27.80	*2.73*	2.25
Turkey	ME	32.10	*17.19*	2.25
MIDDLE EAST		30.55	*24.56*	2.17
Algeria	NA	27.40	*7.03*	2.20
Egypt, Arab Republic	NA	32.00	*17.38*	2.16
Libya	NA	32.50	*1.21*	2.19
Morocco	NA	26.10	*5.63*	2.19
Tunisia	NA	26.90	*2.07*	2.21
NORTH AFRICA		29.50	*33.33*	2.18
MIDDLE EAST & NORTH AFRICA		29.93	*57.89*	2.18
MEDITERRANEAN AREA		26.10	*94.69*	2.28

2.4 – Legend
- ≤ 10
- $10 < x \leq 17.5$
- $17.5 < x \leq 25$
- > 25
- *No data*

2.5 – Legend
- ≤ 2.2
- $2.2 < x \leq 2.3$
- $2.3 < x \leq 2.4$
- > 2.4
- *No data*

Data source [Source (Reference year)]:
2.4 – WHO (2016)
2.5 – Bonhommeau et al. (2017)

3.4.3. Challenge: Sustainable Agriculture

Indicators give a general information on self-sufficiency of national food systems, compared with food requirements of the population, and on the type of agricultural production (intensive vs. extensive; conventional vs. organic). Cereal production yield is lower in the ME despite the use of chemical fertilizers per hectare, much higher in Western EuroMed.

Countries and regions			Goal 2 Cereal yield (2.6) t/ha	Land under cereal production *mln ha*	Tonnes of cereals per capita *t/cap*
France	W-EU	●	6.89	*9.11*	*0.93*
Greece	W-EU	●	3.80	*0.80*	*0.28*
Italy	W-EU	●	5.27	*3.11*	*0.26*
Malta	W-EU	●	4.92	*0.00*	*0.03*
Portugal	W-EU	●	4.76	*0.23*	*0.11*
Spain	W-EU	●	4.07	*5.99*	*0.52*
Western EuroMed			5.89	*19.24*	*0.54*
Albania	E-EU	●	4.84	*0.14*	*0.22*
Bosnia and Herzegovina	E-EU	●	5.49	*0.32*	*0.45*
Croatia	E-EU	●	6.98	*0.47*	*0.76*
Cyprus	E-EU	●	1.96	*0.02*	*0.03*
Montenegro	E-EU	●	3.31	*0.00*	*0.01*
North Macedonia	E-EU	●	3.72	*0.16*	*0.28*
Slovenia	E-EU	●	6.05	*0.10*	*0.29*
Eastern EuroMed			6.00	*1.20*	*0.40*
EuroMed			5.90	*20.44*	*0.53*
Israel	ME	●	3.04	*0.07*	*0.02*
Jordan	ME	●	1.51	*0.06*	*0.01*
Lebanon	ME	●	3.16	*0.05*	*0.03*
Palestine	ME	●	1.81	*0.02*	*0.01*
Syrian Arab Republic	ME	●	1.21	*1.42*	*0.10*
Turkey	ME	●	3.16	*10.87*	*0.42*
MIDDLE EAST			3.07	*12.50*	*0.28*
Algeria	NA	●	1.76	*3.45*	*0.15*
Egypt, Arab Republic	NA	●	7.15	*3.08*	*0.22*
Libya	NA	●	0.66	*0.37*	*0.04*
Morocco	NA	●	2.26	*4.59*	*0.30*
Tunisia	NA	●	1.43	*1.58*	*0.20*
NORTH AFRICA			4.76	*13.07*	*0.21*
MIDDLE EAST & NORTH AFRICA			3.96	*25.57*	*0.24*
MEDITERRANEAN AREA			5.12	*46.02*	*0.36*

2.6 – Legend
- ● ≥ 2.5
- ● $2.5 > x \geq 2$
- ● $2 > x \geq 1.5$
- ● < 1.5
- ● *No data*

Data source [Source (Reference year)]:
2.6 – FAO (2018)
2.6 Add1: Land under cereal production – FAO (2018)
2.6 Add2: Tonnes of cereals per capita – Our elaboration

Countries and regions		Goal 2 Sustainable Nitrogen Management Index (2.7)	Fertilizer consumption
		-	*kg/ha*
France	W-EU	0.39	*172.68*
Greece	W-EU	0.64	*133.26*
Italy	W-EU	0.59	*130.59*
Malta	W-EU	0.89	*167.85*
Portugal	W-EU	1.07	*198.51*
Spain	W-EU	0.83	*157.70*
Western EuroMed		*0.61*	*158.87*
Albania	E-EU	0.83	*66.59*
Bosnia and Herzegovina	E-EU	1.00	*84.76*
Croatia	E-EU	0.49	*221.00*
Cyprus	E-EU	1.07	*157.71*
Montenegro	E-EU	1.06	*246.80*
North Macedonia	E-EU	0.75	*60.85*
Slovenia	E-EU	0.73	*261.76*
Eastern EuroMed		0.78	*128.24*
EuroMed		0.62	*156.27*
Israel	ME	0.87	*240.68*
Jordan	ME	0.65	*114.04*
Lebanon	ME	0.92	*286.36*
Palestine	ME	-	-
Syrian Arab Republic	ME	0.71	*2.35*
Turkey	ME	0.62	*109.73*
MIDDLE EAST		0.65	*85.33*
Algeria	NA	0.71	*20.75*
Egypt, Arab Republic	NA	0.64	*569.12*
Libya	NA	0.88	*9.84*
Morocco	NA	0.80	*74.93*
Tunisia	NA	0.99	*44.15*
NORTH AFRICA		0.71	*58.55*
MIDDLE EAST & NORTH AFRICA		0.69	*67.95*
MEDITERRANEAN AREA		0.66	*99.05*

2.7 – Legend
- ≤ 0.3
- $0.3 < x \leq 0.5$
- $0.5 < x \leq 0.7$
- > 0.7
- *No data*

Data source [Source (Reference year)]:
2.7 – Zhang and Davidson (2015)
2.7 Add1: Fertilizer consumption - FAO (2018)

3.4.4. Challenge: Healthy Environment

Some diseases such as cardiovascular, diabetes and respiratory, are indirectly correlated, albeit not exclusively, with food, land and water quality. These more affect Eastern EuroMed and NA. If properly promoted, the Mediterranean diet can play a relevant role for improvements as it determines half the rate of cardiovascular mortality and the highest longevity.

Countries and regions		Goal 3 — Age-standardized death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years (3.6) %	*n. people*
France	W-EU	10.60	*3,637.73*
Greece	W-EU	12.40	*727.49*
Italy	W-EU	9.50	*3,336.51*
Malta	W-EU	10.80	*26.16*
Portugal	W-EU	11.10	*647.12*
Spain	W-EU	9.90	*2,689.50*
Western EuroMed		10.19	*11,064.51*
Albania	E-EU	17.00	*241.82*
Bosnia and Herzegovina	E-EU	17.80	*405.69*
Croatia	E-EU	16.70	*405.40*
Cyprus	E-EU	11.30	*74.33*
Montenegro	E-EU	20.60	*67.77*
North Macedonia	E-EU	20.30	*233.79*
Slovenia	E-EU	12.70	*153.97*
Eastern EuroMed		16.70	*1,582.76*
EuroMed		10.72	*12,647.28*
Israel	ME	9.60	*336.02*
Jordan	ME	19.20	*658.19*
Lebanon	ME	17.90	*507.55*
Palestine	ME	-	-
Syrian Arab Republic	ME	21.80	*1,364.41*
Turkey	ME	16.10	*6,051.13*
MIDDLE EAST		16.25	*8,917.31*
Algeria	NA	14.20	*2,452.82*
Egypt, Arab Republic	NA	27.70	*9,394.22*
Libya	NA	20.10	*514.46*
Morocco	NA	12.40	*1,809.13*
Tunisia	NA	16.10	*865.16*
NORTH AFRICA		20.40	*15,035.79*
MIDDLE EAST & NORTH AFRICA		18.63	*23,953.10*
MEDITERRANEAN AREA		14.84	*36,600.37*

3.6 – Legend
- ≤ 15
- $15 < x \leq 20$
- $20 < x \leq 25$
- > 25
- *No data*

Data source [Source (Reference year)]:
3.6 – WHO (2016)

3.4.5. Challenge: Wellbeing

Western EuroMed shows the best performances in terms of healthiness and wellbeing, that is indirectly correlated, albeit not exclusively, with food, land and water quality. A general improvement in environmental and social sustainability of national economies would contribute to increase longevity rates and the perception of wellbeing.

Countries and regions		Goal 3: Life expectancy at birth (3.9) years	Goal 3: Subjective Wellbeing (3.14) -
France	W-EU	82.48	6.70
Greece	W-EU	81.10	5.80
Italy	W-EU	82.97	6.50
Malta	W-EU	81.89	6.20
Portugal	W-EU	81.57	5.80
Spain	W-EU	83.22	6.50
Western EuroMed		82.69	6.49
Albania	E-EU	78.00	5.40
Bosnia and Herzegovina	E-EU	76.75	6.00
Croatia	E-EU	78.64	6.50
Cyprus	E-EU	83.14	6.30
Montenegro	E-EU	75.88	5.40
North Macedonia	E-EU	74.82	5.00
Slovenia	E-EU	81.31	6.50
Eastern EuroMed		78.19	5.95
EuroMed		82.33	6.45
Israel	ME	82.62	7.30
Jordan	ME	77.87	4.10
Lebanon	ME	76.44	4.00
Palestine	ME	-	4.60
Syrian Arab Republic	ME	72.67	3.50
Turkey	ME	78.63	4.90
MIDDLE EAST		75.02	4.74
Algeria	NA	77.13	4.70
Egypt, Arab Republic	NA	71.82	4.50
Libya	NA	75.78	5.30
Morocco	NA	72.99	4.80
Tunisia	NA	77.04	4.70
NORTH AFRICA		73.61	4.64
MIDDLE EAST & NORTH AFRICA		74.17	4.68
MEDITERRANEAN AREA		77.41	5.38

3.9 – Legend
- ≥ 80
- $80 > x \geq 75$
- $75 > x \geq 70$
- < 70
- *No data*

3.14 – Legend
- ≥ 6
- $6 > x \geq 5.5$
- $5.5 > x \geq 5$
- < 5
- *No data*

Data source [Source (Reference year)]:
3.9 – WHO (2019)
3.14 - Gallup (2020)

3.4.6. Challenge: Water Management

Critical issues in the Mediterranean, especially in MENA, are related to the condition of water scarcity and negative trends due to the effects of climate change. 11 million people in NA are left out of basic services for the provision of drinking water and renewability of water sources looks to be a hotspot.

Countries and regions		Goal 6: Population using at least basic drinking water services (6.1) %	mln people left	Freshwater withdrawal (6.3) %	billion m^3
France	W-EU	100.00	*0.00*	23.14	*26.44*
Greece	W-EU	100.00	*0.00*	22.74	*11.24*
Italy	W-EU	99.92	*0.05*	30.00	*34.05*
Malta	W-EU	100.00	*0.00*	85.15	*0.04*
Portugal	W-EU	99.91	*0.01*	18.38	*9.15*
Spain	W-EU	99.93	*0.04*	42.57	*31.22*
Western EuroMed		99.95	*0.10*	30.23	*112.13*
Albania	E-EU	95.07	*0.15*	7.14	*1.19*
Bosnia and Herzegovina	E-EU	96.11	*0.15*	2.66	*0.40*
Croatia	E-EU	98.68	*0.06*	1.50	*0.67*
Cyprus	E-EU	99.77	*0.00*	29.52	*0.22*
Montenegro	E-EU	98.86	*0.01*	-	*0.16*
North Macedonia	E-EU	97.74	*0.05*	25.27	*1.04*
Slovenia	E-EU	99.50	*0.01*	6.30	*0.93*
Eastern EuroMed		97.54	*0.43*	11.04	*4.61*
EuroMed		99.76	*0.52*	29.50	*116.75*
Israel	ME	100.00	*0.00*	103.36	*1.20*
Jordan	ME	98.94	*0.11*	100.08	*0.90*
Lebanon	ME	92.60	*0.40*	58.79	*1.81*
Palestine	ME	97.88	*0.10*	48.75	*0.41*
Syrian Arab Republic	ME	93.93	*1.18*	124.36	*13.96*
Turkey	ME	97.01	*2.45*	44.57	*60.01*
MIDDLE EAST		96.76	*4.25*	60.69	*78.30*
Algeria	NA	94.44	*2.39*	137.92	*9.80*
Egypt, Arab Republic	NA	99.44	*0.58*	116.94	*64.20*
Libya	NA	99.89	*0.01*	817.14	*5.72*
Morocco	NA	90.40	*3.41*	50.75	*10.57*
Tunisia	NA	97.54	*0.29*	121.07	*4.77*
NORTH AFRICA		96.68	*6.68*	154.08	*95.06*
MIDDLE EAST & NORTH AFRICA		96.71	*10.93*	111.90	*173.36*
MEDITERRANEAN AREA		97.91	*11.45*	78.77	*290.11*

6.1 – Legend
- ≥ 98
- $98 > x \geq 89$
- $89 > x \geq 80$
- < 80
- *No data*

6.3 – Legend
- ≤ 25
- $25 < x \leq 50$
- $50 < x \leq 75$
- > 75
- *No data*

Data source [Source (Reference year)]:
6.1 – JMP (2020)
6.3 - FAO (2017)

3.4.7. Challenge: Water Quality

Wastewater treatment is not a practice deployed enough. Besides Western EuroMed (78%), MENA countries need consistent improvements (33% only). Some countries in particular in Eastern EuroMed and MENA show unsatisfactory performances and call for investments in wastewater infrastructures and management.

Countries and regions		Goal 6 – Anthropogenic wastewater that receives treatment (6.4) %
France	W-EU	88.00
Greece	W-EU	81.66
Italy	W-EU	58.75
Malta	W-EU	100.00
Portugal	W-EU	54.98
Spain	W-EU	91.51
Western EuroMed		77.63
Albania	E-EU	2.67
Bosnia and Herzegovina	E-EU	1.13
Croatia	E-EU	51.71
Cyprus	E-EU	50.00
Montenegro	E-EU	8.37
North Macedonia	E-EU	0.94
Slovenia	E-EU	89.09
Eastern EuroMed		28.38
EuroMed		73.69
Israel	ME	81.70
Jordan	ME	18.63
Lebanon	ME	38.16
Palestine	ME	-
Syrian Arab Republic	ME	48.00
Turkey	ME	30.40
MIDDLE EAST		34.50
Algeria	NA	33.12
Egypt, Arab Republic	NA	41.96
Libya	NA	9.60
Morocco	NA	5.40
Tunisia	NA	43.04
NORTH AFRICA		32.45
MIDDLE EAST & NORTH AFRICA		33.27
MEDITERRANEAN AREA		49.46

6.4 – Legend
- ≥ 50
- $50 > x \geq 32.5$
- $32.5 > x \geq 15$
- < 15
- *No data*

Data source [Source (Reference year)]:
6.4 – EPI (2018)

3.4.8. Challenge: Environmental Impact

Environmental impacts of industrial production are higher in more industrialised countries, also depending on population density, but can also reveal insufficient measures of impact mitigation. Values would be much improved based on strategies of energy saving, renewability and circular economy.

Countries and regions		Goal 12 – Production-based nitrogen emissions (12.5) kg/capita	Goal 12 – Production-based nitrogen emissions (12.5) tot Mt/year
France	W-EU	42.08	*2.73*
Greece	W-EU	50.56	*0.56*
Italy	W-EU	37.30	*2.27*
Malta	W-EU	34.34	*0.01*
Portugal	W-EU	35.52	*0.38*
Spain	W-EU	45.03	*2.09*
Western EuroMed		41.40	*8.04*
Albania	E-EU	16.96	*0.05*
Bosnia and Herzegovina	E-EU	17.00	*0.07*
Croatia	E-EU	20.50	*0.09*
Cyprus	E-EU	27.32	*0.03*
Montenegro	E-EU	30.75	*0.02*
North Macedonia	E-EU	17.05	*0.04*
Slovenia	E-EU	29.22	*0.06*
Eastern EuroMed		20.54	*0.35*
EuroMed		39.70	*8.39*
Israel	ME	60.50	*0.44*
Jordan	ME	10.01	*0.07*
Lebanon	ME	15.08	*0.07*
Palestine	ME	-	-
Syrian Arab Republic	ME	10.40	*0.23*
Turkey	ME	25.49	*1.90*
MIDDLE EAST		22.73	*2.71*
Algeria	NA	9.94	*0.36*
Egypt, Arab Republic	NA	10.85	*0.88*
Libya	NA	19.72	*0.13*
Morocco	NA	10.29	*0.33*
Tunisia	NA	13.71	*0.14*
NORTH AFRICA		11.07	*1.84*
MIDDLE EAST & NORTH AFRICA		15.95	*4.55*
MEDITERRANEAN AREA		26.06	*12.95*

12.5 – Legend
- ≤ 20
- $20 < x \leq 35$
- $35 < x \leq 50$
- > 50
- *No data*

Data source [Source (Reference year)]:
12.5 – Oita et al. (2010)

3.4.9. Challenge: Carbon Emissions

CO2 emissions per capita depending on energy use are more located in Western EuroMed, responsible for half of the total CO2 emissions in MED (tot 2,000 million tons per year). Given the high impact of climate change in the MED area, policies of carbon mitigation must be urgently implemented in all countries.

Countries and regions		Goal 13 – CO_2 emissions from fossil fuel combustion and cement production (13.1)	
		tCO_2/cap	*mln tCO_2*
France	W-EU	4.97	*336.10*
Greece	W-EU	6.42	*68.30*
Italy	W-EU	5.57	*346.85*
Malta	W-EU	3.53	*1.60*
Portugal	W-EU	4.75	*48.99*
Spain	W-EU	5.41	*255.76*
Western EuroMed		5.33	*1,057.60*
Albania	E-EU	1.94	*5.96*
Bosnia and Herzegovina	E-EU	8.07	*30.99*
Croatia	E-EU	4.33	*18.40*
Cyprus	E-EU	6.10	*7.64*
Montenegro	E-EU	3.92	*2.40*
North Macedonia	E-EU	3.86	*8.19*
Slovenia	E-EU	6.59	*13.85*
Eastern EuroMed		5.07	*87.45*
EuroMed		5.31	*1,145.04*
Israel	ME	7.53	*64.25*
Jordan	ME	2.58	*27.53*
Lebanon	ME	4.11	*24.01*
Palestine	ME	0.66	*3.13*
Syrian Arab Republic	ME	1.58	*29.36*
Turkey	ME	4.86	*396.71*
MIDDLE EAST		4.19	*545.00*
Algeria	NA	4.00	*169.22*
Egypt, Arab Republic	NA	2.50	*254.42*
Libya	NA	6.90	*46.63*
Morocco	NA	2.00	*70.43*
Tunisia	NA	2.70	*31.38*
NORTH AFRICA		2.89	*572.08*
MIDDLE EAST & NORTH AFRICA		3.41	*1,117.08*
MEDITERRANEAN AREA		4.16	*2,262.12*

13.1 – Legend
- ≤ 2
- $2 < x \leq 3$
- $3 < x \leq 4$
- > 4
- *No data*

Data source [Source (Reference year)]:
13.1 – Gütschow et al. (2019)

3.4.10. Challenge: Fisheries

Fishery is still based on unsustainable practices and need special attention in order to stop the increasing loss of fish stocks and biodiversity. Solutions such as the emerging activities of sustainable aquaculture are promising.

Countries and regions		Goal 14: Fish caught by trawling or dredging (14.4) %	Capture fisheries production (metric tons)	Aquaculture production (metric tons)
France	W-EU	20.14	611,842.38	185,650.00
Greece	W-EU	41.42	77,236.80	132,392.20
Italy	W-EU	43.54	206,936.00	143,338.19
Malta	W-EU	93.66	2,733.00	10,022.38
Portugal	W-EU	34.26	178,270.00	11,814.30
Spain	W-EU	50.27	928,815.31	347,824.72
Western EuroMed		38.96	2,005,833.48	831,041.78
Albania	E-EU	79.76	8,648.30	6,258.00
Bosnia and Herzeg.	E-EU	0.00	305.00	3,638.80
Croatia	E-EU	16.75	70,557.34	18,067.17
Cyprus	E-EU	25.54	1,490.00	7,347.04
Montenegro	E-EU	43.62	1,292.80	1,097.00
North Macedonia	E-EU	-	140.00	1,359.30
Slovenia	E-EU	31.17	263.74	1,918.50
Eastern EuroMed		23.21	82,697.18	39,685.81
EuroMed		38.31	2,088,530.67	870,727.59
Israel	ME	52.68	2,054.00	17,000.00
Jordan	ME	0.00	873.00	900.00
Lebanon	ME	0.00	2,796.00	1,031.00
Palestine	ME	-	3,201.00	749.00
Syrian Arab Republic	ME	31.32	4,374.00	2,350.00
Turkey	ME	23.15	314,095.00	311,681.00
MIDDLE EAST		22.83	327,393.00	333,711.00
Algeria	NA	20.75	115,255.00	5,100.12
Egypt, Arab Republic	NA	34.62	373,286.00	1,561,457.00
Libya	NA	17.63	32,266.00	10.00
Morocco	NA	70.78	1,386,548.00	1,266.91
Tunisia	NA	20.12	106,046.30	21,826.20
NORTH AFRICA		58.87	2,013,401.30	1,589,660.23
MIDDLE EAST & NORTH AFRICA		53.61	2,340,794.30	1,923,371.23
MEDITERRANEAN AREA		46.58	4,429,324.96	2,794,098.81

14.4 – Legend
- ≤ 7
- $7 < x \leq 33.5$
- $33.5 < x \leq 60$
- > 60
- *No data*

Data source [Source (Reference year)]:
14.4 – Sea Around Us (2016)

3.4.11. Challenge: Environmental Protection

Seawater quality is a critical issue and must be improved in all MED countries (see the Ocean Health Index); Protected areas (including freshwater and lands) are insufficient and need to be further enlarged. A comprehensive overview on current state of protected areas has been provided by Claudet et al. (2020).

Countries and regions		Goal 14: Mean area that is protected in marine sites important to biodiversity (14.1) %	Goal 14: Ocean Health Index: Clean Waters (14.2) -
France	W-EU	81.13	49.14
Greece	W-EU	86.09	58.80
Italy	W-EU	77.17	50.04
Malta	W-EU	93.43	41.16
Portugal	W-EU	65.54	52.31
Spain	W-EU	84.13	48.70
Western EuroMed		80.84	49.98
Albania	E-EU	70.70	56.83
Bosnia and Herzegovina	E-EU	-	40.71
Croatia	E-EU	80.59	64.67
Cyprus	E-EU	54.24	58.74
Montenegro	E-EU	0.00	61.53
North Macedonia	E-EU	-	-
Slovenia	E-EU	97.91	28.41
Eastern EuroMed		49.04	45.01
EuroMed		76.69	49.58
Israel	ME	10.83	30.24
Jordan	ME	-	47.25
Lebanon	ME	12.65	33.11
Palestine	ME	-	-
Syrian Arab Republic	ME	0.00	37.26
Turkey	ME	3.79	50.50
MIDDLE EAST		3.06	44.36
Algeria	NA	48.93	41.58
Egypt, Arab Republic	NA	43.01	50.40
Libya	NA	0.00	55.64
Morocco	NA	44.96	55.31
Tunisia	NA	39.58	49.19
NORTH AFRICA		32.36	49.49
MIDDLE EAST & NORTH AFRICA		27.69	47.47
MEDITERRANEAN AREA		37.97	48.30

14.1 – Legend
- ≥ 50
- $50 > x \geq 30$
- $30 > x \geq 10$
- < 10
- *No data*

14.2 – Legend
- ≥ 70
- $70 > x \geq 65$
- $65 > x \geq 60$
- < 60
- *No data*

Data source [Source (Reference year)]:
14.1 – Birdlife International et al. (2019)
14.2 – Ocean Health Index (2020)

Countries and regions		Goal 15: Mean area that is protected in terrestrial sites important to biodiversity (15.1)	Goal 15: Mean area that is protected in freshwater sites important to biodiversity (15.2)
		%	%
France	W-EU	80.35	78.11
Greece	W-EU	86.05	87.24
Italy	W-EU	77.35	84.66
Malta	W-EU	84.49	-
Portugal	W-EU	73.27	63.99
Spain	W-EU	57.59	48.40
Western EuroMed		72.56	69.78
Albania	E-EU	57.18	92.68
Bosnia and Herzegovina	E-EU	18.18	66.67
Croatia	E-EU	76.49	85.69
Cyprus	E-EU	74.06	36.57
Montenegro	E-EU	11.11	-
North Macedonia	E-EU	26.00	93.64
Slovenia	E-EU	88.70	93.05
Eastern EuroMed		53.25	77.03
EuroMed		70.04	70.72
Israel	ME	20.34	25.23
Jordan	ME	13.48	18.68
Lebanon	ME	12.34	21.06
Palestine	ME	24.40	0.00
Syrian Arab Republic	ME	0.00	0.00
Turkey	ME	2.34	4.29
MIDDLE EAST		3.31	5.32
Algeria	NA	16.63	18.75
Egypt, Arab Republic	NA	39.41	28.49
Libya	NA	0.00	-
Morocco	NA	53.81	71.81
Tunisia	NA	40.09	43.40
NORTH AFRICA		19.06	19.53
MIDDLE EAST & NORTH AFRICA		16.55	17.26
MEDITERRANEAN AREA		27.78	28.49

15.1 – Legend
- ≥ 50
- $50 > x \geq 30$
- $30 > x \geq 10$
- < 10
- *No data*

15.2 – Legend
- ≥ 50
- $50 > x \geq 30$
- $30 > x \geq 10$
- < 10
- *No data*

Data source [Source (Reference year)]:
15.1 – Birdlife International et al. (2019)
15.2 – Birdlife International et al. (2019)

3.4.12. Challenge: Environmental Protection

Tree cover removal for urbanization, commodity production and small-scale agriculture (not including temporary forest loss due to the forestry sector or wildfires) tends to moderately increase. Differences in terms of forest area per country are relevant in the Mediterranean area due to climate zones.

Countries and regions			Goal 15: Permanent deforestation (15.4) %	Goal 15: Forest area %
France	W-EU	green	0.008	*31.51*
Greece	W-EU	green	0.001	*30.27*
Italy	W-EU	green	0.005	*32.13*
Malta	W-EU	grey	-	*1.44*
Portugal	W-EU	green	0.019	*36.15*
Spain	W-EU	green	0.007	*37.17*
Western EuroMed			0.007	*33.60*
Albania	E-EU	green	0.001	*28.79*
Bosnia and Herzegovina	E-EU	green	0.001	*42.73*
Croatia	E-EU	green	0.001	*34.27*
Cyprus	E-EU	yellow	0.131	*18.67*
Montenegro	E-EU	green	0.000	*61.49*
North Macedonia	E-EU	green	0.000	*39.71*
Slovenia	E-EU	green	0.000	*61.47*
Eastern EuroMed			0.006	*39.34*
EuroMed			0.007	*34.35*
Israel	ME	green	0.005	*6.47*
Jordan	ME	grey	-	*1.10*
Lebanon	ME	yellow	0.063	*14.01*
Palestine	ME	grey	-	*1.68*
Syrian Arab Republic	ME	yellow	0.156	*2.84*
Turkey	ME	green	0.035	*28.87*
MIDDLE EAST			0.052	*21.59*
Algeria	NA	red	0.783	*0.82*
Egypt, Arab Republic	NA	green	0.005	*0.05*
Libya	NA	grey	-	*0.12*
Morocco	NA	yellow	0.157	*12.87*
Tunisia	NA	red	0.545	*4.52*
NORTH AFRICA			0.353	*1.51*
MIDDLE EAST & NORTH AFRICA			0.305	*4.72*
MEDITERRANEAN AREA			0.242	*10.94*

15.4 – Legend
- green: ≤ 0.05
- yellow: $0.05 < x \leq 0.275$
- orange: $0.275 < x \leq 0.5$
- red: > 0.5
- grey: *No data*

Data source [Source (Reference year)]:
15.4 – Curtis et al. (2018)
15.4 Add: Forest area – FAO (2020)

3.5 Transformation Sustainable Cities and Communities

A set of indicators has been selected as the most relevant to report on the current state, highlight hotspots and track the progress towards the Transformation 5. This aims to make cities economically productive, socially inclusive and environmentally sustainable, give wide access to basic services (such as water and waste management), efficient and sustainable mobility systems and guarantee safe and healthy settlements. Cities also need to increase resilience against climate change and extreme weather events, for example by enforcing the role of ecosystems and nature based solutions in urban areas (Sachs et al. 2019).

Figure 3.5 | Selected indicators and challenges in the transformation 5. Sustainable Cities and Communities.

SUSTAINABLE CITIES AND COMMUNITIES

05

GOALS	INDICATORS	CHALLENGES
3 - Good Health and wellbeing	Traffic deaths rate (per 100,000 population)	Healthy environment
8 - Decent work and economic growth	Adults (15 years and older) with an account at a bank or other financial institutions OECD only: Employment-to-Population ratio (%)	Job market
9 - Industry, innovation and infrastructure	Population using the internet (%) Mobile broadband subscriptions (per 100 inhabitants)	Digital infrastructures
6 - Clean water and sanitation	Population using at least basic drinking water services (%) Population using at least basic sanitation services (%)	Water management
11 - Sustainable cities and communities	Anthropogenic wastewater that receives treatment (%) Access to improved water source, piped (% urban population)	Water quality
	Annual mean concentration of particulate matter of less than 2.5 microns	Air quality
	Satisfaction with public transport (%) OECD only: Population with rent overburden (%)	Accessibility
12 - Responsible production and consumption	Municipal Solid Waste (kg/day/capita) Electronic waste (kg/capita) OECD only: Non-Recycled Municipal Solid Waste (kg/day/capita)	Waste
16 - Peace, Justice and strong institutions	Homicides (per 100,000 population) Population who feel safe walking alone at night in the city or area where they live Corruption Perception Index (0-100)	Crime

Figure 3.5 shows the 18 representative indicators and the corresponding Goal, that allowed for identifying the 9 challenges to be faced to accomplish the transformation. The following records, one per each challenge, show values of the indicators and their representation into tables. Indicators in the tables are often coupled with the corresponding absolute values, such as the number of people involved, and, when useful, other additional data for their interpretation. References for all indicators and additional data (namely, Add.) are listed in captions.

3.5.1. Challenge: Healthy Environment

The traffic deaths rate involves 52,000 people in the MED area, including 12,000 in Europe and 40,000 in MENA, the latter depending on investments in secure infrastructures and economic capacity of families compared to Europe. Investments in infrastructures and prevention through people behavioural changes are desirable.

Countries and regions			Goal 3 Traffic deaths rate (3.8) n./10^5	Goal 3 Traffic deaths rate (3.8) *n. people*
France	W-EU		5.13	*3,469.21*
Greece	W-EU		8.31	*884.04*
Italy	W-EU		5.32	*3,312.80*
Malta	W-EU		4.11	*18.63*
Portugal	W-EU		8.20	*845.80*
Spain	W-EU		3.91	*1,848.44*
Western EuroMed			5.23	*10,378.92*
Albania	E-EU		11.70	*359.53*
Bosnia and Herzegovina	E-EU		13.51	*518.82*
Croatia	E-EU		7.95	*337.92*
Cyprus	E-EU		5.75	*72.03*
Montenegro	E-EU		7.64	*46.76*
North Macedonia	E-EU		5.15	*109.30*
Slovenia	E-EU		5.05	*106.17*
Eastern EuroMed			8.99	*1,550.54*
EuroMed			5.53	*11,929.45*
Israel	ME		3.91	*333.64*
Jordan	ME		16.00	*1,707.06*
Lebanon	ME		16.44	*960.27*
Palestine	ME		5.40	*255.14*
Syrian Arab Republic	ME		14.94	*2,776.55*
Turkey	ME		6.68	*5,452.76*
MIDDLE EAST			8.84	*11,485.41*
Algeria	NA		20.90	*8,841.86*
Egypt, Arab Republic	NA		10.10	*10,278.54*
Libya	NA		21.30	*1,439.45*
Morocco	NA		16.96	*5,972.86*
Tunisia	NA		16.49	*1,916.28*
NORTH AFRICA			14.39	*28,449.00*
MIDDLE EAST & NORTH AFRICA			12.19	*39,934.41*
MEDITERRANEAN AREA			9.54	*51,863.86*

3.8 – Legend

- ≤ 8.4
- $8.4 < x \leq 12.6$
- $12.6 < x \leq 16.8$
- > 16.8
- *No data*

Data source [Source (Reference year)]:
3.8 – WHO (2019)

3.5.2. Challenge: Job Market

Access to basic financial services, such as a bank account, is widely guaranteed but still 122 million people in MENA remain out (only 36% in NA access these services). The ratio of employees per population in OECD countries shows consistent gaps (e.g. Turkey).

Countries and regions		Goal 8: Adults with an account at a bank or other financial institution or with a mobile-money-service provider (8.3)		Goal 8: Employment-to-population ratio (8.6)
		%	*mln people left*	%
France	W-EU	94.00	*3.28*	65.30
Greece	W-EU	85.47	*1.33*	56.27
Italy	W-EU	93.79	*3.33*	58.08
Malta	W-EU	97.36	*0.01*	x
Portugal	W-EU	92.34	*0.68*	69.00
Spain	W-EU	93.76	*2.50*	60.95
Western EuroMed		93.33	*11.12*	-
Albania	E-EU	40.02	*1.50*	x
Bosnia and Herzegovina	E-EU	58.84	*1.38*	x
Croatia	E-EU	86.14	*0.51*	x
Cyprus	E-EU	88.72	*0.12*	x
Montenegro	E-EU	68.36	*0.16*	x
North Macedonia	E-EU	76.57	*0.41*	x
Slovenia	E-EU	97.53	*0.04*	70.85
Eastern EuroMed		71.81	*4.12*	-
EuroMed		91.59	*15.24*	-
Israel	ME	92.81	*0.43*	66.78
Jordan	ME	42.49	*3.85*	x
Lebanon	ME	44.75	*2.61*	x
Palestine	ME	25.02	*2.05*	x
Syrian Arab Republic	ME	23.25	*8.87*	x
Turkey	ME	68.59	*19.14*	47.50
MIDDLE EAST		60.11	*36.96*	-
Algeria	NA	42.78	*16.58*	x
Egypt, Arab Republic	NA	32.78	*43.52*	x
Libya	NA	65.67	*1.48*	x
Morocco	NA	28.64	*17.75*	x
Tunisia	NA	36.91	*5.39*	x
NORTH AFRICA		35.55	*84.72*	-
MIDDLE EAST & NORTH AFRICA		45.70	*121.67*	-
MEDITERRANEAN AREA		66.22	*136.92*	-

8.3 – Legend
- ≥ 80
- 80 > x ≥ 65
- 65 > x ≥ 50
- < 50
- *No data*

8.6 – Legend
- ≥ 60
- 60 > x ≥ 55
- 55 > x ≥ 50
- < 50
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
8.3 – Demirguc-Kunt et al. (2017)
8.6 – OECD (2020)

3.5.3. Challenge: Water Management

North Africa is the Med area that mostly suffers from limited access to basic drinking water services (6.7 million people) and basic sanitation services (14.2 million people).

Countries and regions		Goal 6: Population using at least basic drinking water services (6.1)		Population using at least basic sanitation services (6.2)	
		%	*mln people left*	%	*mln people left*
France	W-EU	100.00	*0.00*	98.65	*0.92*
Greece	W-EU	100.00	*0.00*	98.99	*0.11*
Italy	W-EU	99.92	*0.05*	99.89	*0.07*
Malta	W-EU	100.00	*0.00*	99.96	*0.00*
Portugal	W-EU	99.91	*0.01*	99.60	*0.04*
Spain	W-EU	99.93	*0.04*	99.90	*0.05*
Western EuroMed		99.95	*0.10*	99.41	*1.18*
Albania	E-EU	95.07	*0.15*	99.30	*0.02*
Bosnia and Herzeg.	E-EU	96.11	*0.15*	95.39	*0.18*
Croatia	E-EU	98.68	*0.06*	96.57	*0.15*
Cyprus	E-EU	99.77	*0.00*	99.40	*0.01*
Montenegro	E-EU	98.86	*0.01*	97.77	*0.01*
North Macedonia	E-EU	97.74	*0.05*	98.33	*0.04*
Slovenia	E-EU	99.50	*0.01*	98.10	*0.04*
Eastern EuroMed		97.54	*0.43*	97.45	*0.44*
EuroMed		99.76	*0.52*	99.25	*1.62*
Israel	ME	100.00	*0.00*	99.95	*0.00*
Jordan	ME	98.94	*0.11*	97.08	*0.32*
Lebanon	ME	92.60	*0.40*	99.20	*0.04*
Palestine	ME	97.88	*0.10*	98.58	*0.07*
Syrian Arab Rep.	ME	93.93	*1.18*	89.69	*2.00*
Turkey	ME	97.01	*2.45*	99.22	*0.64*
MIDDLE EAST		96.76	*4.25*	97.66	*3.07*
Algeria	NA	94.44	*2.39*	85.97	*6.03*
Egypt, Arab Rep.	NA	99.44	*0.58*	97.33	*2.78*
Libya	NA	99.89	*0.01*	92.11	*0.54*
Morocco	NA	90.40	*3.41*	87.25	*4.53*
Tunisia	NA	97.54	*0.29*	97.43	*0.30*
NORTH AFRICA		96.68	*6.68*	92.95	*14.19*
MIDDLE EAST & NORTH AFRICA		96.71	*10.93*	94.81	*17.26*
MEDITERRANEAN AREA		97.91	*11.45*	96.56	*18.88*

6.1 – Legend

- ≥ 98
- $98 > x \geq 89$
- $89 > x \geq 80$
- < 80
- *No data*

6.2 – Legend

- ≥ 95
- $95 > x \geq 85$
- $85 > x \geq 75$
- < 75
- *No data*

Data source [Source (Reference year)]: 6.1 – JMP (2020) / 6.2 – JMP (2020)

3.5.4. Challenge: Water quality

Water networks look well-structured in most of the Mediterranean area, including MENA countries, despite gaps in accessing basic drinking water and sanitation services mostly affecting rural areas.

Countries and regions		Goal 6: Anthropogenic wastewater that receives treatment (6.4) %	Goal 11: Access to improved water source, piped (11.3) %	*mln people left*
France	W-EU	88.00	100.00	*0.00*
Greece	W-EU	81.66	100.00	*0.00*
Italy	W-EU	58.75	97.49	*1.07*
Malta	W-EU	100.00	100.00	*0.00*
Portugal	W-EU	54.98	100.00	*0.00*
Spain	W-EU	91.51	99.91	*0.03*
Western EuroMed		77.63	99.26	*1.10*
Albania	E-EU	2.67	92.36	*0.13*
Bosnia and Herzegovina	E-EU	1.13	97.65	*0.04*
Croatia	E-EU	51.71	99.57	*0.01*
Cyprus	E-EU	50.00	99.55	*0.00*
Montenegro	E-EU	8.37	94.14	*0.02*
North Macedonia	E-EU	0.94	98.35	*0.02*
Slovenia	E-EU	89.09	99.26	*0.01*
Eastern EuroMed		28.38	97.45	*0.23*
EuroMed		73.69	99.16	*1.33*
Israel	ME	81.70	100.00	*0.00*
Jordan	ME	18.63	88.76	*1.00*
Lebanon	ME	38.16	-	-
Palestine	ME	-	-	-
Syrian Arab Republic	ME	48.00	74.72	*2.31*
Turkey	ME	30.40	98.62	*0.84*
MIDDLE EAST		34.50	89.02	*4.15*
Algeria	NA	33.12	81.88	*5.40*
Egypt, Arab Republic	NA	41.96	98.58	*0.58*
Libya	NA	9.60	-	-
Morocco	NA	5.40	94.10	*1.30*
Tunisia	NA	43.04	99.24	*0.06*
NORTH AFRICA		32.45	88.13	*7.35*
MIDDLE EAST & NORTH AFRICA		33.27	88.54	*11.49*
MEDITERRANEAN AREA		49.46	93.25	*12.83*

6.4 – Legend
- (green) ≥ 50
- (yellow) $50 > x \geq 32.5$
- (orange) $32.5 > x \geq 15$
- (red) < 15
- (grey) *No data*

11.3 – Legend
- (green) ≥ 98
- (yellow) $98 > x \geq 86.5$
- (orange) $86.5 > x \geq 75$
- (red) < 75
- (grey) *No data*

Data source [Source (Reference year)]:
6.4 – EPI (2018)
11.3 – WHO and UNICEF (2017)

3.5.5. Challenge: Air Quality

MENA countries show high levels of exposition to PM 2.5 (50 μg/m3). Values in Europe are lower but not negligible (13 μg/m3) especially considering specific sites with high concentrations. The percentage of med population exposed at PM2.5 is about 90%; even higher in MENA.

Countries and regions		Goal 11 Annual mean concentration of particulate matter of less than 2.5 microns in diameter (PM 2.5) (11.2) *μg/m³*	PM2.5 air pollution, population exposed *%*
France	W-EU	11.19	*78.21*
Greece	W-EU	15.39	*100.00*
Italy	W-EU	15.82	*94.78*
Malta	W-EU	13.31	*100.00*
Portugal	W-EU	7.52	*16.01*
Spain	W-EU	9.36	*41.12*
Western EuroMed		11.63	*72.52*
Albania	E-EU	17.54	*100.00*
Bosnia and Herzegovina	E-EU	26.75	*99.96*
Croatia	E-EU	16.82	*99.78*
Cyprus	E-EU	16.59	*100.00*
Montenegro	E-EU	19.61	*100.00*
North Macedonia	E-EU	29.18	*100.00*
Slovenia	E-EU	15.37	*99.49*
Eastern EuroMed		20.42	*99.87*
EuroMed		12.77	*74.72*
Israel	ME	18.46	*100.00*
Jordan	ME	33.45	*100.00*
Lebanon	ME	30.60	*100.00*
Palestine	ME	-	*100.00*
Syrian Arab Republic	ME	46.16	*100.00*
Turkey	ME	45.21	*100.00*
MIDDLE EAST		43.73	*100.00*
Algeria	NA	41.26	*100.00*
Egypt, Arab Republic	NA	91.28	*100.00*
Libya	NA	55.52	*100.00*
Morocco	NA	33.42	*100.00*
Tunisia	NA	40.26	*100.00*
NORTH AFRICA		53.69	*100.00*
MIDDLE EAST & NORTH AFRICA		52.10	*100.00*
MEDITERRANEAN AREA		43.84	*89.79*

11.2 – Legend

- ≤ 10
- $10 < x \leq 17.5$
- $17.5 < x \leq 25$
- > 25
- *No data*

Data source [Source (Reference year)]:
11.2 – IHME (2019)
11.2 Add: PM2.5 air pollution, population exposed to levels exceeding WHO guideline value – Brauer, M. et al. (2017)

3.5.6. Challenge: Accessibility

Quality of public transport based on satisfaction rates is around 54% in Med calling for consistent improvements. Cost of households compared to family income in OECD countries is variable and would need proper monitoring.

Countries and regions		Goal 11: Satisfaction with public transport (11.4) %	Goal 11: Population with rent overburden (11.5) %
France	W-EU	60.00	5.30
Greece	W-EU	36.00	14.19
Italy	W-EU	48.00	8.42
Malta	W-EU	64.00	x
Portugal	W-EU	55.00	5.70
Spain	W-EU	64.00	11.11
Western EuroMed		55.65	
Albania	E-EU	46.00	x
Bosnia and Herzegovina	E-EU	42.00	x
Croatia	E-EU	49.00	x
Cyprus	E-EU	44.00	x
Montenegro	E-EU	46.00	x
North Macedonia	E-EU	51.00	x
Slovenia	E-EU	66.00	3.39
Eastern EuroMed		48.76	-
EuroMed		55.10	-
Israel	ME	59.00	-
Jordan	ME	65.00	x
Lebanon	ME	33.00	x
Palestine	ME	-	x
Syrian Arab Republic	ME	15.00	x
Turkey	ME	55.00	-
MIDDLE EAST		47.38	-
Algeria	NA	43.00	x
Egypt, Arab Republic	NA	65.00	x
Libya	NA	43.00	x
Morocco	NA	55.00	x
Tunisia	NA	43.00	x
NORTH AFRICA		56.46	-
MIDDLE EAST & NORTH AFRICA		52.86	-
MEDITERRANEAN AREA		53.75	-

11.4 – Legend
- ≥ 72
- $72 > x \geq 57.5$
- $57.5 > x \geq 43$
- < 43
- *No data*

11.5 – Legend
- ≤ 7
- $7 < x \leq 12$
- $12 < x \leq 17$
- > 17
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
11.4 – Gallup (2020)
11.5 – OECD (2019)

3.5.7. Challenge: Waste

Waste management shows some criticalities and would require improvements in systematic data monitoring and integrated waste management systems to avoid landfilling and increase rates of recycling, besides reduction.

Countries and regions		Goal 12: Municipal solid waste (12.1)		Electronic waste (12.2)	
		kg/day/cap	*tot Mt/year*	*kg/capita*	*tot Mt/year*
France	W-EU	1.74	*42.56*	20.95	*1.42*
Greece	W-EU	1.70	*6.66*	16.94	*0.18*
Italy	W-EU	1.94	*43.81*	17.50	*1.09*
Malta	W-EU	1.80	*0.29*	14.47	*0.01*
Portugal	W-EU	1.92	*7.30*	16.56	*0.17*
Spain	W-EU	1.48	*25.51*	19.02	*0.90*
Western EuroMed		1.75	*126.12*	18.95	*3.76*
Albania	E-EU	1.77	*1.97*	7.45	*0.02*
Bosnia and Herzeg.	E-EU	2.02	*2.85*	7.79	*0.03*
Croatia	E-EU	1.91	*3.01*	11.89	*0.05*
Cyprus	E-EU	1.87	*0.82*	16.80	*0.02*
Montenegro	E-EU	2.16	*0.49*	10.69	*0.01*
North Macedonia	E-EU	1.81	*1.39*	7.87	*0.02*
Slovenia	E-EU	2.24	*1.71*	15.07	*0.03*
Eastern EuroMed		1.94	*12.24*	10.39	*0.18*
EuroMed		1.76	*138.36*	18.27	*3.94*
Israel	ME	1.89	*5.64*	14.53	*0.12*
Jordan	ME	0.77	*2.82*	5.45	*0.06*
Lebanon	ME	1.04	*2.35*	8.21	*0.05*
Palestine	ME	-	-	-	-
Syrian Arab Rep.	ME	1.25	*8.09*	5.18	*0.10*
Turkey	ME	1.39	*40.76*	10.20	*0.83*
MIDDLE EAST		1.29	*59.67*	8.92	*1.16*
Algeria	NA	1.11	*16.34*	7.11	*0.30*
Egypt, Arab Rep.	NA	1.36	*46.85*	5.90	*0.60*
Libya	NA	1.14	*2.63*	11.54	*0.08*
Morocco	NA	0.83	*10.36*	4.62	*0.16*
Tunisia	NA	0.92	*3.79*	6.43	*0.07*
NORTH AFRICA		1.17	*79.97*	6.16	*1.22*
MIDDLE EAST & NORTH AFRICA		1.22	*139.63*	7.25	*2.38*
MEDITERRANEAN AREA		1.44	*277.99*	11.63	*6.32*

12.1 – Legend
- ≤ 1
- $1 < x \leq 1.5$
- $1.5 < x \leq 2$
- > 2
- *No data*

12.2 – Legend
- ≤ 5
- $5 < x \leq 7.5$
- $7.5 < x \leq 10$
- > 10
- *No data*

Data source [Source (Reference year)]:
12.1 – World Bank (2016)
12.2 – UNU-IAS (2019)

Countries and regions		Goal 12 Non-recycled municipal solid waste (12.7) kg/day/cap
France	W-EU	0.81
Greece	W-EU	1.14
Italy	W-EU	0.62
Malta	W-EU	-
Portugal	W-EU	0.98
Spain	W-EU	0.84
Western EuroMed		-
Albania	E-EU	x
Bosnia and Herzegovina	E-EU	x
Croatia	E-EU	x
Cyprus	E-EU	x
Montenegro	E-EU	x
North Macedonia	E-EU	x
Slovenia	E-EU	0.34
Eastern EuroMed		-
EuroMed		-
Israel	ME	1.43
Jordan	ME	x
Lebanon	ME	x
Palestine	ME	x
Syrian Arab Republic	ME	x
Turkey	ME	0.99
MIDDLE EAST		-
Algeria	NA	x
Egypt, Arab Republic	NA	x
Libya	NA	x
Morocco	NA	x
Tunisia	NA	x
NORTH AFRICA		-
MIDDLE EAST & NORTH AFRICA		-
MEDITERRANEAN AREA		-

12.7 – Legend
- ≤ 0.8
- $0.8 < x \leq 0.9$
- $0.9 < x \leq 1$
- > 1
- *No data*
- *No OECD Country*

Data source [Source (Reference year)]:
12.7 – OECD (2018)

3.5.8. Challenge: Crime

Safety is a priority for dignified standards of life and look depending first on political stability and then on social wellbeing and equality, as well as levels of corruption in the exercise of public functions. MENA countries show higher criticalities.

Countries and regions		Goal 16 – Homicides (16.1) n./10^5	Goal 16 – Homicides (16.1) n.people
France	W-EU	1.20	*808.58*
Greece	W-EU	0.94	*100.29*
Italy	W-EU	0.57	*354.46*
Malta	W-EU	1.59	*7.14*
Portugal	W-EU	0.79	*81.70*
Spain	W-EU	0.62	*293.02*
Western EuroMed		0.83	*1,645.20*
Albania	E-EU	2.29	*70.17*
Bosnia and Herzeg.	E-EU	1.17	*45.01*
Croatia	E-EU	0.58	*24.77*
Cyprus	E-EU	1.26	*15.59*
Montenegro	E-EU	2.23	*13.70*
North Macedonia	E-EU	1.20	*25.43*
Slovenia	E-EU	0.48	*10.09*
Eastern EuroMed		1.19	*204.77*
EuroMed		0.86	*1,849.97*
Israel	ME	1.49	*125.26*
Jordan	ME	1.36	*142.23*
Lebanon	ME	2.49	*151.74*
Palestine	ME	0.50	*23.17*
Syrian Arab Repub.	ME	2.18	*386.71*
Turkey	ME	2.59	*2,103.79*
MIDDLE EAST		2.28	*2,932.89*
Algeria	NA	1.36	*566.28*
Egypt, Arab Repub.	NA	2.55	*2,534.88*
Libya	NA	2.50	*165.54*
Morocco	NA	1.42	*495.12*
Tunisia	NA	3.06	*352.37*
NORTH AFRICA		2.12	*4,114.20*
MIDDLE EAST & NORTH AFRICA		2.18	*7,047.09*
MEDITERRANEAN AREA		1.65	*8,897.06*

16.1 – Legend
- ≤ 1.5
- $1.5 < x \leq 2.75$
- $2.75 < x \leq 4$
- > 4
- *No data*

Data source [Source (Reference year)]:
16.1 – UNODC (2018)

Countries and regions		Goal 16: Population who feel safe walking alone at night in the city or area where they live (16.3)	Goal 16: Corruption Perception Index (16.6)
		%	-
France	W-EU	74.00	69.00
Greece	W-EU	69.00	50.00
Italy	W-EU	73.00	53.00
Malta	W-EU	79.00	53.00
Portugal	W-EU	83.00	61.00
Spain	W-EU	80.00	62.00
Western EuroMed		75.32	60.85
Albania	E-EU	68.00	36.00
Bosnia and Herzeg.	E-EU	70.00	35.00
Croatia	E-EU	87.00	47.00
Cyprus	E-EU	71.00	57.00
Montenegro	E-EU	79.00	45.00
North Macedonia	E-EU	68.00	35.00
Slovenia	E-EU	91.00	60.00
Eastern EuroMed		76.52	43.14
EuroMed		75.42	59.44
Israel	ME	79.00	60.00
Jordan	ME	83.00	49.00
Lebanon	ME	54.00	25.00
Palestine	ME	-	-
Syrian Arab Repub.	ME	32.00	14.00
Turkey	ME	59.00	40.00
MIDDLE EAST		55.93	36.13
Algeria	NA	51.00	36.00
Egypt, Arab Repub.	NA	82.00	33.00
Libya	NA	58.00	17.00
Morocco	NA	61.00	40.00
Tunisia	NA	52.00	44.00
NORTH AFRICA		69.10	34.97
MIDDLE EAST & NORTH AFRICA		63.91	35.43
MEDITERRANEAN AREA		68.44	44.89

16.3 – Legend
- ≥ 70
- $70 > x \geq 60$
- $60 > x \geq 50$
- < 50
- *No data*

16.6 – Legend
- ≥ 60
- $60 > x \geq 50$
- $50 > x \geq 40$
- < 40
- *No data*

Data source [Source (Reference year)]:
16.3 – Gallup (2020)
16.6 – Transparency International (2020)

3.6 Transformation Digital Revolution for Sustainable Development

Tracking the progress towards the Transformation 6 requires an indirect approach. Except for a few indicators (e.g. population using the internet; mobile broadband subscriptions), the transition to digital services can have multiple applications in various sectors, concerning different goals and targets.

Figure 3.6 | Selected indicators and challenges in the transformation 6. Digital Revolution for Sustainable Development.

DIGITAL REVOLUTION for SUSTAINABLE DEVELOPMENT

06

GOALS	INDICATORS	CHALLENGES
1 - No poverty	Poverty headcount ratio at $3.20/day (% population)	Poverty
2 - Zero Hunger	Prevalence of obesity, BMI = 30 (% adult population)	Food habits (diet)
	Human Trophic Level (best 2 - 3 worst)	
3 - Good Health and wellbeing	New HIV infections (per 1,000)	Healthy environment
	Age-standardised death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years	
	Traffic deaths rate (per 100,000 population)	
	OECD only: Daily smokers (% population age 15+)	
4 - Quality education	Net primary enrolment rate (%)	Scholarship
	Lower secondary completion rate (%)	
	OECD only: Participation rate in pre-primary organized learning (% ages 4-6)	
	OECD only: Population age 25-34 with tertiary educational attainment (%)	
	OECD only: Underachievers in science (% 15 years old)	Literacy
	OECD only: Resilient students in science (% 15 years old)	
5 - Gender equality	Ratio of female to male labour force participation rate	Women emancipation
	OECD only: Gender wage gap (Total, % male median wage)	
6 - Clean water and sanitation	Population using at least basic drinking water services (%)	Water management
	Freshwater withdrawal as % total renewable water resources	
	Anthropogenic wastewater that receives treatment (%)	Water Quality
7 - Affordable and clean energy	Access to electricity (% population)	Energy supply
	CO2 emissions from fuel combustion for electricity and heating per total electricity output (MtCO2/TWh)	Sustainable energy
	OECD only: Share of renewable energy in total final energy supply (%)	
8 - Decent work and economic growth	Adjusted GDP Growth (%)	Job market
	Adults (15 years and older) with an account at a bank or other financial institutions	
	Unemployment rate (% total labor force)	
	OECD only: Employment-to-Population ratio (%)	
	OECD only: Youth not in employment, education or training (NEET) (%)	
	Victims of Modern Slavery (per 1,000 population)	Labor rights
	Fatal work-related accidents embodied in imports (deaths per 100,000)	
9 - Industry, innovation and infrastructure	Population using the internet (%)	Digital infrastructures
	Mobile broadband subscriptions (per 100 inhabitants)	

3.6.1. Challenge: Digital Infrastructures

Access to Internet services is limited in NA, with over 62 million people offline. Almost 38 million in Europe and over 38 in ME stay offline.
Use of mobile devices is more deployed with some improvements still needed in MENA.

Countries and regions		Goal 9: Population using the Internet (9.1) %	Population using the Internet (9.1) *mln people left*	Mobile broadband subscriptions (9.2) n./10^2
France	W-EU	83.34	*11.31*	69.99
Greece	W-EU	78.12	*2.32*	87.10
Italy	W-EU	76.10	*14.90*	92.20
Malta	W-EU	86.86	*0.06*	87.23
Portugal	W-EU	78.26	*2.24*	79.06
Spain	W-EU	93.21	*3.21*	102.94
Western EuroMed		82.88	*34.03*	86.23
Albania	E-EU	72.24	*0.86*	62.10
Bosnia and Herzegovina	E-EU	73.21	*1.03*	47.27
Croatia	E-EU	78.32	*0.92*	82.10
Cyprus	E-EU	90.80	*0.12*	118.70
Montenegro	E-EU	81.37	*0.11*	80.50
North Macedonia	E-EU	81.41	*0.40*	6.92
Slovenia	E-EU	86.60	*0.28*	84.07
Eastern EuroMed		78.51	*3.71*	64.38
EuroMed		82.53	*37.74*	84.48
Israel	ME	86.79	*1.14*	115.03
Jordan	ME	66.79	*3.59*	77.01
Lebanon	ME	78.18	*1.19*	42.81
Palestine	ME	70.62	*1.41*	-
Syrian Arab Republic	ME	34.25	*12.75*	11.50
Turkey	ME	77.67	*18.31*	74.80
MIDDLE EAST		70.72	*38.41*	64.42
Algeria	NA	57.50	*18.25*	95.99
Egypt, Arab Republic	NA	71.91	*29.24*	59.34
Libya	NA	21.76	*5.39*	35.76
Morocco	NA	84.12	*5.65*	64.92
Tunisia	NA	66.70	*3.90*	77.79
NORTH AFRICA		68.97	*62.44*	68.46
MIDDLE EAST & NORTH AFRICA		69.66	*100.84*	66.85
MEDITERRANEAN AREA		74.73	*138.58*	73.85

9.1 – Legend
- ≥ 80
- $80 > x \geq 65$
- $65 > x \geq 50$
- < 50
- *No data*

9.2 – Legend
- ≥ 75
- $75 > x \geq 57.5$
- $57.5 > x \geq 40$
- < 40
- *No data*

Data source [Source (Reference year)]:
9.1 – ITU (2020)
9.2 – ITU (2019)

This transformation aims to deploy digital technologies disrupting nearly every sector of the economy, including agriculture (precision agriculture), mining (autonomous vehicles), manufacturing (robotics), retail (e-commerce), finance (e-payment and trading strategies), media (social network), health (diagnostics and telemedicine), education (online learning), public administration (e-governance and e-voting), and science and technology. Main objectives concern the universal access to the internet through mobile broadband, digital inclusion and privacy protection. Digital innovation is especially expected to tackle implementation challenges towards sustainable development across the six SDG Transformations (Sachs et al. 2019).

Figure 3.6 shows a selection of indicators and emerging challenges (already mentioned in the previous transformations) that can be indirectly influenced by the use of digital technologies. Rather than directly monitored through specific indicators, the effects of the digital revolution are expected to support and contribute to accomplish the previous 5 transformations. Nevertheless, the strategic role of digitalization and the definition of proper policies and strategies for its implementation require a specific focus (next section).

Focus on The Union for the Mediterranean: regional positive agenda for implementing the SDGs in the Mediterranean

The Union for the Mediterranean (UfM), an intergovernmental institution bringing together 42 Member States from the European Union and the Southern and Eastern Mediterranean, promotes regional cooperation aimed at tackling the root causes of the challenges faced in the Euro-Mediterranean area.

The UfM seeks to address global issues such as climate change, environment, water, higher education, gender equality and research and innovation, based on an inclusive approach while guaranteeing its coherence with and its contribution to the implementation of the Sustainable Development Goals (SDGs) in the region.

The last few years have marked a turning point for the institution, both at a political and operational level. Indeed, a Roadmap adopted by UfM Ministers of Foreign Affairs in 2017 enabled the enhancement of regional dialogue and cooperation, and was reaffirmed in 2020 through five priorities: Environmental and climate action, Sustainable and inclusive economic and human development, Social inclusiveness and equality, Digital transformation and Civil protection.

The first-ever Mediterranean Day took place in 2021, with a series of events that showcased the importance of working jointly in order to achieve the Sustainable Development Agenda in the area. The UfM works as a catalyser for the region and brings together, through its convening power, a wide range of experts and stakeholders to share ideas, build consensus and coordinate efforts in the key areas mentioned above. A role further demonstrated by the approval, in 2021, of a new UfM Research agenda on Climate Change, Renewable Energy and Health, key entry points for a global approach to sustainable development.

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
IN THE MEDITERRANEAN AREA

PRIMA
Partnership of research and innovation in Mediterranean Area

Since 2017, PRIMA has proven to be a successful example of research and innovation partnership, an effective model of cooperation among States and a solid instrument of science diplomacy between Europe, Africa and Middle East. Based on the principle of equal footing among its members, PRIMA has been able to increase the participation of researchers to international calls and projects, and to align national policies on key areas such as water management, sustainable agriculture and food value chain, ensuring coherence with the major agendas and initiatives for the region. This has allowed consolidating trust among countries, between the scientific community and PRIMA and between PRIMA and other relevant actors of the Region. Moreover, in only a few years, it has funded 168 projects involving around 1600 research units, 38% of non EU countries, for an allocated budget of almost 230 million, with around 28% of it going to no European Countries.

From a thematic standpoint, PRIMA is dealing with some of the main challenges addressed at global level, which are crucial for the Euro-Mediterranean societies, such as climate change adaptation and mitigation, sustainable use of natural resources, food safety and security, valorisation of small farmers' productivity, promotion of local products, and fight against food loss and waste. In particular, projects aim at fostering sustainable agrifood systems, addressing water scarcity, promoting soil restoration, protecting biodiversity, ensuring animal welfare, advancing the resilience of agro-livelihood systems and boosting productivity of local value-chains. Several food value-chains have been targeted from tomato to fish, from cheese to different varieties of fruits, from poultry to goats and milk. Projects have also tested and developed conservative agriculture practices, the application of DSS (Decision Support Systems) and IoT (Internet of things) systems to farming systems, irrigation and water management. Moreover, solutions have been funded to promote circularity of production, aquaponics' systems, genetic characterization of resilient cultivars, innovative packaging and blockchain's systems for food safety and security. Similar ideas and projects will benefit significantly from the continuation of PRIMA. Moreover, PRIMA has been innovative in the design of calls, adopting since 2019 a nexus approach able to integrate the interconnections among topics, and launching calls aligned with the EU Mission a Soil Deal for Europe.

PRIMA has funded 168 projects, disbursed around 230 million euro, involving almost 1600 research units across the Mediterranean, and it has proven successful in creating a research and innovation community. The total amount of allocated funding (62.5 million, around 30%) directed to non-EU countries bear witness of this success. This funding and the number of non-EU beneficiaries involved (605, around 38%) prove the interests of the research and innovation communities towards the Initiative, the attractiveness of PRIMA and the relevance of the programme in terms of competitiveness of international research, as well as scientific diplomacy and knowledge exchange. Through international calls, PRIMA has promoted scientific excellence and an increased integration in research and innovation among States and among scientists, including north-south, south-south and north-north cooperation. These results could not have been reached without an integrated, effective Partnership like PRIMA, which has also fostered the alignment of national policies in critical areas such as sustainable agriculture, water management, food value chains.

Recognizably, PRIMA has a major geostrategic role to play. It could foster the green transition in the Mediterranean, capitalizing its results and leveraging on the new opportunities of the EU Green Deal. Significantly, PRIMA is considered a key player in the framework of the Union for the Mediterranean (UfM). In fact, it is the candidate to be the implementer of the thematic priorities (renewable energies, climate change and health) identified in the context of the EC and UfM Research and Innovation Roadmaps. On these priorities, PRIMA can already show some existing or potential complementarities and synergies.

The experience acquired by PRIMA, its efficient management, its institutional features, the strategic role of the Euro-Mediterranean area, as well as the themes funded, make PRIMA an ideal instrument to build back better our societies and to strengthen the ties among the different shores of the Mediterranean, acting as a science-based research and innovation platform.

UNEP/MAP State of the Environment and Development in the Mediterranean

In the framework of the UNEP/MAP-Barcelona Convention system and as mandated by the Contracting Parties to the Barcelona Convention (i.e. 21 Mediterranean countries and the European Union), Plan Bleu has organized and edited the report on the State of the Environment and Development in the Mediterranean (SoED), a collective effort involving more than 150 contributors.

SoED aims at presenting a comprehensive and updated assessment of the interactions between environment and development in the Mediterranean region. This assessment study analyses socio-economic drivers and impacts of environmental degradation of the Mediterranean marine and coastal ecosystems. By applying an integrated and systemic approach, SoED is expected to increase awareness and understanding of environmental status and trends in the region, their driving forces and impacts, facilitating the measurement of progress towards sustainable development, providing an up-to-date foundation for improved decision-making at all levels, and enhancing the implementation of the UN 2030 Agenda, Sustainable Development Goals (SDGs) and the Mediterranean Strategy for Sustainable Development (MSSD).

Over the last decades, human-induced pressures have increasingly affected the Mediterranean region. Population growth and unsustainable production and consumption patterns have led to environmental degradation. Despite some progress, economic growth continues to increase resource consumption and carbon emissions. Land- and sea-use change, in particular on the coast, are detrimental to the environment. Exploitation of resources and organisms, pollution and climate change are projected to exacerbate pre-existing fragilities in the Mediterranean, leading to “multiple stresses and systemic failures”, putting health and livelihoods at risk.

Progress has been achieved in policy responses and actions to manage the Mediterranean more sustainably. Results are positive compared to scenarios with no intervention. However, these results have not been sufficient to reduce the most significant pressures on the environment and to safeguard the Mediterranean for present and future generations while meeting human development needs. Current trends do not allow achievement of Good Environmental Status (GES) of the Mediterranean Sea by 2020.

Urgent and collective efforts for transformative change are required to safeguard the Mediterranean environment, while simultaneously fostering human development, taking into account differences between Mediterranean countries. Mediterranean countries have committed to achieve GES of the Mediterranean Sea and coast and more largely the SDGs under the 2030 Agenda. A fundamental reorganization of economic and social systems, including changes in paradigms and values, is required to achieve these commitments.

Reference

UNEP/MAP and Plan Bleu (2020). State of the Environment and Development in the Mediterranean. Nairobi

UNEP/MAP and Plan Bleu (2020). State of the Environment and Development in the Mediterranean. Summary for Decision Makers. Nairobi

UNEP/MAP and Plan Bleu (2020). State of the Environment and Development in the Mediterranean. Key Messages. Nairobi

https://planbleu.org/en/soed-2020-state-of-environment-and-development-in-mediterranean/

#SustainableMED

4. Recommended policies

The indicators selected and the corresponding tables, elaborated and interpreted by area, trace a general picture of Mediterranean countries in relation to the actuation of the six transformations. The emerging picture allows for highlighting the main challenges to tackle in the short, medium and long period. The list of challenges has been taken as guideline to determine a series of policies and strategies to accomplish each transformation. This is aimed at addressing the planning of coordinated actions, relating to the characteristics of the four macro-regions, and foster the interaction between research centres and both the public and the private sectors. In particular, the following sections have been outlined, one per each transformation, and relevant initiatives or projects selected (within dedicated boxes) to support the transition process in the complex Mediterranean context.
In general, recommended policies can be classified into the following seven categories.

Regulation and control protocols to be applied by public authorities at both transnational and national level, as part of a cooperative action shared by all the Mediterranean countries or specific Mediterranean regions.

Practices of governance aimed at improving performance of public-private facilities and services through sectorial planning, including urbanism, resource and waste management (e.g. energy and water supply networks), mobility in all its forms, coastal and marine governance, ecosystem services, climate change mitigation.

Incentive schemes and supporting programs for sustainable development, aimed at deploying best practices through political agreements, financial support, and public-private initiatives. Governments, international organizations and businesses should coordinate their action and increase their investments for SDG implementation.

Information and educational programs including awareness raising campaigns, knowledge transfer, capacity building and innovation development, especially targeting young generations, enterprises, value chain operators in any productive sector.

Stakeholders engagement mechanisms to promote broad public support for each transformation. The scientific community can play an important role to develop tools and methods for multi-stakeholder engagement allowing for technical feasibility of long-term pathways.

Digital and technological development to implement monitoring systems as decision-support tools and data sharing systems at transnational level. For example, the development of open access repositories of successful experiences and solutions in the Mediterranean region can contribute to support the SDGs achievement and the emergence of new transnational partnerships. This action clearly refers to the Transformation 6 that is mentioned among strategic policies for the achievement of all the transformations.

Economic and market development by fostering innovation through the engagement of value chain actors and providing information directly to consumers thus promoting healthier and more sustainable behaviours.

In general, the perception of the Mediterranean as a common stage needs to be emphasised and strengthened through a more intense cooperation and transnational collaboration among countries, besides interactions between disciplines, to face complex challenges and fill the gap towards the SDGs.

5. Conclusions

The present report, Sustainable Development in the Mediterranean, uses indicators taken from the world edition of the Sustainable Development Report 2021, grouped into six transformations as proposed by Sachs et al. (2019). Its main goal is to use the SDSN indicators as a decision support tool aimed at driving choices and addressing multiple stakeholders activities to achieve the SDGs in the Mediterranean area.

After analysing selected indicators and specific challenges per each transformation, a set of policies were determined and suggested as possible solutions.
A few major findings from the report can be shared by the 24 Mediterranean countries.

- Endorsements of the SDGs in official statements, regulations, sectorial plans and programs at transnational, national and local levels are highly desirable in the next future. The "European Green Deal" (EC 2019) is a first example of a consistent operative framework shared by European countries; it can be taken as reference for similar initiatives in the MENA area and for determining a common strategy for sustainability in the Mediterranean.

- Public authorities should act in collaboration with businesses, civil society and other stakeholders by supporting initiatives and participative approaches through economic incentives and investments. The European Taxonomy (EU-TEG 2020, EU 2020) represents a first step in this direction since it lays the basis for tracing new legal obligations for financial markets, large companies and the member states, by providing detailed technical screening criteria for determining when an economic activity can be considered sustainable. Taking inspiration from this initiative, research centres in all the Mediterranean countries can play a crucial role to address choices and develop mechanisms for stakeholders engagement, contributing to make all the members of the society be part of well designed and widely agreed transformation processes.

- Businesses are expected to change their mission, fully embracing sustainability as a driving principle for their activities. Increasing environmental and social performances throughout the production chains becomes a competitive factor for value chain actors and open opportunities for market development in a new sustainable rationale, with benefits in terms of economic growth, resilience and duration in time. This would progressively transform the market from a linear to a circular economy.

- The digital revolution can multiply opportunities for life and business assuring wide accessibility to basic services and supporting market oriented initiatives, such as through the emergence of thematic networks and clusters to foster knowledge transfer and innovation capacity building. Moreover, increased traceability systems and transparency on information sources would support fairness and security with benefits for any user and consumer.

- High-income countries often generate high environmental and socio-economic spillover effects. Domestic implementation of the SDGs should not undermine other countries' ability to achieve the goals, for example though the tolerance for poor labour or low environmental standards in international supply chains. This makes international partnerships important elements for coordinating actions at the transnational level and sharing a common roadmap for sustainability in the Mediterranean region.

This report provides a general view, not pretending to be exhaustive, on the SDGs achievement in the Mediterranean and proposes a set of possible policies and best practices as a shareable roadmap for sustainability. It can be used a decision support tool by taking into account recommended actions and their measures through specific indicators, allowing for maximising the impact of policies through backcasting and progressively monitoring their ex post effects. Scope of the report is to start a coherent transformation process and, as stated in the foreword, contribute to close the gap between rhetoric and action.

References

Alsamawi, A., Murray, J., Lenzen, M., and Reyes, R. C. (2017). Trade in occupational safety and health: Tracing the embodied human and economic harm in labour along the global supply chain. Journal of Cleaner Production, 147, 187–196.

Balde, C.P., V. Forti, V. Gray, R. Kuehr, P. Stegmann (2017). The Global E-waste Monitor 2017. United Nations University (UNU), International Telecommunication Union (ITU) and the International Solid Waste Association (ISWA), Bonn/Geneva/Vienna

BirdLife International, IUCN, UNEP-WCMC (2021). Resources and Data. Available from: https://unstats.un.org/sdgs/indicators/database/

Bonhommeau, S., Dubroca, L., Le Pape, O., Barde, J., Kaplan, D. M., Chassot, E., and Nieblas, A. E. (2013). Eating up the world's food web and the human trophic level. Proceedings of the National Academy of Sciences, 110(51), 20617-20620. Available from: https://doi.org/10.1073/pnas.1305827110

Brauer, M. et al. 2017, for the Global Burden of Disease Study 2017. PM2.5 air pollution, population exposed to levels exceeding WHO guideline value (% of total) (EN.ATM.PM25.MC.ZS)

Chandy, L., Seidel B. (2017). How much do we really know about inequality within countries around the world? Adjusting Gini coefficients for missing top incomes. Op-Ed, 17 February. The Brookings Institution. Available from: https://www.brookings.edu/opinions/how-much-do-we-really-know-aboutinequality-within-countries-around-the-world/

Claudet, J., Loiseau, C., Sostres, M., & Zupan, M. (2020). Underprotected Marine Protected Areas in a Global Biodiversity Hotspot. One Earth, 2(4), 380-384.

Cramer, W., Guiot, J., Fader, M., Garrabou, J., Gattuso, J-P., Iglesias, A., Lange, M.A., Lionello, P., Lla-sat, M.C., Paz, S., Peñuelas, J., Snoussi, M., Toreti, A., Tsimplis, M.N., Xoplaki, E. (2018). Climate change and interconnected risks to sustainable development in the Mediterranean. Nature Climate Change 8, 972-980.

Curtis et al. (2018). Classifying drivers of global forest loss. Science, Vol. 361, Issue 6407, pp. 1108–1111. (Data updated in 2020).

Demirgüç-Kunt, A.i, Klapper, L., Singer, D., Ansar, S., and Hess, J. (2018). Global Financial Inclusion Database. World Bank, Washington, D.C. Available from: https://data.worldbank.org/indicator/FX.OWN.TOTL.ZS

EC (2019). Communication from the Commission to the European Parliament [...]. The European Green Deal. December 2019.

EU (2020). Regulation EU 2020/852 of the European Parliament and the Council on the establishment of a framework to facilitate sustainable investment. June 2020

EU-TEG (2020). Financing a Sustainable European Economy. Taxonomy: Final report of the Technical Expert Group on Sustainable Finance. March 2020.

Eurostat (2017). Your key to European Statistics. Available at: https://ec.europa.eu/eurostat/web/main/home

FAO (2021). Aquaculture production (metric tons). Food and Agriculture Organization, Rome. https://data.worldbank.org/indicator/ER.FSH.AQUA.MT

FAO (2021). Capture fisheries production (metric tons). Food and Agriculture Organization, Rome. http://data.worldbank.org/indicator/ER.FSH.CAPT.MT

FAO (2021). Cereal yield (kg per hectare). Food and Agriculture Organization, Rome. Available from: http://data.worldbank.org/indicator/AG.YLD.CREL.KG.

FAO (2021). Forest area (% of land area). Food and Agriculture Organization, Rome. http://data.worldbank.org/indicator/AG.LND.FRST.ZS

FAO (2021). AQUASTAT. Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (%). Food and Agriculture Organization, Rome. Available from: http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

FAO (2021). Prevalence of undernourishment (% of population). Food and Agriculture Organization, Rome. Available from: http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS.

Forti V., Baldé C.P., Kuehr R., Bel G. (2020). The Global E-waste Monitor 2020: Quantities, Flows and the Circular Economy Potential. United Nations University/United Nations Institute for Training and Research, International Telecommunication Union, and International Solid Waste Association, Bonn/Geneva/Rotterdam.

Gallup (2021). Gallup World Poll. http://www.gallup.com,

Gutschow, J., Jeffery, L., Gieseke, R. (2019): The PRIMAP-hist national historical emissions time series (1850–2016). v2.0.GFZ Data Services. https://doi.org/10.5880/pik.2019.001

IEA (2019). CO2 Emissions from Fuel Combustion. International Energy Agency, Paris. Available from: https://www.iea.org/reports/co2-emissions-from-fuel-combustion-2019

IHME (2020). The global burden of disease study 2019. Institute for Health Metrics and Evaluation (IHME), University of Washington. The Lancet, 17 October 2020, Volume 396, Issue 10258, Pages 1129–1306

Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Washington, DC: World Bank

ILO (2021). Ratio of female to male labor force participation rate (%) (modeled ILO estimate). International Labour Organization, Geneva. Available from: https://data.worldbank.org/indicator/SL.TLF.CACT.FM.ZS.

ILO (2021). Unemployment, total (% of total labor force) (modeled ILO estimate). International Labour Organization, Geneva. Available from: http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS

International Labour Organization, Geneva. Available from: https://data.worldbank.org/indicator/SL.TLF.CACT.FM.ZS.ILO (2021b). Unemployment, total (% of total labor force) (modeled ILO estimate).

International Labour Organization, Geneva. Available from: http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS.

ILO (2021). Wage and salaried workers, total (% of total employment) (modeled ILO estimate). International Labour Organization, Geneva. http://data.worldbank.org/indicator/SL.EMP.WORK.ZS

International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates, (2020). Air transport, passengers carried (IS.AIR.PSGR). https://datacatalog.worldbank.org/public-licenses#cc-by

International Union of Railways (UIC), (2020). Railways, passengers carried (million passenger-km) (IS.RRS.PASG.KM). https://datacatalog.worldbank.org/public-licenses#cc-by

IPU (2021). Proportion of seats held by women in national parliaments (%). Inter-Parliamentary Union, Geneva. Available from: http://data.worldbank.org/indicator/SG.GEN.PARL.ZS.

ITU (2021). World Telecommunication/ICT Indicators database. International Telecommunication Union, Geneva. Available from: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx

Lenzen, M., Malik, A., Li, M., Fry, J., Weisz, H., Pichler, P-P., Chaves, L.S.M., Capon, A. Pencheon, D. (2020). The environmental footprint of health care: a global assessment, The Lancet Planetary Health 4(7).

MedECC (2019). Risks associated to climate and environmental changes in the Mediterranean Region.

National Science Foundation (2021). Scientific and technical journal articles. National Science Foundation, Arlington, VA. Available from: http://data.worldbank.org/indicator/IP.JRN.ARTC.SC.

Ocean Health Index (2019). Ocean Health Index 2019 Global Assessment. National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara. Available from: http://data.oceanhealthindex.org/data-anddownloads.

OECD (2020). OECD Affordable Housing Database. Available from: http://www.oecd.org/housing/data/affordablehousing-database/), indicator HC1.2.

OECD (2021). Environmental Policy: Effective Carbon Rates. OECD Environment Statistics (database), https://doi.org/10.1787/108c55c1-en.

OECD (2021). OECD Statistics. Organisation for Economic Cooperation and Development, Paris. Available from: http://stats.oecd.org/.

OECD (2021). PISA Database. Organisation for Economic Cooperation and Development, Paris. Available from: http://pisadataexplorer.oecd.org/ide/idepisa/dataset.aspx.

Oita, A., Malik, A., Kanemoto, K. et al. (2016). Substantial nitrogen pollution embedded in international trade. Nature Geoscience, 9, pp. 111–115. Available from: doi: 10.1038/ngeo2635.

Pauly D, Zeller D, and Palomares M.L.D. (editors) (2020). Sea Around Us Concepts, Design and Data (www.seaaroundus.org).

Reporters without Borders (2020). World Press Freedom Index 2020. Available from: https://rsf.org/en/ranking

Sachs, J.D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., Rockström, J. (2019). Six Transformations to achieve the Sustainable Development Goals. Nature Sustainability 2, 805–814.

Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G. (2019a). Sustainable Development Report 2019. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Sachs, J., Schmidt-Traub, G., Pulselli, R.M., Gigliotti, M., Cresti, S., Riccaboni, A. (2019b). Sustainable Development Report 2019 – Mediterranean Countries Edition. Siena: Sustainable Development Solutions Network Mediterranean (SDSN Mediterranean).

Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. (2020). The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.

Saladini, F., Betti, G., Ferragina, E., Bouraoui, F., Cupertino, S., Canitano, G., Gigliotti, M., Autino, A., Pulselli, F.M., Riccaboni, A., Bidoglio, G., Bastianoni, S. (2018). Linking the water-energy-food nexus and sustainable development indicators for the Mediterranean region. Ecological Indicators 91 689-697.

SE4All (2021). Access to electricity (% of population). Sustainable Energy for All. Available from: http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS.

SIPRI (2021). SIPRI Arms Transfers Database. Stockholm International Peace Research Institute. Available from: https://www.sipri.org/databases/armstransfers.

Times Higher Education (2021). World University Rankings 2021.

Transparency International (2021). Corruption Perceptions Index 2020. Transparency International, Berlin. Available from: https://www.transparency.org/en/cpi/

UN Comtrade (2021). UN Comtrade Database. Available from: https://comtrade.un.org

UN Habitat (2021). Proportion of urban population living in slums. United Nations Human Settlements Programme, Nairobi, Kenya. Available from: https://data.unhabitat.org/datasets/52c52084f31a403397e2c3bbee37f378_0/data

UN IGME (2021). Mortality rate, neonatal (per 1,000 live births). United Nations Interagency Group for Child Mortality Estimation (UN IGME). United Nations Children's Fund (UNICEF), New York. Available from: http://data.worldbank.org/indicator/SH.DYN.NMRT

UN IGME (2021). Mortality rate, under 5 (per 1,000 live births). United Nations Interagency Group for Child Mortality Estimation (UN IGME). United Nations Children's Fund (UNICEF), New York. Available from: http://data.worldbank.org/indicator/SH.DYN.MORT

UNAIDS (2021). Aidsinfo. HIV incidence per 1000 population (15–49). Joint United Nations Programme on HIV and AIDS, Geneva. Available from: http://aidsinfo.unaids.org

UNDESA (2021). Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods (% of women aged 15–49 years).

UNESCO (2021). Government expenditure on education. United Nations Educational, Scientific and Cultural Organization, Paris. Available from: http://data.worldbank. org/indicator/SE.XPD.TOTL.GD.ZS. WHO (2021).

UNESCO (2020). Pupil-teacher ratio, primary. UNESCO, Institute for Statistics. Available from: https://data.worldbank.org/indicator/SE.PRM.ENRL.TC.ZS

UNICEF (2021). Births attended by skilled health staff (% of total). United Nations Children's Fund (UNICEF), New York. Available from: http://data.worldbank.org/indicator/SH.STA.BRTC.ZS.

UNICEF (2021). Child Labour. United Nations Children's Fund (UNICEF), New York. Available from: http://data.unicef.org/topic/child-protection/child-labour/.

UNICEF, WHO, World Bank (2021). Prevalence of stunting, height for age (% of children under 5). Joint Child Malnutrition Estimates. United Nations Children's Fund (UNICEF), New York. Available from: https://data.worldbank.org/indicator/SH.STA.STNT.ZS.

UNICEF, WHO, World Bank (2021). Prevalence of wasting, weight for height (% of children under 5). Joint Child Malnutrition Estimates. United Nations Children's Fund (UNICEF), New York. Available from: https://data.worldbank.org/indicator/SH.STA.WAST.ZS.

UNODC (2021). Global Study on Homicide. United Nations Office on Drugs and Crime, Vienna. Available from: https://www.unodc.org/unodc/en/data-and-analysis/globalstudy-on-homicide.html.

Walk Free Foundation (2018). Global Slavery Index. Walk Free Foundation, Broadway Nedlands, Australia. Available from: https://www.globalslaveryindex.org/.

Wendling, Z. A., Emerson, J. W., Esty, D. C., Levy, M. A., de Sherbinin, A., et al. (2018). 2018 Environmental Performance Index. Yale Center for Environmental Law and Policy, New Haven, CT. Available from: http://epi.yale.edu.

WHO (2020). World Health Expenditure Database. World Health Organization, Geneva. Available from: http://apps.who.int/nha/database.

WHO (2021). Age-standardized death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years, per 100 000 population. World Health Organization, Geneva. Available from: https://apps.who.int/gho/data/view.main.GSWCAH21v

WHO (2021). GHO Life expectancy and healthy life expectancy. World Health Organization, Geneva. Available from: http://apps.who.int/gho/data/node.main.688.

WHO (2021). GHO Obesity (age- standardized estimate). World Health Organization, Geneva. Available from: http://apps.who.int/gho/data/view.main.CTRY2450A?lang=en

WHO (2021). GHO Road traffic deaths. World Health Organization, Geneva. Available from: http://apps.who.int/gho/data/node.main.A997

WHO (2021). Incidence of tuberculosis (per 100,000 people). World Health Organization, Geneva. Available from: http://data.worldbank.org/indicator/SH.TBS.INCD.

WHO (2021). Tracking Universal Health Coverage: 2021 Global Monitoring Report. World Health Organization, Geneva. Available from: http://www.who.int/healthinfo/universal health_coverage/report/2021/en/.

WHO and UNICEF (2021). Immunization Coverage. World Health Organization and United Nations Children's Fund, Geneva and New York. Available from: http://data.unicef.org/topic/child-health/immunization/.

WHO and UNICEF (2021b). Data and Estimates. WHO / UNICEF Joint Monitoring Programme: World Health Organization and United Nations Children's Fund, Geneva and New York. Available from: https://washdata.org/data.

WHO, UNICEF, and UNFPA, World Bank Group, and the United Nations Population Division (2021). Maternal mortality ratio (modeled estimate, per 100,000 live births). In Trends in Maternal Mortality: 2000 to 2017. World Health Organization, Geneva. Available from: http://data.worldbank.org/ indicator/SH.STA.MMRT.

WHO, UNICEF (2020). WHO / UNICEF Joint Monitoring Programme: Data and estimates. People using at least basic drinking water services (% of population). World Health Organization and United Nations Children's Fund, Geneva and New York. https://washdata.org/data

WHO, UNICEF (2020). WHO / UNICEF Joint Monitoring Programme: Data and estimates. People using at least basic sanitation services (% of population). World Health Organization and United Nations Children's Fund, Geneva and New York. https://washdata.org/data

World Bank (2018). Logistics performance index (LPI). World Bank, Washington, D.C. Available from: http://lpi.worldbank.org/international/global.

World Bank (2021). Female share of graduates from science, technology, engineering and mathematics (STEM) programmes, tertiary (%). World Bank, Washington, D.C. Available from: https://databank.worldbank.org/reports.aspx?source=283&series=SE.TER.GRAD.FE.SI.ZS.

World Bank (2021). Firms with female top manager (% of firms). World Bank, Washington, D.C. Available from: https://data.worldbank.org/indicator/IC.FRM.FEMM.ZS

World Bank (2021). GDP per capita, PPP (current international $). World Bank, Washington, D.C. Available from: https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD.

World Bank (2021). Proportion of people living below 50 percent of median income (%). World Bank, Washington, D.C. Available from: https://data.worldbank.org/indicator/SI.DST.50MD

World Data Lab (2021). Poverty headcount ratio at $3.20/day. Available from: https://worldpoverty.io/

Zhang, X., and Davidson, E. (2019). Sustainable Nitrogen Management Index. Earth and Space Science Open Archive. Available from: https://doi.org/10.1002/essoar.10501111.1.

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Climate Change and Security in the Mediterranean: Exploring the Nexus, Unpacking International Policy Responses

edited by
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Edizioni Nuova Cultura

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List of abbreviations

ACER	European Union Agency for the Cooperation of Energy Regulators
AFID	Alternative Fuels Infrastructure Directive
ALG	Autorité du Liptako-Gourma
AP	Agency for Peacebuilding
AU	African Union
BTC	Bilateral Transfer Capacity
CBAM	Carbon Border Adjustment Mechanism
CEN-SAD	Community of Sahel-Saharan States
CILSS	Comité permanent inter-État de lutte contre la sécheresse au Sahel
CO2	Carbon dioxide
COMELEC	Comité Maghrébin de l’Electricité (Maghreb Electricity Committee)
COP26	2021 United Nations Climate Change Conference
CSP	Concentrated Solar Power
EEAS	European External Action Service
EED	Energy Efficiency Directive
EIP	Economic and Investment Plan
EMP	Euro-Mediterranean Partnership
ENP	European Neighbourhood Policy
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
ESR	Effort Sharing Regulation
EU	European Union
EU ETS	European Union Emissions Trading System
GCF	Green Climate Fund
GDP	Gross Domestic Product

GHG	Greenhouse Gas
Ios	International organisations
IPCC	Intergovernmental Panel on Climate Change
kV	Kilovolt
LULUCF	Land Use, Land-Use Change and Forestry
MAP	Mediterranean Action Plan
MedECC	Mediterranean Experts on Climate and Environmental Change
MEDREG	Association of Mediterranean Energy Regulators
Med-TSO	Association of Mediterranean Transmission System Operators
MENA	Middle East and North Africa
MSP	Mediterranean Solar Plan
MW	Megawatt
NATO	North Atlantic Treaty Organization
NDC	Nationally Determined Contribution
NDICI	Neighbourhood, Development and International Cooperation Instrument
NGO	Non-governmental organisation
O3	Tropospheric ozone
OECD	Organization for Economic Cooperation and Development
OSCE	Organization for Security and Co-operation in Europe
PPRD	Prevention, Preparedness and Response to Natural and Man-made Disasters
PV	Photovoltaic
RCP	Representative Concentration Pathway
RED	Renewable Energy Directive
SEM	Southern and Eastern Mediterranean
SO2	Sulphur dioxide
UfM	Union for the Mediterranean
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme

Foreword

The current geological era is known to many as the Anthropocene. This concept aims to underline the way in which the terrestrial environment is shaped by the effects of human action. Yet, while the problem of human behaviour is no doubt present,[1] it is almost fully linked to certain societies and economies, located in particular in Northern Europe, on the Atlantic coast of the United States and in Eastern China. Most of the rest of the world and its inhabitants bear little responsibility for the causes and dynamics related to the Anthropocene, beyond sharing its dramatic effects.

Although the Anthropocene is a largely inaccurate concept – and despite being considered by a growing number of scholars as a "Eurocentric" and "unnecessary" intellectual posturing – ongoing debates surrounding this term are nonetheless igniting a few positive effects. The most important is reaffirmation of the salience of human beings and their actions. The marginal centrality of our planet and its inhabitants was reinforced by many discoveries made in modern times. Think about Copernicus (1473–1543), who confirmed that the Earth revolves around the Sun and that therefore the former is not positioned at the centre of our solar system; or Kepler (1571–1630), whose telescopes confirmed for the first time that the Earth is only one planet among billions of others. The same applies to dozens of others scholars and scientists, including Charles Darwin (1809–1882), who contended that monkeys, apes and humans must share a common ancestor and are therefore part of a broader and more complex process connected to life on Earth. After

[1] Jürgen Renn noted that "the present concentration of carbon dioxine has been reached at a rate at least ten, and possibly one hundred times faster than increases at any time during the previous 420,000 years". See Jürgen Renn, *The Evolution of Knowledge. Rethinking Science for the Anthropocene*, Princeton, Princeton University Press, 2020, p. 4.

many centuries, the concept of the Anthropocene is making a contribution towards tackling what has long appeared as an inherent "perception of marginality" of human beings, giving new strength to the positive and negative impact that we can all exert on our planet.

Climate Change and Security in the Mediterranean is a timely work which places human beings and their actions at centre stage. The editors and contributors to this volume analyse the relation between security and climate change, while also informing readers about innovative ideas and practical strategies that human beings can adopt to tackle climate-related dynamics in the Mediterranean space and beyond.

Last but not least, the volume provides inputs that pertain to both state and societal levels, and shed further light on the Sahel and other areas deeply affected by conflict and what some call "climate-induced migration", with all the repercussions that this issue has on African countries and, to a much lesser extent, on Europe. The latter, for many centuries, contributed to intercontinental migration more than any other continent: between 1820 and 1930 more than 60 million Europeans emigrated toward Australia, New Zealand, North America and a number of other areas defined by Alfred W. Crosby as "Neo-Europes". On the other hand, migrants from other continents rarely chose Europe as a destination. Humanising the ongoing "othering" process – increasingly common in our times – should indeed be considered as a key component of climate-related solutions.

Lorenzo Kamel
May 2022

Introduction: Framing the Climate Emergency in the Mediterranean

Andrea Dessì and Flavia Fusco

A conveyer belt of knowledge, traditions and heritages, the Mediterranean has historically acted as a connector between different regions and continents. Stretching from the Atlantic Ocean to the Red Sea and the Bosporus, the Mediterranean is the world's largest inland sea, connecting the African, European and Asian continents and witnessing a significant cross-fertilisation of people, ideas and goods. Host to a broad diversity of states and societies, elements of a shared historical heritage continue to define the contemporary *mediterraneus*, beyond the clear political, economic and social diversity that inherently characterise this common space. Rather than a simple geographic backdrop, the Mediterranean has represented a fundamental constitutive element for the flourishing of societies, expansive empires and technological advancements, elements that have propelled human development but also produced conflict, colonial oppression, uneven development and unjust exploitation. In this regard, the Mediterranean maintains its characteristic of literally – albeit not unproblematically – being a "sea in the middle", caught between elements of a shared past and an increasingly divergent present but in which geography continues to shape forms of interaction and coexistence, both in terms of perceived threats and opportunities.

The ties that bind Mediterranean societies have survived the appearance and disappearance of empires, world wars and global ideational conflicts, the advent of industrialisation and information technologies as well as the diverging trajectories of growth and political development. Yet, with the beginning of the European integration process, first through the establishment of the European Economic Community and then via the creation of the European Union, trends of divergence have increased. One by product of these processes was that the Mediterranean gradually moved from a bridge into a boundary and eventually a socio-political and economic border separating Europe in the north from the Middle East and North Africa (MENA) in the south and eastern Mediterranean. While examples of conviviality and shared praxis or traditions have survived and do exist especially at the societal level, the European integration process has accelerated alternate trajectories across the Mediterranean Basin, itself becoming a constitutive element for the development of a new political identity across Europe that was increasingly separate from other Mediterranean Basin states to the south and the east. As Europe's southern Mediterranean states re-oriented their priorities northwards, the ties that bind the Mediterranean Basin were increasingly overshadowed by new political and socio-economic boundaries separating Europe from its co-called "southern neighbourhood", where priorities were different and efforts to promote genuine integration and inclusive cooperation have struggled to materialise.

Some have framed the Mediterranean's unity in diversity as a by-product of the particular geography of the region in which a peculiar *complicity* between land and sea, symbolising rootedness and emancipation has materialised. In this understanding, multiplicity and diversity emerge as values in and of themselves allowing for the production of a shared identity rooted in the "accidental historical coexistence of multiple ways of living in a single basin".[1] Inherent to this land-sea relationship is the Mediterranean's traditionally mild and hospitable climate, the harbinger for human development and a key constitutive element of this shared diversity that has become stratified in the historical experiences of Mediterranean states and societies. It was this "Mediterranean climate" that brought about the agricultural revolution roughly 10,000 years ago and it was thanks to this element that the Mediterranean would not only be host to some of the most expansive

[1] Onofrio Romano, "Mediterraneanism", in Ashish Kothari et al. (eds), *Pluriverse. A Post-Development Dictionary*, New Delhi, Tulika Books, 2019, p. 237-240 at p. 238.

empires, but also the harbinger of ground breaking architectural and technological innovations, many of which sought to harness the environment and climatic specificities of the Mediterranean, both on land and sea. These would propel constant interactions between and across the Mediterranean Basin, making the environment and specific geography of the region a fundamental constituent element for the political, economic and socio-cultural development of Mediterranean societies.

Today, the changing Mediterranean climate is again defining and re-defining this region, replicating this relationship of unity in diversity across its lands and waters. Rising temperatures and sea levels, stronger and reoccurring heat waves, declining precipitation, droughts and other extreme weather events have turned the Mediterranean into a climate change hotspot, meaning that climate has become even more crucial in shaping the present and future trajectories of the countries and populations that inhabit this space. Whether this new, common and even existential threat will produce convergence or divergence across the Mediterranean Basin remains to be seen. What is clear is that the climate emergency will be far reaching, exacerbating pre-existing challenges across Mediterranean states and making the need for genuine north-south and south-south cooperation ever more urgent if mitigating and adaptation strategies are to be pursued in an inclusive manner.

The Mediterranean hotspot

In August 2021, a monitoring station on the Italian island of Sicily deep in the Mediterranean set a new record for the highest temperature ever recorded in Europe. Measuring 48.8 degrees Celsius (119.84 Fahrenheit), this replaced a previous record of 48°C set by the Greek capital Athens back in July 1977.[2] At the same time, across the Strait of Sicily, in Tunisia, an even greater measurement – 49°C – was recorded in the capital Tunis, far outstripping the previous record of 46.8°C set in 1982 by

[2] Gaia Pianigiani, "Sicily Registers Record-High Temperature as Heat Wave Sweeps Italian Island", in *The New York Times*, 12 August 2021, https://www.nytimes.com/2021/08/12/world/europe/sicily-record-high-temperature-119-degrees.html.

Tunisia's Meteorological Institute.[3] The unprecedented heat wave – with 2021 being the fifth warmest year on record since 1850 according to the EU Copernicus Climate Change Service[4] – would coincide with massive wildfires in various localities across the globe, including Turkey, Greece, Algeria, Italy and France, causing deaths and widespread damage to livelihoods, infrastructure and the economy.[5]

Far from being restricted to the Mediterranean, the climate emergency has made itself evident in every corner of the globe. The direct, climate-related effects of a warming climate are caused by carbon and methane emissions linked to unsustainable growth and consumption models born in Europe and the US and subsequently exported to much of the rest of the world. A vast body of scientific research has long demonstrated the causal link between highly polluting human activities and the worsening global climate emergency, demonstrating in concrete terms how no dimension of human and planetary health is spared from the direct and indirect effects of a warming climate.[6] Widely recognised as a threat multiplier, climate change will (and already is) having cascading effects on the full spectrum of human livelihoods, severely impacting the sustainability of living eco-

[3] "Tunis Hit Record 49C in Heat Wave on Tuesday", in *Reuters*, 11 August 2021, https://www.reuters.com/article/climate-change-tunisia-idAFL1N2PI0JP.

[4] The hottest years on record were 2020 and 2016. See, "2021 Was the Fifth-Hottest Year on Record as Emissions Surge", in *Al Jazeera*, 10 January 2021, https://aje.io/33zx6k.

[5] During the same month, major flooding in Turkey, China and the US, combined with a hurricane in Mexico, only added to a growing global awareness about the visible effects of the climate emergency, and this after major flooding ravaged northern Europe in July 2021, causing over 200 deaths in Germany, Belgium and the Netherlands in what was the continent's deadliest flood since 1985. See, UN Regional Information Centre, *2021 Floods: UN Researchers Aim to Better Prepare for Climate Risks*, 24 January 2022, https://unric.org/en/2021-floods-un-researchers-aim-to-better-prepare-for-climate-risks; Bob Henson and Jeff Masters, "Central Europe Staggers toward Recovery from Catastrophic Flooding: More than 200 Killed", in *Yale Climate Connections*, 21 July 2021, https://yaleclimateconnections.org/?p=77745.

[6] See for instance, Benjamin Franta, "Shell and Exxon's Secret 1980s Climate Change Warnings", in *The Guardian*, 19 September 2018, https://www.theguardian.com/p/9d8z4; Intergovernmental Panel on Climate Change (IPCC), *Climate Change Widespread, Rapid, and Intensifying – IPCC*, 9 August 2021, https://www.ipcc.ch/?p=38565.

systems and species diversity as well as the upholding of social contracts, given its effects on food and water security, public health, state budgets, social justice and inequality.[7]

Growing evidence about the multidimensional effects of climate change on both the environment *and* human health and socio-political security has spurred efforts to develop mitigating and adaptation strategies at the international, regional and nation-state levels. In this context, while the United States and even more so the European Union have both adopted ambitious blueprints for a green energy transition to net-zero emissions by 2050, other states and regions are struggling to reorganise their economies to limit pollution and waste while increasing the use of renewables. At the international level, world states remain committed to limiting global temperature increases to 1.5–2°C compared to preindustrial times, a target first set during the 2015 UN Climate Summit in Paris. Yet, the pace of international efforts to tackle pollution levels and empower renewables and the green energy transition are far from sufficient to meet such an objective, as demonstrated by the repeated warnings issued by the UN Intergovernmental Panel on Climate Change (IPCC).[8] These have illustrated, in minute detail, the real-world implications of the climate emergency, producing modelling and simulations that demonstrate the ramifications of temperatures rising beyond the 1.5°C target and reaching as far as a 3°C and even 4°C compared to pre-industrial levels, a scenario that would imply existential disruptions for all living ecosystems, particularly in the developing world and in regions already suffering from significant socio-economic and political crises and where weak social contracts could well be pushed over the brink by such developments.

While many states beyond Europe and the US have similarly pledged

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[7] See for instance, IPCC, *Climate Change: A Threat to Human Wellbeing and Health of the Planet. Taking Action Now Can Secure Our Future*, 28 February 2022, https://www.ipcc.ch/?p=40120.

[8] See for instance, Valérie Masson-Delmotte et al. (eds), *Global Warming of 1.5 C. An IPCC Special Report on the Impacts of Global Warming…*, 2019, https://www.ipcc.ch/sr15; Zeke Hausfather, "UNEP: 1.5C Climate Target 'Slipping Out of Reach'", in *Carbon Brief*, 26 November 2019, https://www.carbonbrief.org/unep-1-5c-climate-target-slipping-out-of-reach.

to phase-out highly polluting activities and align with international targets on the green transition, this process is fraught with challenges. Many states, particularly in the Global South, are significantly exposed to the adverse effects of climate change and yet do not have access to similar funds and technologies needed to implement adaptation and mitigating strategies. Trends are slightly different in the Mediterranean Basin and broader Middle East and North Africa, but weak social contracts and the consequent lack of legitimacy of many ruling elites do complicate the process, given the nature of these transformations which require a high degree of buy-in from the population and the fact that many of these states rely on energy and hydrocarbon exports to service their state budgets and promote social peace, including through heavily subsidised energy goods and services. This has given rise to significant grievances and calls for reparations and assistance by struggling states and harmed societies. Calls for burden sharing and financial assistance to help partner states implement the necessary reforms while mitigating its possible effects on internal stability have therefore increased. While funding and assistance have been made available by the UN and individual states, including the European Union via its New Agenda for the Mediterranean, these tend to prioritise certain areas and regions rather than a broader multilateral and collective effort to preserve planetary health and security.

Against this backdrop, growing emphasis has been placed on the security dimension(s) of the climate emergency, with policy, academic and media analyses increasingly framing the debate in terms of real-world security implications of a changing climate. Resource scarcity and abundance have been widely discussed in their complex relationship with conflict in the literature.[9] Yet, findings remain inconclusive and despite the many theoretical arguments on how the occurrence of violent conflict relates to the availability and access to natural resources, the lack of clear evidence has led many to question a direct correlation. Acknowl-

[9] Stormy-Annika Mildner, Gitta Lauster and Wiebke Wodni, "Scarcity and Abundance Revisited: A Literature Review on Natural Resources and Conflict", in *International Journal of Conflict and Violence*, Vol. 5, No. 1 (2011), p. 155-172, https://doi.org/10.4119/ijcv-2852.

edging the security implications of the climate emergency extends well beyond the domain of hard security, war and military conflict, however. A more encompassing methodology is required, one centred around human security or, to adopt a different terminology that has been promoted over the decades by the Organization for Security and Co-operation in Europe (OSCE), "comprehensive security", an approach that considers a broad spectrum of military, governance and socio-economic dimensions, all of which also maintain security dimensions.[10] In this regard, deeper understandings of security allow for environmental, social, economic and political aspects to be prioritised in policy agendas and for individuals and communities as opposed to only states, governments and the private sector to be factored into such approaches.

The multifaceted and multidimensional impact of the climate emergency on human security and development has spurred rich debates that resonate well beyond academia, reaching both the decision-making *loci* and environmentalist circles. While some maintain that talking of "climate migrants", "weak and failing states", "resource conflicts" and "food and water scarcity and security" has helped raise political awareness and funding to tackle these emergencies – and simultaneously underscore the shared, globalised nature of these threats,[11] – others argue that the securitisation of climate change carries a number of risks. If it is true that talking about climate change in terms of security provides a sense of urgency, it is also true that such approaches tend to shift the issue "out of the realm of 'normal' political debate", allowing for extraordinary measures in the shadow of an emergency logic.[12] While no one debates the urgent need for extraordinary measures to tackle the climate emergency, the risk is that of an excessive prioritisation of climate-related effects over other, deeper, political, governance and security challenges

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[10] See for instance, OSCE, *The OSCE Concept of Comprehensive and Co-operative Security. An Overview of Major Milestones* (SEC.GAL/100/09), 17 June 2009, https://www.osce.org/node/37592.

[11] Matt McDonald, "Climate Change and Security: Towards Ecological Security?", in *International Theory*, Vol. 10, No. 2 (July 2018), p. 153-180.

[12] Columba Peoples and Nick Vaughan-Williams, *Critical Security Studies. An Introduction*, 2nd ed., Routledge, 2015, p. 94.

that pre-date and overlap with the climate emergency. While these pre-existing challenges will be further aggravated by the changing climate, addressing their causes requires a different policy toolkit, one that remains grounded in a genuinely political engagement with partner states that similarly requires long-term commitments, funding and political backing and yet risks being diluted or overshadowed by more "technical" approaches cantered on emission reductions or mitigating strategies that necessarily rely on close cooperation with governing authorities and an often corrupt or co-opted private sector. In this domain, the prioritisation of security related effects and government-to-government engagements without a similarly sustained focus on human rights, socio-economic exclusion, authoritarian governance and the role of civil society risks undermining the reach and effectiveness of mitigating and adaptation measures due to a lack of popular buy-in and the weak legitimacy of ruling elites, while also possibly serving to further entrench authoritarianism, corruption and top-down co-optation.

Against this backdrop, many civil society organisations, international NGOs, scholars and individual activists have come to frame the issue as one of "climate justice".[13] Such a framing highlights the shared nature of the threat but places more emphasis on its unequal impacts, with struggling and underprivileged states and societies, mostly located in the Global South, facing the most adverse repercussions even though they are by far the least responsible for the climate emergency (Figure 1). Climate justice, moreover, seeks to move beyond the technical realm of emission reductions and new mitigating or adaptation technologies to focus on social justice and how the implications of the climate emergency will further increase socio-political and economic inequalities as well as systemic marginalisation, both across and within regions and states.[14]

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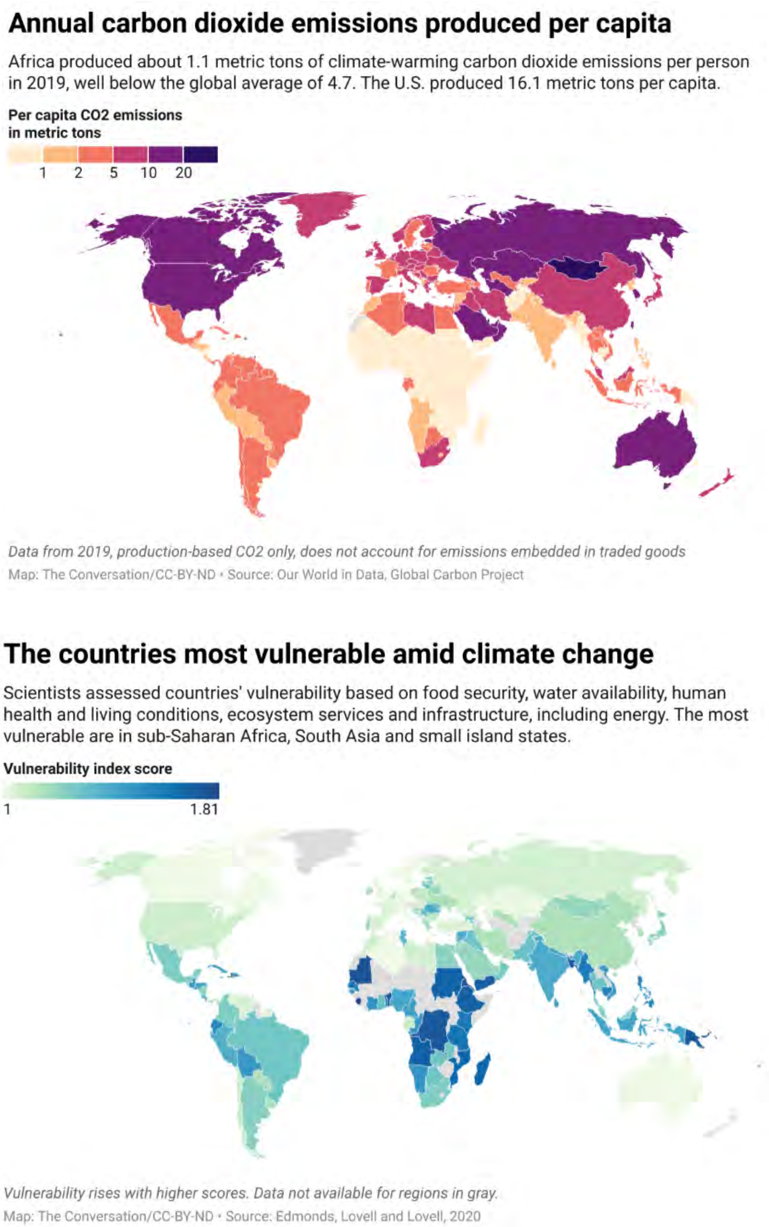
[13] See for instance, Josh Gabbatiss and Ayesha Tandon, "In-depth Q&A: What Is 'Climate Justice'?", in *Carbon Brief*, 4 October 2021, https://www.carbonbrief.org/science/in-depth-qa-what-is-climate-justice; Daisy Simmons, "What Is 'Climate Justice'?", in *Yale Climate Connections*, 29 July 2020, https://yaleclimateconnections.org/?p=63960.

[14] Ibid. Also see, Farhana Sultana, "Climate Change, COVID-19, and the Co-Production of Injustices: A Feminist Reading of Overlapping Crises", in *Social & Cultural Geography*, Vol. 22, No. 4 (2021), p. 447-460.

Figure 1 | Climate justice



Source: Sonja Klinsky, "Climate Change Is a Justice Issue - These 6 Charts Show Why", in *The Conversation*, 3 November 2021, https://theconversation.com/climate-change-is-a-justice-issue-these-6-charts-show-why-170072.

The climate emergency is indeed deeply intertwined with pre-existing political, security and socio-economic challenges. More comprehensive and encompassing policy approaches to tackle it are therefore needed. These go beyond mitigating and adaptation strategies or support for the green transition and instead revolve around more traditional modalities of support for political reforms, including the strengthening of the rule of law and human rights, as well as the fight against inequalities and corruption through enhanced engagement with civil society and other relevant stakeholders. From the perspective of international cooperation, the growing emphasis on the security implications of climate change should therefore progress in parallel with these more traditional elements of political engagement with partner states, which require equal focus by policymakers and international organisations, not least given that effective implementation of any climate change reforms will undoubtedly also depend on the support of local populations and thereby on the sustainability of social contracts and the legitimacy of ruling elites.

While sections of the industrialised world may hope to be spared from some of the most existential implications of the climate emergency, thanks to geography and the availability of resources to implement some mitigation and adaptation strategies, states in the Global North are by no means immune to such developments. They will not be able to shield themselves from broader global disruptions tied to climate change, including in the domain of trade and supply chains, the spectre of state collapse or violent conflict and mass population movements that would follow in their wake.[15] Moreover, the climate emergency is already having a dramatic impact on societies *within* developed states and regions, straining state budgets and increasing inequality, as the most vulnerable sections of the population – like the more disadvantaged states internationally – are facing and will increasingly face the greatest burden from

[15] A September 2021 World Bank report predicted that climate change may displace as many as 216 million people across the globe by 2050. See, Viviane Clement et al., *Groundswell Part 2. Acting on Internal Climate Migration*, Washington, World Bank, 2021, http://hdl.handle.net/10986/36248.

these transformations in terms of unemployment and poor working conditions, dwindling social safety nets, rising prices and limited access to housing, food and other resources. It is also in this context that the European Union has unveiled its "Just Transition Mechanism", which will provide funding for more disadvantaged regions and states within the Union to ensure that "no one is left behind".[16]

All of this translates into extremely concerning trends when it comes to the Mediterranean. With its air, land and sea warming 20 per cent faster than the global average,[17] the Mediterranean Basin is also growing more polluted, water scarce and food insecure, with dramatic consequences for the health of its ecosystems and populations, not least in light of its growing energy demands.[18] The unsustainable and extractive use of land and sea resources has damaged and impoverished ecosystems in dramatic ways, with unequal and uneven consequences for vulnerable social groups and already fragile areas. Recent research has demonstrated how the ecological footprint of Mediterranean Basin states is higher than the global average, and its ecological deficit is twice as high, meaning that Mediterranean countries consume approximately 2.5 times more natural resources and ecological services than the region's ecosystems can provide.[19] Water is a particularly worrying dynamic, as the Mediterranean's

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[16] For more on the Just Transition Mechanism see the European Commission website: *The Just Transition Mechanism: Making Sure No One Is Left Behind*, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en.

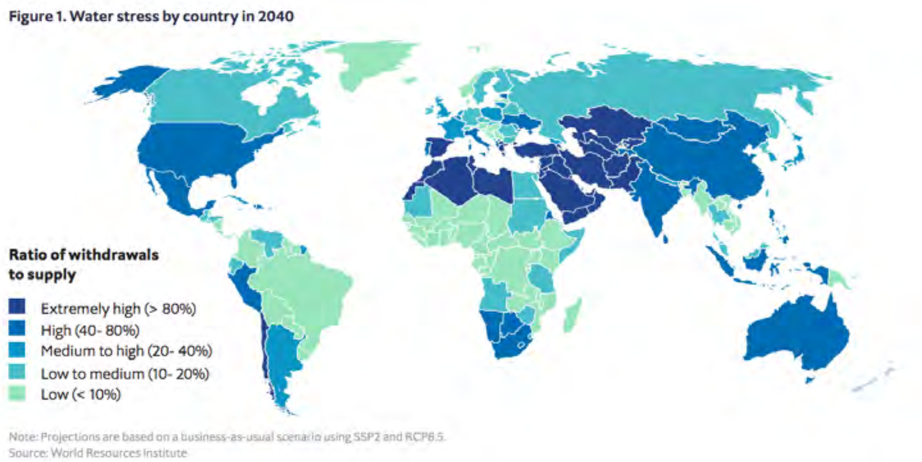
[17] UNEP/MAP website: *Climate Change in the Mediterranean*, https://www.unep.org/unepmap/node/20387.

[18] See for instance, Andrea Dessì, Daniele Fattibene and Flavia Fusco (eds), *Climate Change and Sustainability: Mediterranean Perspectives*, Rome, Nuova Cultura, 2021, https://www.iai.it/en/node/13843. On the rising energy demand of Mediterranean Basin states see, Observatoire Méditerranéen de l'Energie (OME), *Mediterranean Energy Perspectives to 2050. 2021 Edition. Executive Summary*, September 2021, https://www.ome.org/wp-content/uploads/2021/09/MEPto2050-2021-ed-Executive-Summary.pdf.

[19] Emel Akçalı, Evrim Görmüş and Soli Özel, "Energy Transitions and Environmental Geopolitics in the Southern Mediterranean", in *IAI Commentaries*, No. 22|17 (April 2021), https://www.iai.it/en/node/15057. Also see, Global Footprint Network, *Ecological Footprint Explorer*, https://data.footprintnetwork.org.

water resources are already unevenly distributed across the basin (73 per cent of resources in the North, 23 per cent in the East and only 5 per cent in the South[20]), while modelling and predictions have demonstrated how most countries in the basin are set to experience "extremely high" to "high" water stress by 2040 (Figure 2). This also implies significant challenges in the domain of food, given the growing relevance of the water-energy-food nexus in the Mediterranean region.[21]

Figure 2 | Water stress by country in 2040



Source: Economist Intelligence Unit, *Reimagining Urban Water Systems. The City Water Optimization Framework*, 2021, p. 6, https://impact.economist.com/sustainability/project/water-optimisation/download/water-opt-report-EIU-version.pdf.

Cooperative solutions to tackle the multidimensional impact of the climate emergency in the Mediterranean are therefore more urgent than

[20] Emel Akçalı, Evrim Görmüş and Soli Özel, "Energy Transitions and Environmental Geopolitics in the Southern Mediterranean", cit.; Maria Serena Mancini and Alessandro Galli, "Measuring and Monitoring Sustainability Trends in the Mediterranean: The Ecological Footprint Viewpoint", in *Quaderns de la Mediterrània*, No. 25 (2018), p. 119-126 at p. 121, https://www.iemed.org/?p=42280.

[21] See for instance, Vasileios Markantonis et al., "Can the Implementation of the Water-Energy-Food Nexus Support Economic Growth in the Mediterranean Region? The Current Status and the Way Forward", in *Frontiers in Environmental Science*, 2 July 2019, https://doi.org/10.3389/fenvs.2019.00084.

ever. Yet, such efforts also face a number of challenges. The uneven power relations embedded in the region have so far hindered genuine cooperation. While formal institutional frameworks have been established, these have generally failed to promote more balanced north-south cooperation beyond the remit of governing elites. Indeed, with the passage of time, many of these frameworks – from the Barcelona Process in the 1990s to the European Neighbourhood Policy and the Union for the Mediterranean in the mid-2000s – have shed much of their normative or political ambition, increasingly becoming vehicles for the promotion of economic interests via the standardisation of trade barriers, rules and regulations that are important for commercial exchanges but have also ultimately benefitted large multinational companies while creating a conducive environment for the further consolidation of authoritarian rule in much of the MENA region. Indeed, and differently from Europe's approach to the "eastern neighbourhood", where the prospect of EU membership has helped promote reforms and integration, the absence of such prospects for southern and south-eastern Mediterranean states has weakened the reach – or "normative appeal" – of the EU, further increasing trends of division between the two shores of the Mediterranean.

As an example of this, the Mediterranean region faces significant opportunities but also huge challenges in developing its renewable energy potential, in the realm of which fragmentation and lack of coordination remains prevalent despite the theoretical complementarity between northern and southern and south-eastern shores. As new efforts are directed at unleashing the complementary potential of air, wind, solar and hydro power across Mediterranean Basin states, the lack of south-south trade and infrastructure integration and uneven north-south relations are hindering collaborative frameworks to promote genuine Mediterranean integration in the realm of renewable energy, an indispensable component for the sustainability of states, societies and living ecosystems in this shared Mediterranean space.

Division of the volume

How to make sense of the many security implications of the present climate emergency and promote more balanced and genuine north-south and south-south engagements across Mediterranean Basin states represents the underlining objective of this collective volume. Born out of an ongoing research effort directed by the Rome-based Istituto Affari Internazionali (IAI) under the rubric of the New-Med Research Network, individual chapters delve into different dimensions of the Mediterranean climate hotspot while also addressing past and current international efforts to promote adequate mitigating and adaptation strategies to limit its most adverse effects.[22] Supported by the Italian Ministry of Foreign Affairs and International Cooperation, the OSCE Secretariat in Vienna and the Compagnia di San Paolo Foundation, the New-Med Research Network has since 2014 worked on a broad diversity of security and political themes impacting the Mediterranean Basin, adopting a "comprehensive security" approach to analyse the multiple overlapping drivers of insecurity and societal grievances that continue to characterise this common space.

Between 2020–2022, the New-Med Research Network specifically tackled environmental and climate aspects in the contemporary Mediterranean, publishing reports[23] and organising conferences in partnership with other international organisations – the Agency for Peacebuilding (AP)[24] and the Union for the Mediterranean (UfM)[25] – to strengthen

[22] For more information on the New-Med Research Network see the dedicated website: https://www.new-med.net.

[23] See for instance, Anis Germani and Rania Masri, "The Covid-19 Crisis and the Mediterranean Basin: Overcoming Disparities, Promoting Genuine Cooperation", in *IAI Papers*, No. 21|41 (September 2021), https://www.iai.it/en/node/14053; Andrea Dessì, Daniele Fattibene and Flavia Fusco (eds), *Climate Change and Sustainability: Mediterranean Perspectives*, cit.; Michaël Tanchum, "Europe–Africa Connectivity Outlook 2021: Post-Covid-19 Challenges and Strategic Opportunities", in *IAI Papers*, No. 21|20 (May 2021), https://www.iai.it/en/node/13326.

[24] On 18–19 May 2021, New-Med partnered with the AP in co-organising the second day of the annual Bologna Peacebuilding Forum, focused on climate change and peacebuilding. A New-Med/AP co-edited volume was published following the forum. See, Bernardo Venturi and Andrea Dessì (eds), *Bologna Peacebuilding Forum 2021. Peacebuilding and Climate Change*, Bologna, Agency for Peacebuilding, October 2021, https://www.iai.it/en/node/14256.

[25] On 17 December 2021, New-Med partnered with the UfM and other partners to co-organise an international conference on the climate change-security nexus in the Mediterranean. The full conference report and agenda is available here: Flavia Fusco,

outreach and engagement efforts with key stakeholders across the southern, eastern and northern shores of the Mediterranean. This volume therefore fits into a broader research and outreach effort which aims at one and the same time to further raise awareness about the multidimensional impacts of the climate emergency on Mediterranean states and societies and to explore potential avenues for improved cooperative action across basin states.

Structured around four chapters, the volume begins with a comprehensive overview of climate related regional cooperation initiatives in the Mediterranean. Authored by Niklas Bremberg, Associated Senior Researcher at the Stockholm International Peace Research Institute (SIPRI) and Associate Professor of Political Science at Stockholm University, the chapter outlines how regional and global cooperation remains indispensable to respond to climate-related security risks in the Mediterranean and strengthen state and societal resilience to withstand its many implications. The analysis addresses the clear links between global and regional efforts to tackle the climate emergency, as well as the need to promote enhanced knowledge exchanges across regions and local contexts, to develop the most effective mitigating and adaptation strategies. In mapping the key international organisations that are increasingly shaping cooperation on climate-related security risks, the analysis addresses the UN, OSCE, EU and other regional, Mediterranean frameworks involved in promoting policy proposals for prevention and preparedness, as well as early warning and information sharing, taking stock of the lessons learned that could help spur enhanced Mediterranean cooperation in the field of climate security.

In chapter two, Wolfgang Cramer and Joël Guiot,[26] lead authors of the international network of Mediterranean Experts on Climate and Envi-

"Climate Change and Security in the Mediterranean", in *Documenti IAI*, No. 22|04 (March 2021), https://www.iai.it/en/node/14917.

[26] Wolfgang Cramer is Director of Research within the Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale (IMBE) at the French Centre national de la recherche scientifique (CNRS) and member of the Académie d'Agriculture de France. Joël Guiot is Emeritus scientist in the Centre de Recherche et d'Enseignement de Géosciences de l'Environnement (CEREGE), Aix-Marseille University.

ronmental Change (MedECC), delve into the various dimensions of the Mediterranean as a climate change hotspot, outlining the concrete, real-world implications the warming climate will have on state, societal and ecosystem resilience in the area. By drawing on recent scientific research and modelling simulations, the authors note that current climatic disruptions are expected to be exacerbated in the coming decades, especially if international action to meet the 2015 Paris Commitment falls short and temperature increases exceed 1.5°C compared to pre-industrial times. In outlining both climate and non-climatic drivers of change, the authors underscore that significantly enhanced efforts are needed to tackle the implications of the climate emergency. In this regard, achieving the UN Sustainable Development Goals in the Mediterranean remains unlikely within current economic and environmental policy frameworks, calling for alternative models for equitable and sustainable development within and among Mediterranean Basin states.

Having covered prevalent policy frameworks to tackle the climate emergency and improved our understandings of the Mediterranean as a climate change hotspot, chapter three moves beyond the traditional boundaries of the Mediterranean region, re-thinking regionalisation processes and broadening its conceptualisation to address an increasingly salient feature of current policy debates on the security implications of the climate emergency: conflict and displacement in the Sahel region. In this chapter, Luca Raineri, Assistant Professor in the Institute of Law, Politics and Development at the Sant'Anna School of Advanced Studies in Pisa, Italy, dissects policy and media discourses promoting the existence of a direct, causal relationship between climate change and conflict, using the Sahel region as a case study. By drawing on the examples of the Sahelian droughts in the 1970s–80s and the ongoing (alleged) desertification of the central Sahel, the author notes that while climatic factors *per se* are neither sufficient nor necessary to trigger armed violence, climatic changes may fuel violent conflicts because they contribute to an erosion of fragile socio-economic systems and the relative mechanisms of conflict regulation. By adopting a political ecology framework, the analysis places emphasis on the crucial "weight" of governance schemes in making conflicts over natural resources veer towards either violent escalation or peaceful management. That said, the author also notes that in the long-run governance mechanisms themselves can be affected or disrupted by changing climatic conditions, thereby stressing the importance of re-politicising the climate-conflict nexus in present policy and academic debates on the implications of the climate emergency in the Sahel and broader Mediterranean.

In the final chapter of the volume, Silvia Pariente-David and Philippe Drobinski, climate experts from the MedECC network with years of high-level experience in policy research and outreach with international organisations and policymaking communities on climate change, tackle the issue of renewable energy resources as an avenue that requires enhanced regional cooperation and integration across the Mediterranean Basin. Stressing how the Mediterranean is among the world's richest regions in renewable energy resources, the authors underscore how their development can assist the objective of achieving the Paris Agreement targets while enhancing beneficial forms of regional north-south and south-south integration. While multiple challenges remain, the authors argue that these resources can promote European efforts to achieve carbon neutrality by 2050 and at the same time improve the economic and social welfare of southern and eastern Mediterranean states. Enhancing regional energy market integration remains a fundamental objective, however, necessitating coordinated approaches across markets and power systems as well as enhanced cooperation between stakeholders involved at various levels, including governments, system operators, market operators and regulators as well as regional and international organisations. Success in this domain, argue the authors, can contribute to the creation of a genuine Mediterranean Union, thus restoring the Mediterranean to its historical position as a central hub for cultural and commercial exchanges across its multiple shores.

References

Emel Akçalı, Evrim Görmüş and Soli Özel, "Energy Transitions and Environmental Geopolitics in the Southern Mediterranean", in *IAI Commentaries*, No. 22|17 (April 2021), https://www.iai.it/en/node/15057

Viviane Clement et al., *Groundswell Part 2. Acting on Internal Climate*

Migration, Washington, World Bank, 2021, http://hdl.handle.net/10986/36248

Andrea Dessì, Daniele Fattibene and Flavia Fusco (eds), *Climate Change and Sustainability: Mediterranean Perspectives*, Rome, Nuova Cultura, 2021, https://www.iai.it/en/node/13843

Benjamin Franta, "Shell and Exxon's Secret 1980s Climate Change Warnings", in *The Guardian*, 19 September 2018, https://www.theguardian.com/p/9d8z4

Flavia Fusco, "Climate Change and Security in the Mediterranean", in *Documenti IAI*, No. 22|04 (March 2021), https://www.iai.it/en/node/14917

Josh Gabbatiss and Ayesha Tandon, "In-depth Q&A: What Is 'Climate Justice'?", in *Carbon Brief*, 4 October 2021, https://www.carbonbrief.org/science/in-depth-qa-what-is-climate-justice

Anis Germani and Rania Masri, "The Covid-19 Crisis and the Mediterranean Basin: Overcoming Disparities, Promoting Genuine Cooperation", in *IAI Papers*, No. 21|41 (September 2021), https://www.iai.it/en/node/14053

Zeke Hausfather, "UNEP: 1.5C Climate Target 'Slipping Out of Reach'", in *Carbon Brief*, 26 November 2019, https://www.carbonbrief.org/unep-1-5c-climate-target-slipping-out-of-reach

Bob Henson and Jeff Masters, "Central Europe Staggers toward Recovery from Catastrophic Flooding: More than 200 Killed", in *Yale Climate Connections*, 21 July 2021, https://yaleclimateconnections.org/?p=77745

Intergovernmental Panel on Climate Change (IPCC), *Climate Change: A Threat to Human Wellbeing and Health of the Planet. Taking Action Now Can Secure Our Future*, 28 February 2022, https://www.ipcc.ch/?p=40120

IPCC, *Climate Change Widespread, Rapid, and Intensifying – IPCC*, 9 August 2021, https://www.ipcc.ch/?p=38565

Maria Serena Mancini and Alessandro Galli, "Measuring and Monitoring Sustainability Trends in the Mediterranean: The Ecological Footprint Viewpoint", in *Quaderns de la Mediterrània*, No. 25 (2018), p. 119-126, https://www.iemed.org/?p=42280

Vasileios Markantonis et al., "Can the Implementation of the Water-Energy-Food Nexus Support Economic Growth in the Mediterranean Region? The Current Status and the Way Forward", in *Frontiers in Environmental Science*, 2 July 2019, https://doi.org/10.3389/fenvs.2019.00084

Valérie Masson-Delmotte et al. (eds), *Global Warming of 1.5 C. An IPCC Special Report on the Impacts of Global Warming*..., 2019, https://www.ipcc.ch/sr15

Matt McDonald, "Climate Change and Security: Towards Ecological Security?", in *International Theory*, Vol. 10, No. 2 (July 2018), p. 153-180

Stormy-Annika Mildner, Gitta Lauster and Wiebke Wodni, "Scarcity and Abundance Revisited: A Literature Review on Natural Resources and Conflict", in *International Journal of Conflict and Violence*, Vol. 5, No. 1 (2011), p. 155-172, https://doi.org/10.4119/ijcv-2852

Observatoire Méditerranéen de l'Energie (OME), *Mediterranean Energy Perspectives to 2050. 2021 Edition. Executive Summary*, September 2021, https://www.ome.org/wp-content/uploads/2021/09/MEP-to2050-2021-ed-Executive-Summary.pdf

Organization for Security and Co-operation in Europe (OSCE), *The OSCE Concept of Comprehensive and Co-operative Security. An Overview of Major Milestones* (SEC.GAL/100/09), 17 June 2009, https://www.osce.org/node/37592

Columba Peoples and Nick Vaughan-Williams, *Critical Security Studies. An Introduction*, 2nd ed., Routledge, 2015

Gaia Pianigiani, "Sicily Registers Record-High Temperature as Heat Wave Sweeps Italian Island", in *The New York Times*, 12 August 2021, https://www.nytimes.com/2021/08/12/world/europe/sicily-record-high-temperature-119-degrees.html

Onofrio Romano, "Mediterraneanism", in Ashish Kothari et al. (eds), *Pluriverse. A Post-Development Dictionary*, New Delhi, Tulika Books, 2019, p. 237-240

Daisy Simmons, "What Is 'Climate Justice'?", in *Yale Climate Connections*, 29 July 2020, https://yaleclimateconnections.org/?p=63960

Farhana Sultana, "Climate Change, COVID-19, and the Co-Production of Injustices: A Feminist Reading of Overlapping Crises", in *Social &*

Cultural Geography, Vol. 22, No. 4 (2021), p. 447-460

Michaël Tanchum, "Europe–Africa Connectivity Outlook 2021: Post-Covid-19 Challenges and Strategic Opportunities", in *IAI Papers*, No. 21|20 (May 2021), https://www.iai.it/en/node/13326

UN Regional Information Centre, *2021 Floods: UN Researchers Aim to Better Prepare for Climate Risks*, 24 January 2022, https://unric.org/en/2021-floods-un-researchers-aim-to-better-prepare-for-climate-risks

Bernardo Venturi and Andrea Dessì (eds), *Bologna Peacebuilding Forum 2021. Peacebuilding and Climate Change*, Bologna, Agency for Peacebuilding, October 2021, https://www.iai.it/en/node/14256

1.

Climate Security in the Mediterranean: What Prospects for Regional Cooperation?

Niklas Bremberg[1]

The adverse effects of climate change are increasingly being acknowledged by political actors across the world. UN Secretary-General António Guterres described climate change as "a direct existential threat [with] disastrous consequences for people and all the natural systems that sustain us".[2] Recently, the sixth assessment report from the Intergovernmental Panel on Climate Change concluded that "human-induced climate change is already affecting many weather and climate extremes in every region across the globe" and that the scientific evidence of observed changes in extremes such as for example heatwaves, heavy precipitation and droughts, as well as their attribution to human influence, has strengthened since its previous analysis.[3] Reports in international media about weather-related events registered in summer 2021, such as extreme temperatures and uncontrolled wildfires in many Mediter-

[1] The author would like to thank Dr Johan Schaar for his valuable comments on climate-related security risks in the MENA region and Ms Ebba Behre for her excellent work as research assistant as well as the editors of this volume for helpful comments on earlier drafts of this chapter.

[2] United Nations, *Secretary-General's Remarks on Climate Change, Delivered on 10 September 2018*, https://www.un.org/sg/en/content/sg/statement/2018-09-10/secretary-generals-remarks-climate-change-delivered.

[3] Richard P. Allan et al., "Summary for Policymakers", in International Panel on Climate Change, *Climate Change 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 2021, https://www.ipcc.ch/report/ar6/wg1.

ranean countries, including Algeria, Greece and Turkey, as well as devastating floods due to heavy precipitation in northern Europe, mainly Belgium and Germany, are examples of increased public attention to risks to humans and eco-systems attributed to climate change.[4]

A fundamental characteristic of climate-related security risks to states, societies and individuals is their transnational dimension. Droughts, wildfires, water shortages, floods and extreme weather events often affect several countries in a certain region more or less simultaneously. The transnational character is not just linked to geophysical exposure and connection through, for instance, shared water basins and coastlines. It also entails the transnational movements of goods, finance and people.[5] It might therefore seem self-evident that the better states and societies are at coping with and mitigating adverse climate impacts, the greater the chances that negative effects on human security and societal stability will be alleviated and contained. Global and regional cooperation among states is generally understood to be of fundamental importance for increasing the capacity to adequately respond to climate-related security risks as well as other transnational challenges.[6]

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[4] Angela Dewan, "This Summer Was Europe's Hottest on Record as Mediterranean Heat Soared", in *CNN*, 7 September 2021, https://edition.cnn.com/2021/09/07/europe/europe-hottest-summer-climate-intl/index.html; Loveday Morris, Jennifer Hassan and Emily Rauhala, "Death Toll from European Floods Climbs to More Than 150", in *The Washington Post*, 17 July 2021, https://www.washingtonpost.com/world/2021/07/16/europe-flooding-deaths-germany-belgium.

[5] Johanna Hedlund et al., "Quantifying Transnational Climate Impact Exposure: New Perspectives on the Global Distribution of Climate Risk", in *Global Environmental Change*, Vol. 52 (September 2018), p. 75-85; Bodil Elmhagen et al., "Interacting Effects of Change in Climate, Human Population, Land Use, and Water Use on Biodiversity and Ecosystem Services", in *Ecology and Society*, Vol. 20, No. 1 (2015), Article 23, https://doi.org/10.5751/ES-07145-200123; W. Neil Adger, Hallie Eakin and Alexandra Winkels, "Nested and Teleconnected Vulnerabilities to Environmental Change", in *Frontiers in Ecology and the Environment*, Vol. 7, No. 3 (April 2009), p. 150-157, https://doi.org/10.1890/070148; Robin Leichenko and Karen O'Brien, *Environmental Change and Globalization. Double Exposures*, Oxford, Oxford University Press, 2008.

[6] Jörn Birkmann and Korinna von Teichman, "Integrating Disaster Risk Reduction and Climate Change Adaptation: Key Challenges, Scales, Knowledge, and Norms", in *Sustainability Science*, Vol. 5, No. 2 (July 2010), p. 171-184; Mark Rhinard, "European Cooperation on Future Crises: Toward a Public Good?", in *Review of Policy Research*, Vol.

International organisations (IOs), at both the global and regional levels, are getting more involved in efforts to assist states and societies mitigate and adapt to climate-related security risks.[7] These efforts include policy development on prevention and preparedness; early warning systems and information sharing; as well as enhancing crisis management and relief capabilities, to name but a few.[8] Research has also highlighted that knowledge exchange between local, national and international actors on context-specific vulnerabilities in particular regions is key to developing adequate responses to climate-related security risks.[9]

That said, it cannot be assumed that a perceived need for increased international cooperation on climate-related security risks will necessarily lead to adequate global and regional responses to manage and reduce such risks. Diverging national interests, political conflicts or lack of resources are factors that might hamper efforts to develop global as well as regional responses to climate-related security risks.[10] From this

26, No. 4 (July 2009), p. 439-455.

[7] Niklas Bremberg, Malin Mobjörk and Florian Krampe, "Global Responses to Climate Security: Towards a Framework for Analysis", manuscript under review; Lisa M. Dellmuth et al., "Intergovernmental Organizations and Climate Security: Advancing the Research Agenda", in *WIREs Climate Change*, Vol. 9 (January/February 2018), Article e496, https://doi.org/10.1002/wcc.496; Judith Nora Hardt, *Environmental Security in the Anthropocene. Assessing Theory and Practice*, London/New York, Routledge, 2017; Ken Conca, *An Unfinished Foundation. The United Nations and Global Environmental Governance*, Oxford, Oxford University Press, 2015; Shirley V. Scott, "Implications of Climate Change for the UN Security Council: Mapping the Range of Potential Policy Responses", in *International Affairs*, Vol. 91, No. 6 (November 2015), p. 1317-1333.

[8] Joshua W. Busby, "Beyond Internal Conflict: The Emergent Practice of Climate Security", in *Journal of Peace Research*, Vol. 58, No. 1 (January 2021), p. 186-194, https://doi.org/10.1177/0022343320971019.

[9] Camilla Born, Karolina Eklöw and Malin Mobjörk, "Advancing United Nations Responses to Climate-related Security Risks", in *SIPRI Policy Briefs* (September 2019), https://www.sipri.org/node/4907.

[10] See e.g., Niklas Bremberg, "Do Regional Organizations Contribute to Security? Perspectives on Euro-Mediterranean Cooperation", in Richard Gillespie and Frédéric Volpi (eds), *Routledge Handbook on Mediterranean Politics*, London/New York, Routledge, 2018, p. 194-206; Jonas Tallberg et al., "The Performance of International Organizations: A Policy Output Approach", in *Journal of European Public Policy*, Vol. 23, No. 7 (2016), p. 1077-1096; Michael Barnett and Martha Finnemore, *Rules for the World. Inter-*

perspective, it is worth stressing that the Mediterranean not only faces particular climate risks related to a rapidly warming climate in an already hot and dry region but also the huge challenge of long-standing conflicts and protracted tensions among and within countries in the region. These tensions might hinder regional cooperation to prevent and mitigate risks such as land degradation, desertification and coastal erosion and develop strategies to deal with the impacts on water, food and climate security.[11] Moreover, the southern and eastern parts of the Mediterranean are among the least integrated regions in the world, both politically and economically. While all countries in the region need to seriously step up efforts to accelerate the transition to low-carbon economies, this becomes a tougher challenge for some Mediterranean countries that are still heavily dependent on fossil fuel production to ensure state revenues.

Against this background, the analysis in this chapter draws on recent research on international cooperation in the field of climate security. It focuses on climate-related security risks in the Mediterranean and highlights recent developments within a set of IOs, particularly the European Union and the Union for the Mediterranean (UfM), that are relevant for states and societies in the region. The analysis ends with a discussion on lessons that might help spur enhanced Mediterranean cooperation to address climate-related security risks.

1.1 International cooperation on climate security: An overview

The notion that climate change threatens to cause catastrophic outcomes for living ecosystems at a scale "second only to nuclear war" was recognised already in the 1980s and paved the way for the establishment of the UN Framework Convention on Climate Change in 1992.[12] Discussions

national Organizations in Global Politics, Ithaca/London, Cornell University Press, 2004.

[11] Niklas Bremberg, "Do Regional Organizations Contribute to Security?", cit.

[12] Bentley B. Allan, "Second Only to Nuclear War: Science and the Making of Existential Threat in Global Climate Governance", in *International Studies Quarterly*, Vol. 61, No. 4 (December 2017), p. 809-820, https://doi.org/10.1093/isq/sqx048; Angela Oels, "From 'Securitization' of Climate Change to 'Climatization' of the Security Field: Comparing Three Theoretical Perspectives", in Jürgen Scheffran et al. (eds), *Climate Change,*

concerning the security implications of climate change also occurred in the UN Security Council starting from 2007.[13] Traditional security concerns, such as the potentially adverse effects of climate change on inter-state peace and stability in developing countries, tended to dominate early on, but more comprehensive understandings of climate security have emerged in recent years.[14] It is now common to emphasise that climate change simultaneously covers multiple dimensions of security, including human security, state security and international peace.[15]

The multidimensional character of the concept of climate security implies that responses at the global, regional and national levels should integrate diverse policy areas, relating both to mitigation and adaptation.[16] There are several interesting examples of international cooperation in the field of climate security. For example, the UN Mechanism for Climate Security was established in 2018 to fill an institutional

Human Security and Violent Conflict. Challenges for Societal Stability, Berlin/Heidelberg, Springer, 2012, p. 185-205; Andrew Baldwin, Chris Methmann and Delf Rothe, "Securitizing 'Climate Refugees': The Futurology of Climate-Induced Migration", in *Critical Studies on Security*, Vol. 2, No. 2 (2014), p. 121-130, https://doi.org/10.1080/21624887.2014.943570; Simon Dalby, *Security and Environmental Change*, Cambridge, Polity Press, 2009; Jon Barnett, "Security and Climate Change", in *Global Environmental Change*, Vol. 13, No. 1 (April 2003), p. 7-17.

[13] Maria Julia Trombetta, "Environmental Security and Climate Change: Analysing the Discourse", in *Cambridge Review of International Affairs*, Vol. 21, No. 4 (2008), p. 585-602, https://doi.org/10.1080/09557570802452920.

[14] See for instance, Renate Schubert et al., *Climate Change as a Security Risk*, Berlin, Earthscan, 2008, https://www.wbgu.de/en/publications/publication/welt-im-wandel-sicherheitsrisiko-klimawandel.

[15] Andrew Baldwin, Chris Methmann and Delf Rothe, "Securitizing 'Climate Refugees'", cit.; W. Neil Adger et al., "Human Security", in Christopher B. Field et al. (eds), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 2014, p. 755-791, https://www.ipcc.ch/report/ar5/wg2; Matt McDonald, "Discourses of Climate Security", in *Political Geography*, Vol. 33 (March 2013), p. 42-51; Jon Barnett, Richard A. Matthew and Karen L. O'Brien, "Global Environmental Change and Human Security: An Introduction", in Richard A. Matthew et al. (eds), *Global Environmental Change and Human Security*, Cambridge, MIT Press, 2010, p. 3-32.

[16] Richard A. Matthew, "Integrating Climate Change into Peacebuilding", in *Climatic Change*, Vol. 123, No. 1 (March 2014), p. 83-93.

gap within the UN with regard to assessing and mitigating the risks of insecurity arising from the interaction between climate change and social, economic and political factors.[17] Regional organisations such as the Association of Southeast Asian Nations and the South Asian Association for Regional Cooperation have also undertaken several initiatives to address climate-related security risks.[18] In the African Union (AU), the Department of Rural Economy and Agriculture has become the entry point for discussions on climate security, such as food security and migration, and the AU Interdepartmental Taskforce on Conflict Prevention has been instrumental in institutionalising a "climate cluster".[19] NATO as well as the Organization for Security and Cooperation in Europe (OSCE) are also more involved in the field of climate security compared to a few years ago. The OSCE has promoted regional cooperation on environmental security for several decades now, and its role in the field of climate security is currently being discussed among the participating states.[20]

In the EU, the work to develop responses to climate-related security risks as part of the Union's foreign and security policy is being advanced mainly through the European External Action Service (EEAS). The EU's Green Diplomacy Network was made part of the EEAS in 2012 to better integrate EU climate, environmental and developmental policies into EU external relations on climate security.[21] A key finding from a study on the

[17] Camilla Born, Karolina Eklöw and Malin Mobjörk, "Advancing United Nations Responses to Climate-related Security Risks", cit.

[18] Florian Krampe, Roberta Scassa and Giovanni Mitrotta, "Responses to Climate-related Security Risks: Regional Organizations in Asia and Africa", in *SIPRI Insights on Peace and Security*, No. 2018/2 (August 2018), https://www.sipri.org/node/4580.

[19] Vane Moraa Aminga and Florian Krampe, "Climate-related Security Risks and the African Union", in *SIPRI Policy Briefs*, May 2020, https://www.sipri.org/node/5133.

[20] Niklas Bremberg, "European Regional Organizations and Climate-related Security Risks: EU, OSCE and NATO", in *SIPRI Insights on Peace and Security*, No. 2018/1 (February 2018), https://www.sipri.org/node/4404; Niklas Bremberg and Anniek Barnhoorn, "Advancing the Role of the OSCE in the Field of Climate Security", in *SIPRI Policy Briefs*, September 2021, https://www.sipri.org/node/5520.

[21] Niklas Bremberg, "The EU and Climate-Related Security Risks: The Case of the Sahel", in Abdelhak Bassou, Aleksandra Chmielewska and Xira Ruiz-Campillo (eds), "Climate Security in the Sahel and the Mediterranean: Local and Regional Responses", in *EuroMeSCo*

EU's responses to climate-related security risks is that a European community of practice is emerging on climate security. However, the emergence of a European policy discourse has not guaranteed coherence once translated into policy measures in the climate diplomacy, development, security and foreign policy domains, nor effectiveness of the outcomes.[22] At the core of EU's climate policy is the European Green Deal, launched in 2019, and now in its implementation phase. While the Green Deal is mainly focused on achieving net zero emissions of greenhouse gases by 2050 within the EU, there are aspects that are relevant also from the perspective of broader Mediterranean climate security as the Deal allocates resources to support climate diplomacy and promote international cooperation on climate-related security issues. Relatedly, efforts by the EU at the COP26 meeting in Glasgow in November 2021 to increase climate financing to developing countries, included those on the southern and eastern shores of the Mediterranean, is a further example.[23]

Building early warning systems and creating risk assessment capacities are stressed by several IOs, including the EU, as important tools for mitigating climate-related security risks and strengthening the resilience of states and local communities. Actions to enhance risk assessments can support the identification of key risks and subsequently provide policy advice to states. In addition to improving risk assessment and early warning, research also suggests that information sharing and knowledge exchange are crucial to help states and societies better prepare for the adverse effects of climate change.[24] However, previous research highlights that many regional organisations in less developed

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Joint Policy Studies, No. 13 (2019), p. 86-115, https://www.euromesco.net/publication/climate-security-in-the-sahel-and-the-mediterranean-local-and-regional-response.

[22] Niklas Bremberg, Hannes Sonnsjö and Malin Mobjörk, "EU and Climate Security: A Community of Practice in the Making?", in *Journal of European Integration*, Vol. 41, No. 5 (2019), p. 623-639.

[23] European Commission, *EU at COP26: Commission Pledges €100 Million to the Adaptation Fund*, 9 November 2021, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5886.

[24] Florian Krampe and Malin Mobjörk, "Responding to Climate-Related Security Risks: Reviewing Regional Organizations in Asia and Africa", in *Current Climate Change Reports*, Vol. 4, No. 4 (December 2018), p. 330-337.

parts of the world are dependent on external donors in order to develop activities and implement policies. Donor dependency could reduce the ability of both states and regional organisations in developing states to establish their own priorities and actions on climate-related security risks.[25] It is thus important to further explore issues of how climate funding relates to local ownership, especially in an emergent policy field such as climate security, and particularly in a region such as the Mediterranean in which most countries are exposed to many such risks at the same time as regional cooperation is hampered by geopolitical conflicts.

1.2 Climate-related security risks in the Mediterranean region

Countries in the Mediterranean region are heavily exposed to the adverse effects of climate change. A report issued by the Mediterranean Experts on Climate and Environmental Change (MedECC) notes how the "climate is changing in the Mediterranean Basin, historically and projected by climate models, faster than global trends".[26] Rising temperature levels and changing precipitation patterns will most probably lead to increased and prolonged periods of drought and water scarcity, affecting both the advanced economies in the northern Mediterranean and the less diversified economies in the southern and eastern Mediterranean.[27]

The Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region, led by the UN Economic and Social Commission for West Asia, provides climate models for the countries in the southern and eastern Mediterranean (SEM) as well as the wider Middle East and North Africa (MENA). These assessments estimate effects on the vulnerability of biodiversity, ecosystems, agriculture, infrastructure, health and employ-

[25] Florian Krampe, Roberta Scassa and Giovanni Mitrotta, "Responses to Climate-Related Security Risks", cit.

[26] Mediterranean Experts on Climate and Environmental Change (MedECC), "Summary for Policymakers", in Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First Mediterranean Assessment Report*, MedECC, November 2020, p. 6, https://www.medecc.org/?p=3506.

[27] Richard P. Allan et al., "Summary for Policymakers", cit.

ment, and the probability of extreme weather events.[28] Climate impact scenarios for countries in the Mediterranean are a source of concern since temperatures are estimated to rise and droughts will be longer, more severe and more frequent than the global average, which will most likely have negative effects on biological systems and human societies. In short, climate projections show rapidly warming trends in an already hot and dry region. If current trends continue undiminished, parts of the region could become uninhabitable for humans in the future.[29]

The immediate climate-related security risks in the region are likely to be caused by increased water shortages, extreme weather events, floods and wildfires.[30] More indirect and long-term security risks caused by a changing climate are linked to sustained crop failures, sea level rise, desertification and changes to marine and terrestrial ecosystems that are expected to primarily impact less diversified SEM economies in a negative, meaningful way and potentially spur internal as well as international migration from affected areas.[31] It is nonetheless important to note that previous research on climate-related security risks stresses that climate change does not necessarily translate into security risks in a linear fashion. Instead, the changing climate interacts with pre-existing political, social and economic factors in rather complex ways to produce certain risks for states and societies in and across a particular region. This is of course true also for Mediterranean countries, where highly illustrative examples can be seen in the different ways in which climate change affects water and food security across the region.

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[28] United Nations Economic and Social Commission for Western Asia (ESCWA) et al., *Arab Climate Change Assessment Report: Main Report*, Beirut, ESCWA, 2017, https://www.preventionweb.net/node/46443.

[29] Johan Schaar, "A Confluence of Crises: On Water, Climate and Security in the Middle East and North Africa", in *SIPRI Insights on Peace and Security*, No. 2019/4 (July 2019), p. 5, https://www.sipri.org/node/4879.

[30] Elizabeth Sellwood, "A Tougher Climate in the Eastern Mediterranean: Policy Directions in a Context of Climate Change and Regional Crises", in *Re-imagining the Eastern Mediterranean Series: PCC Reports*, No. 1/2018, https://www.prio.org/publications/11150.

[31] Ibid.

Large parts of the population in SEM countries currently live in areas with high or very high surface water stress (understood to mean that more water is used than replenished, in comparison with a global average of about 35 per cent).[32] In the MENA region, nearly all countries are among the most water stressed in the world. The World Bank expects economic losses from water scarcity to reach 6–14 per cent of GDP in the MENA region by 2050.[33] Moreover, water from rivers and other resources is used for agricultural, industrial and domestic purposes at unsustainable volumes. For example, Jordan is in a particularly vulnerable position as climate change is likely to exacerbate the current problem that the country's aquifer is no longer being refilled from rainfalls to cover its water consumption. On top of that, the population of Jordan is growing rapidly, not least due to the intake of Syrian refugees since 2011, which puts additional pressure on its already limited water supplies. Furthermore, decades of poor governance have led to unsustainable water management. The combination of these factors "has rendered Jordan one of the poorest nations on the planet in terms of its water resources".[34]

Johan Schaar notes that most water policy measures implemented by SEM countries are not necessarily aimed at saving water and ensuring efficient management, but rather increasing access through further exploitation of water resources.[35] Currently, few MENA countries can be said to use policy instruments and economic subsidies to promote more sustainable means of water usage and consumption. For example, more than 80 per cent of the region's wastewater, which could be used for irrigation or industrial processes, is lost.[36]

Another study conducted by Elizabeth Sellwood emphasises risks linked to transboundary water sources in the Mediterranean region,

[32] Johan Schaar, "A Confluence of Crises", cit.

[33] World Bank, *Beyond Scarcity. Water Security in the Middle East and North Africa*, Washington, World Bank, 2018, http://hdl.handle.net/10986/27659.

[34] Elizabeth Whitman, "A Land without Water: The Scramble to Stop Jordan from Running Dry", in *Nature*, Vol. 573, No. 7772 (5 September 2019), p. 20-23 at p. 21, https://doi.org/10.1038/d41586-019-02600-w.

[35] Johan Schaar, "A Confluence of Crises", cit., p. 3.

[36] World Bank, *Beyond Scarcity*, cit.

such as the Nile, the Jordan River and the Euphrates, as a source of potential conflicts in the region. She suggests that while

> inter-state tensions relating to transboundary watercourses are not a new phenomenon [in this part of the world], climate change, combined with rapid population growth and urbanization, will intensify competition over such shared water resources – particularly in the absence of rapid improvements in water management.[37]

However, agreements such as those from the 1990s and 2000s on joint management of transboundary water between Jordan and Israel as well as between Syria and Lebanon, and Syria and Jordan, are an exception. Yet, the lack of implementation of the latter two agreements due to the protracted crisis in Syria since 2011 clearly demonstrates these shortcomings.[38]

Increased water scarcity is also likely to negatively impact food security in many Mediterranean countries, especially in the southern and eastern parts.[39] Productivity growth in the agricultural sector has been slow in many MENA countries, and even though the sector's contribution to GDP is small, farming is still a major source of employment in some of the most populated SEM countries. For instance, farming occupies 39 per cent of the workforce in Morocco and 28 per cent in Egypt.[40] In contrast, Italy and Spain, two of the largest agricultural exporters in the northern Mediterranean, only have about 4 per cent of their workforce employed in the agricultural sector.[41] These fig-

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[37] Elizabeth Sellwood, "A Tougher Climate in the Eastern Mediterranean", cit., p. 11.

[38] Johan Schaar, "A Confluence of Crises", cit.

[39] United Nations Economic and Social Commission for West Asia (ESCWA) and Food and Agriculture Organization (FAO), *Arab Horizon 2030: Prospects for Enhancing Food Security in the Arab Region*, Beirut, United Nations, 2017, https://www.unescwa.org/node/644.

[40] Ibid.

[41] European Commission, *Spain: Agriculture Statistical Factsheet*, June 2021, https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-es_en.pdf; European Commission, *Italy: Agriculture Statistical Factsheet*, June 2021, https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-it_en.pdf.

ures should be seen in relation to the expected population growth in the MENA region of about 2 per cent annually, which is anticipated to nearly double the population between 2000 and 2050 and suggests rising levels of food imports, alongside the likelihood of increased water insecurity in the region (see above). For example, in the period 1990–2016, the gap between production and consumption of cereals in the MENA region grew from 30 to 100 million metric tonnes; and in 2014–16, the region imported 65 per cent of its consumption of cereals and about 25 to 35 per cent of global trade in sheep meat, milk and wheat.[42] Thus, water and food security risks in the Mediterranean are deeply connected to climate change.

Still, specific climate risks related to water management and food production do not automatically translate into security challenges. Previous research does not only stress the complex pathways through which changing climate factors might lead to conflicts and tensions,[43] as many researchers also emphasise that one of the most important factors to take into account when trying to assess the impact of climate-related security risks is the capacity to adapt of affected societies.[44] States' capacities to adapt to climate change, reduce climate-related security risks and protect their populations are key. The capacity to adapt to a changing climate ultimately rests on institutional capacity in terms of knowledge, technology and infrastructure, as well as regulatory capacity and rule of law. Public trust in the government and low levels of corruption are also essential features of institutional capacity, since it is difficult for states to effectively implement policies to address the adverse effects of climate change without the support of their populations and officials.[45] Schaar notes

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[42] Johan Schaar, "A Confluence of Crises", cit.

[43] Nina von Uexkull and Halvard Buhaug, "Security Implications of Climate Change: A Decade of Scientific Progress", in *Journal of Peace Research*, Vol. 58, No. 1 (January 2021), p. 3-17, https://doi.org/10.1177/0022343320984210.

[44] W. Neil Adger, Hallie Eakin and Alexandra Winkels, "Nested and Teleconnected Vulnerabilities to Environmental Change", cit.

[45] See for instance, Bo Rothstein, *The Quality of Government. Corruption, Social Trust, and Inequality in International Perspective*, Chicago/London, University of Chicago

that responses to climate-related security risks are thus "ultimately subordinate to politics".[46] At the same time, Schaar says,

> Adaptive capacity is not static. In the MENA region, conflicts displace populations, destroy infrastructure and damage economies, thus reducing societies' adaptive capacity. The depth of these changes may determine if climate-induced stress escalates into a severe crisis. Conversely, adaptive capacity can be strengthened through institution-building, providing access to resources and increasing political stability.[47]

It needs to be taken into account that the history of conflicts and protracted tensions in the Mediterranean region provides a distinctive challenge for promoting regional cooperation on climate-related security risks.[48] The Mediterranean is also one of the least integrated regions in the world, measured in terms of political and economic integration, and the gap between the advanced northern economies, all of which are deeply integrated in the EU's Internal Market, and the less diversified southern economies, situated in North Africa and the Middle East, is vast. The instability in the MENA region as a result of many authoritarian regimes' inability to answer to popular demands for political inclusion and social justice in the wake of the Arab uprisings in 2011, particularly in Syria, Libya and Egypt, has led to a situation where the prospects for developing regional cooperation on climate-related security risks appear even bleaker than a decade ago.

There are nonetheless a few promising examples of regional cooperation that are relevant for developing actions also in the field of climate security. These include, for example, the Mediterranean Action Plan (MAP) which was established back in 1975 as a multilateral environmental agreement under the auspices of the UN Environment Programme (UNEP) to address common challenges of marine environmental deg-

Press, 2011.

[46] Johan Schaar, "A Confluence of Crises", cit., p. 5.

[47] Ibid.

[48] Niklas Bremberg, "Do Regional Organizations Contribute to Security?", cit.

radation.[49] Furthermore, the EU has been involved in attempts to promote Mediterranean regional cooperation since the 1990s, such as the Euro-Mediterranean Partnership (EMP), and the European Commission supports regulatory capacity and economic reforms in countries such as Morocco and Tunisia within the framework of the European Neighbourhood Policy (ENP). The most recent attempt to promote regional cooperation is the Union for the Mediterranean (UfM), launched in 2008. The UfM brings together all EU member states and 15 countries in the southern and eastern Mediterranean with the aim of enhancing regional cooperation and dialogue, focusing on projects and initiatives with "tangible impact on the citizens" in the region. The UfM secretariat was created in Barcelona in 2010 and is meant to serve as an operational institution to promote projects as well as coordinate the dialogue between UfM member states, partners and stakeholders.

However, previous research points to various obstacles for advancing regional cooperation in the Mediterranean such as, on the one side, a too heavy emphasis placed by the EU and its member states on "exporting" lessons from the European integration process and practices of EU policymaking to non-members in the southern and eastern Mediterranean; and on the other, protracted conflicts among SEM countries and the enduring character of authoritarian rule in the broader MENA region.[50] It is noticeable that the shift from the EMP to the UfM entailed a significant de-emphasis on issues related to human rights and political reforms in favour of technical cooperation and economic development as a basis for regional cooperation, without this having led to any obvious advancements. As already suggested, the prospects for regional cooperation in the Mediterranean seem in many ways bleaker today than a few decades ago, but the shared vulnerabilities that societies in the region

[49] See for instance, Peter M. Haas, *Saving the Mediterranean. The Politics of International Environmental Cooperation*, New York, Columbia University Press, 1990.

[50] See for instance, Federica Bicchi, *European Foreign Policy Making toward the Mediterranean*, New York, Palgrave Macmillan, 2007; Niklas Bremberg, "From 'Partnership' to 'Principled Pragmatism': Tracing the Discursive Practices of the High Representatives in the EU's Relations with the Southern Mediterranean", in *European Security*, Vol. 29, No. 3 (2020), 359-375.

face as a result of the adverse effects of climate change may push even authoritarian regimes to embrace regional cooperation in order to try to ensure their own survival, although this of course remains to be seen.

1.3 Recent regional climate actions in the Mediterranean

Before the COP26 meeting in Glasgow, the second UfM Ministerial Conference on Environment and Climate Action was held on 4 October 2021 in Cairo (the COP27 meeting in 2022 is scheduled to be held in Sharm el-Sheikh, Egypt). Ministers from UfM member states, as well as Frans Timmermans, Vice President of the European Commission responsible for the European Green Deal and Virginijus Sinkevičius, European Commissioner for Environment, issued a declaration stressing their shared intention to implement global and regional climate commitments, including increased "action on adaptation by taking appropriate measures aimed at enhancing the countries' capacities to respond to the impacts of climate change and make the Mediterranean region more climate-resilient".[51] Such adaptive measures should include "ecosystems management and restoration; sustainable water and coastal management solutions; actions targeting land degradation, desertification and coastal erosion; disaster risk reduction including emergency preparedness; climate-proofing infrastructures and investments; and promotion of nature-based solutions".[52]

The UfM conference in Cairo in 2021 was preceded by the first UfM Ministerial Meeting on Environment and Climate Change held in Athens in 2014. Following this initial meeting, the network of Mediterranean Experts on Climate and Environmental Change (MedECC) was created in 2015 as an international network of scientific experts to assist decision-makers on the basis of available research. Gathering about 600 scientists from 35 countries, MedECC is also supported by the UNEP/MAP through the Regional Framework for Climate Change Adaptation in the

[51] Union for the Mediterranean, *Declaration from 2nd Union for the Mediterranean Ministerial Conference on Environment and Climate Action*, Cairo, 4 October 2021, p. 3, https://ufmsecretariat.org/?p=125338.

[52] Ibid.

Mediterranean. The MedECC's first assessment report on the risks associated to climate and environmental changes in the Mediterranean was presented at the fourth UfM Regional Forum for Ministers of Foreign Affairs in Barcelona in 2019.

In terms of UfM-supported projects to enhance climate action in the Mediterranean region, CLIMA-MED is particularly worthy of mention. Financed by the EU and promoted by the European Commission, the project seeks to enhance energy security and adaptive capacity in Algeria, Egypt, Israel, Jordan, Lebanon, Palestine, Morocco and Tunisia while at the same time encouraging transition to low-carbon and climate-resilient economies. Other initiatives include the SEMed Private Renewable Energy Framework which aims to promote private renewable energy markets in Morocco, Tunisia, Egypt, Jordan and Lebanon, with financing from the European Bank of Reconstruction and Development, the Clean Technology Fund and the Global Environment Facility. The UfM Energy University by Schneider Electric, meanwhile, aims to develop expertise in energy efficiency and renewable energy for professionals via online courses, initially in Morocco, Tunisia, Turkey and Algeria; alongside the Tafila Wind Farm in Jordan which the UfM frames as a good example of a partnership between government and private sector in the field of renewable energy.

That said, it should be acknowledged that UfM-supported projects are rather limited and the effects are still to be seen. Yet, given the difficult circumstances that any project of this kind would face in the Mediterranean region it is worth pointing out that the cooperative logic that informs such projects at least does not run counter to what previous research on international cooperation on climate-related security risks has stressed as key factors for developing global and regional responses. This is because a crucial yet inherently difficult task for actors in the region is to develop capacities to continuously make context-specific assessments on such risks (see also above). Furthermore, in early 2021 the EU launched its "New Agenda for the Mediterranean" to strengthen its partnership with countries in the southern Mediterranean. The New Agenda includes an Economic and Investment Plan to spur economic development, and under the EU's Neighbourhood, Development and International Cooperation Instrument, up to 7 billion euro for 2021–27 is said to be allocated to the implementation of the agenda. It should be noted that one focus area of the New Agenda is "green transition", including climate resilience, energy and environment.[53] While taking these recent initiatives to promote cooperation on climate-related security risks into account, it should also be mentioned that countries in the region have engaged in civil protection cooperation to better respond to natural and man-made disasters for several decades now. Euro-Mediterranean civil protection cooperation was launched in the 1990s and brings together practitioners from Mediterranean countries in training exercises and operations.[54] Currently, the EU-funded Prevention, Preparedness and Response to Natural and Man-Made Disasters in Middle East and North Africa Partnership Countries (PPRD) South III programme aims to increase resilience and reduce the social, economic and environmental costs of natural and man-made disasters in ENP partner countries (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia). More specifically, the PPRD South III aims to: further develop national approaches to disaster management, based on prevention, mitigation and preparedness rather than on response; strengthen coordinated responses of Mediterranean Basin countries affected by the same disaster; and deepen institutional cooperation between the EU Civil Protection Mechanism and the national civil protection agencies in SEM countries.[55] These efforts can be said to enhance much-needed capacities for adapting to the adverse effects of climate change, in a region where regional cooperation in many other policy areas is poorly developed.

[53] European Commission, *Southern Neighbourhood: EU Proposes New Agenda for the Mediterranean*, 9 February 2021, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_426.

[54] Niklas Bremberg, *Diplomacy and Security Community-Building. EU Crisis Management in the Western Mediterranean*, London/New York, Routledge, 2016; Niklas Bremberg, "Security, Governance and Community beyond the European Union: Exploring Issue-Level Dynamics in Euro-Mediterranean Civil Protection", in *Mediterranean Politics*, Vol. 15, No. 2 (2010), p. 169-188.

[55] EU Neighbours portal: *PPRD South III: Prevention, Preparedness and Response to Natural and Man-Made Disasters in Middle East and North Africa Partnership Countries*, https://www.euneighbours.eu/en/node/33959.

1.4 Prospects for regional cooperation on climate security

There is little doubt that all Mediterranean countries are facing a climate emergency and that they need to seriously step up efforts to accelerate their transition into low-carbon economies as well as boost their capacities to manage immediate and more long-term climate-related security risks. Of course, the reduction of state revenues from fossil fuels presents huge challenges for those SEM economies that remain heavily dependent on hydrocarbons, at a time when there are deeply felt concerns over political instability and social unrest in the region, which might only contribute to making the necessary transition even harder to achieve. Nonetheless, developing responses in the field of climate security is fundamentally a political issue, and improving adaptive capacities is ultimately a question of strengthening institutional capacity as well as accountability within and among Mediterranean countries.

To be sure, the many protracted conflicts and tensions in the region suggest that it is difficult to advance regional cooperation on the highest political level, but examples such as projects and initiatives promoted by the UfM and EU discussed above nonetheless suggest that there are avenues for practical and technical cooperation to explore among actors on sub-state and local levels, not least in the fields of civil protection and climate risk assessment. This kind of cooperation could be further supported and expanded, for instance through the OSCE Mediterranean Partnership. In light of previous research stressing that knowledge exchange on climate-related security risks between international, national and local actors is key to developing adequate responses, the projects and initiatives referred to above, not least the MedECC and the PPRD South III, point to the potential of such practical cooperative ventures.

Finally, the sense of shared vulnerabilities facing all Mediterranean countries in the face of the adverse effects of climate change could become a factor that might push political elites in SEM countries to embrace regional cooperation to a larger extent than in the past, as well as motivating governments in northern Mediterranean countries to push harder for sustainable development. That said, the fact that it took almost seven years for the UfM to convene a second ministerial meeting on environment and climate action does not bode well in this regard. The advanced economies in the northern Mediterranean need to take on further responsibilities and seek to compensate for their larger share in carbon emissions and pollution in the past as well as in the present; but as long as governments in the southern and eastern Mediterranean are not held fully accountable to their citizens it is difficult to see how they would be able to develop and implement policies that help transform their societies in a more sustainable direction. In this way, the climate emergency does not only revolve around issues of historic responsibilities and the adverse effects of climate change being felt today and increasingly tomorrow, it also highlights the disastrous consequences that the lack of democracy and cooperation as well as poor governance have on societies across and beyond the Mediterranean region.

References

W. Neil Adger, Hallie Eakin and Alexandra Winkels, "Nested and Teleconnected Vulnerabilities to Environmental Change", in *Frontiers in Ecology and the Environment*, Vol. 7, No. 3 (April 2009), p. 150-157, https://doi.org/10.1890/070148

W. Neil Adger et al., "Human Security", in Christopher B. Field et al. (eds), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 2014, p. 755-791, https://www.ipcc.ch/report/ar5/wg2

Bentley B. Allan, "Second Only to Nuclear War: Science and the Making of Existential Threat in Global Climate Governance", in *International Studies Quarterly*, Vol. 61, No. 4 (December 2017), p. 809-820, https://doi.org/10.1093/isq/sqx048

Richard P. Allan et al., "Summary for Policymakers", in International Panel on Climate Change, *Climate Change 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 2021, https://www.ipcc.ch/report/ar6/wg1

Vane Moraa Aminga and Florian Krampe, "Climate-related Security Risks and the African Union", in *SIPRI Policy Briefs*, May 2020, https://

www.sipri.org/node/5133

Andrew Baldwin, Chris Methmann and Delf Rothe, "Securitizing 'Climate Refugees': The Futurology of Climate-Induced Migration", in *Critical Studies on Security*, Vol. 2, No. 2 (2014), p. 121-130, https://doi.org/10.1080/21624887.2014.943570

Michael Barnett and Martha Finnemore, *Rules for the World. International Organizations in Global Politics*, Ithaca/London, Cornell University Press, 2004

Jon Barnett, Richard A. Matthew and Karen L. O'Brien, "Global Environmental Change and Human Security: An Introduction", in Richard A. Matthew et al. (eds), *Global Environmental Change and Human Security*, Cambridge, MIT Press, 2010, p. 3-32

Federica Bicchi, *European Foreign Policy Making toward the Mediterranean*, New York, Palgrave Macmillan, 2007

Jörn Birkmann and Korinna von Teichman, "Integrating Disaster Risk Reduction and Climate Change Adaptation: Key Challenges, Scales, Knowledge, and Norms", in *Sustainability Science*, Vol. 5, No. 2 (July 2010), p. 171-184

Camilla Born, Karolina Eklöw and Malin Mobjörk, "Advancing United Nations Responses to Climate-related Security Risks", in *SIPRI Policy Briefs* (September 2019), https://www.sipri.org/node/4907

Niklas Bremberg, *Diplomacy and Security Community-Building. EU Crisis Management in the Western Mediterranean*, London/New York, Routledge, 2016

Niklas Bremberg, "Do Regional Organizations Contribute to Security? Perspectives on Euro-Mediterranean Cooperation", in Richard Gillespie and Frédéric Volpi (eds), *Routledge Handbook on Mediterranean Politics*, London/New York, Routledge, 2018, p. 194-206

Niklas Bremberg, "The EU and Climate-Related Security Risks: The Case of the Sahel", in Abdelhak Bassou, Aleksandra Chmielewska and Xira Ruiz-Campillo (eds), "Climate Security in the Sahel and the Mediterranean: Local and Regional Responses", in *EuroMeSCo Joint Policy Studies*, No. 13 (2019), p. 86-115, https://www.euromesco.net/publication/climate-security-in-the-sahel-and-the-mediterranean-local-and-regional-response

Niklas Bremberg, “European Regional Organizations and Climate-related Security Risks: EU, OSCE and NATO”, in *SIPRI Insights on Peace and Security*, No. 2018/1 (February 2018), https://www.sipri.org/node/4404

Niklas Bremberg, “From ‘Partnership’ to ‘Principled Pragmatism’: Tracing the Discursive Practices of the High Representatives in the EU’s Relations with the Southern Mediterranean”, in *European Security*, Vol. 29, No. 3 (2020), 359-375

Niklas Bremberg, “Security, Governance and Community beyond the European Union: Exploring Issue-Level Dynamics in Euro-Mediterranean Civil Protection”, in *Mediterranean Politics*, Vol. 15, No. 2 (2010), p. 169-188

Niklas Bremberg and Anniek Barnhoorn, “Advancing the Role of the OSCE in the Field of Climate Security”, in *SIPRI Policy Briefs*, September 2021, https://www.sipri.org/node/5520

Niklas Bremberg, Malin Mobjörk and Florian Krampe, “Global Responses to Climate Security: Towards a Framework for Analysis”, manuscript under review

Niklas Bremberg, Hannes Sonnsjö and Malin Mobjörk, ”EU and Climate Security: A Community of Practice in the Making?”, in *Journal of European Integration*, Vol. 41, No. 5 (2019), p. 623-639

Joshua W. Busby, “Beyond Internal Conflict: The Emergent Practice of Climate Security”, in *Journal of Peace Research*, Vol. 58, No. 1 (January 2021), p. 186-194, https://doi.org/10.1177/0022343320971019

Ken Conca, *An Unfinished Foundation. The United Nations and Global Environmental Governance*, Oxford, Oxford University Press, 2015

Simon Dalby, *Security and Environmental Change*, Cambridge, Polity Press, 2009; Jon Barnett, “Security and Climate Change”, in *Global Environmental Change*, Vol. 13, No. 1 (April 2003), p. 7-17

Lisa M. Dellmuth et al., “Intergovernmental Organizations and Climate Security: Advancing the Research Agenda”, in *WIREs Climate Change*, Vol. 9 (January/February 2018), Article e496, https://doi.org/10.1002/wcc.496

Angela Dewan, “This Summer Was Europe’s Hottest on Record as Mediterranean Heat Soared”, in *CNN*, 7 September 2021, https://edition.cnn.com/2021/09/07/europe/europe-hottest-summer-climate-intl/index.html

Bodil Elmhagen et al., "Interacting Effects of Change in Climate, Human Population, Land Use, and Water Use on Biodiversity and Ecosystem Services", in *Ecology and Society*, Vol. 20, No. 1 (2015), Article 23, https://doi.org/10.5751/ES-07145-200123

European Commission, *EU at COP26: Commission Pledges €100 Million to the Adaptation Fund*, 9 November 2021, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5886

European Commission, *Italy: Agriculture Statistical Factsheet*, June 2021, https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-it_en.pdf

European Commission, *Southern Neighbourhood: EU Proposes New Agenda for the Mediterranean*, 9 February 2021, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_426

European Commission, *Spain: Agriculture Statistical Factsheet*, June 2021, https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-es_en.pdf

Peter M. Haas, *Saving the Mediterranean. The Politics of International Environmental Cooperation*, New York, Columbia University Press, 1990

Judith Nora Hardt, *Environmental Security in the Anthropocene. Assessing Theory and Practice*, London/New York, Routledge, 2017

Johanna Hedlund et al., "Quantifying Transnational Climate Impact Exposure: New Perspectives on the Global Distribution of Climate Risk", in *Global Environmental Change*, Vol. 52 (September 2018), p. 75-85

Florian Krampe and Malin Mobjörk, "Responding to Climate-Related Security Risks: Reviewing Regional Organizations in Asia and Africa", in *Current Climate Change Reports*, Vol. 4, No. 4 (December 2018), p. 330-337

Florian Krampe, Roberta Scassa and Giovanni Mitrotta, "Responses to Climate-related Security Risks: Regional Organizations in Asia and Africa", in *SIPRI Insights on Peace and Security*, No. 2018/2 (August 2018), https://www.sipri.org/node/4580

Robin Leichenko and Karen O'Brien, *Environmental Change and Globalization. Double Exposures*, Oxford, Oxford University Press, 2008

Richard A. Matthew, "Integrating Climate Change into Peacebuilding", in

Climatic Change, Vol. 123, No. 1 (March 2014), p. 83-93

Matt McDonald, "Discourses of Climate Security", in *Political Geography*, Vol. 33 (March 2013), p. 42-51

Mediterranean Experts on Climate and Environmental Change (MedECC), "Summary for Policymakers", in Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First Mediterranean Assessment Report*, MedECC, November 2020, https://www.medecc.org/?p=3506

Loveday Morris, Jennifer Hassan and Emily Rauhala, "Death Toll from European Floods Climbs to More Than 150", in *The Washington Post*, 17 July 2021, https://www.washingtonpost.com/world/2021/07/16/europe-flooding-deaths-germany-belgium

Angela Oels, "From 'Securitization' of Climate Change to 'Climatization' of the Security Field: Comparing Three Theoretical Perspectives", in Jürgen Scheffran et al. (eds), *Climate Change, Human Security and Violent Conflict. Challenges for Societal Stability*, Berlin/Heidelberg, Springer, 2012, p. 185-205

Mark Rhinard, "European Cooperation on Future Crises: Toward a Public Good?", in *Review of Policy Research*, Vol. 26, No. 4 (July 2009), p. 439-455

Bo Rothstein, *The Quality of Government. Corruption, Social Trust, and Inequality in International Perspective*, Chicago/London, University of Chicago Press, 2011

Johan Schaar, "A Confluence of Crises: On Water, Climate and Security in the Middle East and North Africa", in *SIPRI Insights on Peace and Security*, No. 2019/4 (July 2019), https://www.sipri.org/node/4879

Renate Schubert et al., *Climate Change as a Security Risk*, Berlin, Earthscan, 2008, https://www.wbgu.de/en/publications/publication/welt-im-wandel-sicherheitsrisiko-klimawandel

Shirley V. Scott, "Implications of Climate Change for the UN Security Council: Mapping the Range of Potential Policy Responses", in *International Affairs*, Vol. 91, No. 6 (November 2015), p. 1317-1333

Elizabeth Sellwood, "A Tougher Climate in the Eastern Mediterranean: Policy Directions in a Context of Climate Change and Regional Crises", in *Re-imagining the Eastern Mediterranean Series: PCC Reports*, No. 1/2018, https://www.prio.org/publications/11150

Jonas Tallberg et al., "The Performance of International Organizations: A Policy Output Approach", in *Journal of European Public Policy*, Vol. 23, No. 7 (2016), p. 1077-1096

Maria Julia Trombetta, "Environmental Security and Climate Change: Analysing the Discourse", in *Cambridge Review of International Affairs*, Vol. 21, No. 4 (2008), p. 585-602, https://doi.org/10.1080/09557570802452920

Union for the Mediterranean, *Declaration from 2nd Union for the Mediterranean Ministerial Conference on Environment and Climate Action*, Cairo, 4 October 2021, https://ufmsecretariat.org/?p=125338

United Nations, *Secretary-General's Remarks on Climate Change, Delivered on 10 September 2018*, https://www.un.org/sg/en/content/sg/statement/2018-09-10/secretary-generals-remarks-climate-change-delivered

United Nations Economic and Social Commission for West Asia (ESCWA) and Food and Agriculture Organization (FAO), *Arab Horizon 2030: Prospects for Enhancing Food Security in the Arab Region*, Beirut, United Nations, 2017, https://www.unescwa.org/node/644

United Nations Economic and Social Commission for Western Asia (ESCWA) et al., *Arab Climate Change Assessment Report: Main Report*, Beirut, ESCWA, 2017, https://www.preventionweb.net/node/46443

Nina von Uexkull and Halvard Buhaug, "Security Implications of Climate Change: A Decade of Scientific Progress", in *Journal of Peace Research*, Vol. 58, No. 1 (January 2021), p. 3-17, https://doi.org/10.1177/0022343320984210

Elizabeth Whitman, "A Land without Water: The Scramble to Stop Jordan from Running Dry", in *Nature*, Vol. 573, No. 7772 (5 September 2019), p. 20-23, https://doi.org/10.1038/d41586-019-02600-w

World Bank, *Beyond Scarcity. Water Security in the Middle East and North Africa*, Washington, World Bank, 2018, http://hdl.handle.net/10986/27659

2.

The Mediterranean as a Climate Change Hotspot: Implications for State and Societal Resilience

Wolfgang Cramer and Joël Guiot

The Mediterranean Basin is characterised by a long history of human settlement and is now widely recognised as a hotspot of risks to people and their livelihoods, due to a combination of socio-cultural and economic tensions on the one hand, and rapid environmental change on the other.[1] A growing human population is faced with critical instability due to rapid warming, increased droughts and heat waves, sea level rise, pollution of air and all water on land and in the ocean. These changes affect human lives directly and negatively, but they also impact the underlying ecosystems that provide essential benefits to people and represent fundamental ("intrinsic") values on Earth. Through tens of thousands of publications, scientific studies have analysed multiple, but not all, aspects of environmental degradation across Mediterranean states and societies, permitting a robust understanding of risks and also projections of future developments. Overall, a synthesis of this literature shows that impacts of environmental change on people and ecosystems are likely to reduce the resilience of socio-ecological systems, including governance and human security, during coming decades.[2]

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[1] Jacques Blondel et al. (eds), *The Mediterranean Region. Biological Diversity in Space and Time*, 2nd ed., Oxford, Oxford University Press, 2010.

[2] Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First*

The primary drivers of these negative trends are climate change, pollution, unsustainable use of land and sea, and the arrival of invasive species, acting in combination. The consequences on people and ecosystems are highly dependent on location, however disadvantaged populations in fragile or conflict-ridden contexts, especially in southern and eastern Mediterranean countries, are significantly more likely to suffer from environmental change compared to others, particularly among northern Mediterranean countries. The following contribution builds on the multi-sectoral comprehensive risk analysis framework developed by the network of Mediterranean Experts on Climate and Environmental Change (MedECC) and will first analyse the key determinants of climate and non-climatic risks in the Mediterranean. It then moves to discuss several likely impacts of environmental change, examining both the climatic and socio-economic aspects of such impacts before ending with a few remarks regarding possible pathways to foster greater state and societal resilience across the Mediterranean Basin.

2.1 Climate-related drivers of risk

Average air temperature increase across the Mediterranean Basin has now reached +1.5°C above the pre-industrial period (1850–1900), more than the global average increase which recently passed +1.1°C. This more rapid warming is similar to most of the world's land areas that generally warm faster than the ocean surface. The Mediterranean Sea, being semi-enclosed and relatively shallow, is also warming faster than the global ocean (+0.3°C to +0.4°C per decade vs. approximately 0.2°C globally). Over Mediterranean land areas, future additional warming during the 21st century is projected to be at least 0.9–1.5°C for a highly ambitious scenario of greenhouse gas emission reductions, but more likely in the range of 3.7–5.6°C in the event of a continued absence of strong climate policies (Figure 1). In all pathways, future regional warming will exceed global mean values by approximately 20 per cent on an annual basis and up to 50 per cent in the summer. With such high warming

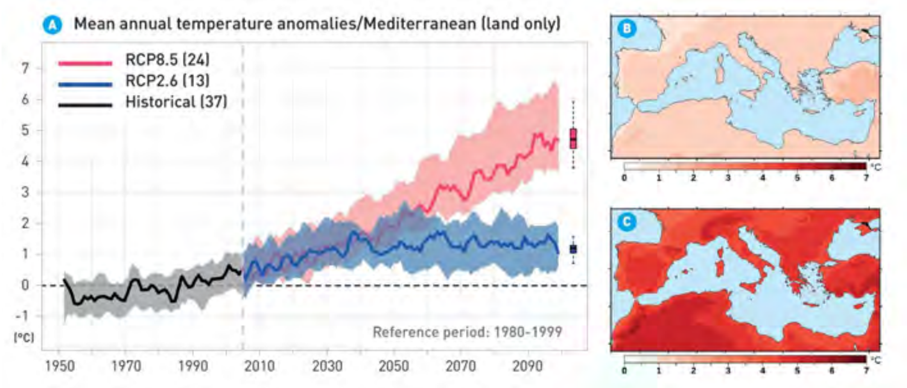
Mediterranean Assessment Report, Mediterranean Experts on Climate and Environmental Change (MedECC), November 2020, https://www.medecc.org/?p=3506.

rates, the intensity and frequency of heat waves will increase strongly, particularly in urban settings but also in the ocean. In addition, acidification of the Mediterranean Sea, caused by the rise in atmospheric CO2, is expected to progress more rapidly than it does in the global ocean, due to the higher alkalinity of Mediterranean waters. By 2100, the increased acidity could reach as much as -0.46 pH units, causing significant losses of shell-forming organisms and other biota.

Mediterranean coastal areas are heavily impacted by global sea level rise, caused by thermal expansion of the world oceans, but increasingly also by ice loss in the world's mountains and in Greenland – the current rate is accelerating and has recently reached 4.8 mm per year. Depending on emission pathways, sea levels in the Mediterranean will likely be 40–120 cm higher than today in 2100. The most recent Intergovernmental Panel on Climate Change (IPCC) report noted that much higher levels (1.7 m in 2100), caused by the destabilisation of Antarctic ice-sheets, cannot be ruled out.[3] Even without such catastrophic events, the commitment for additional sea level rise during coming centuries will be locked into the climate system, possibly reaching 7–15 m in 2300. This means that, even with ambitious climate policies and dramatic reductions in greenhouse concentrations, sea level rise is bound to continue. In the major river deltas and estuaries, this causes rapid retreat of the coastline, a process which is amplified further by the decrease in sediment input from the rivers due to upstream dams and urbanisation. Sea level rise poses particular problems for the densely populated Mediterranean coasts where, due to the absence of tides, people, agrosystems, cultural heritage sites and coastal infrastructure are all located dangerously near the coastline. The city of Venice in Italy is only the most famous example for a Basin-wide situation, with widely differing conditions between various places due to coastal landscapes but also large differences in technical and financial means for coastal protection.

[3] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers", in *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the IPCC*, Geneva, 2021, https://www.ipcc.ch/report/ar6/wg1.

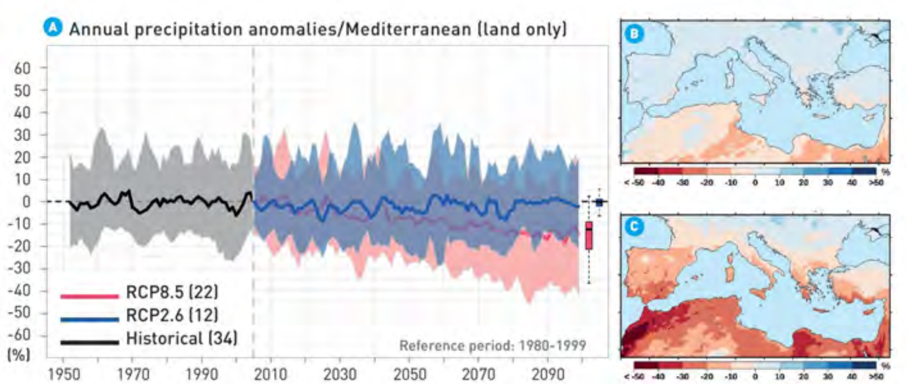
Figure 1 | Projected warming in the Mediterranean Basin



Note: Projected changes in annual temperature relative to the period 1980–1999, a: simulations for low and high greenhouse gas emission pathways (RCP2.6 and RCP8.5), b: temperature change at the end of the 21st century (2080–2099) for RCP2.6, c: idem for RCP8.5.

Source: Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin*, cit., p. 10.

Figure 2 | Projected rainfall change in the Mediterranean Basin



Note: Projected changes in annual rainfall relative to the period 1980–1999, a: simulations for low and high greenhouse gas emission pathways (RCP2.6 and RCP8.5), b: rainfall anomalies at the end of the 21st century (2080–2099) for RCP2.6, c: idem for RCP8.5.

Source: Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin*, cit., p. 11.

The contrast between dry summers and wet winters, a characteristic of all "Mediterranean" climates, will be intensified by drier summers and increased heavy rains and thus flood risk in the winter months.

While such extremes are already common in some regions, the increase is likely to be strong in most areas. Overall, precipitation is projected to decrease only slightly (about 4 per cent for each degree of global warming), but by the end of the 21st century even this small change adds up to an important reduction (Figure 2) which, together with stronger evaporation with higher temperatures, substantially reduces water availability for all forms of use.

2.2 Non-climatic drivers of risk

The impacts of climate change are exacerbated by strong non-climatic changes in the environment. In the Mediterranean Basin, these include multiple forms of pollution (air, land, rivers and ocean), the changing and unsustainable use of land (urbanisation, tourism, agricultural intensification) and the sea (overfishing) as well as the arrival of non-indigenous plant and animal species. Sulphur dioxide (SO2) and nitrogen oxide (NOx), produced by transport and industries, continue to increase drastically, the strongest cause being increased shipping activity in the Mediterranean. Tropospheric ozone (O3) concentrations increase due to the combination of pollution and warming, and high-level episodes will be more frequent in the future, with high impacts on human health, notably during hot summers. Saharan dust transport is likely to also increase due to stronger southern wind, likewise with impacts on human health.

The Mediterranean Sea is heavily polluted by multiple substances including plastic, emerging contaminants, heavy metals, faecal bacteria and viruses. All of these are expected to increase in the future. Urban and peri-urban areas are growing rapidly all over the Mediterranean, especially along the coasts of North Africa and among eastern Mediterranean countries. Urbanisation is also a major driving force of biodiversity loss and loss of open habitats. Outside urban areas and areas with intensive agriculture, forest and shrub encroachment, as a consequence of abandoned agro-pastoralism, mainly affects marginal lands with high importance for biodiversity, as well as arid and mountain regions, primarily in the north. In many regions of the Middle East and North Africa (MENA), remaining forests are degraded by unsustainable land management. In the sea, fishing activities have strongly increased since the 1990s. In 2010, 60 per cent of fish stocks were overexploited or had collapsed across the Mediterranean, especially in the eastern basin.[4] The Mediterranean Sea is invaded by many non-indigenous species, in particular from the Red Sea but also through the Strait of Gibraltar, migrating by their own means but also through maritime transport and aquaculture. On land, non-indigenous species are particularly invasive in regions with high infrastructure and commerce development, including accidentally introduced phytophagous pests which cause damage to crops and forests. A common feature of all these trends is that they are expected to continue and further aggravate in the future.

2.3 Risks for water resources and food supply

Water resources in the Mediterranean are generally scarce, even in the absence of environmental change, particularly among southern and eastern Mediterranean countries where freshwater supplies are limited, unevenly distributed and often insufficient to satisfy human and environmental needs.[5] In these countries, which hold less than 30 per cent of the freshwater in the entire region, agriculture currently uses 76–79 per cent of this resource. In southern Europe, the four main sectors of cooling, industrial use, household use and agriculture are more evenly balanced (Figure 3). As a consequence, 180 million people in the southern and eastern Mediterranean countries currently suffer from water scarcity (<1000 m3 capita-1 yr-1) and 80 million people from extreme water shortage (<500 m3 capita-1 yr-1).[6]

Overall, water demand is expected to increase by 22–74 per cent by 2100 due to enhanced irrigation needs for agriculture, population growth and tourism. The resulting shortfall will be most significant in southern and east-

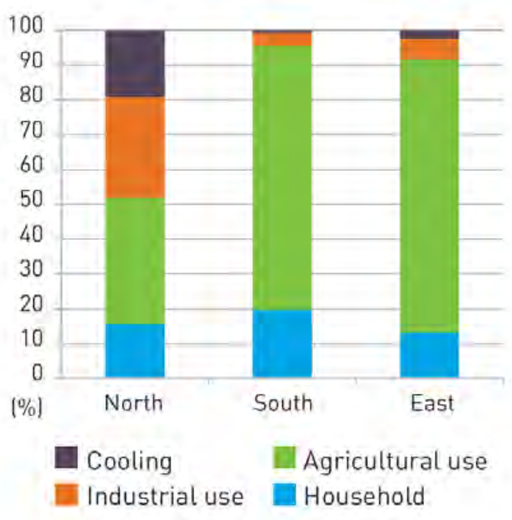
[4] Paraskevas Vasilakopoulos, Christos D. Maravelias and George Tserpes, "The Alarming Decline of Mediterranean Fish Stocks", in *Current Biology*, Vol. 24, No. 14 (21 July 2014), p. 1643-1648, https://doi.org/10.1016/j.cub.2014.05.070.

[5] Stèphane Simonet, "Adapting to Climate Change in the Water Sector in the Mediterranean: Situation and Prospects", in *Blue Plan Papers*, No. 10 (September 2011), https://issuu.com/mohamedhassouna/docs/cahier10_eau_cc_en.

[6] Marianne Milano et al., "Current State of Mediterranean Water Resources and Future Trends under Climatic and Anthropogenic Changes", in *Hydrological Sciences Journal*, Vol. 58, No. 3 (2013), p. 498-518, https://doi.org/10.1080/02626667.2013.774458.

ern Mediterranean countries where three quarters of the Basin's population live. Climate change will significantly increase the area affected by water shortages for all uses, but the exact numbers depend both on the pathway of climate policies and the implementation of adaptation measures. There is indeed considerable adaptive potential, mainly in the improvement of water use efficiency and reuse.[7] Further important adaptation options are changing agriculture practices and the reduction of food waste. Maintaining the traditional Mediterranean diet and shifting back to locally produced Mediterranean food, in conjunction with a reduction of food waste, could generate significant water savings in comparison to the present increasingly meat-based diet, often involving large quantities of imported animal feed, in addition to benefits for health (obesity, diabetes) and for local economies.

Figure 3 | Total water consumption rates across four main sectors and the three Mediterranean sub-regions



Source: Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin*, cit., p. 16. Data from FAO 2016 Aquastat main database.

[7] Arthur Deboos et al., "Reuse of Treated Waste Water in the Mediterranean and Impacts on Territories", in *IPEMED Palimpsestes*, No. 19 (March 2018), http://www.ipemed.coop/en/publications-r17/ipemed-palimpsestes-c47/n%C2%B019-re-use-in-the-mediterranean-and-its-impact-on-territories-a3322.html.

Food production on land and in the sea is strongly impacted by climate change, notably through more frequent and intense extreme events, together with soil salinisation, ocean acidification and land degradation. Rising sea levels challenge agricultural production in river deltas such as the Nile Delta: even if land is not submerged, irrigation potential will be more limited due to saltwater intrusion from the sea. Crop yield reductions are therefore projected for the next decades in most current areas of production and for most crops (up to 60 per cent with 3–4°C global warming). These reductions could be worsened by emerging pests and pathogens. There is large adaptation potential in changing farming practices and management to agroecological methods, providing also important potential for climate change mitigation by increased carbon storage in soils.[8] Marine food production, already threatened by unsustainable fishing practices, encounters further challenges from invasive species, warming, acidification and water pollution. Taken together, these factors may affect species distribution and trigger local extinction of more than 20 per cent of commercially exploited fish and marine invertebrates around 2050.[9] Mitigation of these risks is possible but requires more rigorous management of fisheries in the Mediterranean. The sustainability of the Mediterranean food sector is also affected by changes in highly interconnected global food markets – which may be affected by environmental change in other world regions.

2.4 Risks for marine and terrestrial ecosystems

Marine ecosystems and their biodiversity are impacted by overfishing, warming (notably marine heat waves), acidification and the spread of non-indigenous species. Consequences include increased jellyfish outbreaks, mucilage and algal bloom outbreaks, and general biodiversity

[8] Eduardo Aguilera et al., "Managing Soil Carbon for Climate Change Mitigation and Adaptation in Mediterranean Cropping Systems: A Meta-Analysis", in *Agriculture, Ecosystems and Environment*, Vol. 168 (15 March 2013), p. 25-36.

[9] Miranda C. Jones and William W.L. Cheung, "Multi-model Ensemble Projections of Climate Change Effects on Global Marine Biodiversity", in *ICES Journal of Marine Science*, Vol. 72, No. 3 (March/April 2015), p. 741-752, https://doi.org/10.1093/icesjms/fsu172.

loss due to altered conditions for all organisms throughout the trophic web, from primary producers to top predators. In addition, tropical species arriving through the Suez Canal or the Strait of Gibraltar now find a sufficiently warm sea to replace many native species. The effects of warming are amplified by ocean acidification and increasing nutrient flows from the land. In coastal systems, sea level rise will impact coastal wetlands throughout the Basin – ultimately many current wetlands risk disappearing entirely during the present century. The survival and growth of seagrass "meadows" (which represent an important store of carbon) is also at risk from many processes in coastal systems, including warming and sea level rise.

All measures that improve marine ecosystem health, resilience or biodiversity have the potential to delay and reduce adverse effects of climate and non-climatic drivers. There is some potential for mitigating impacts through improved conservation within and beyond marine protected areas, more sustainable fishing practices and by reducing pollution from agriculture, urban areas and industry. Marine protected areas can provide an "insurance" role for biodiversity if they are placed in locations with limited vulnerability for ocean acidification and climate change. While marine protected areas cannot halt climate change and are fully exposed to its consequences such as ocean acidification, they are still an important tool for enhancing the resilience and adaptive capacity of ecosystems. To be efficient, surveillance will need to be strongly enhanced given that a large part of current protected areas do not have sufficient protection. The multiple levels of land-sea interactions could benefit from application of new approaches of ecosystem-based Integrated Coastal Zone Management and conservation planning. With current rates of land degradation, overfishing and sea level rise, all these approaches will nevertheless encounter "hard limits", meaning they are at risk to fail.

On land, biodiversity is at risk of decline in most parts of the Basin, in multiple ways. During the last 40 years, biodiversity changes and species loss, largely caused by unsustainable land use (agricultural intensification, urbanisation, land abandonment) have led to homogenisation and a general simplification of biotic interactions. In countries of the northern rim, forest area increases at the expense of extensive agriculture and grazing, while forested landscapes in southern countries are more at risk of fragmentation or even disappearance due to clearing and cultivation, overexploitation and overgrazing. Freshwater ecosystems offer many important ecosystem services (e.g., water supply for drinking, agriculture and industries, water purification, erosion control, recreation, tourism and flood mitigation), yet they are at risk from higher temperatures, increased evaporation and water pollution. Between 1970 and 2013, 48 per cent of Mediterranean wetlands have been lost, with 36 per cent of wetland-dependent animals in the Mediterranean threatened by extinction.[10] Increases in wildfires and hence burnt areas are projected in Mediterranean Europe under most global warming scenarios. Burnt area could increase in this part of the basin by 40 per cent for 1.5°C warming and up to 100 per cent of current levels for 3°C warming at the end of the 21st century.[11] Mediterranean drylands have a large and specific biodiversity, with many plants and animals that are highly adapted to limited water conditions – their areal extent may actually increase due to drier conditions, at the expense of other biota.

For most land ecosystems, multiple adaptation options exist that can enhance their stability despite a changing environment.[12] One is the promotion of "climate wise connectivity", or the facilitation of expected range shifts[13] which in many areas may be achieved by "building" linear and latitudinal corridors and taking advantage of the river network. Such connectivity networks may facilitate, for example, upward migrations of lowland species to higher areas. In forests, there are many ways to promote more appropriate management taking into account local conditions and future projections, such as mixed-species forest stands, thin-

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[10] Ilse Geijzendorffer et al. (eds), *Mediterranean Wetland Outlook 2. Solutions for Sustainable Mediterranean Wetlands*, Mediterranean Wetlands Observatory, 2018, https://medwet.org/publications/med-wetlands-outlook-2-2018.

[11] Marco Turco et al., "Exacerbated Fires in Mediterranean Europe Due to Anthropogenic Warming Projected with Non-Stationary Climate-Fire Models", in *Nature Communications*, Vol. 9 (2018), Article 3821, https://doi.org/10.1038/s41467-018-06358-z.

[12] Didier Aurelle et al., "Biodiversity, Climate Change and Adaptation in the Mediterranean", in *Ecosphere*, Vol. 13 (2022), forthcoming.

[13] Annika T. H. Keeley et al., "New Concepts, Models, and Assessments of Climate-Wise Connectivity", in *Environmental Research Letters*, Vol. 13, No. 7 (2018), Article 073002, https://doi.org/10.1088/1748-9326/aacb85.

ning and management of understory. The management of spatial heterogeneity in landscapes can also help reduce fire extent under climate warming scenarios. For freshwater ecosystems, preservation of natural flow variability of Mediterranean rivers and streams and wide riparian zones, along with reductions in water demand may assist their adaptation to future environmental change.

2.5 Risks for human livelihoods

Already today, human health is impacted by high temperatures as well as air and water pollution throughout the Mediterranean Basin.[14] The combined impacts of expected environmental changes (notably pollution and climate change) increase risks for human health in multiple ways, primarily from longer, more frequent and hotter heat waves (the deadliest of all extreme events), but also through food shortages as well as vector-borne, respiratory and cardio-vascular diseases.[15] Vector-borne disease outbreaks in the Mediterranean region are favoured by warmer climate and changing rainfall patterns which create hospitable environments for mosquitoes, ticks and other climate-sensitive vectors, particularly for the West Nile virus, chikungunya and leishmaniasis. All these health risks are particularly strong for populations including the elderly and young children, and virtually the entire population in disadvantaged areas and lower income countries.

Mediterranean cities grow due to increasing population and socio-economic change, notably on the coasts of southern countries. Increasing heat stress, exacerbated by urban "heat island" effects and also by further local warming caused by more widespread use of air-conditioning, kills people and challenges the planning and management of cities around the Mediterranean. Soil sealing for roads and parking spaces is an additional

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[14] Cristina Linares et al., "Impacts of Climate Change on the Public Health of the Mediterranean Basin Population: Current Situation, Projections, Preparedness and Adaptation", in *Environmental Research*, Vol. 182 (March 2020), Article 109107.

[15] Jos Lelieveld et al., "Cardiovascular Disease Burden from Ambient Air Pollution in Europe Reassessed Using Novel Hazard Ratio Functions", in *European Heart Journal*, Vol. 40, No. 2 (May 2019), p. 1590-1596, https://doi.org/10.1093/eurheartj/ehz135.

hazard amplifier for flooding during heavy storms in most urban areas. Urban development that promotes the uptake of nature-based solutions, provides benefits to biodiversity and contributes to ecosystem services however also presents important opportunities for a stronger focus on human health and general resilience to environmental change.

Human livelihoods are also affected by increasing risks for infrastructure and housing associated with extreme events and coastal flooding. In addition to the risks faced by the resident population, these factors will also impact tourism which will lose attractiveness due to reduced thermal comfort, degradation of natural resources, including freshwater availability, and coastal erosion due to sea level rise and urban development.[16] The net effect on tourism will depend on country and season. Mediterranean tourism has a major role for employment and thus socio-economic sustainability throughout the region and has potential to become more resilient to climate change than the overall economy, for instance by becoming more oriented towards culture and outdoor activities[17] – although this potential could also be limited by the need to substantially curb greenhouse gas emissions from transport, including aviation and cruise ship tourism.

Recent human migration (mostly within southern and eastern Mediterranean countries but also south–north) has been partially attributed to environmental change (notably drought destabilising agricultural systems), but other drivers such as economic, security and political factors are usually more important.[18] While slow-onset environmental and climatic events have significantly affected human well-being in some areas, strengthened adaptation remains a key for reducing migration drivers. In contrast, fast-onset events with associated environmental

[16] Arnau Amengual et al., "Projections for the 21st Century of the Climate Potential for Beach-based Tourism in the Mediterranean", in *International Journal of Climatology*, Vol. 34, No. 13 (15 November 2014), p. 3481-3498.

[17] Mita Drius et al., "Tackling Challenges for Mediterranean Sustainable Coastal Tourism: An Ecosystem Service Perspective", in *Science of the Total Environment*, Vol. 652 (20 February 2019), p. 1302-1317.

[18] Mohamed Charef and Kamel Doraï, "Human Migration and Climate Change in the Mediterranean Region", in Jean-Paul Moatti and Stéphane Thiébault (eds), *The Mediterranean Region under Climate Change. A Scientific Update*, Marseille, IRD éditions, 2016, p. 439-444, https://books.openedition.org/irdeditions/23727.

degradation (such as storms and floods) have indeed led to migration, mostly temporary and over a short distance.[19]

2.6 Increasing economic resilience through mitigation and adaptation

All Mediterranean countries have significant potential to enhance their resilience by mitigating the various drivers of environmental change, as well as by enhancing adaptation efforts to face some of its unavoidable manifestations – the two forms of environmental policy are needed and complement each other. The primary and unavoidable goal is the mitigation of environmental change, in the Mediterranean Basin just like everywhere else. It is essential to reduce greenhouse gas emissions and all forms of pollution to zero within a few years, a target requiring a dramatically accelerated energy transition, implying the rapid phasing out of fossil fuels and an accelerated development of renewable energy resources. This objective is often considered "unrealistic" for a large number of reasons, however it must also be recognised that current policies favouring "small steps" are unrealistic since they are proven to be insufficient to reduce significant harm to human livelihoods, ecosystems and the economy.

An ambitious energy transition, reaching beyond the plans and targets announced by governments and policy makers in line with commitments made for the 2015 Paris Agreement requires a significant transformation of energy policies and economic models in Mediterranean countries, as well as their international context. Most northern rim countries show some progress towards an energy transition by gradually diversifying their energy mix, improving energy efficiency and enlarging the fraction of renewables, however both declarations and their implementation are clearly insufficient for the achievement of "Paris goals". Most eastern and southern rim countries lag further behind in these developments and require stronger financial support, technology transfer and capacity building to sustain their own transitions in already fragile socio-politi-

[19] Stefanie Schütte et al., "Connecting Planetary Health, Climate Change, and Migration", in *Lancet Planetary Health*, Vol. 2, No. 2 (February 2018), p. e58-e59, https://doi.org/10.1016/S2542-5196(18)30004-4.

cal contexts. Under current transition scenarios, the share of renewables in these countries could triple to reach 13–27 per cent in 2040, but much stronger efforts will be necessary, based on existing technologies, notably solar and wind, but also techniques under development, notably using ocean currents. Current policies are constrained by many factors, including the absence of regional energy market integration.[20]

Air and water pollution are also sectors with high potential for the mitigation of environmental change drivers, notably through a transformation of the transport sector and many industrial processes. The food production system has capacity to increase its resilience while simultaneously reducing its environmental footprint, through improved water management, better storage of soil organic carbon and carbon sequestration, nitrogen fertilisation optimisation, management of crop residues and agroindustry by-products.[21] Soil organic carbon content in Mediterranean croplands is responsive to management changes such as organic amendments, cover crops and tillage reduction. This provides the basis for high potential to enhance soil organic carbon storage through land restoration. Organic fertilisers, tillage reduction and residue retention are effective practices in herbaceous systems. Marine food production would experience gains in resilience from both improved management of fishing quotas and enhanced and well supervised marine protected areas.

2.7 The Mediterranean potential for sustainability transformation

In a recent Plan Bleu report,[22] a large group of experts developed an updated view on the Mediterranean region's potential to advance

[20] Observatoire Méditerranéen de l'Energie (OME), *Mediterranean Energy Perspectives 2018. Executive Summary*, Paris, OME, 2018, https://www.ome.org/mep-2018-2.

[21] Xavier Poux and Pierre-Marie Aubert, "An Agroecological Europe in 2050: Multifunctional Agriculture for Healthy Eating", in *IDDRI Studies*, No. 9/18 (September 2018), https://www.iddri.org/en/node/23298.

[22] United Nations Environment Programme/Mediterranean Action Plan and Plan Bleu, *State of the Environment and Development in the Mediterranean* (SoED 2020), Nairobi, UNEP, 2020, https://planbleu.org/en/soed-2020-state-of-environment-and-development-in-mediterranean.

towards greater environmental sustainability. In their conclusions, they point towards the need for major changes in production and consumption patterns, with an explicit focus on climate change concerns, biodiversity protection and restoration, the circular economy and a transition towards the blue/green economy. Such inclusive development will have to address inequalities and involve civil society in design and implementation, directly and explicitly. Women, but also younger generations and their demands and potential for action are central to short- and long-term progress. Achieving food and water security in the Mediterranean will require integrated water resources management, the use of new nonconventional water resources and better water demand management. For energy, both improved efficiency and stronger reliance on low-carbon energy solutions will be key. Currently, there are substantial subsidies and other incentives for fossil fuel use and even exploration throughout the Mediterranean Basin, and these obviously need to be replaced by policies in support of demand reduction through energy-saving measures. Moving towards more sustainable tourism will involve the development of more sustainable models that capture economic, social and environmental benefits. Tourism can also benefit from a transition to sustainability in all components of the transport sector.

In closing, the Plan Bleu report notes that the "economic benefits of the blue economy are accompanied by threats to the health of marine and coastal ecosystems",[23] calling for better planning policies to avoid negative consequences. These threats are substantial and go well beyond ecosystems. Most likely, deeper transformation will be needed to outweigh the benefits of conventional economics for most current pathways of greenhouse gas emissions. A step in this direction, so far not taken with a focus on Mediterranean countries, would be to address actual human needs beyond growing consumption of goods, and what socio-economic conditions might satisfy such needs.[24] After identifying

[23] Ibid., p. 7.

[24] Jefim Vogel et al., "Socio-economic Conditions for Satisfying Human Needs at Low Energy Use: An International Analysis of Social Provisioning", in *Global Environmental Change*, Vol. 69 (July 2021), Article 102287, https://doi.org/10.1016/j.gloenvcha.2021.102287.

these, the "social tipping points" that might enable the transition could be studied in detail, following an approach recently proposed for global climate action.[25] Unfortunately, such studies are currently lacking in the Mediterranean Basin, and most of the literature is characterised by conventional economic growth optimisation.

2.8 Equity, climate justice and human rights

Poverty, inequalities and gender imbalances presently hamper the achievement of sustainable development and climate resilience across Mediterranean Basin countries. Culture is a key factor to the success of adaptation policies in a highly diverse multicultural setting such as the Mediterranean Basin. There are important cultural dimensions to how societies respond and adapt to climate-related risks since culture mediates changes in the environment and changes in societies. Culture is thus central to understanding and implementing adaptation; the identification of risks, decisions about responses and means of implementation are all mediated by culture. Cultures are dynamic and reflexive and are therefore in turn shaped by the idea of climate change. This is highly relevant in the multi-cultural Mediterranean context.

Policies for climate adaptation and environmental resilience potentially infringe on human rights – they need to account for concerns such as justice, equity, poverty alleviation, social inclusion and redistribution.[26] Broadly speaking, environmental change currently enhances the existing disequilibrium between south/east and north, through the uneven change in human livelihoods and economic losses, all of which amplify the risks of conflict, migration and significant suffering of populations. Even if the southern/eastern countries have so far contributed only a small fraction of past greenhouse gas emissions, they now confront significantly higher

[25] Ilona M. Otto et al., "Social Tipping Dynamics for Stabilizing Earth's Climate by 2050", in *PNAS*, Vol. 117, No. 5 (4 February 2020), p. 2354-2365, https://doi.org/10.1073/pnas.1900577117.

[26] Mohamed Behnassi, Himangana Gupta and Olaf Pollmann (eds), *Human and Environmental Security in the Era of Global Risks. Perspectives from Africa, Asia and the Pacific Islands*, Cham, Springer, 2019.

risks for people and ecosystems than the northern countries and their capacity of adaptation is lower. The Covid-19 crisis visibly put additional strain on the adaptive capacity and the resilience of these countries. Even if more ambitious climate policies were implemented today, there remains high urgency for additional adaptation efforts, but even with such efforts, a significant gap will remain as long as the 2015 Paris Agreement is not fully applied to transform production systems.[27]

The international community's past failure (and insufficient current actions) to mitigate climate change and biodiversity loss are a recognised issue of justice since they ultimately threaten human livelihoods and human rights. In particular, the rights of vulnerable peoples, who are already experiencing the adverse effects of climate change, are especially threatened in the Mediterranean, alongside some other world regions. Adaptation policies have the potential to infringe on human rights in the Mediterranean region if they are disconnected from concerns such as equity, poverty alleviation, social inclusion and income redistribution. This concerns policies for food, water, forests, fisheries and the availability of other resources that support the livelihoods of vulnerable populations. States must therefore ensure that appropriate adaptation measures are taken to protect and fulfil the rights of all people, particularly those most threatened by negative climate impacts.[28]

To implement adaptation policies, Mediterranean countries need sufficient resources. Lower income and climate-vulnerable countries are generally not in a financial position to give sufficient priority to policies that protect their environment, whether in relation to climate change, pollution or unsustainable use. Since much of their limited public budgets are dedicated to cover sectors considered to be even more vital, such as infrastructure, health, nutrition and education, adaptation policies require other sources of funding. Although the UNFCCC established the

[27] Lea Berrang-Ford et al., "A Systematic Global Stocktake of Evidence on Human Adaptation to Climate Change", in *Nature Climate Change*, Vol. 11, No. 11 (November 2021), p. 989-1000.

[28] Center for International Environmental Law (CIEL), *Climate Change & Human Rights: A Primer*, Washington/Geneva, CIEL, 2013, https://www.ciel.org/?p=3962.

Green Climate Fund (GCF),[29] from which many Mediterranean countries are already benefiting to support their adaptation policies, mechanisms to ensure social and environmental safeguards have yet to be applied to the fund. To do so, institutions involved in funding climate-related activities are required to provide transparent processes, maintain policies and procedures that respect internationally recognised rights, and allow meaningful opportunities for public participation.

Many Mediterranean countries also lack the scientific and technological capacities to deal appropriately and efficiently with environmental change. Thus, science and technology transfer remain critical to supporting sustainability and avoiding the shifting of polluting industries from developed countries to the developing world, including from northern Mediterranean countries to the southern ones. Establishing an institutional mechanism for science and technology transfer could help to implement a future climate framework in the region. In terms of effective implementation of adaptation strategies, the Sustainable Development Goals framework can help ensure that scientific inputs required by the most vulnerable peoples and communities are systematically considered a priority.

References

Eduardo Aguilera et al., "Managing Soil Carbon for Climate Change Mitigation and Adaptation in Mediterranean Cropping Systems: A Meta-Analysis", in *Agriculture, Ecosystems and Environment*, Vol. 168 (15 March 2013), p. 25-36

Arnau Amengual et al., "Projections for the 21st Century of the Climate Potential for Beach-based Tourism in the Mediterranean", in *International Journal of Climatology*, Vol. 34, No. 13 (15 November 2014), p. 3481-3498

Didier Aurelle et al., "Biodiversity, Climate Change and Adaptation in the Mediterranean", in *Ecosphere*, Vol. 13 (2022), forthcoming

[29] GCF website: https://www.greenclimate.fund.

Mohamed Behnassi, Himangana Gupta and Olaf Pollmann (eds), *Human and Environmental Security in the Era of Global Risks. Perspectives from Africa, Asia and the Pacific Islands*, Cham, Springer, 2019

Lea Berrang-Ford et al., "A Systematic Global Stocktake of Evidence on Human Adaptation to Climate Change", in *Nature Climate Change*, Vol. 11, No. 11 (November 2021), p. 989-1000

Jacques Blondel et al. (eds), *The Mediterranean Region. Biological Diversity in Space and Time*, 2nd ed., Oxford, Oxford University Press, 2010

Center for International Environmental Law (CIEL), *Climate Change & Human Rights: A Primer*, Washington/Geneva, CIEL, 2013, https://www.ciel.org/?p=3962

Mohamed Charef and Kamel Doraï, "Human Migration and Climate Change in the Mediterranean Region", in Jean-Paul Moatti and Stéphane Thiébault (eds), *The Mediterranean Region under Climate Change. A Scientific Update*, Marseille, IRD éditions, 2016, p. 439-444, https://books.openedition.org/irdeditions/23727

Wolfgang Cramer, Joël Guiot and Katarzyna Marini (eds), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First Mediterranean Assessment Report*, Mediterranean Experts on Climate and Environmental Change (MedECC), November 2020, https://www.medecc.org/?p=3506

Arthur Deboos et al., "Reuse of Treated Waste Water in the Mediterranean and Impacts on Territories", in *IPEMED Palimpsestes*, No. 19 (March 2018), http://www.ipemed.coop/en/publications-r17/ipemed-palimpsestes-c47/n%C2%B019-reuse-in-the-mediterranean-and-its-impact-on-territories-a3322.html

Mita Drius et al., "Tackling Challenges for Mediterranean Sustainable Coastal Tourism: An Ecosystem Service Perspective", in *Science of the Total Environment*, Vol. 652 (20 February 2019), p. 1302-1317

Ilse Geijzendorffer et al. (eds), *Mediterranean Wetland Outlook 2. Solutions for Sustainable Mediterranean Wetlands*, Mediterranean Wetlands Observatory, 2018, https://medwet.org/publications/med-wetlands-outlook-2-2018

Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers", in *Climate Change 2021: The Physical Science Basis. Con-*

tribution of Working Group I to the Sixth Assessment Report of the IPCC, Geneva, 2021, https://www.ipcc.ch/report/ar6/wg1

Miranda C. Jones and William W.L. Cheung, "Multi-model Ensemble Projections of Climate Change Effects on Global Marine Biodiversity", in *ICES Journal of Marine Science*, Vol. 72, No. 3 (March/April 2015), p. 741-752, https://doi.org/10.1093/icesjms/fsu172

Annika T. H. Keeley et al., "New Concepts, Models, and Assessments of Climate-Wise Connectivity", in *Environmental Research Letters*, Vol. 13, No. 7 (2018), Article 073002, https://doi.org/10.1088/1748-9326/aacb85

Jos Lelieveld et al., "Cardiovascular Disease Burden from Ambient Air Pollution in Europe Reassessed Using Novel Hazard Ratio Functions", in *European Heart Journal*, Vol. 40, No. 2 (May 2019), p. 1590-1596, https://doi.org/10.1093/eurheartj/ehz135

Cristina Linares et al., "Impacts of Climate Change on the Public Health of the Mediterranean Basin Population: Current Situation, Projections, Preparedness and Adaptation", in *Environmental Research*, Vol. 182 (March 2020), Article 109107

Marianne Milano et al., "Current State of Mediterranean Water Resources and Future Trends under Climatic and Anthropogenic Changes", in *Hydrological Sciences Journal*, Vol. 58, No. 3 (2013), p. 498-518, https://doi.org/10.1080/02626667.2013.774458

Observatoire Méditerranéen de l'Energie (OME), *Mediterranean Energy Perspectives 2018. Executive Summary*, Paris, OME, 2018, https://www.ome.org/mep-2018-2

Ilona M. Otto et al., "Social Tipping Dynamics for Stabilizing Earth's Climate by 2050", in *PNAS*, Vol. 117, No. 5 (4 February 2020), p. 2354-2365, https://doi.org/10.1073/pnas.1900577117

Xavier Poux and Pierre-Marie Aubert, "An Agroecological Europe in 2050: Multifunctional Agriculture for Healthy Eating", in *IDDRI Studies*, No. 9/18 (September 2018), https://www.iddri.org/en/node/23298

Stefanie Schütte et al., "Connecting Planetary Health, Climate Change, and Migration", in *Lancet Planetary Health*, Vol. 2, No. 2 (February 2018), p. e58-e59, https://doi.org/10.1016/S2542-5196(18)30004-4

Stèphane Simonet, “Adapting to Climate Change in the Water Sector in the Mediterranean: Situation and Prospects”, in *Blue Plan Papers*, No. 10 (September 2011), https://issuu.com/mohamedhassouna/docs/cahier10_eau_cc_en

Marco Turco et al., “Exacerbated Fires in Mediterranean Europe Due to Anthropogenic Warming Projected with Non-Stationary Climate-Fire Models”, in *Nature Communications*, Vol. 9 (2018), Article 3821, https://doi.org/10.1038/s41467-018-06358-z

United Nations Environment Programme/Mediterranean Action Plan and Plan Bleu, *State of the Environment and Development in the Mediterranean* (SoED 2020), Nairobi, UNEP, 2020, https://planbleu.org/en/soed-2020-state-of-environment-and-development-in-mediterranean

Paraskevas Vasilakopoulos, Christos D. Maravelias and George Tserpes, “The Alarming Decline of Mediterranean Fish Stocks”, in *Current Biology*, Vol. 24, No. 14 (21 July 2014), p. 1643-1648, https://doi.org/10.1016/j.cub.2014.05.070

Jefim Vogel et al., “Socio-economic Conditions for Satisfying Human Needs at Low Energy Use: An International Analysis of Social Provisioning”, in *Global Environmental Change*, Vol. 69 (July 2021), Article 102287, https://doi.org/10.1016/j.gloenvcha.2021.102287

3.

Drought, Desertification and Displacement: Re-Politicising the Climate-Conflict Nexus in the Sahel

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3.1 The Sahel, a key test for the climate-conflict nexus hypothesis

Environmental fragility is a defining characteristic of the Sahel. The concept of "Sahel" as a geo-political identifier was hardly in use until early post-colonial times.[1] Its salience increased dramatically after the major droughts that hit the region in the 1970s and 1980s. The early regional organisations grouping Sahelian countries – such as the Sahel Group at the Organization for Economic Cooperation and Development (OECD), the Community of Sahel-Saharan States (CEN-SAD), the Comité permanent inter-État de lutte contre la sécheresse au Sahel (CILSS) and the Autorité du Liptako-Gourma (ALG) – all stressed environmental fragility as a defining feature of the region. Building on this view, the modern Sahel was then identified as a transitional eco-region characterised by a scarce – but not absent – pluviometry, in between the absolute dryness of the Sahara and the abundant rainfall of the tropical band.[2]

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[1] Gregory Mann, *From Empires to NGOs in the West African Sahel. The Road to Nongovernmentality*, Cambridge, Cambridge University Press, 2014.

[2] Olivier Walther and Denis Retaillé, "Sahara or Sahel? The Fuzzy Geography of Terrorism in West Africa", in *CEPS/Instead Working Papers*, No. 2010-35 (November 2010), https://liser.elsevierpure.com/en/publications/

Structural environmental fragility in the area is increasingly compounded by climate change, which risks exacerbating the vulnerability of Sahelian countries, societies and individuals. Traditionally, the rhythmic alternation of dry and rainy seasons (respectively, from October to June, and from July to September) dictates the sequencing of agriculture and pastoralism. These activities contribute to the livelihoods of the overwhelming majority of the Sahelian population – 60 to 75 per cent in Mali and Niger, according to the World Bank.[3] Rainfall determines a complex social organisation based on the rotation of land use and animal transhumance.[4] Climate change, however, can seriously affect the fragile balance that sustains this customary way of life. Available evidence suggests that the Sahel is exposed to major rainfall variability. Rainfall decreased overall throughout the 20th century, with extreme droughts in the 1970s and 1980s prompting fears that the frequency and severity of Sahelian droughts was experiencing an upward spiral.[5]

More recently, growing precipitation has been compounded by greater unpredictability, with irregular seasonal cycles, erratic geographic migration of the Sahel rainband and more frequent extreme events. Furthermore, long-term climate trends indicate that temperatures are rising across the region – albeit unevenly[6] – leading to unprecedented heat peaks. Increasing evaporation, in combination with ill-devised irrigation schemes and unsustainable logging to meet the demands of a growing

sahara-or-sahel-the-fuzzy-geography-of-terrorism-in-west-africa.

3 World Bank Data: *Employment in Agriculture (% of Total Employment)*, https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS.

4 Luca Raineri and Youssouf Bâ, "Hybrid Governance and Mobility in the Sahel: Stabilisation Practices Put to Test", in Bernardo Venturi (ed.), *Governance and Security in the Sahel: Tackling Mobility, Governance and Climate Change*, Brussels, FEPS / Rome, IAI, 2019, p. 15-38, https://www.iai.it/en/node/10476.

5 Sharon E. Nicholson, Chris Funk and Andreas H. Fink, "Rainfall over the African Continent from the 19th through the 21st Century", in *Global and Planetary Change*, Vol. 165 (June 2018), p. 114-127, https://doi.org/10.1016/j.gloplacha.2017.12.014.

6 Aoife McCullough, Leigh Mayhew and Sarah Opitz-Stapleton, "When Rising Temperatures Don't Lead to Rising Tempers. Climate and Insecurity in Niger", in *BRACED Working Papers*, September 2019, https://odi.org/en/publications/when-rising-temperatures-dont-lead-to-rising-tempers-climate-and-insecurity-in-niger.

population, is feared to be paving the way to desertification of the Sahel. This trend was first detected in the late 20th century, although evidence is today more ambiguous.[7] Overall, these changes run the risk of upsetting local patterns of productivity, mobility and livelihoods across the region, with potential reverberations on social stability and even peace and conflict.

Over the last decade, the Sahel's environmental fragility has been predicated in the context of a variety of complex and interconnected crises. While the Sahel is stricken by worsening climatic trends, demographic growth in the region is reaching worldwide heights, fuelling fears of a rapid depletion of natural resources. At the same time, the Sahel is experiencing major political and security crises, in which weakening state control and communal polarisation have unleashed widespread violence and massive population displacement. The Tuareg-led rebellion of 2012 has precipitated Mali into a spiral of political crises, military-led coups and overall state collapse. Profiting from the weaknesses of Mali, transnational networks of organised crime and terrorism have proliferated across the region, progressively sweeping across large portions of neighbouring countries including Burkina Faso and Niger. The growing presence of criminal, rebel and terrorist cells across the broader region, including in Nigeria, Libya, Ivory Coast and Chad, are testing the resilience of local societies and the capacities of international responses.

Within this framework, the Sahara-Sahel region is increasingly portrayed as a conveyor belt which, owing to its inherent connectivity, could project its shockwaves to North Africa, fuelling the destabilisation across the Mediterranean Basin.[8] The trans-Saharan smuggling of weapons between North and Sub-Saharan Africa is rampant, and the strong connections between jihadist formations in Algeria and Mali, as well as

[7] Tor A. Benjaminsen, "Let the Desertification Zombie Rest in Peace", in *Climate and Conflict PRIO Blog*, 4 December 2017, https://blogs.prio.org/ClimateAndConflict/?p=42.

[8] Judith Scheele, *Smugglers and Saints of the Sahara. Regional Connectivity in the Twentieth Century*, Cambridge, Cambridge University Press, 2012; Mark Micallef, *The Human Conveyor Belt: Trends in Human Trafficking and Smuggling in Post-Revolution Libya*, Geneva, Global Initiative Against Transnational Oragnised Crime, March 2017, https://globalinitiative.net/?p=19042.

Libya and Niger, are now well documented.[9] It is therefore not by chance that the Sahel has been framed as part of the broader Mediterranean space by regional security strategies of foreign interveners, first and foremost the EU and its member states. In this context, the migration flows from Africa to Europe via the Sahel, the Sahara and North Africa are depicted as an illustration of the complex interactions between fragile environments, conflict settings and precarious livelihoods.

The concomitance of these trends has spurred debate that the coexistence of worsening climatic and security trends may be in fact indicative of correlation, if not causation. Policy and media discourses increasingly air the belief that there may be a direct causal link between climate change and armed conflicts.[10] Building more or less explicitly on the Malthusian assumption that population growth erodes the sustainability of ecosystems and will lead to the exhaustion of natural resources, the so-called climate-conflict nexus hypothesis argues that climate change, in combination with population growth, leads to environmental degradation and dwindling natural resources, which in turn fuel increased competition and conflict escalation. The prominence of climatic stress and conflict dynamics makes the Sahel a quintessential case to test this hypothesis and explore its scope-conditions.

3.2 Exploring the nexus across time

In recent years, several studies have tested the validity of the climate-conflict nexus hypothesis, whether in general[11] or in the Sahel in

[9] Djallil Lounnas, *Le djihad en Afrique du Nord et au Sahel. D'AQMI à Daech*, Paris, L'Harmattan, 2019.

[10] Illustrating this, the French President Emmanuel Macron frequently emphasises the alleged link between climate change and conflicts, most notably in the Sahel (see: Statement by the President of France, Emmanuel Macron, at the UN video-teleconference on "Maintenance of international peace and security: Climate and security", 23 February 2021, https://undocs.org/en/S/2021/198). Also, international (UNCCD) and regional (EU, AU, G7) organisations have embraced the idea that the fight against environmental degradation can contribute to tackling the root causes of violent conflicts in the Sahel.

[11] Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence*, Princeton, Princeton University Press, 1999; Ole Magnus Theisen, Nils Petter Gleditsch & Halvard Buhaug,

particular.[12] These studies, have reached divergent conclusions regarding how and how much climate change is impacting the Sahel. Most importantly, they have failed to exhibit any unambiguous and consistent causal link between climate factors and (in-)security events in the region.[13] Instead of climatic factors per se, these studies highlight the significance of governance, especially at local level: the legitimacy, efficacy and cogency of customary norms, local institutions, dispute-settlement mechanisms and participatory commissions matter overwhelmingly in making potential conflicts over natural resources veer towards either conflict escalation or peaceful management.

These results, while providing a healthy dose of scepticism vis-à-vis simplistic Malthusian assumptions underpinning the early conceptualisations of the climate-conflict nexus, are arguably influenced by methodological shortcomings.[14] The search for correlations – in this case, between climate and conflict events – has in fact led scholars to uncritically import positivistic approaches originally devised for econometric studies, which however are ill-suited to exploring complex social phenomena. The well-known challenge of coding conflicts is only magnified by the diversity of proxies used to capture the independent variable (climate change), with some studies focusing on rainfall levels and others on changing temperatures, freshwater availability, natural disasters, agricultural output and so on. Furthermore, most of these stud-

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"Is Climate Change a Driver of Armed Conflict?", in *Climatic Change*, Vol. 117, No. 3 (2013), p. 613-625.

[12] Sebastien Hissler, *Econometric Study on the Impact of Rainfall Variability on Security in the Sahel Region*, Paris, OECD, 2010, https://www.oecd.org/swac/publications/44245104.pdf; Tor A. Benjaminsen et al., "Does Climate Change Drive Land-Use Conflicts in the Sahel?", in *Journal of Peace Research*, Vol. 49, No. 1 (January 2012), p. 97-111; Erik Alda, *Rising Tempers, Rising Temperatures: A Look at Climate Change, Migration and Conflict and the Implications for Youth in the Sahel*, Washington, World Bank, 2014, http://hdl.handle.net/10986/23838.

[13] See also Halvard Buhaug, "Climate Not to Blame for African Civil Wars", in *PNAS*, Vol. 107, No. 38 (21 September 2010), p. 16477-16482, https://doi.org/10.1073/pnas.1005739107.

[14] Jan Selby, "Positivist Climate Conflict Research: A Critique", in *Geopolitics*, Vol. 19, No. 4 (2014), p. 829-856.

ies are based on the analysis of temporal correlations between climate events (however considered) and conflicts (however coded) occurring in the same year. Some more sophisticated studies perform analyses to explore whether climatic variations might affect conflict in the year that immediately follows. These approaches implicitly assume a mechanism whereby exceptional climatic variations are supposed to trigger competition and conflict in a very short timeframe. Yet, as political ecologists have long argued, "resource conflicts" are less akin to sudden outbursts of violence than to protracted processes of political contention intercepting long-term socio-political struggles. It is therefore unsurprising that positivistic analyses of the climate-conflict nexus have proved unable to identify any meaningful linkage between climatic and conflict events.

At the same time, the lack of a demonstrable correlation between climate change (proxies) and conflicts has led a second generation of studies to tone down the early scholarship's emphasis on causal claims and positivistic approaches. Following the 2015 *New Climate for Peace* report commissioned by the G7, recent research has reframed the understanding of the climate-conflict nexus less in terms of direct causality than of a multiplier of threats and risks coming from pre-existing vulnerabilities. Methodologically, this more recent scholarship has increasingly rejected abstract, generalisable approaches, and focused instead on single case-studies. This has paved the way to the analysis of fine-grained qualitative evidence – including interviews with experts and key informants – across longer timespans. Such developments have enabled scholars to illustrate that climatic and environmental factors may indeed be linked to conflict exacerbation in the Sahel, particularly in countries like Mali,[15] Niger[16] or Burkina Faso.[17] Nevertheless, the actual "weight" of climatic

[15] Chitra Nagarajan, *Climate-Fragility Risk Brief: Mali*, Berlin, Adelphi, 28 May 2020, https://www.adelphi.de/en/node/56472; Fara Hegazi, Florian Krampe and Elizabeth Seymour Smith, "Climate-Related Security Risks and Peacebuilding in Mali", in *SIPRI Policy Papers*, No. 60 (April 2021), https://www.sipri.org/node/5411.

[16] Aoife McCullough, Leigh Mayhew and Sarah Opitz-Stapleton, "When Rising Temperatures Don't Lead to Rising Tempers", cit.

[17] Sanfo Abroulaye et al., "Climate Change: A Driver of Crop Farmers - Agro Pastoralists Conflicts in Burkina Faso", in *International Journal of Applied Science and Technol-*

factors in determining conflict outcomes is only vaguely addressed by these studies, meaning that the overall climate-conflict nexus hypothesis remains underspecified.

The mixed results of existing research exhibit some common shortcomings and highlight where additional research is most needed. Both the difficulty that quantitative studies encounter in demonstrating a verifiable correlation, and the shallowness of qualitative studies in illustrating a compelling connection, point to the need to devote more attention to understanding the causal mechanisms that can reasonably link climate trends and events to conflict dynamics.

Building on the available literature and extensive fieldwork experience, this study hypothesises at least four mechanisms[18] that, in the case of the Sahel, can plausibly link climate and conflict events, especially when the problematic temporal correlation assumption is dropped, and potential impacts are considered throughout longer timespans:

1) *The Malthusian mechanism*: Worsening climatic trends (combined with other environmental stressors, such as demographic growth and/or unsustainable livelihoods) contribute to the progressive depletion of valuable natural resources, including fertile agricultural land, pasturelands and water sources. This dynamic exacerbates competition over increasingly scarce resources, in a struggle for survival. This competition can be political; or, in the most acute cases, it can escalate and lead to violent conflicts.

2) *The Greed mechanism*: Like in the Malthusian mechanism, climatic factors (possibly in combination with other factors) reduce the availability of natural resources. Yet in this case reduced supply is not seen as a survival threat, but as an economic opportunity, because the inelas-

ogy, Vol. 5, No. 3 (June 2015), p. 92-104, http://www.ijastnet.com/journal/index/749.

[18] A focus on mechanisms provides a promising departure from abstract econometric models, with a more bottom-up emphasis on fine-grained empirical accuracy. By mechanisms, we do not refer here to linear regularities, but to pathways in which causality is emergent in combination with parallel processes, as argued in non-deterministic approaches to mechanism research. See for instance, Stefano Guzzini (ed.), *The Return of Geopolitics in Europe? Social Mechanisms and Foreign Policy Identity Crises*, Cambridge, Cambridge University Press, 2012.

tic demand of basic consumption goods pushes prices upward. Conflict then results from the hoarding of resources driven by greedy (violent) entrepreneurs.

3) *The Sons-of-the-Soil mechanism*: Climate change–induced depletion of resources is not uniform, but uneven and irregular. Enhanced mobility, including migration and rural exoduses, therefore represent a valuable coping strategy, especially for traditionally mobile groups such as pastoralists and nomads. This trend is further amplified by forced displacement flows caused by “natural” disasters such as floods and droughts, whose frequency and magnitude are also increased due to climate change.[19] Yet population movements may intensify frictions and heighten tensions between indigenous/host communities and displaced/migrant groups, possibly leading to violent conflict escalation.

4) *The Political Ecology mechanism*: By prompting meteorological unpredictability, climate change critically undermines the fragile balance between natural ecosystems and productive systems that has long sustained the traditional way of life of Sahelian populations. As a result, the social organisation is upset: customary mechanisms of social integration and conflict regulation are less and less adapted to changing conditions, thereby prompting disenfranchisement and leaving grievances unaddressed, while the competition to redistribute the “goods and bads” resulting from climatic and social changes increases the risk of violent conflicts.

The analysis below will explore the plausibility of these mechanisms to explain alleged manifestations of the climate-conflict nexus in the Sahel. This does not mean that the climate-conflict nexus is assumed to exist unproblematically. On the contrary, if the analysis were to show that none of these mechanisms apply, the overall confidence in the heuristic value of the climate-conflict nexus hypothesis would be significantly diminished. Alternatively, the identification of one (or more) of these mechanisms at play in the Sahel would help corroborate the valid-

[19] This is not to imply a reductionist view whereby climatic factors and events “cause” migration in a deterministic fashion. Research has demonstrated the complexity of the socio-political dynamics shaping “push” and “pull” factors of migratory flows. See: Lily Salloum Lindegaard, “What Makes a Climate Migrant?”, in *DIIS Long Read*, 2 March 2021, https://www.diis.dk/en/node/24648.

ity, and specifying the actual content and scope-conditions of the overall climate-conflict nexus hypothesis.

To this end, the analysis empirically investigates the mechanisms – if any – potentially linking changing climate dynamics and conflict outcomes in the two cases that most arguably illustrate the climate-conflict nexus in the Sahel: (i) the droughts and famines that hit the region in the 1970s and 1980s; (ii) the ongoing alleged desertification of central Sahel and the agro-pastoral competition for the use of natural resources. Looking at the complex interactions between environmental stressors, mobility and access to natural resources, the cross-time exploration of these cases will help address the temporal correlation bias of positivist climate-conflict research, whose implausibility has been noted above. The findings of such a research design are expected to provide policy-relevant indications on how to address conflict drivers in the Sahel and – possibly – in the broader Mediterranean space. Furthermore, given that the Sahel provides a most-likely case for the climate-conflict hypothesis to hold, as discussed above, the analysis herein delineated can provide valuable insights of more general applicability.

3.3 Droughts, famines and rebellions

Between the late 1960s and the late 1980s, the Sahel experienced severe precipitation decline. Rainfall levels fell by 15–25 per cent compared to the long-term average, and by 25–50 per cent compared to the extraordinarily wet period that preceded it since the 1950s. As a result, the region went through more frequent and severe droughts, which also proved exceptionally long in time and extensive in space, affecting an area of almost 5 million square kilometres across West Africa.

Early studies tended to attribute these events mostly to local anthropic factors, that is, the aggregated impact of human mismanagement of natural resources by Sahelian communities through overgrazing, deforestation and poor land management, compounded by rapid population growth. Later research however suggested that the prolonged drought was more probably among the indirect consequences of air pollution generated in Europe and North America, as global warming altered the trajectories of monsoons and tropical rains.[20]

Given its inherent environmental fragility, the impact of these dynamics on the semi-arid Sahelian band was particularly severe. Scholars have found that the Sahelian droughts of the 1970s and 1980s brought about a major loss of biodiversity and ecological degradation, with unprecedented soil exhaustion and erosion.[21] The non-reproduction of pasturelands and the disruption of transhumance patterns also caused large-scale herd losses. Livestock depletion is hard to quantify, but was arguably massive. As a result, social groups whose livelihoods are based on pastoralism – most notably the ethnic Tuareg and Fulani – plunged into poverty.

The Sahelian droughts of the 1970s and 1980s were also accompanied by major famines, which became particularly acute in 1973 and 1985. The causal link between these two phenomena – droughts and famines in the Sahel – remains controversial however. There is little doubt that resource depletion and widespread poverty, caused by a prolonged drought, contributed to the Sahel's overall proneness to food crises. Yet one may argue that the Sahel's famines of those years could have been mitigated, if not averted, had it not been for the contribution of exogenous political factors. In the 1970s, for instance, the concomitant global oil crisis and hyperinflation rates drastically eroded the purchasing power of the vulnerable poor in oil-importing Sahelian countries. In the 1980s, the famines highlighted the failure of market-based regulatory mechanisms promoted by international financial institutions such as the World Bank and the International Monetary Fund. As it turned out, neoliberal doctrines underestimated the devastating impact of fluctuation in exchange rates and commodity prices for the cash-starved Sahelian populations.

Furthermore, discriminatory policies fostered by the region's authoritarian regimes exacerbated horizontal inequalities and unpaired access

[20] Isaac M. Held et al., "Simulation of Sahel Drought in the 20th and 21st Centuries", in *PNAS*, Vol. 102, No. 50 (13 December 2005), p. 17891-1789, https://doi.org/10.1073/pnas.0509057102.

[21] Bruno A. Walther, "A Review of Recent Ecological Changes in the Sahel, with Particular Reference to Land-Use Change, Plants, Birds and Mammals", in *African Journal of Ecology*, Vol. 54, No. 3 (September 2016), p. 268-280.

to critical food supplies and food aid for marginalised nomadic groups, as documented in the cases of northern Mali[22] and northern Nigeria.[23] These observations suggest that the mere lack of food availability was possibly less important than the lack of food accessibility and affordability in bringing about the famines that struck the Sahel in the 1970s and 1980s. One may therefore see such famines less as the result of mere food shortages than of inadequate food policies, thereby undermining the plausibility of the hypothesis posing a deterministic link between climate change–induced droughts and famines.

The environmental and food crises that struck the Sahel impacted local communities heavily. Estimates of drought-related deaths in those two decades range between 100,000 and 1 million people. Another 7–800,000 became dependent on food aid. Hundreds of thousands also left the hardest stricken areas straddling across the Sahel and the Sahara, and swelled the ranks of regional migratory flows, moving either to larger towns or to neighbouring countries. It is precisely in those years that numerous Tuaregs from northern Mali and northern Niger left their countries of origin and settled with their families in North African countries – Algeria and Libya most notably – whose hydrocarbons-based economies were then booming.[24] This circumstance by the way highlights the significant intersections of security dynamics affecting the Sahel and the broader Mediterranean region.

It is noteworthy that such crises, in spite of their huge economic, social and human impact, did not trigger any notable escalation of armed violence, at least in the short term. Paradoxically, the 1970s and 1980s represent an uncommon period of peace in Mali and Niger. The rebellious northern regions of these countries make no exception: Tuareg-led revolts broke out here in the 1960s and then in the 1990s and 2000s, but the peak years of the environmental and food crises were not accompanied by any obvious manifestation of armed violence. These obser-

[22] Gregory Mann, *From Empires to NGOs in the West African Sahel*, cit.

[23] Michael Watts, *Silent Violence. Food, Famine and Peasantry in Northern Nigeria*, 2nd ed., Athens, University of Georgia Press, 2013.

[24] Judith Scheele, *Smugglers and Saints of the Sahara*, cit.

vations contribute to questioning the applicability of the "Malthusian mechanism" to this case: in the face of dramatic climate changes and food shortages, armed resistance has arguably proved to local communities a less convincing option than creative adaptation. Noteworthy, mobility – including transhumance, trans-Saharan migration and rural exodus – has provided one of the most common coping strategies.

It is nevertheless possible to argue that the experience of dispossession and displacement nurtured feelings of anger and widespread grievances, especially among the Tuaregs.[25] Such feelings planted the seeds of revanchist ideals, which found a particularly fertile ground in the Libyan camps where displaced Tuaregs took refuge. Gaddafi's hospitality proved capricious and manipulative, but the large-scale recruitment in Libyan militias nevertheless exposed Sahelian Tuareg refugees to revolutionary ideologies and combat expertise. Such political and military skills empowered the Tuaregs who subsequently mounted a series of rebellions in north Mali and north Niger, starting from the 1990s. It is no coincidence that most of these rebellions were first planned in, if not supported by, Libya. In 2012, too, the Tuareg insurrection that triggered Mali's state collapse and soon enflamed the entire region was prompted by the Sahelian diaspora in Libya, who made return to northern Mali after the Gaddafi regime crumbled, bringing "home" combat experience and military hardware.

These observations may contribute to drawing a possible, although admittedly tenuous, link between the droughts and famines of the 1970s and 80s, and the insurgencies of the 1990s and 2000s in north Mali and north Niger, that is: between climate and conflict events. The lack of temporal overlap should not cause us to overlook the plausibility of a cross-temporal – and even cross-generational – linkage. At the same time, the "weight" of climatic factors in determining conflict outcomes should be viewed with caution. In light of the mismatch between the slowness of incremental climate change, and the sudden disruption through which longstanding tensions erupt into violent conflicts, a multiplicity of addi-

[25] Baz Lecocq, *Disputed Desert. Decolonization, Competing Nationalism and Tuareg Rebellions in Northern Mali*, Leiden, Brill, 2010.

tional factors should be accounted for to trace the causal chain possibly connecting armed conflicts to climate and environmental crises that occurred decades earlier. Process-tracing such an alleged causal chain would be a necessary but onerous endeavour, that falls beyond the scope of the present analysis.

Here we should content ourselves with highlighting the overall poor applicability of most of the mechanisms sketched above to the case in point. The limited explanatory power of the "Malthusian mechanism" has been already noted. The "Greed mechanism", too, contrasts with the temporal mismatch between climate and conflict events, and there are no obvious indications that commodity price fluctuations may have motivated the Tuareg-led insurgencies that swept the Sahel since the 1990s up to date. Instead of greed, the predominant explanations for these insurgencies highlight the grievances – to borrow a widely influential dichotomy of civil war studies – of disenfranchised Tuaregs against authoritarian rule, marginalisation and horizontal inequalities.[26]

The explanatory capacity of the "Sons-of-the-Soil mechanism" is also limited. The massive population displacement triggered by the environmental crisis of the 1970s and 80s did not lead to violent conflict escalations between groups forced to relocate and host communities. The reliance on transnational family networks and longstanding inter-ethnic solidarities helped assuage tensions. One could argue, however, that such tensions surfaced decades later. In fact, the Tuareg-led insurrections propelled by former "climate refugees" returning from Libya in the 1990s and then after the capitulation of Gaddafi in 2011 prompted the violent reaction of other indigenous Sahelian ethnic groups, who then formed self-protection armed factions some of which explicitly hailed a "Sons-of-the-Soil" rhetoric. In this case too, however, reductionist explanations attributing such polarisation to climate-induced mobility and competition over natural resources would be misleading. Recent research has

[26] Pierre Boilley, *Les Touaregs Kel Adagh. Dépendances et révoltes: du Soudan français au Mali contemporain*, Paris, Karthala, 2012; Hélène Claudot-Hawad, "La question touarègue: quels enjeux?", in Michel Galy (ed.), *La guerre au Mali. Comprendre la crise au Sahel et au Sahara: enjeux et zones d'ombre*, Paris, La Découverte, 2013, p. 125-147.

in fact demonstrated that political manoeuvring by local and national leaders played a prominent role in accelerating the fragmentation and antagonism of social and ethnic groups in northern Sahel.[27]

The "Political Ecology" approach may possibly provide a more promising explanation. There is evidence that the environmental crises of the 1970s and 80s, while disrupting the economic fabric, contributed to upsetting the social organisation and to severing inter- and intra-ethnic ties.[28] The rapid decay of customary institutions that followed diminished the threshold for violence seen as a legitimate means of conflict regulation. The outbreaks of armed violence in the Sahel over the last decades can be partly attributed to this long-term trend, originating since the 1970s at the intersection of environmental, economic, social and political crises. When Tuareg refugees came back from Libya in 2011–12 carrying their weapons, the capacity of local mechanisms for inter-ethnic conflict management was so eroded that, in the face of competing entitlement claims, nothing was left to prevent a violent escalation.

3.4 Desertification, regreening and competition for land use

Policy and media discourses have insistently claimed that the Sahel is going through a process of rapid desertification.[29] Such claims are arguably based on the inherent environmental fragility of the Sahelian band, its proximity to the Sahara Desert and the expected impact of diminishing precipitation combined with unsustainable logging to meet the increasing demand for wood by a rapidly growing population. The con-

[27] Luca Raineri and Francesco Strazzari, "Drug Smuggling and the Stability of Fragile States. The Diverging Trajectories of Mali and Niger", in *Journal of Intervention and Statebuilding*, 17 May 2021, DOI: 10.1080/17502977.2021.1896207.

[28] Georg Klute, "From Friends to Enemies: Negotiating Nationalism, Tribal Identities, and Kinship in the Fratricidal War of the Malian Tuareg", in *L'Année du Maghreb*, Vol. 7 (2011), p. 163-175, https://doi.org/10.4000/anneemaghreb.1191.

[29] See We Are Water Foundation, *The Sahel, Desertification beyond Drought*, 17 June 2019, https://www.wearewater.org/en/the-sahel-desertification-beyond-drought_318262. For a more explicit reference to the linkage between desertification, conflicts and security, see Jérôme Piodi, "La désertification : une bombe à retardement au cœur du Sahel", in *Revue Défense Nationale*, No. 783 (2015), p. 28-32, https://doi.org/10.3917/rdna.783.0028.

cern about the alleged desertification of the Sahel has fuelled fears that the exhaustion of natural resources would lead to heightened competition for access and exploitation, with the risk to prompt violent escalations and climate-induced migration. The discourse securitising the alleged desertification of the Sahel has gained traction in policy circles, also because of the support granted by international institutions such as the UN Environment Programme (UNEP) and the UN Convention to Combat Desertification (UNCCD). Even today's UN Secretary General António Guterres, speaking before the Security Council in 2012, argued that in the Sahel "poverty and underdevelopment, exacerbated by desertification and the effects of climate change, are being exploited by ideologies that are either based on ethnicity or religious extremism".[30]

In spite of such claims, there is now a growing scholarly consensus that the alleged desertification of the Sahel, if it ever occurred, has halted. The southward push of the Sahara Desert is receding, and the Sahelian belt features much higher degrees of green cover and water availability now than it used to be the case in the late 20th century.[31]

Several explanations have been put forward to account for this unexpected trend reversal. Some highlight natural dynamics, such as the spontaneously changing cycles of pluviometry that underpin the Sahel's inherent rainfall variability. Others instead underline the positive impact of policies deliberately devised since the 1970s drought in order to increase local ecosystems' resilience and mitigate the impact of environmental degradation, including large-scale reforestation programmes, logging bans and the expansion of agricultural production to meet the population's food needs. The fear of desertification in the Sahel has in fact prompted international donors – including Western

[30] UNHCR, *Statement by António Guterres, United Nations High Commissioner for Refugees, to the United Nations Security Council*, New York, 10 December 2012, http://www.unhcr.org/50c7346e9.html.

[31] Roy H. Behnke and Michael Mortimore (eds), *The End of Desertification? Disputing Environmental Change in the Drylands*, Berlin/Heidelberg, Springer, 2016, https://doi.org/10.1007/978-3-642-16014-1; Martin Brandt et al., "Changes in Rainfall Distribution Promote Woody Foliage Production in the Sahel", in *Communications Biology*, Vol. 2 (2019), Article 133, https://doi.org/10.1038/s42003-019-0383-9.

countries and international organisations – to relaunch late-colonial projects to stop the southward advance of the Sahara by raising a "great green wall" at the edge of the desert.[32] At the same time, Sahelian governments have enforced strict regulations against informal wood collection and for the overall conservation of natural resources. Moreover, international donors and Sahelian governments have supported ambitious programmes to strengthen food security by enhancing domestic agricultural output. Building on the "green revolution" blueprint, the production of cereals and staples in Sahelian countries has drastically increased in the last few decades, while malnutrition rates have conversely declined.[33]

These observations call into question the applicability of the "Malthusian mechanism" in this case. It is true that sporadic clashes for access to and control of water (re)sources have been observed in the Sahel over the last few years. Yet, contrarily to Malthusian expectations, conflict escalations have paradoxically taken place as rainfall and overall water and food availability were rising. If access to vital resources was at stake, it was arguably less due to climate-induced reduction of natural resource stocks than to social inequality and general demographic growth trends. The "Greed mechanism" is equally questioned. The substantial overlap – both temporal and spatial – between escalating conflict events and increasing food availability and affordability is in fact in contradiction with this hypothesis.

A more promising pathway possibly linking resource competition and conflict trends consists in shifting the analytical focus away from food availability and affordability per se, to the factors of food production, first and foremost the land. The retreat of the desert and the increase in food production, in fact, have been achieved through the exploitation of almost all the land suitable for agricultural purposes. Shrinking land availability, combined with growing demand as a result of population

[32] See Green Great Wall website: https://www.greatgreenwall.org/about-great-green-wall.

[33] International Crisis Group (ICG), "The Central Sahel: Scene of New Climate Wars?", in *Crisis Group Africa Briefings*, No. 154 (24 April 2020), https://www.crisisgroup.org/node/13812.

growth, has pushed land prices considerably upwards across the entire Sahel.[34] While the “Malthusian mechanism” still does not apply here, because land ownership per se is not a survival need, the “Greed mechanism” becomes more persuasive when applied to land shortages.

The large-scale land privatisation schemes (the phenomenon dubbed land-grabbing) are seen as profitable by domestic and international investors, but they have aggravated the competition for the acquisition of land – a resource customarily experienced and managed as a common good. Amidst uncertain legal frameworks and management schemes, land competition is arguably one of the main drivers of the current conflict dynamics in central Sahel.[35] The linkage with climate change is however paradoxical in this case: it is not so much climate change per se that fuelled conflict escalation in the Sahel; instead, the ill-conceived environmental protection programmes to fight desertification and prevent food crises – mentioned above – have ended up contributing to the exacerbation of conflict drivers, by alienating natural resource management and use to local communities for productive and protective purposes.

The applicability of “Sons-of-the-Soil mechanism” to this case appears to follow the same logic. The processes of desertification and regreening of the Sahel have arguably prompted flows of population displacement, driven respectively by humanitarian needs and livelihood opportunities. Conflict data however suggest that communal clashes over access to natural resources have been more frequent and acute during the last couple of decades, thereby correlating more with food and water abundance, and land scarcity. Indeed, many of the ongoing conflicts in the Sahel are linked to competing claims of autochthony and priority rights over the access to land and use of the natural resources localised therein.[36] The

[34] Ruth Hall, Ian Scoones and Dzodzi Tsikata (eds), *Africa’s Land Rush: Rural Livelihoods and Agrarian Change*, Woodbridge, James Currey, 2015.

[35] Tor A. Benjaminsen and Boubacar Ba, “Why Do Pastoralists in Mali Join Jihadist Groups? A Political Ecological Explanation”, in *The Journal of Peasant Studies*, Vol. 46, No. 1 (2019), p. 1-20.

[36] Tor A. Benjaminsen and Boubacar Ba, “Fulani-Dogon Killings in Mali: Farmer-Herder Conflicts as Insurgency and Counterinsurgency”, in *African Security*, Vol. 14, No. 1 (2021), p. 4-26, https://doi.org/10.1080/19392206.2021.1925035.

clashes escalating between the Dogon and the Fulani in central Mali, or between Fulani, Tuaregs and Zerma at the Mali–Niger border illustrate this trend: they articulate with increasing violence the longstanding competition over land use between sedentary farmers and transhuman pastoralists, which violent extremist groups skilfully manipulate to gain local rooting.

Too narrow a focus on mobility, population displacement and claims of indigeneity, however, runs the risk of reifying abstract categories (such as host-migrant), and overlooking deeper political dynamics, which the "Political Ecology" framework appears more suited to capturing. As political ecologists have pointed out,[37] all environmental transformation – including instances linked to climate change – generate winners and losers, depending on the capacity of social groups to reap the benefits of environmental change and externalise costs onto other groups. This capacity is shaped by the political and economic power of such groups, and the case of the desertification and regreening of the Sahel makes no exception. The environmental protection programmes to fight desertification – mentioned above – have unequally impacted sedentary farmers and transhumant pastoralists. Reforestation initiatives, for instance, have largely encroached upon grazing lands. At the same time, the harsh and uneven implementation of the logging bans across the Sahel has been perceived as discriminating against pastoralists, and especially the most vulnerable among them. Furthermore, the enhancement of food production has largely been achieved through the expansion of agriculture to the detriment of pastoralism. Grazing areas have been turned to cultivation, and the shrinking of pasturelands and transhumance routes has considerably increased the chances for friction and the potential for conflict.

These outcomes are not merely the result of technical choices but reflect the power balance shaping Sahelian polities. Large-scale agricultural development, in fact, underpins narratives of modernisation, sedentarisation and capital accumulation long connected to state-build-

[37] Susan Paulson, Lisa L. Gezon and Michael Watts, "Locating the Political in Political Ecology: An Introduction", in *Human Organization*, Vol. 62, No. 3 (Fall 2003), p. 205-217.

ing. From this perspective, the underprivileged status of pastoralism in Sahelian environmental protection policies reflects not only the perceived greater food output of agriculture, but also, and importantly, the greater alignment of the latter with the political and economic interests of ruling elites in Sahelian capital cities.[38]

Looking at the processes of desertification and regreening in the Sahel, one could therefore conclude that climate changed–induced environmental change (rainfall variability and desertification) in combination with context-insensitive environmental protection policies (regreening via green "walls" and green "revolutions") have contributed to unsettling the customary organisation of production rooted in local ecosystems. The disruption of the fragile ecological balance between agricultural and pastoralist activities, based on rotating land use, has exacerbated inequalities and grievances, while undermining the cogency of traditional dispute settlement mechanisms and authorities. These dynamics have, on the one hand, increased the frequency and gravity of conflicts related to land allocation and use while, on the other, fuelled the disenfranchisement of vulnerable communities, and their resentment vis-à-vis the state. Indeed, available evidence suggests that the growing frustration and (unfulfilled) demand for protection by animal farmers are among the main drivers of violent escalation and terrorist mobilisation across the Sahel.[39]

From this point of view, then, in the case of the desertification and regreening of the Sahel the mechanism labelled "Political Ecology" appears to provide the most convincing pathway connecting climatic and environmental dynamics, on the one hand, and conflict outcomes, on the other.

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[38] Gregory Mann, *From Empires to NGOs in the West African Sahel*, cit.; Luca Raineri, "Sahel Climate Conflicts? When (Fighting) Climate Change Fuels Terrorism", in *EUISS Policy Briefs*, No. 20 (November 2020), https://www.iss.europa.eu/node/2495.

[39] Marc-Antoine Pérouse de Montclos, *L'Afrique, nouvelle frontière du djihad?*, Paris, La Découverte, 2018; Luca Raineri, *If Victims Become Perpetrators. Factors Contributing to Vulnerability and Resilience to Violent Extremism in the Central Sahel*, London, International Alert, 2018, https://www.international-alert.org/?p=2624.

3.5 Re-politicising the climate-conflict nexus

The Sahel is subject to a seemingly intractable, multifaceted crisis, illustrated by soaring levels of instability and violence across the region. What are the causes of this unprecedented conflict escalation? While the contributing factors are arguably complex and manifold, this analysis has investigated the applicability of some mechanisms which may help trace a plausible connection between conflict outcomes in the Sahel and climatic factors. The analysis has focused in particular on two micro-cases in which the exceptional prominence of the independent variable (climate events) makes the climate-conflict nexus hypothesis more likely: on the one hand, droughts (and famines), and their possible link to Tuareg irredentism; and on the other hand, desertification (and regreening), allegedly connected to inter-ethnic polarisation and the rise of violent extremism. Both cases span across decades, from the early manifestations of environmental stress in the 1970s to the ongoing security crisis in the region.

Among the four mechanisms analysed – dubbed “Malthusian”, “Greed”, “Sons-of-the-Soil”, and “Political Ecology” – only the “Political Ecology” appears to retain some degree of applicability to the cases analysed. The pathway of “Political Ecology” has in fact proved the most plausible linkage between climatic and conflict events in both cases, while the three other mechanisms turn out to provide ill-suited explanations for the dynamics observed in each case. These findings have two important theoretical implications: first, that the hypothesis of a possible nexus between climate and conflicts dynamics retains some validity in some cases; second, that the “Political Ecology” mechanism provides the most convincing explanation of this nexus. This means that climatic change may indeed fuel violent conflicts, mostly because they contribute to upsetting fragile socio-economic systems and the relative mechanisms of conflict regulation.

At the same time, demonstration of the heuristic value of the “Political Ecology”, alongside lack of substantiation of the other three mechanisms hypothesised, indicates that climate dynamics per se are neither sufficient nor necessary to trigger violent conflicts, and that additional exogenous factors need to be considered in order to provide an exhaustive causal explanation of conflict outcomes.

The key "Political Ecology" features – that is, the resilience of existing modes of production, and the legitimacy of the rules regulating them – are first and foremost political issues, which changing climatic conditions can influence, but not determine. This observation thus places emphasis on the crucial "weight" of governance schemes (including customary norms, domestic institutions and international laws) in making emerging tensions over natural resources veer towards either conflict escalation, or peaceful management.

This conclusion is not trivial, because it further contributes to ruling out the simplistic yet still influential Malthusian assumptions about the climate-conflict nexus. But it is not surprising either, as it corroborates the findings of a long tradition of positivist climate-conflict research. Interestingly, the "Political Ecology" framework, by focusing on cross-temporal causal paths, complements these findings by noting that, while it is true that climate-induced conflict outcomes depend primarily on governance mechanisms, it is also true that in the long run governance mechanisms themselves can be affected, modified or disrupted by changing climatic conditions.

Furthermore, the analysis of both cases highlights that mobility is another crucial factor mediating between climatic stressors and possible conflict outcomes in the Sahel. Rooted in customary practices, mobility is arguably the most widespread coping strategy put in place by Sahelians in the face of both incremental climatic changes and sudden climate disasters. The perceptions and practices of local populations, therefore, tend to see mobility much more as a source of resilience than as a threat. At the same time, the cases of Sahelian drought and desertification processes show that climate dynamics – as well as ill-suited climate change mitigation projects – can drastically affect customary mobility patterns. Forced displacement and spatial dispossession, in turn, often fuel resentment and plant the seeds of revenge, which in the long run can contribute to violent conflict escalation. While mobility thus seems to offer an immediate response to the challenges of climate change, the spatial and temporal dispersion brought about by forced mobility can ultimately lead to unravelling the social fabric and loosening the political bond. By eroding the social organisation, these dynamics crate a fertile ground to trigger the "Political Ecology" mechanism and transform climatic stressors into conflict drivers.

Lastly, one needs to observe that, in both cases analysed above, the social disruption inherent to the "Political Ecology" framework would arguably be insufficient to translate widespread grievances about unequal access to natural resources into violent conflicts, unless two additional conditions are met: the unimpeded accessibility of weapons to prospective insurgents, and the supply of political narratives and ideologies legitimising the resort to violence by non-state actors. Both conditions are verified in the Sahel, largely owing to the weakness and poor professionalism of local states' security apparatuses. Weapons diverted from local state arsenals are widely available across the Sahel's black market. And extremist ideologies – whether irredentism, ethno-nationalism or jihadism – have been frequently mobilised by the Sahel's violent entrepreneurs to reframe small-scale conflicts for access to natural resources into large-scale armed conflicts.[40]

From this perspective, it may be useful to borrow concepts and methods from the study of social movements of political contention in order to investigate conflicts seemingly influenced by climatic and environmental factors. In order to make sense of the conflicts over natural resources, one needs to look at the broader spectrum of material and immaterial resources that contribute to violent mobilisations: that is, not only more or less legitimate grievances linked to changing natural resource availability, affordability and accessibility, but also weapons, ideologies, material incentives and mobility opportunities, amongst others. Within this framework, climate factors contribute to changing the structure of political opportunity – either progressively or suddenly – by undermining existing modes of production and related social hierarchies.

In conclusion, this analysis has highlighted the relevance of political ecology and social movement studies lenses to make sense of how climate and conflict dynamics interact in the Sahel. The approach sketched herein therefore stresses the key importance of re-politicising (the anal-

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[40] Morten Bøås, Abdoul Wahab Cissé and Laouali Mahamane, "Explaining Violence in Tillabéri: Insurgent Appropriation of Local Grievances?", in *The International Spectator*, Vol. 55, No. 4 (December 2020), p. 118-132, https://doi.org/10.1080/03932729.2020.1833567.

ysis of) the climate-conflict nexus. As can be expected, in fact, the securitisation of climate change has paved the way to the progressive de-politicisation of conflicts over natural resources in the Sahel. Sahelian governments have deliberately encouraged the narrative linking conflict escalation in the region and climate change, as a way to attract financial assistance by connecting two issues that mobilise international donors. The recent efforts by the government of Niger to foster a climate security narrative – and, most importantly, a resolution – within the UN Security Council provides an illustration of this.[41] However, laying blame on a "natural" phenomenon – one for which foreign, formerly colonial countries could be reproached – can also be seen as helping Sahelian rulers divert attention from their own responsibilities for growing insecurity and social unrest.[42]

Similarly, the belief that violent conflicts and climate change are somehow connected has offered international donors the opportunity to address jointly what are arguably the most pressing issues facing the international community, thereby overcoming political divides.[43] The European Union, in particular, has eagerly embraced this narrative, which seems to provide a coherent framework to reconcile its diverse (divergent?) ambitions: fighting climate change, stabilising the (extended) neighbourhood, fostering green development and undercutting irregular migration. The Commission's emphasis on Africa has made of the Sahel a laboratory to devise and test new foreign policy approaches combining the security-development nexus with the climate-conflict nexus in the name of climate security and green development.

These rather simplistic assumptions and deterministic rhetoric actually run the risk of obfuscating the root causes of the violent disruptions currently undermining the Sahel's stability, in which political and social factors are predominant. They could therefore jeopardise the adoption of appropriate responses to prevent, pre-empt and manage conflicts

[41] ICG, *Time for the UN Security Council to Act on Climate Security*, 7 December 2021, https://www.crisisgroup.org/node/18545.

[42] ICG, "The Central Sahel", cit.

[43] Luca Raineri, "Sahel Climate Conflicts?", cit.

over the access to natural resources in the region, both locally and internationally. From this perspective, re-politicising the climate-conflict nexus amounts not only to a matter of theoretical consistency, but also of political expediency in order to devise relevant strategies of risk reduction and conflict management.

3.6 Recommendations

Building on the above, it is possible to draw some recommendations on how to address the climate-conflict nexus in the Sahel in a more cogent, evidence-based fashion.

Firstly, research suggests that, in the Sahel, climate change depends more on macro drivers, while conflicts are more often the result of micro-dynamics. The articulation of these two levels is non-linear, and leads to complex, hardly predictable outcomes. This highlights the need for a holistic and nuanced understanding of the climate-conflict nexus, one that rules out simple mechanistic correlations and puts instead political struggles at the core of the analysis and policy-making. From this perspective, the current securitisation of climate change at the macro level (such as the proposed UN-resolution on climate security, or the UNCCD strategy) is as misleading as the blaming of micro-level environmental practices, no matter how predatory, for large-scale climate changes, which was in vogue in the 1980s and 1990s. This approach should therefore be equally dropped, replaced by strategies that recognise the politicisation of climate change and environmental struggles.

Secondly, portrayed as the quintessential illustration of environmental and political fragility, the Sahel has become the target of a plethora of programmes and projects to foster environmental protection. Such initiatives may have a positive impact and help reduce the overall security volatility of the region, provided that foreign interveners realise they do not operate in a vacuum. Past experiences demonstrate that large-scale projects of green- "revolutions", "walls", and "development" in the Sahel can do more harm than good if they are administered in a top-down fashion by authoritarian or technocratic elites without local buy-in. By overlooking local customs and governance mechanisms, such projects often tend to exacerbate tensions and grievances, paving the way to conflict escalation. In the domain of environmental protection, too, conflict sensitivity is therefore paramount. The recent turn to community-based conservation has led to the development of approaches and tools which could provide valuable guidelines to this end.[44]

Thirdly, while the actual contribution of environmental and climate factors to conflict drivers remains uncertain, there is little doubt that conflicts over natural resources, irrespective of their cause, would hardly escalate to large-scale violence were it not for the widespread availability and accessibility of weapons. Therefore, while fighting climate change remains a worthwhile objective per se, combating arms trafficking appears to be a more effective and immediate means of reducing the lethality of conflicts and the overall regional instability. Sahel states' partners should invest in better monitoring arms transfers, securing arms stockpiles, disciplining arms users and combating organised crime.

Fourthly, the simplistic belief whereby security relevant phenomena as disparate as conflicts for natural resources, terrorist mobilisation and long-range migration can be traced back to the common root cause of climatic changes is flawed, and it is a recipe for policy failure. In particular, the specific characteristics of the Sahel's social-economic fabric make of mobility less a manifestation of vulnerability than of resilience in the face of climatic changes, whether incremental or sudden, while the evidence for climate change-induced migration remains contested. This prompts the observation that climate change and conflict mitigation strategies in the Sahel may be in contradiction with the EU-sponsored securitisation and interdiction of cross-border mobility to fight irregular migration. Foreign interveners – first and foremost the EU and its member states – should then carefully balance their priorities in the Sahel to avoid wasting resources or producing contradicting outcomes. Enhancing, rather than fighting, regional and trans-Saharan circulation schemes has the potential to help mitigate the drivers of conflict escalation and terrorist mobilisation.

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[44] Mikkel Funder and Marie Ladekjær Gravesen, "Biodiversity and Development: The Evolution of Community-based Conservation and Implications for Danish Development Cooperation", in *DIIS Working Papers*, No. 2021:16, https://www.diis.dk/en/node/25282.

Lastly, the strength and legitimacy of governance makes a crucial difference in making potential conflicts over natural resources veer over either violent escalation or peaceful management. With its emphasis on governance, the EU's recently adopted Integrated Strategy in the Sahel[45] represents a step in the right direction. In the implementation of the Strategy, the EU and its member states should devote a special attention to the multi-level and multi-actor governance of natural resources. In particular, there is a need to better integrate customary rules, equitable legal frameworks and international norms, and to promote a less technocratic and more socially inclusive approach to land governance reforms in Sahelian countries.

References

Sanfo Abroulaye et al., "Climate Change: A Driver of Crop Farmers - Agro Pastoralists Conflicts in Burkina Faso", in *International Journal of Applied Science and Technology*, Vol. 5, No. 3 (June 2015), p. 92-104, http://www.ijastnet.com/journal/index/749

Erik Alda, *Rising Tempers, Rising Temperatures: A Look at Climate Change, Migration and Conflict and the Implications for Youth in the Sahel*, Washington, World Bank, 2014, http://hdl.handle.net/10986/23838

Roy H. Behnke and Michael Mortimore (eds), *The End of Desertification? Disputing Environmental Change in the Drylands*, Berlin/Heidelberg, Springer, 2016, https://doi.org/10.1007/978-3-642-16014-1

Tor A. Benjaminsen, "Let the Desertification Zombie Rest in Peace", in *Climate and Conflict PRIO Blog*, 4 December 2017, https://blogs.prio.org/ClimateAndConflict/?p=42

Tor A. Benjaminsen and Boubacar Ba, "Fulani-Dogon Killings in Mali: Farmer-Herder Conflicts as Insurgency and Counterinsurgency", in *African Security*, Vol. 14, No. 1 (2021), p. 4-26, https://doi.org/10.1080/19392206.2021.1925035

[45] Council of the European Union, *The European Union's Integrated Strategy in the Sahel*, 16 April 2021, https://data.consilium.europa.eu/doc/document/ST-7723-2021-INIT/en/pdf.

Tor A. Benjaminsen and Boubacar Ba, "Why Do Pastoralists in Mali Join Jihadist Groups? A Political Ecological Explanation", in *The Journal of Peasant Studies*, Vol. 46, No. 1 (2019), p. 1-20

Tor A. Benjaminsen et al., "Does Climate Change Drive Land-Use Conflicts in the Sahel?", in *Journal of Peace Research*, Vol. 49, No. 1 (January 2012), p. 97-111

Morten Bøås, Abdoul Wahab Cissé and Laouali Mahamane, "Explaining Violence in Tillabéri: Insurgent Appropriation of Local Grievances?", in *The International Spectator*, Vol. 55, No. 4 (December 2020), p. 118-132, https://doi.org/10.1080/03932729.2020.1833567

Pierre Boilley, *Les Touaregs Kel Adagh. Dépendances et révoltes: du Soudan français au Mali contemporain*, Paris, Karthala, 2012

Martin Brandt et al., "Changes in Rainfall Distribution Promote Woody Foliage Production in the Sahel", in *Communications Biology*, Vol. 2 (2019), Article 133, https://doi.org/10.1038/s42003-019-0383-9

Halvard Buhaug, "Climate Not to Blame for African Civil Wars", in *PNAS*, Vol. 107, No. 38 (21 September 2010), p. 16477-16482, https://doi.org/10.1073/pnas.1005739107

Hélène Claudot-Hawad, "La question touarègue: quels enjeux?", in Michel Galy (ed.), *La guerre au Mali. Comprendre la crise au Sahel et au Sahara: enjeux et zones d'ombre*, Paris, La Découverte, 2013, p. 125-147

Council of the European Union, *The European Union's Integrated Strategy in the Sahel*, 16 April 2021, https://data.consilium.europa.eu/doc/document/ST-7723-2021-INIT/en/pdf

Mikkel Funder and Marie Ladekjær Gravesen, "Biodiversity and Development: The Evolution of Community-based Conservation and Implications for Danish Development Cooperation", in *DIIS Working Papers*, No. 2021:16, https://www.diis.dk/en/node/25282

Stefano Guzzini (ed.), *The Return of Geopolitics in Europe? Social Mechanisms and Foreign Policy Identity Crises*, Cambridge, Cambridge University Press, 2012

Ruth Hall, Ian Scoones and Dzodzi Tsikata (eds), *Africa's Land Rush: Rural Livelihoods and Agrarian Change*, Woodbridge, James Currey, 2015

Fara Hegazi, Florian Krampe and Elizabeth Seymour Smith, "Climate-Related Security Risks and Peacebuilding in Mali", in *SIPRI Policy Papers*, No. 60 (April 2021), https://www.sipri.org/node/5411

Isaac M. Held et al., "Simulation of Sahel Drought in the 20th and 21st Centuries", in *PNAS*, Vol. 102, No. 50 (13 December 2005), p. 17891-1789, https://doi.org/10.1073/pnas.0509057102

Sebastien Hissler, *Econometric Study on the Impact of Rainfall Variability on Security in the Sahel Region*, Paris, OECD, 2010, https://www.oecd.org/swac/publications/44245104.pdf

Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence*, Princeton, Princeton University Press, 1999

International Crisis Group (ICG), "The Central Sahel: Scene of New Climate Wars?", in *Crisis Group Africa Briefings*, No. 154 (24 April 2020), https://www.crisisgroup.org/node/13812

ICG, *Time for the UN Security Council to Act on Climate Security*, 7 December 2021, https://www.crisisgroup.org/node/18545

Georg Klute, "From Friends to Enemies: Negotiating Nationalism, Tribal Identities, and Kinship in the Fratricidal War of the Malian Tuareg", in *L'Année du Maghreb*, Vol. 7 (2011), p. 163-175, https://doi.org/10.4000/anneemaghreb.1191

Baz Lecocq, *Disputed Desert. Decolonization, Competing Nationalism and Tuareg Rebellions in Northern Mali*, Leiden, Brill, 2010

Lily Salloum Lindegaard, "What Makes a Climate Migrant?", in *DIIS Long Read*, 2 March 2021, https://www.diis.dk/en/node/24648

Djallil Lounnas, *Le djihad en Afrique du Nord et au Sahel. D'AQMI à Daech*, Paris, L'Harmattan, 2019

Gregory Mann, *From Empires to NGOs in the West African Sahel. The Road to Nongovernmentality*, Cambridge, Cambridge University Press, 2014

Aoife McCullough, Leigh Mayhew and Sarah Opitz-Stapleton, "When Rising Temperatures Don't Lead to Rising Tempers. Climate and Insecurity in Niger", in *BRACED Working Papers*, September 2019, https://odi.org/en/publications/when-rising-temperatures-dont-lead-to-rising-tempers-climate-and-insecurity-in-niger

Mark Micallef, *The Human Conveyor Belt: Trends in Human Trafficking* *and Smuggling in Post-Revolution Libya*, Geneva, Global Initiative Against Transnational Oragnised Crime, March 2017, https://globalinitiative.net/?p=19042

Chitra Nagarajan, *Climate-Fragility Risk Brief: Mali*, Berlin, Adelphi, 28 May 2020, https://www.adelphi.de/en/node/56472

Sharon E. Nicholson, Chris Funk and Andreas H. Fink, "Rainfall over the African Continent from the 19th through the 21st Century", in *Global and Planetary Change*, Vol. 165 (June 2018), p. 114-127, https://doi.org/10.1016/j.gloplacha.2017.12.014

Susan Paulson, Lisa L. Gezon and Michael Watts, "Locating the Political in Political Ecology: An Introduction", in *Human Organization*, Vol. 62, No. 3 (Fall 2003), p. 205-217

Marc-Antoine Pérouse de Montclos, *L'Afrique, nouvelle frontière du djihad?*, Paris, La Découverte, 2018

Jérôme Piodi, "La désertification : une bombe à retardement au cœur du Sahel", in *Revue Défense Nationale*, No. 783 (2015), p. 28-32, https://doi.org/10.3917/rdna.783.0028

Luca Raineri, *If Victims Become Perpetrators. Factors Contributing to Vulnerability and Resilience to Violent Extremism in the Central Sahel*, London, International Alert, 2018, https://www.international-alert.org/?p=2624

Luca Raineri, "Sahel Climate Conflicts? When (Fighting) Climate Change Fuels Terrorism", in *EUISS Policy Briefs*, No. 20 (November 2020), https://www.iss.europa.eu/node/2495

Luca Raineri and Youssouf Bâ, "Hybrid Governance and Mobility in the Sahel: Stabilisation Practices Put to Test", in Bernardo Venturi (ed.), *Governance and Security in the Sahel: Tackling Mobility, Governance and Climate Change*, Brussels, FEPS / Rome, IAI, 2019, p. 15-38, https://www.iai.it/en/node/10476

Luca Raineri and Francesco Strazzari, "Drug Smuggling and the Stability of Fragile States. The Diverging Trajectories of Mali and Niger", in *Journal of Intervention and Statebuilding*, 17 May 2021, DOI: 10.1080/17502977.2021.1896207

Judith Scheele, *Smugglers and Saints of the Sahara. Regional Connectivity in the Twentieth Century*, Cambridge, Cambridge University Press, 2012

Jan Selby, “Positivist Climate Conflict Research: A Critique”, in *Geopolitics*, Vol. 19, No. 4 (2014), p. 829-856

Ole Magnus Theisen, Nils Petter Gleditsch & Halvard Buhaug, “Is Climate Change a Driver of Armed Conflict?”, in *Climatic Change*, Vol. 117, No. 3 (2013), p. 613-625

UNHCR, *Statement by António Guterres, United Nations High Commissioner for Refugees, to the United Nations Security Council*, New York, 10 December 2012, http://www.unhcr.org/50c7346e9.html

Bruno A. Walther, “A Review of Recent Ecological Changes in the Sahel, with Particular Reference to Land-Use Change, Plants, Birds and Mammals”, in *African Journal of Ecology*, Vol. 54, No. 3 (September 2016), p. 268-280

Olivier Walther and Denis Retaillé, “Sahara or Sahel? The Fuzzy Geography of Terrorism in West Africa”, in *CEPS/Instead Working Papers*, No. 2010-35 (November 2010), https://liser.elsevierpure.com/en/publications/sahara-or-sahel-the-fuzzy-geography-of-terrorism-in-west-africa

Michael Watts, *Silent Violence. Food, Famine and Peasantry in Northern Nigeria*, 2nd ed., Athens, University of Georgia Press, 2013

We Are Water Foundation, *The Sahel, Desertification beyond Drought*, 17 June 2019, https://www.wearewater.org/en/the-sahel-desertification-beyond-drought_318262

4.

Renewable Energy in the Mediterranean: Pathways for Multilateral Cooperation

Silvia Pariente-David and Philippe Drobinski

While it is difficult to clearly define a Mediterranean identity, three characteristics are often listed as specific to the region: olive trees, blue sea and sun. Far from just being good for tourism (the Mediterranean is among the top world destinations), the sun and sea represent invaluable assets for energy and climate. The Mediterranean is one of the world's climate change hotspots, which might compromise the natural and cultural heritage of the Mediterranean, with consequences for people's livelihoods and economic growth more generally. However, the region has all the resources not only to combat climate change, but also to contribute to the objective of climate neutrality elsewhere, due to its vast untapped potential for renewable energy.

To materialise that potential, enhanced cooperation and regional integration are required. However, the complexity of the Mediterranean ecosystem and the fraught geopolitics of the region make the task arduous. Diverging interests of regional and international players fuel rivalries and conflicts for influence and control over energy resources, intensifying regional fragmentation and instability. Europe in particular has a key role to play (more than half of the Mediterranean countries are part of the European Union), and could draw in its wake the rest of the Mediterranean Basin on the journey towards carbon neutrality. This might help restore the long-gone Mediterranean grandeur while demonstrating that addressing climate change and maintaining economic welfare can go hand-in-hand if all resources are mobilised through a cooperative approach. Indeed, the Mediterranean is a veritable microcosm of that challenge. Nowhere else in the world are so many developing countries in such close physical proximity to so many developed ones. About ten per cent of the world's countries are clustered together around the "sea in the middle of the land",[1] sharing an ecosystem, being interconnected by infrastructure, exchanging goods and services, and witnessing significant, multi-directional human flows of different kinds. The time may be ripe for a more *genuine* Mediterranean Union.

This chapter first presents the policy context toward carbon neutrality. It then presents the renewable energy potential of the Mediterranean region. The following section explains why that potential cannot be mobilised without Mediterranean energy market integration. Finally, the last section attempts to identify pathways for multilateral cooperation to implement an integrated Mediterranean energy market propitious for renewable energy development.

4.1 The policy context

The Mediterranean region stands at the crossroads of three continents: Europe, Asia and Africa. The future of the Mediterranean energy market is bound to be shaped by energy and climate policies in those three continents. Among those, Europe will be the one having overwhelming influence over the process – since it is the first continent to endorse climate neutrality as a political objective – and will therefore labour to draw the rest of the world along towards this objective of climate neutrality. To reach this ambitious objective, it will need to start by strengthening ties and cooperation with third countries in the Mediterranean Basin, developing means to access the necessary carbon-free energy resources from southern and eastern Mediterranean states, while embracing more genuine forms of cooperation, solidarity and burden sharing in the process.

4.1.1 The EU Green Deal and the "Fit for 55" Package

The European Green Deal, presented by the European Commission in December 2019,[2] is both the EU's new growth strategy and a plan to

[1] From the Latin "Mediterraneus".

[2] European Commission, *The European Green Deal* (COM/2019/640), 11 December

make Europe the world's first climate-neutral continent by 2050, an objective endorsed by the European Parliament in March 2019. Although it is first and foremost a set of internal plans and strategies for the EU, it will have global effects, as the EU intends to lead the world in the quest for carbon neutrality and for that purpose will need partners and further resources.[3] The European Green Deal is articulated around eight areas for action, which are interlinked and mutually reinforcing: (i) increasing the EU's climate ambition for 2030 (reduction of 55 per cent of GHG emissions compared to 1990[4]) and achieving climate neutrality by 2050, (ii) supplying clean, affordable and secure energy, (iii) mobilising industry for a clean and circular economy, (iv) building and renovating in more efficient ways, (v) accelerating the shift to sustainable and smart mobility, (vi) designing a fair, healthy and environmentally friendly food system, (vii) preserving and restoring ecosystems and biodiversity and (viii) a zero pollution ambition for a toxic-free environment.

The "Fit for 55" Package,[5] proposed on 14 July 2021, is the set of policy, regulatory and legislative tools to implement the Green Deal. It updates the "Clean Energy for All Europeans" Package to reflect the new

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2019, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640.

[3] Some have deemed the European Green Deal a form of "climate colonialism", as it places significant burdens on partner countries and tends to obfuscate Europe's historical responsibility in increasing Mediterranean vulnerability to climate change through the foreign policies of certain member states. The emphasis placed on resources from the south has led some to criticise elements of the Green Deal. See for instance, Myriam Douo, "Climate Colonialism and the EU's Green Deal", in *Al Jazeera*, 23 June 2021, https://aje.io/rnvwvr. The EU Green Deal, in particular the proposal to introduce a carbon border tax, could be interpreted as being in contradiction with the Paris Agreement principle of "common but differentiated responsibilities and respective capabilities". While not disagreeing with that view, the present chapter takes a different angle: the EU quest for carbon neutrality represents an opportunity for the Mediterranean, as it opens new markets for products and resources for which it has a comparative advantage, thus feeding its economic growth and contributing to prosperity.

[4] Target endorsed by the European Council on 11 December 2020 and enshrined into legislation by the Climate Law of July 2021.

[5] European Commission, *'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality*, (COM/2021/550), 14 July 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0550.

objectives of 55 per cent GHG emission reductions by 2030 and climate neutrality by 2050. The package consists of 13 legislative proposals, of which five are new and eight are revisions of existing laws (see Table 1).

Table 1 | The legislative proposals of the Fit for 55 Package

1. Revision of the EU emission trading scheme (EU ETS)
2. Revision of the regulation on land use, land use change and forestry (LULUCF)
3. Revision of the effort sharing regulation (ESR)
4. Amendment to the renewable energy directive (RED)
5. Amendment to the energy efficiency directive (EED)
6. Revision of the alternative fuels infrastructure directive (AFID)
7. Amendment of the regulation setting CO_2 emission standards for cars and vans
8. Revision of the energy taxation directive
9. New EU forest strategy
10. A carbon border adjustment mechanism (CBAM)
11. A Climate Action Social Facility
12. ReFuelEU Aviation – on sustainable aviation fuels
13. FuelEU Maritime – on greening Europe's maritime space

In addition, a Directive and a Regulation were proposed on 15 December 2021, as part of the Package, to decarbonise gas markets, promote hydrogen and reduce methane emissions. The European Commission proposals lay the conditions for a shift from fossil natural gas to renewable and low-carbon gases, including hydrogen and biomethane. In particular, they establish a framework for renewable and low-carbon gases to access existing gas transport infrastructure. To avoid locking-in fossil fuels and to create markets for the new gases, the proposals call for long-term fossil natural gas contracts not to be extended beyond 2049.

One important element of Fit for 55 which is likely to have critical implications for EU trading partners is the CBAM proposal.[6] The nature of trade with southern Mediterranean countries is also likely to be affected by the switch to renewable energy as Europe will need to import less hydrocarbons from those countries that are oil and gas

[6] European Commission, *Proposal for a Regulation Establishing a Carbon Border Adjustment Mechanism* (COM/2021/564), 14 July 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0564.

producers. The main objective of the CBAM proposal is to prevent carbon leakages and to preserve the competitiveness of Europe's industry, as Europe adopts more stringent climate objectives. Under the current proposal, the CBAM system would initially target a selected number of carbon-intensive goods including cement, iron and steel, aluminium, fertilisers and electricity. EU importers of these goods will be required to buy CBAM certificates, the price of which is to mirror that of the ETS, and surrender them to a newly established CBAM Authority.

Several non-EU Mediterranean countries are interconnected with the EU power system and trade electricity regularly with EU countries. According to the current proposals, they would be subject to the CBAM, unless their electricity market is coupled with those of the EU, they have adopted ambitious CO2 reduction targets commensurate with those of Europe or are implementing an ETS or analogous carbon pricing measures.

Moreover, the proposed CBAM would affect the export of various other products and equipment according to their carbon content. This could severely affect the economies of third countries that trade extensively with the EU, including those from the eastern and southern Mediterranean shores. Thus, the CBAM provides an incentive for non-EU Mediterranean countries to adopt ambitious climate change policies, including accelerated coal phase-out where this is relevant. However, it might be perceived negatively, as a threat and source of friction between trading partners. To be effective, the CBAM needs to be implemented with a spirit of cooperation, working together to avoid carbon leakages and reaching the ambitious objectives of the Paris Agreement.

4.1.2 Green Deal diplomacy and the Mediterranean

The Council conclusions on "Climate and Energy Diplomacy" of January 2021 invited the Commission to further reinforce the external dimension of the European Green Deal.[7] This seeks to make appropriate capacity available and to strengthen – together with the member states –

[7] Council of the European Union, *Climate and Energy Diplomacy - Delivering on the External Dimension of the European Green Deal*, 25 January 2021, https://www.consilium.europa.eu/media/48057/st05263-en21.pdf.

coordination and information exchanges through, among others, the EU Green Diplomacy Network and the Energy Diplomacy Expert Group. EU energy diplomacy aims to accelerate the global energy transition, while ensuring affordability, safeguarding the environment and achieving the Sustainable Development Goals. To this end, EU energy diplomacy promotes the deployment of safe and sustainable low-carbon technologies, the increasing uptake and system integration of renewable energy (including through increased interconnections) and international cooperation on hydrogen. Moreover, the EU calls for a complete phase-out of fossil-fuel subsidies and an immediate end to all financing of new coal infrastructure in third countries.

As part of the external dimension of the Green Deal, in February 2021 the European Commission proposed a new policy framework called "Renewed Partnership with the Southern Neighbourhood – A New Agenda for the Mediterranean".[8] The framework proposes a range of actions in the following areas: (i) human development, good governance and the rule of law; (ii) resilience, prosperity and digital transition; (iii) peace and security; (iv) migration and mobility and (v) green transition: climate resilience, energy and environment. Under the energy heading, the Communication states that cooperation is essential, given that "Europe and the Mediterranean region have interdependent, complementary and converging energy interests". The following priorities have been identified for cooperation: (i) massive deployment of renewable energy and clean hydrogen production; (ii) a stronger interconnection of electricity systems; (iii) energy efficiency efforts and measures, with a focus on buildings and appliances, and (iv) policies to address fugitive methane emissions from fossil fuel production, transport and use.

The New Agenda for the Mediterranean is accompanied by an Economic and Investment Plan (EIP)[9] that focuses on long-term socio-eco-

[8] European Commission, *Renewed Partnership with the Southern Neighbourhood. A New Agenda for the Mediterranean* (JOIN/2021/2), 9 February 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021JC0002.

[9] European Commission, *Renewed Partnership with the Southern Neighbourhood Economic and Investment Plan for the Southern Neighbours* (SWD/2021/23), 9 February 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021SC0023.

nomic recovery and aims to increase the region's attractiveness for investors. The EIP announces several flagship activities, among them technical and financial cooperation in Morocco to accelerate green hydrogen production, intensification of international cooperation in Egypt on energy research and technologies, support of the Jordanian national energy strategy, in particular regarding the energy-water-food nexus, and support for Algeria to diversify its economy and international energy trade away from hydrocarbons.

4.1.3 Policy in non-EU Med countries

According to the Energy and Climate Intelligence Unit,[10] 137 countries around the world have committed to carbon neutrality by 2050. Those countries account for 72 per cent of global GHG emissions and 75 per cent of world GDP. Those commitments are gradually being turned into national law, including in seven EU countries, none of them a Mediterranean country. While the ten EU countries that are part of the Mediterranean and account for around 55 per cent of Mediterranean CO2 emissions are committed to carbon neutrality under the EU Climate Law, none of the southern and eastern Mediterranean (SEM) countries has yet committed to carbon neutrality, with the exception of Turkey. Barely three weeks before the start of COP26, Turkey ratified the Paris Agreement and adopted the objective of net zero emissions by 2053. Turkey alone accounts for over 30 per cent of the Mediterranean emissions, while only three countries account for 73 per cent (Egypt and Algeria in addition to Turkey).

An analysis of the nationally determined contributions (NDCs)[11] concluded that Mediterranean Basin countries, as a whole, are not in line with the 1.5 °C goal, because 77 per cent of the emissions budget that should

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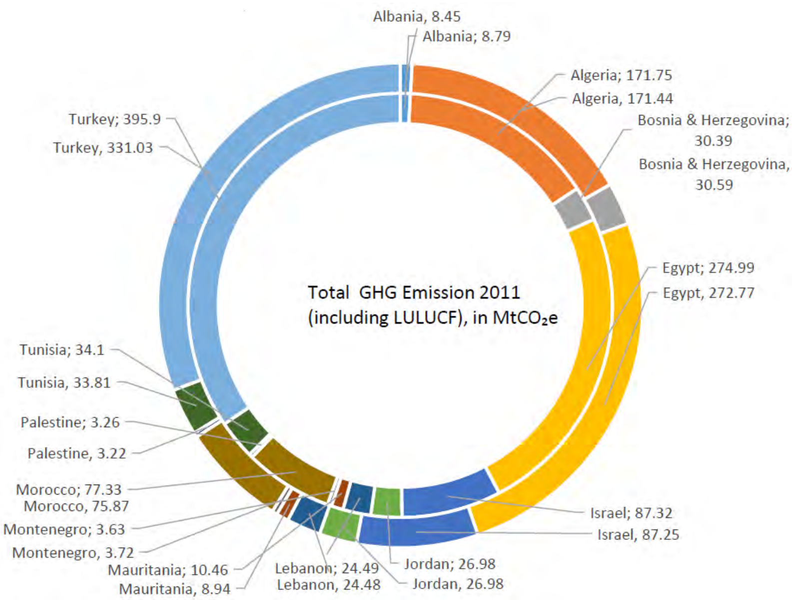
[10] See Energy and Climate Intelligence Unit website: *Net Zero Scorecard*, https://eciu.net/netzerotracker.

[11] CITEPA, *Enhancement of Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) for the Southern and Eastern Mediterranean (SEMed) Region. Regional Analysis on Nationally Determined Contributions (NDCs) – 2nd phase*, Barcelona, Union for the Mediterranean, 2020, https://ufmsecretariat.org/wp-content/uploads/2021/01/Enhancement-of-NDCs-in-the-SEMed-Region_WEB.pdf; Jaime D. Fernández M. and Ashanapuri Herta, *Regional Analysis of (I)NDCs in the SEMed Region*, cit.

be available until 2100 will already have been emitted by 2030. The NDCs show significant differences in the degree of ambition across countries, as indicated in the table 2 below on NDCs in SEM countries; however, a common feature is that more ambitious commitments are conditioned on external financial and technical support. Morocco and Israel are the countries with the most ambitious objectives, with Morocco having pledged for a 18.3 per cent reduction of its greenhouse gases emissions by 2030 and 45.5 per cent reduction conditional on international assistance under the NDC submitted in June 2021 and Israel having pledged a more ambitious target of 85 percent reduction by 2050 under the revised NDC submitted in July 2021. By end September 2021, none of the other SEM countries had submitted updated NDCs. Some of the countries also have targets for renewables: 52 per cent of installed power generating capacity by 2030 in Morocco, 42 per cent of electricity production by 2035 in Egypt and 30 percent of electricity production by 2030 in Israel.

Figure 1 | Total GHG emission (excluding LULUCF), 2011



Source: Jaime D. Fernández M. and Ashanapuri Herta, *Regional Analysis of (I)NDCs in the SEMed Region*, Barcelona, Union for the Mediterranean, 2020, p. 23, https://www.medecc.org/?p=2753.

Table 2 | SEM country commitments under first NDCs

	Unconditional (%)	Conditional (%)	Base year
Albania	-	11.50	2016
Algeria	7	22	-
Bosnia & Herzegovina	-	3	1990
Egypt	-	-	-
Israel	26	-	-
Jordan	1.50	12.5-14	2006
Lebanon	15	30	-
Mauritania	12	88	2010
Montenegro	30	-	1990
Morocco	17	42	2010
Palestine		12.8 (status quo) 24.4 (independence	
Tunisia	13	41	2010
Turkey	-	21	2012

Source: Jaime D. Fernández M. and Ashanapuri Herta, *Regional Analysis of (I)NDCs in the SEMed Region*, cit., p. 25.

The EU Green Deal could entice SEM countries to adopt more stringent climate objectives, as financial assistance is available under the new EU Neighbourhood, Development and International Cooperation Instrument (NDICI) and as a solution to avoid trade barriers such as the CBAM.[12] Consequently, they could also adopt more ambitious renewable energy targets, thus developing their vast solar potential to serve their home market and feed Europe's increasing appetite for carbonless electricity and green hydrogen. In order to trade clean energy and derived products such as green hydrogen, SEM countries would have to adopt, as part of the energy and climate policies, a system to certify that those products are indeed free of carbon. Some funding from the Euro-

[12] For instance, that was partially the case for Turkey's climate neutrality target. See Zia Weise, "EU's Looming Carbon Tax Nudged Turkey toward Paris Climate Accord, Envoy Says", in *Politico*, 6 November 2021, https://www.politico.eu/?p=1883551.

pean Commission is available to help SEM countries set up certification schemes, either from the bilateral twinning programmes or the Neighbourhood Instrument.

Achieving the ambition of the European Green Deal will not be possible without commensurate efforts on the part of third countries, in particular in the EU neighbourhood, with whom member states share gas and electricity infrastructure. In this context, the initiatives aimed at implementing the external dimension of the European Green Deal, such as the Green Agenda for the Western Balkans, the Energy Community Treaty or the New Agenda for the Mediterranean, could provide platforms to address the particular challenges arising in third countries. The EU Green Deal has the potential to spur new forms of cooperation towards a more genuine Mediterranean Union. Yet, if managed improperly and not accompanied by carefully tailored policies that reflect the current socio-economic challenges affecting individual SEM states, it could instead exacerbate regional fragmentation and even add further stress to already struggling states and societies in the Mediterranean.

4.2 The Mediterranean wealth: Plentiful carbonless energy resources

4.2.1 Mediterranean energy: An overview

As of now, renewables only account for a limited share of the primary energy supply in the Mediterranean Basin (11 per cent in 2016, Figure 2), with a strong North-South divide which complicates the picture even further.[13] In 2019, among MENA countries, only 4 per cent of overall power generation came from renewables,[14] which account for nearly 35 per cent in EU Mediterranean countries, where the share has doubled over the last 15 years.[15] The most used renewable energy sources are biomass and hydropower. Geothermal energy represents an important source in only a few countries – mainly Italy, Turkey and, to a lesser extent, France, Spain and Portugal. In recent years, wind and solar, both

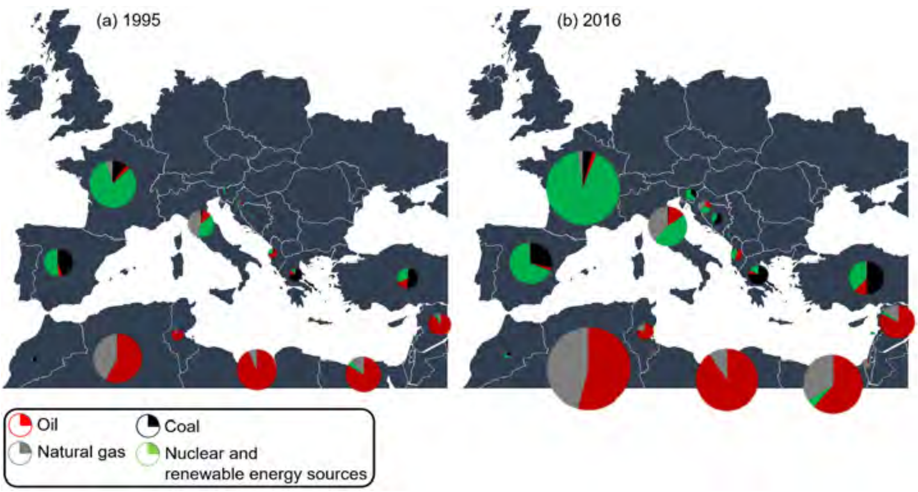
[13] Data source: IEA (2019).

[14] Data source: Enerdata (2019).

[15] Data source: Eurostat.

for electricity and for heat production, have entered the energy mix. Figure 2 shows the recent evolution of primary energy production by juxtaposing what it looked like in 1995 and in 2016. During this period, the contribution of oil has remained stable, while the contribution of coal has decreased by about 10 per cent. Consumption of natural gas has doubled, while the contribution of low-carbon energy, such as nuclear and renewable energy sources, has increased by about 43 per cent. In the Mediterranean region, France has the biggest energy-consuming economy with roughly 50 per cent of the primary energy consumption produced locally thanks to the large share of nuclear power in the country's energy mix. The vast majority of Mediterranean nations are strongly dependent on hydrocarbons both for imports to service the economy and as exports to garner funds and investments.

Figure 2 | Primary energy mix across the Mediterranean in 1995 (a) and 2016 (b)



Source: Philippe Drobinski et al., "Energy Transition in the Mediterranean", in Wolfgang Cramer, Joël Guiot, Katarzyna Marini (eds.), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First Mediterranean Assessment Report*, Marseille, Union for the Mediterranean, Plan Bleu, UNEP/MAP, p. 265-322, https://www.medecc.org/?p=3506

Against this background, it is necessary to rapidly improve the penetration of renewable energies in the Mediterranean to address both the depletion of fossil fuels and climate change mitigation. This would be favoured by the large potential the region has for energy production from terrestrial renewable energy, as well as for the development of marine energy. Yet, such an energy transition needs to consider both positive and negative externalities on material resources,[16] the environment[17] and societies across the region.[18]

4.2.2 Renewable energy as a driver for Mediterranean complementarity

Renewable energy resources are unevenly distributed across the region. In Europe, large scale on- and offshore wind and photovoltaic (PV), as well as low cost hydropower and geothermal electricity, can be produced in some EU member states.[19] Looking south, countries from the SEM region (Morocco, Algeria, Tunisia, Libya, Egypt, Israel, Occupied Palestinian Territory, Lebanon, Syria and Turkey) have huge solar irradiation levels, which makes these countries the ideal location for large-scale development of solar PV and concentrated solar power (CSP),[20] even compared to Southern Europe. The most promising regions for solar power plants are located in deserts which are sparsely inhabited and not used for agriculture or urban settlement. Efficiency is also higher in these areas.

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[16] Samuel Carrara et al., *Raw Materials Demand for Wind and Solar PV Technologies in the Transition towards a Decarbonised Energy System*, Luxembourg, Publications Office of the European Union, 2020, https://op.europa.eu/s/vJi3.

[17] Charles J. Vörösmarty et al., "Anthropogenic Sediment Retention: Major Global Impact from Registered River Impoundments", in *Global and Planetary Change*, Vol. 39, No. 1-2 (October 2003), p. 169-190; Christiane Zarfl et al., "A Global Boom in Hydropower Dam Construction", in *Aquatic Science*, Vol. 77, No. 1 (January 2015), p. 161-170; Rosamond L. Naylor et al., "The Ripple Effect: Biofuels, Food Security, and the Environment", in *Environment*, Vol. 49, No. 9 (November 2007), p. 30-43.

[18] Charlotte von Möllendorff and Heinz Welsch, "Measuring Renewable Energy Externalities: Evidence from Subjective Well-Being Data", in *SOEPpapers on Multidisciplinary Panel Data Research*, No. 779 (2015), http://hdl.handle.net/10419/115874; Tatyana Bulavskaya and Frédéric Reynès, "Job Creation and Economic Impact of Renewable Energy in the Netherlands", in *Renewable Energy*, Vol. 119 (April 2018), p. 528-538.

[19] These include northern European countries as well as Spain and Portugal for wind electricity production, southern European countries for solar, in mountainous regions and along major rivers for hydropower.

[20] Rosaria Ciriminna et al., "Solar Energy and New Energy Technologies for Mediterranean Countries", in *Global Challenges*, Vol. 3, No. 10 (October 2019), Article 1900016, https://doi.org/10.1002/gch2.201900016.

Theoretically, about 1 per cent of the earth's total desert surface could provide enough energy to supply the entire population of the world.[21] In this context, the Sahara Desert is the world's sunniest area year-round.[22] Covering 8 per cent of the Sahara with solar panels would be enough to supply all the energy needed by the whole planet.[23]

Regarding wind energy, large wind resources exist in Northern Europe. The sustained high winds of this region correspond to the storm track associated with near-surface westerly wind blowing all year long with some seasonal modulation. More to the south, Atlantic trade winds extend far inland into the Sahara Desert. Indeed, the Sahara is one of the windiest areas on the planet, especially on the west coast, with quite steady winds throughout the year, making this region a favourable place for wind power generation.[24] Regional channel flows accelerated in the valleys of the mountain ranges surrounding the Mediterranean Sea are also favourable for wind energy production. Higher wind resources are found offshore compared to onshore. This is primarily due to the reduced roughness over the sea. In the Euro-Mediterranean, offshore areas of sustained high winds are the storm track region over the Atlantic Ocean and the North Sea; and in the Western Mediterranean the windiest areas are at the exit of the main valleys along which the strong regional winds blow (e.g., mistral, tramontane, cierzo, bora, jugo). Over the Eastern Mediterranean, in the Levantine Basin, the prevalent winds

[21] See, DESERTEC, *Clean Power from Deserts. The Desertec Concept for Energy, Water and Climate Security*, WhiteBook fourth ed., Bonn, Protext Verlag, February 2009, https://www.earthpolicy.org/downloads/articles/trec_white_paper.pdf; Data source: IEA (2019).

[22] Peter F. Varadi, Frank Wouters and Allan R. Hoffman, *The Sun Is Rising in Africa and the Middle East. On the Road to a Solar Energy Future*, Singapore, Pan Stanford Publishing, 2018.

[23] Ad van Wijk, Els van der Roest and Jos Boere, *Solar Power to the People*, Amsterdam, IOS Press, 2017, https://ebooks.iospress.nl/book/solar-power-to-the-people.

[24] Peter Meisen and Oliver Pochert, A Study of Very Large Solar Desert Systems with the Requirements and Benefits to Those Nations Having High Solar Irradiation Potential, Global Energy Network Institute (GENI), 2006, http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/solar/solar-systems-in-the-desert/Solar-Systems-in-the-Desert.pdf.

are the Etesians which persist all year long with a maximum intensity in summer.[25] From a climatological point of view, these coastal regions are promising for offshore wind farm deployment. However, environmental and economic constraints (dense maritime transport activity, tourism, etc.) must be accounted for when planning the installation of offshore wind farms.

The world's electricity sector strongly depends on the availability and temperature of water resources for hydropower generation and for cooling of thermoelectric power (nuclear, fossil-fuelled, biomass-fuelled and geothermal). Thermoelectric power is the dominant power-generating technology except in South America where hydropower dominates.[26] In the Mediterranean region, utilisation rates are fairly constant, around 80–90 per cent for hydropower and 50–60 per cent for thermoelectric power. In Northern Europe, the utilisation rates are similarly constant, exceeding 95 per cent for hydropower and around 50–60 per cent for thermoelectric power. The utilisation rates are significantly reduced during periods of drought (severe streamflow drought impacts hydropower while streamflow drought and high water temperature impacts thermoelectric power, corresponding to a utilisation decrease of about 3–6 per cent).[27]

Among the available renewable sources, ocean energy is experiencing increasing interest and development.[28] The ocean energy sector clearly

[25] Stefano Zecchetto and Francesco De Biasio, "Sea Surface Winds over the Mediterranean Basin from Satellite Data (2000–04): Meso- and Local-Scale Features on Annual and Seasonal Time Scales", in *Journal of Applied Meteorology and Climatology*, Vol. 46, No. 6 (2006), p. 814-827, https://doi.org/10.1175/JAM2498.1.

[26] Michelle T.H. van Vliet et al., "Power-Generation System Vulnerability and Adaptation to Changes in Climate and Water Resources", in *Nature Climate Change*, Vol. 6 (2016), p. 375-380.

[27] Michelle T.H. van Vliet et al., "Impacts of Recent Drought and Warm Years on Water Resources and Electricity Supply Worldwide", in *Environmental Research Letters*, Vol. 11, No. 12 (December 2016), Article 124021, https://doi.org/10.1088/1748-9326/11/12/124021.

[28] Henry Jeffrey, Brighid Jay and Mark Winskel, "Accelerating the Development of Marine Energy: Exploring the Prospects, Benefits and Challenges", in Technol*ogical* Forecast*ing and* Soc*ial* Change, Vol. 80, No. 7 (September 2013), p. 1306-1316.

stands at the intersection of all the converging paths of energy policy. It promises substantial breakthroughs in low-carbon and clean energy technologies, reinforces EU competitiveness on the global market, calls for transnational regulation and management, reduces dependence on energy imports by leveraging indigenous resources, lowers emissions and drives the economic growth of coastal communities.[29] Although the availability of ocean energy resources is higher in the oceans, considerable resources are also available in the Mediterranean Sea, offering new prospects for sustainable energy production in coastal areas and for economic development in southern Europe. In the Mediterranean Sea the two most interesting ocean energy sources are represented by tidal currents and waves.[30] Such developments should be envisaged in the frame of the EU's Blue Economy for a Sustainable Future.[31]

Weather- and climate-driven energy sources are characterised by a significant spatial and temporal variability. One of the commonly mentioned solutions to overcome the mismatch between demand and supply provided by renewable generation is a hybridisation of two or more energy sources into a single power station (like wind-solar, solar-hydro or solar-wind-hydro). The operation of hybrid energy sources is based on the complementary nature of renewable sources.[32] Harnessing and optimising renewable power generation to deliver reliable and continuous supply for Mediterranean Basin states requires the integration of a geographically and operationally diverse range of supply sources – such

[29] European Technology and Innovation Platform for Ocean Energy, *Strategic Research Agenda for Ocean Energy*, Ocean Energy Europe, 2016, https://www.oceanenergy-europe.eu/wp-content/uploads/2017/03/TPOcean-Strategic_Research_Agenda_Nov2016.pdf.

[30] Takvor H. Soukissian et al., "Marine Renewable Energy in the Mediterranean Sea: Status and Perspectives", in *Energies*, Vol. 10, No. (2017), Article 1512, https://doi.org/10.3390/en10101512.

[31] See, European Commission, *A New Approach for a Sustainable Blue Economy in the EU. Transforming the EU's Blue Economy for a Sustainable Future* (COM/2021/240), 17 May 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0240.

[32] Jakub Jurasz et al., "A Review on the Complementarity of Renewable Energy Sources: Concept, Metrics, Application and Future Research Directions", in *Solar Energy*, Vol. 195 (1 January 2020), p. 703-724, https://doi.org/10.1016/j.solener.2019.11.087.

as the vast solar potential of the arid deserts of North Africa, the hydro capability of hill and mountain regions surrounding the Mediterranean Sea, onshore and offshore wind farms in Northern Europe and the capture of ocean tidal and wave power, which is still to be developed.

4.2.3 Climate change and its impact on renewable energy resources in the Mediterranean

Climate change in the Mediterranean is expected to affect energy demand due to lower heating demand and increased cooling needs, as well as energy production.[33] Climate change has a strong impact on the evolution of extreme hydrometeorological events. The Euro-Mediterranean area is particularly prone to extreme events which can cause damage to the energy infrastructure. Heat waves, winter storms, floods and fires can affect the power grid in different ways.[34] They can be associated with power outages as they undermine the foundations of transmission towers, damage electrified equipment and cause lines to either break or touch each other. The resilience of energy systems to climate change may be at stake as future climate projections for the Euro-Mediterranean show a significant increase in frequency and intensity of heat waves, droughts[35] and heavy precipitation[36] which are natural hazards having large impacts on the energy system.

Warming in the region also has an impact on renewable energy production. Indeed, it is shown to result in losses in renewable energy

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[33] Philippe Drobinski et al., "Energy Transition in the Mediterranean", cit.

[34] Georgios Marios Karagiannis et al., *Power Grid Recovery after Natural Hazard Impact*, Luxembourg, Publications Office of the European Union, 2017, https://op.europa.eu/s/vJld.

[35] Philippe Drobinski et al., "How Warmer and Drier Will the Mediterranean Region Be at the End of the Twenty-First Century?", in *Regional Environmental Change*, Vol. 20, No. 3 (September 2020), Article 78; Florian Raymond et al., "Evolution of Mediterranean Extreme Dry Spells During the Wet Season Under Climate Change", in *Regional Environmental Change*, Vol. 19, No. 8 (December 2019), p. 2339-2351.

[36] Philippe Drobinski et al., "Scaling Precipitation Extremes with Temperature in the Mediterranean: Past Climate Assessment and Projection in Anthropogenic Scenarios", in *Climate Dynamics*, Vol. 51, No. 3 (August 2018), p. 1237-1257, https://doi.org/10.1007/s00382-016-3083-x.

production, with marginal impact if global warming does not exceed 2 °C (losses <5 per cent), but deteriorates rapidly above 2 °C.[37] The usable capacity of traditional hydropower and thermoelectric power is expected to decrease due to declines in stream flow and the increase in water temperature, resulting in a decrease in hydropower by 2.5 to 7 per cent and in thermal energy from 10 to 15 per cent by 2050.[38] Adaptation measures to mitigate the vulnerability of the electricity sector to future water constraints under changing climate have been investigated in the form of six options: increase in efficiencies of hydropower plants and thermoelectric power plants, replacement of fuel sources of thermoelectric power plants, replacement of once-through cooling systems by recirculation cooling systems, switching to seawater cooling for thermoelectric power plants close to the coast and decoupling from freshwater resources by switching to seawater and dry air cooling for 10 per cent of the thermoelectric power plants that are most vulnerable to water constraints under climate change.[39]

Except for electricity supply systems relying on water resources, the impact of climate change on renewable energy production remains on the whole limited and can be attenuated by technological innovation and re-powering actions. In 2040, renewables are expected to overtake natural gas and coal and become the second most used energy source in the Mediterranean region.[40] Among the various renewable energy technologies, solar is expected to experience the fastest growth in the region.

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[37] Isabelle Tobin et al., "Vulnerabilities and Resilience of European Power Generation to 1.5 °C, 2 °C and 3 °C Warming", in *Environmental Research Letters*, Vol. 13, No. 4 (April 2018), Article 044024, https://doi.org/10.1088/1748-9326/aab211.

38 Christopher Cooper and Benjamin K. Sovacool, "Miracle or Mirage? The Promise and Peril of Desert Energy Part 1", in *Renewable Energy*, Vol. 50 (February 2013), p. 628-636; Data source: Eurostat.

[39] Ibid.

[40] Observatoire méditerranéen de l'energie (OME), *Mediterranean Energy Perspectives 2018*, Paris, OME, 2018.

4.2.4 Renewable energies for green hydrogen production

Most SEM countries have huge potential in terms of land and resources to produce green hydrogen from solar and wind for export. Indeed, hydrogen can build the bridge between Europe and SEM, with an energy system based on renewable electricity and green hydrogen.[41] For an energy system increasingly based on variable renewables as forecast in many published outlooks,[42] hydrogen could become indispensable for transport and storage. In a Europe-Mediterranean collaboration, green hydrogen could consist of hydrogen produced in Europe, complemented by hydrogen imports, especially from North Africa, and could be beneficial for both Europe and SEM states in terms of energy security, technology leadership, economic development and social stability. Existing infrastructure transporting gas from Algeria and Libya to Europe via Italy and Spain could be used to transport hydrogen from the southern and eastern Mediterranean countries to Europe.[43]

4.3 Mediterranean energy market integration

Regional energy market integration is the least costly and most overlooked solution for climate change mitigation, and it is in the Mediterranean that it holds the best promises. Europe has ambitious climate change objectives, which require rapid decarbonisation of the energy system. The SEM countries have the perfect characteristics to cooperate with Europe towards carbon neutrality: a vast untapped solar energy potential and adequate demographic, climatic and geographical conditions to develop that potential.

[41] Ad van Wijk and Frank Wouters, "Hydrogen–The Bridge Between Africa and Europe", in Margot P. C. Weijnen, Zofia Lukszo and Samira Farahani (eds), *Shaping an Inclusive Energy Transition*, Cham, Springer, 2021, p. 91-119, https://doi.org/10.1007/978-3-030-74586-8_5.

[42] Philippe Drobinski et al., "How Warmer and Drier Will the Mediterranean Region Be", cit.

[43] Sebastian Timmerberg and Martin Kaltschmitt, "Hydrogen from Renewables: Supply from North Africa to Central Europe as Blend in Existing Pipelines – Potentials and Costs", in *Applied Energy*, Vol. 237 (1 March 2019), p. 795-809.

4.3.1 Benefits and challenges

To integrate a high level of renewables, power systems need flexibility to cope with the stress resulting from sudden and unpredictable variations in the availability of renewable energy. Power system flexibility is defined as the ability to manage the variability of demand and supply cost-effectively across all relevant timescales, from ensuring instantaneous stability of the power system to supporting long-term security of supply.[44] Flexibility can be provided by dispatchable power plants, demand-side response, storage and network infrastructure (in particular infrastructure that supports regional market integration)[45] and requires a combination of regulatory, operational and investment measures.[46] Whereas storage addresses the time dimension of flexibility, regional market integration is directed at the spatial dimension. A large power system is easier to balance in real time with vast quantities of intermittent renewables, as wind is always blowing and the sun is shining somewhere.[47]

Regional electricity market integration offers other benefits to the power systems and the economies of participating countries, such as enhanced energy security and power system reliability, reduced need for back-up capacity thanks to reserve sharing, supply mix diversifi-

[44] International Renewable Energy Agency (IRENA), *Power System Flexibility for the Energy Transition. Part 1: Overview for Policy Makers,* Abu Dhabi, IRENA, November 2018, https://www.irena.org/publications/2018/Nov/Power-system-flexibility-for-the-energy-transition; Baraa Mohandes et al., "A Review of Power System Flexibility With High Penetration of Renewables", in *IEEE Transactions on Power Systems*, Vol. 34, No. 4 (July 2019), p. 3140-3155.

[45] Manuel Baritaud and Dennis Volk, *Seamless Power Markets. Regional Integration of Electricity Markets in IEA Member Countries*, Paris, International Energy Agency, 2014, https://www.iea.org/reports/seamless-power-markets.

[46] Lion Hirth and Inka Ziegenhagen, "Balancing Power and Variable Renewables: Three Links", in *Renewable and Sustainable Energy Reviews*, Vol. 50 (October 2015), p. 1035-1051.

[47] Silvia Pariente-David, "Successful Grid Integration of Renewable Energy: Integration is the Name of the Game", in *IAEE Energy Forum*, First Quarter 2014, p. 29-30, https://www.iaee.org/en/publications/newsletterdl.aspx?id=223; Karsten Neuhoff et al., "Renewable Electric Energy Integration: Quantifying the Value of Design of Markets for International Transmission Capacity", in *Energy Economics*, Vol. 40 (November 2013), p. 760-772.

cation, more efficient use of power plants, lower power system costs (both investment and operating) and therefore lower consumer prices.[48] Although several studies have estimated the costs and benefits of the integration of electricity markets in Europe,[49] there is less research on the preconditions and required policies for establishing a successful and integrated Mediterranean market for electricity and a truly seamless transmission system. Studies have estimated the benefits of integrating EU markets at 13–40 billion euro per year for the EU as a whole, depending on assumptions on fuel and carbon prices, renewable energy costs and penetration, among others. If the market integration were broadened to include the whole Mediterranean region, savings would be even larger—possibly reaching 30 billion euro per year according to studies conducted by Dii.[50] Moreover, research has shown that an integrated energy market and a cooperative approach would reduce the cost of meeting the ambitious EU CO2 reduction and renewables targets.[51]

The idea of exporting solar electricity from the Sahara is not new and dates back to the 1940s,[52] but the concept gained momentum when the first EU Renewable Directive was being prepared.[53] The period 2008–2012 saw a flurry of initiatives (Mediterranean Solar Plan – MSP, Desertec,[54] Dii and Medgrid, amongst others) to connect the southern

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[48] World Bank, "Regional Power Sector Integration. Lessons from Global Case Studies and a Literature Review", in *ESMAP Briefing Notes*, No. 004/10 (June 2010), http://hdl.handle.net/10986/17507.

[49] David Newbery, Goran Strbac and Ivan Viehoffc, "The Benefits of Integrating European Electricity Markets", in *Energy Policy*, Vol. 94 (July 2016), p. 253-263.

[50] Florian Zickfeld et al., *Desert Power 2050. Perspectives on a Sustainable Power System for EUMENA*, Munich, Dii, June 2012, http://www.desertec-uk.org.uk/reports/DII/DPP_2050_Study.pdf.

[51] Gustav Resch et al., *Dialogue on a RES Policy Framework for 2030*, Final Report of the Towards 2030-Dialogue Project, 2017.

[52] Gonzalo Escribano et al., "Geopolitical Context for CSP in Europe", in *MUSTEC Project Deliverables*, No. 6.4 (March 2019), https://www.mustec.eu/node/91.

[53] For a comprehensive overview of the historical development of energy cooperation in the Mediterranean, see Simone Tagliapietra, *Energy Relations in the Euro-Mediterranean. A Political Economy Perspective*, Cham, Palgrave Macmillan, 2017.

[54] Trans Mediterranean Renewable Energy Cooperation (TREC) was formed in 2003

and northern shores of the Mediterranean, when it seemed that many EU countries would face difficulties in meeting their commitments under the Directive. Yet, most of these initiatives went into hibernation as EU countries did not express much interest in cooperation mechanisms with southern Mediterranean countries, either because they could meet their 2020 targets from their own resources (in part because of stagnant demand) or because they preferred to use other means such as statistical transfers or cooperation mechanisms with other EU countries. Scholarly research[55] also identifies the following reasons for the failures of Dii, MSP and other ambitious Mediterranean integration initiatives: underdeveloped legal and regulatory frameworks, weak grid infrastructures (in particular lack of interconnection between the two shores), lower than expected socio-economic benefits, high upfront costs and lack of financing mechanisms, high fossil fuel subsidies in SEM countries, energy policy giving priority to domestic production over electricity imports, and electricity surpluses in EU countries.

After a period of lull, there is a revival of interest in electricity exchanges across the Mediterranean, and the quest for carbon neutrality in the EU and elsewhere makes circumstances more auspicious to relaunch the Mediterranean Energy Union process. The cost of renewable energy sources has fallen considerably and there has been progress in fossil fuel subsidy reform in SEM countries. Moreover, cooperation, coordination (both of national policies and of power system operations) and regional market integration are central components of the Fit for 55 Package.

However, challenges remain serious in a region which is one the least integrated in the world and where integration is crucial to boost trade in goods and services in support of economic development. Some of the most serious barriers include the complexity of numerous and diverse trade agreements, inadequate transport

and then became Desertec.

[55] Natàlia Caldés et al., "Renewable Energy Cooperation in Europe: What Next? Drivers and Barriers to the Use of Cooperation Mechanisms", in *Energies*, Vol. 12, No. 1 (2019).

and logistics infrastructure and numerous tariff barriers, as well as lack of harmonisation in regulatory frameworks.[56] Lack of institutional capacity and political will, as well as political instability and conflicts between countries, are also obstacles to the creation of a context favourable to regional energy market integration, as exemplified by the recent decision of Algeria to halt natural gas exports through Morocco.

4.3.2 Implementation issues

Successful regional energy market integration requires substantial physical infrastructure (the "hardware" of regional integration) but this is not enough. "Software" is needed so that markets can interact and operate harmoniously.

For the moment, the two shores are interconnected electrically by a submarine cable of 1400 MW under the Strait of Gibraltar connecting Spain and Morocco, and the resulting exchanges have at times been substantial, covering up to 25 per cent of Morocco's electricity needs. The networks are interconnected in the Eastern Mediterranean, with Turkey connected to Bulgaria through two 400 kV lines (for a total capacity of 2500 MW) and to Greece through a 400 kV line with a capacity of 500 MW. Since 2015, the Turkish electricity system has been synchronised with that of the European continent. Other interconnections between Europe and the southern shore of the Mediterranean are being planned or studied: ELMED Mediterranean power interconnector between Italy and Tunisia, the EuroAsia Interconnector between Israel, Cyprus and Greece and the EuroAfrica Interconnector between Egypt, Cyprus and Greece. All three projects have the status of Project of Common Interest under the Connecting Europe Facility. A more ambitious project to link Morocco to the UK has also been recently announced.[57]

[56] Organisation for Economic Co-operation and Development (OECD), *Regional Integration in the Union for the Mediterranean. Progress Report*, Paris, OECD, 2021, https://doi.org/10.1787/325884b3-en.

[57] "World's Longest Subsea Cable Will Connect Morocco to UK Grid", in *The North Africa Post*, 24 April 2021, https://northafricapost.com/?p=49278.

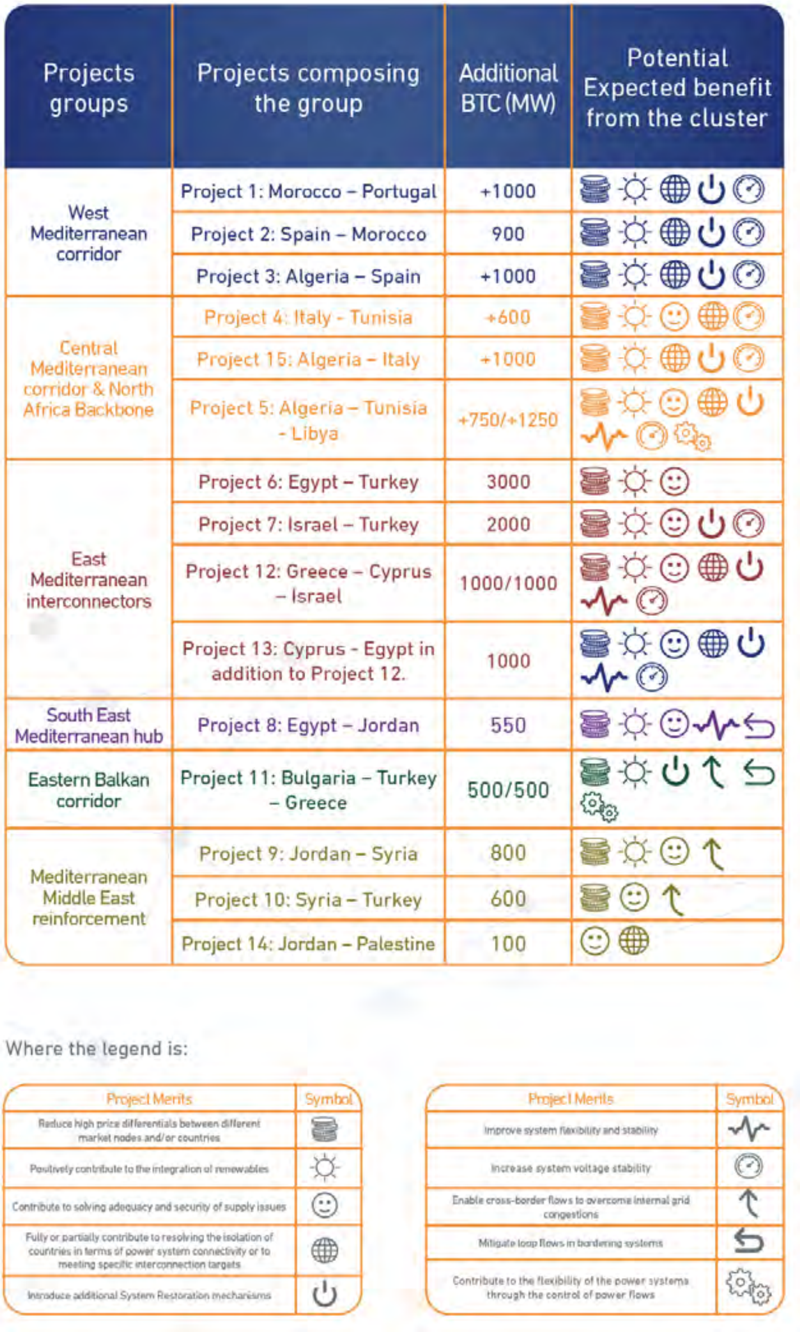
The master plan of Med-TSO, the Association of Mediterranean Transmission System Operators, has identified and analysed 15 projects to strengthen Mediterranean electricity interconnections, which have been grouped into three clusters: the West Mediterranean, Central Mediterranean and Eastern Mediterranean corridors (see Figure 3 and 4 below).

Figure 3 | New interconnectors planned in the Mediterranean

Source: Mediterranean Transmission System Operators (Med-TSO), Mediterranean Network Development Plan at 2020, 2020, p. 26, https://www.med-tso.com/publications4.aspx.

What kind of infrastructure will be needed to further integrate the European and SEM energy markets will depend on whether the interconnectivity develops through exchanges of electrons or molecules (hydrogen or other gases). A holistic approach to planning electricity transmission and gas transport infrastructure and to operating electricity and gas markets is needed. This is likely to be challenging, given the lack of an institutional structure to overview the process. The coordination between ENTSO-E and ENTSO-G, with the help of ACER, to prepare joint scenarios and long-term development plans is barely starting in the EU, so it will take time before this practice extends to the Mediterranean.

Figure 4 | Med-TSO project groups and expected merits



Projects groups	Projects composing the group	Additional BTC (MW)	Potential Expected benefit from the cluster
West Mediterranean corridor	Project 1: Morocco – Portugal	+1000	
	Project 2: Spain – Morocco	900	
	Project 3: Algeria – Spain	+1000	
Central Mediterranean corridor & North Africa Backbone	Project 4: Italy - Tunisia	+600	
	Project 15: Algeria – Italy	+1000	
	Project 5: Algeria – Tunisia - Libya	+750/+1250	
East Mediterranean interconnectors	Project 6: Egypt – Turkey	3000	
	Project 7: Israel – Turkey	2000	
	Project 12: Greece – Cyprus – Israel	1000/1000	
	Project 13: Cyprus - Egypt in addition to Project 12.	1000	
South East Mediterranean hub	Project 8: Egypt – Jordan	550	
Eastern Balkan corridor	Project 11: Bulgaria – Turkey – Greece	500/500	
Mediterranean Middle East reinforcement	Project 9: Jordan – Syria	800	
	Project 10: Syria – Turkey	600	
	Project 14: Jordan – Palestine	100	

Where the legend is:

Project Merits	Symbol
Reduce high price differentials between different market nodes and/or countries	
Positively contribute to the integration of renewables	
Contribute to solving adequacy and security of supply issues	
Fully or partially contribute to resolving the isolation of countries in terms of power system connectivity or to meeting specific interconnection targets	
Introduce additional System Restoration mechanisms	

Project Merits	Symbol
Improve system flexibility and stability	
Increase system voltage stability	
Enable cross-border flows to overcome internal grid congestions	
Mitigate loop flows in bordering systems	
Contribute to the flexibility of the power systems through the control of power flows	

Source: Med-TSO, Mediterranean Network Development Plan at 2020, cit., p. 47-48.

The existence of interconnectors or pipelines connecting the two shores of the Mediterranean is necessary but not sufficient to support the development of an integrated Euro-Med energy market. To operate a flawlessly integrated market where energy can flow freely with no hindrance requires more than physical infrastructure, it requires the "software" of regional integration. This includes compatible market designs, interoperability of power systems, coordination of wholesale markets, joint balancing markets, flexibility assessments, adequate management of interconnection capacity, regulatory convergence, harmonisation of pricing principles and tariff setting, among others.

As experience in Europe shows, it can take several decades to assemble all the right conditions for an integrated electricity market, and the single EU market is still in the making in 2021. The process takes place in stages with sub-groups of countries integrating into sub-regional power pools. For instance, in South East Europe, Western Balkan countries – seven of which are Mediterranean countries – are at an advanced stage of integration with the EU single energy market. Experience around the world indicates that partial integration that enables countries to begin reaping some of the benefits of a regional electricity market can happen relatively rapidly.[58]

4.4 Pathways for multilateral cooperation

The Mediterranean region is endowed with a vast potential for carbonless forms of energy. Developing that potential is crucial for reaching the objectives of the Paris Agreement. Moreover, it could be a source of economic growth and social welfare, possibly bringing political stability to the region. The cost-effective and efficient development of Mediterranean renewable energy resources requires energy market integration, coordination between the various stakeholders and cross-country cooperation. However, this is a major challenge in a region plagued by conflicts and political instability and characterised by diversity of economic

[58] Musiliu O. Oseni and Michael G. Pollitt, "The Promotion of Regional Integration of Electricity Markets: Lessons for Developing Countries", in *Energy Policy*, Vol. 88 (January 2016), p. 628-638.

development, economic and social structures. Flexible forms of cooperation and differentiated integration are necessary to make a Mediterranean Union possible. All stakeholders have to collaborate, including governments, the private sector and financial institutions.

Experience around the world[59] indicates that, although full regional integration of neighbouring electricity markets and the creation of regional power pools can take decades to be realised, regional electricity market integration can start with simple forms of cooperation for reserve sharing and mutual help in case of emergency. This can then evolve to more elaborate integration, with multi-country power systems, technical and regulatory harmonisation, formal common power exchanges, converging market design and competitive trade across borders. Regional power pools often start (and should start) with a small number of countries, and expand over time as success attracts more participants. The creation of cross-border capacity often induces further market integration. The most difficult obstacle is often political. However, power pools can be developed even between countries with a history of conflict, as was the case with the Southern African Power Pool and the South East Europe market.

A realistic interim target in the Mediterranean might be the creation of an integrated Maghreb electricity market (or at least integrating the power systems of Morocco, Algeria and Tunisia as a starting point), given that the Maghreb Electricity Committee (COMELEC) already fulfils some of the functions of a power-pool-type coordinating entity. The process could be similar to the one under way in South East Europe, where Western Balkan countries – seven of which are Mediterranean countries – are at an advanced stage of integration with the EU single energy market. Under the Sofia Declaration of November 2020, they adopted the Green Agenda for the Western Balkans and committed to work in line with the Green Deal towards climate neutrality in 2050.

The rate of progress is likely to depend on many factors, a key one being the institutional capacity for integration and the existence of a supranational institution to coordinate, monitor and guide the overall

[59] Ibid.

effort. As part of the latest train of reforms, the EU has proposed the creation of Regional Coordination Centres that have the responsibility, among others, of sizing and procurement of balancing reserves, of assessing the maximum contribution of external resources in capacity markets and of tasks related to the risk-preparedness of the power sector. Similar institutions could be created in the Mediterranean.

As we have seen above, the EU has a vital interest in the development of Mediterranean renewable energy governance. The need for cooperation is two-way: Europe needs to tap into the vast carbonless resources of the South to reach its climate neutrality objective, while the South needs Europe for technology transfer, financial assistance and technical cooperation. While the rationale for cooperation is strong, the risk is that any EU-led initiative may be experienced by SEM countries as an external imposition and that there will be a lack of ownership in the SEM. Even if the European Green Deal represents a reference model, a Euro-Mediterranean Green Deal could be the key for integration of the Mediterranean energy market, which is essential for an effective energy transition in the region. The challenge is that there is no similar regional counterpart institution to dialog with the EU institutions.

Despite several attempts to revive the Mediterranean Energy Union process, an intergovernmental organisation for the Mediterranean region remains elusive. Regional cooperation in the Mediterranean takes place under the Union for the Mediterranean (UfM), a multilateral partnership created in Paris in 2008 by 43 Euro-Mediterranean heads of state and government. However, this is far from a Mediterranean Energy Community;[60] as the name indicates it is a Union *for* the Mediterranean, not a Union *of* the Mediterranean. The institution remains weak, there is no ownership by SEM countries and the EU hand is visible everywhere given that the financing for the organisation is provided by the EU. Nevertheless, the Lisbon UfM Ministerial Declaration on Energy of June 2021 lays the basis for Mediterranean energy market integration. Moreover, institutions have been established to enable coordination and cooper-

[60] The institution, as proposed by Greece and Italy in 2007, was to have been tailored on the model of the Energy Community for South-East Europe.

ation of Mediterranean stakeholders, including the Association of Mediterranean Transmission System Operators (Med-TSO) and the Association of Mediterranean Regulators (MEDREG), that are the equivalent of ENTSO-E and ACER in Europe. Three platforms (one for gas, one for electricity and one for renewable energies and energy efficiency) were created under the stewardship of the UfM secretariat. Their purpose is to offer all stakeholders a permanent forum to discuss the objectives and implementation of energy policies, and to enable them to identify concrete actions and cooperation projects that promote regional integration.

The forms of multilateral cooperation that are most likely to succeed in the region are flexible and pragmatic ones, initially focusing on specific issues before later broadening the scope (somewhat like the European Coal and Steel Community which was at the origin of the European Union). The recent craze for hydrogen might provide that opportunity. Hydrogen is a game changer in the energy transition, and the Mediterranean is ideally positioned to take a major role in the development of this market. Industry could take the lead in creating the market, which might be the best way to overcome the political difficulties and conflicts between different countries that would be involved in such an initiative. The creation of a Mediterranean Hydrogen Alliance (something similar to the European Airbus imitative), for instance, could help in this regard. This is an opportunity that needs to be seized now as conditions seem to exist in the second decade of the 21st century for the kickstart of a Mediterranean hydrogen market, with extensive trade across the Mediterranean. More generally, SEM countries need to take ownership of the process and design their own Green Deal.[61] Clearly, this will take time given the lack of appropriate institutions to manage the process, possibly missing the opportunity, as the time to act is now to have any chance to reach carbon neutrality by 2050. In this regard, renewable energy and green hydrogen could provide the long-awaited opportunity and form

[61] Blanca Moreno-Dodson, Silvia Pariente-David and Constantin Tsakas, *A Mediterranean Green Deal for an Effective Energy Transition as Part of the Sustainable Post-COVID Recovery*, Marseille, Center for Mediterranean Integration (CMI), November 2021, https://www.cmimarseille.org/node/4998.

the basis for the Mediterranean Union, as did coal and steel at the onset of the European Community.

References

Manuel Baritaud and Dennis Volk, *Seamless Power Markets. Regional Integration of Electricity Markets in IEA Member Countries*, Paris, International Energy Agency, 2014, https://www.iea.org/reports/seamless-power-markets

Timo Behr, "Regional Integration in the Mediterranean: Moving out of the Deadlock?", in *Jacques Delors Institute Studies and Research*, No. 77 (May 2010), https://institutdelors.eu/en/publications/regional-integration-in-the-mediterranean-moving-out-of-the-deadlock

Tatyana Bulavskaya and Frédéric Reynès, "Job Creation and Economic Impact of Renewable Energy in the Netherlands", in *Renewable Energy*, Vol. 119 (April 2018), p. 528-538

Natàlia Caldés et al., "Renewable Energy Cooperation in Europe: What Next? Drivers and Barriers to the Use of Cooperation Mechanisms", in *Energies*, Vol. 12, No. 1 (2019)

Samuel Carrara et al., *Raw Materials Demand for Wind and Solar PV Technologies in the Transition towards a Decarbonised Energy System*, Luxembourg, Publications Office of the European Union, 2020, https://op.europa.eu/s/vJi3

Rosaria Ciriminna et al., "Solar Energy and New Energy Technologies for Mediterranean Countries", in *Global Challenges*, Vol. 3, No. 10 (October 2019), Article 1900016, https://doi.org/10.1002/gch2.201900016

CITEPA, *Enhancement of Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) for the Southern and Eastern Mediterranean (SEMed) Region. Regional Analysis on Nationally Determined Contributions (NDCs) – 2nd phase*, Barcelona, Union for the Mediterranean, 2020, https://ufmsecretariat.org/wp-content/uploads/2021/01/Enhancement-of-NDCs-in-the-SEMed-Region_WEB.pdf

Silvia Colombo and Andrea Dessì, "Collective Security and Multilateral Engagement in the Middle East: Pathways for EU Policy", in *IAI Papers*, No. 20|37 (November 2020), https://www.iai.it/en/node/12388

Christopher Cooper and Benjamin K. Sovacool, "Miracle or Mirage? The Promise and Peril of Desert Energy Part 1", in *Renewable Energy*, Vol. 50 (February 2013), p. 628-636

Council of the European Union, *Climate and Energy Diplomacy - Delivering on the External Dimension of the European Green Deal*, 25 January 2021, https://www.consilium.europa.eu/media/48057/st05263-en21.pdf

DESERTEC, *Clean Power from Deserts. The Desertec Concept for Energy, Water and Climate Security*, WhiteBook fourth ed., Bonn, Protext Verlag, February 2009, https://www.earthpolicy.org/downloads/articles/trec_white_paper.pdf

Myriam Douo, "Climate Colonialism and the EU's Green Deal", in *Al Jazeera*, 23 June 2021, https://aje.io/rnvwvr

Philippe Drobinski et al., "Energy Transition in the Mediterranean", in Wolfgang Cramer, Joël Guiot, Katarzyna Marini (eds.), *Climate and Environmental Change in the Mediterranean Basin. Current Situation and Risks for the Future. First Mediterranean Assessment Report*, Marseille, Union for the Mediterranean, Plan Bleu, UNEP/MAP, p. 265-322, https://www.medecc.org/?p=3506

Philippe Drobinski et al., "How Warmer and Drier Will the Mediterranean Region Be at the End of the Twenty-First Century?", in *Regional Environmental Change*, Vol. 20, No. 3 (September 2020), Article 78

Philippe Drobinski et al., "Scaling Precipitation Extremes with Temperature in the Mediterranean: Past Climate Assessment and Projection in Anthropogenic Scenarios", in *Climate Dynamics*, Vol. 51, No. 3 (August 2018), p. 1237-1257, https://doi.org/10.1007/s00382-016-3083-x

Equinox, *Towards Climate Justice. Rethinking the European Green Deal from a Racial Justice Perspective*, Brussels, May 2021, https://www.equinox-eu.com/wp-content/uploads/2021/06/Towards-Climate-Justice-Equinox.pdf

Gonzalo Escribano and Lara Lázaro, "Balancing Geopolitics with

Green Deal Recovery: In Search of a Comprehensive Euro-Mediterranean Script", in *Elcano Royal Institute Analyses (ARI)*, No. 95/2020 (15 July 2020), https://www.realinstitutoelcano.org/en/analyses/ari95-2020-escribano-lazaro-balancing-geopolitics-with-green-deal-recovery

Gonzalo Escribano et al., "Geopolitical Context for CSP in Europe", in *MUSTEC Project Deliverables*, No. 6.4 (March 2019), https://www.mustec.eu/node/91

Benoît Esnault, Matteo Lambicchi and Veronica Lenzi, *Regulatory Options for the Stimulation of Infrastructure Investments*, Milan, MEDREG Electricity Working Group, 29 November 2018, http://www.medreg-regulators.org/PG/Pubdetail.aspx?IDUNI=nccnewhnudq3iulgfjvg3vdj7687

European Commission, *The European Green Deal* (COM/2019/640), 11 December 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640

European Commission, *'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality*, (COM/2021/550), 14 July 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0550

European Commission, *A New Approach for a Sustainable Blue Economy in the EU. Transforming the EU's Blue Economy for a Sustainable Future* (COM/2021/240), 17 May 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0240

European Commission, *Proposal for a Regulation Establishing a Carbon Border Adjustment Mechanism* (COM/2021/564), 14 July 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0564

European Commission, *Renewed Partnership with the Southern Neighbourhood. A New Agenda for the Mediterranean* (JOIN/2021/2), 9 February 2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021JC0002

European Commission, *Renewed Partnership with the Southern Neighbourhood Economic and Investment Plan for the Southern Neighbours* (SWD/2021/23), 9 February 2021, https://eur-lex.europa.

eu/legal-content/EN/TXT/?uri=CELEX:52021SC0023

European Technology and Innovation Platform for Ocean Energy, *Strategic Research Agenda for Ocean Energy*, Ocean Energy Europe, 2016, https://www.oceanenergy-europe.eu/wp-content/uploads/2017/03/TPOcean-Strategic_Research_Agenda_Nov2016.pdf

Jaime D. Fernández M. and Ashanapuri Herta, *Regional Analysis of (I) NDCs in the SEMed Region*, Barcelona, Union for the Mediterranean, 2020, https://www.medecc.org/?p=2753

Luca Franza, "Greening the Mediterranean: Pathways for Sustainable Energy and Climate Cooperation", in Andrea Dessì, Daniele Fattibene and Flavia Fusco (eds), *Climate Change and Sustainability: Mediterranean Perspectives*, Rome, Nuova Cultura, July 2021, p. 113-135, https://www.iai.it/en/node/13843

Lion Hirth and Inka Ziegenhagen, "Balancing Power and Variable Renewables: Three Links", in *Renewable and Sustainable Energy Reviews*, Vol. 50 (October 2015), p. 1035-1051

Daniela Huber, "The New European Commission's Green Deal and Geopolitical Language: A Critique from a Decentring Perspective", in *IAI Papers*, No. 20|06 (April 2020), https://www.iai.it/en/node/11509

International Renewable Energy Agency (IRENA), *Power System Flexibility for the Energy Transition. Part 1: Overview for Policy Makers,* Abu Dhabi, IRENA, November 2018, https://www.irena.org/publications/2018/Nov/Power-system-flexibility-for-the-energy-transition

Henry Jeffrey, Brighid Jay and Mark Winskel, "Accelerating the Development of Marine Energy: Exploring the Prospects, Benefits and Challenges", in Technol*ogical* Forecast*ing and* Soci*al* Change, Vol. 80, No. 7 (September 2013), p. 1306-1316

Jakub Jurasz et al., "A Review on the Complementarity of Renewable Energy Sources: Concept, Metrics, Application and Future Research Directions", in *Solar Energy*, Vol. 195 (1 January 2020), p. 703-724, https://doi.org/10.1016/j.solener.2019.11.087

Georgios Marios Karagiannis et al., *Power Grid Recovery after Natural Hazard Impact*, Luxembourg, Publications Office of the European Union, 2017, https://op.europa.eu/s/vJld

Rafael Leal-Arcas and Stephen Minas, "The Micro Level: Insights from

Specific Policy Areas. Mapping the International and European Governance of Renewable Energy", in *Yearbook of European Law*, Vol. 35, No. 1 (Deceber 2016), p. 621-666, https://doi.org/10.1093/yel/yew022

Mark Leonard et al., "The Geopolitics of the European Green Deal", in Bruegel Policy Contributions, No. 04/21 (February 2021), https://www.bruegel.org/?p=40941

Mediterranean Transmission System Operators (Med-TSO), *Mediterranean Network Development Plan at 2020*, 2020, https://www.med-tso.com/publications4.aspx

Peter Meisen and Oliver Pochert, A Study of Very Large Solar Desert Systems with the Requirements and Benefits to Those Nations Having High Solar Irradiation Potential, Global Energy Network Institute (GENI), 2006, http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/solar/solar-systems-in-the-desert/Solar-Systems-in-the-Desert.pdf

Baraa Mohandes et al., "A Review of Power System Flexibility With High Penetration of Renewables", in *IEEE Transactions on Power Systems*, Vol. 34, No. 4 (July 2019), p. 3140-3155

Blanca Moreno-Dodson, *Enhancing Mediterranean Integration*, Marseille, Center for Mediterranean Integration, 2020, https://www.cmimarseille.org/node/4710

Blanca Moreno-Dodson, Silvia Pariente-David and Constantin Tsakas, *A Mediterranean Green Deal for an Effective Energy Transition as Part of the Sustainable Post-COVID Recovery*, Marseille, Center for Mediterranean Integration (CMI), November 2021, https://www.cmimarseille.org/node/4998

Antonio Moretti et al., "Grid Integration as a Strategy of Med-TSO in the Mediterranean Area in the Framework of Climate Change and Energy Transition", in *Energies*, Vol. 13, No. 20 (October 2020), Article 5307, https://doi.org/10.3390/en13205307

Rosamond L. Naylor et al., "The Ripple Effect: Biofuels, Food Security, and the Environment", in *Environment*, Vol. 49, No. 9 (November 2007), p. 30-43

Karsten Neuhoff et al., "Renewable Electric Energy Integration: Quantifying the Value of Design of Markets for International Transmission Capacity", in *Energy Economics*, Vol. 40 (November 2013), p. 760-772

David Newbery, Goran Strbac and Ivan Viehoffc, "The Benefits of Integrating European Electricity Markets", in *Energy Policy*, Vol. 94 (July 2016), p. 253-263

Observatoire méditerranéen de l'energie (OME), *Mediterranean Energy Perspectives 2018*, Paris, OME, 2018

Organisation for Economic Co-operation and Development (OECD), *Regional Integration in the Union for the Mediterranean. Progress Report*, Paris, OECD, 2021, https://doi.org/10.1787/325884b3-en

Musiliu O. Oseni and Michael G. Pollitt, "The Promotion of Regional Integration of Electricity Markets: Lessons for Developing Countries", in *Energy Policy*, Vol. 88 (January 2016), p. 628-638

Silvia Pariente-David, "Successful Grid Integration of Renewable Energy: Integration is the Name of the Game", in *IAEE Energy Forum*, First Quarter 2014, p. 29-30, https://www.iaee.org/en/publications/newsletterdl.aspx?id=223

Silvia Pariente-David and Houda Ben Jannet Allal, "North Africa: An Energy Bridge between the African and European Continents", in Lorenzo Colantoni, Giuseppe Montesano and Nicolò Sartori (eds), *Empowering Africa. Access to Power in the African Continent*, Bern [etc.], Peter Lang, 2019, p. 199-231

Florian Raymond et al., "Evolution of Mediterranean Extreme Dry Spells During the Wet Season Under Climate Change", in *Regional Environmental Change*, Vol. 19, No. 8 (December 2019), p. 2339-2351

Gustav Resch et al., *Dialogue on a RES Policy Framework for 2030*, Final Report of the Towards 2030-Dialogue Project, 2017

Takvor H. Soukissian et al., "Marine Renewable Energy in the Mediterranean Sea: Status and Perspectives", in *Energies*, Vol. 10, No. (2017), Article 1512, https://doi.org/10.3390/en10101512

Simone Tagliapietra, *Energy Relations in the Euro-Mediterranean. A Political Economy Perspective*, Cham, Palgrave Macmillan, 2017

Sebastian Timmerberg and Martin Kaltschmitt, "Hydrogen from Renewables: Supply from North Africa to Central Europe as Blend in Existing Pipelines – Potentials and Costs", in *Applied Energy*, Vol. 237 (1 March 2019), p. 795-809

Isabelle Tobin et al., "Vulnerabilities and Resilience of European Power Generation to 1.5 °C, 2 °C and 3 °C Warming", in *Environmental Research Letters*, Vol. 13, No. 4 (April 2018), Article 044024, https://doi.org/10.1088/1748-9326/aab211

Michelle T.H. van Vliet et al., "Impacts of Recent Drought and Warm Years on Water Resources and Electricity Supply Worldwide", in *Environmental Research Letters*, Vol. 11, No. 12 (December 2016), Article 124021, https://doi.org/10.1088/1748-9326/11/12/124021

Michelle T.H. van Vliet et al., "Power-Generation System Vulnerability and Adaptation to Changes in Climate and Water Resources", in *Nature Climate Change*, Vol. 6 (2016), p. 375-380

Ad van Wijk, Els van der Roest and Jos Boere, *Solar Power to the People*, Amsterdam, IOS Press, 2017, https://ebooks.iospress.nl/book/solar-power-to-the-people

Ad van Wijk and Frank Wouters, "Hydrogen–The Bridge Between Africa and Europe", in Margot P. C. Weijnen, Zofia Lukszo and Samira Farahani (eds), *Shaping an Inclusive Energy Transition*, Cham, Springer, 2021, p. 91-119, https://doi.org/10.1007/978-3-030-74586-8_5

Peter F. Varadi, Frank Wouters and Allan R. Hoffman, *The Sun Is Rising in Africa and the Middle East. On the Road to a Solar Energy Future*, Singapore, Pan Stanford Publishing, 2018

Charlotte von Möllendorff and Heinz Welsch, "Measuring Renewable Energy Externalities: Evidence from Subjective Well-Being Data", in *SOEPpapers on Multidisciplinary Panel Data Research*, No. 779 (2015), http://hdl.handle.net/10419/115874

Charles J. Vörösmarty et al., "Anthropogenic Sediment Retention: Major Global Impact from Registered River Impoundments", in *Global and Planetary Change*, Vol. 39, No. 1-2 (October 2003), p. 169-190

Zia Weise, "EU's Looming Carbon Tax Nudged Turkey toward Paris Climate Accord, Envoy Says", in *Politico*, 6 November 2021, https://www.politico.eu/?p=1883551

World Bank, *Beyond the Political Economy of Electricity and Gas Trade in* *the Middle East and North Africa Region*, Washington, World Bank, May 2020, http://hdl.handle.net/10986/35590

World Bank, "Regional Power Sector Integration. Lessons from Global Case Studies and a Literature Review", in *ESMAP Briefing Notes*, No. 004/10 (June 2010), http://hdl.handle.net/10986/17507

World Bank, *The Value of Trade and Regional Investments in the Pan-Arab Electricity Market. Integrating Power Systems & Building Economies*, Washington, World Bank, October 2021, http://hdl.handle.net/10986/36614

Christiane Zarfl et al., "A Global Boom in Hydropower Dam Construction", in *Aquatic Science*, Vol. 77, No. 1 (January 2015), p. 161-170

Stefano Zecchetto and Francesco De Biasio, "Sea Surface Winds over the Mediterranean Basin from Satellite Data (2000–04): Meso- and Local-Scale Features on Annual and Seasonal Time Scales", in *Journal of Applied Meteorology and Climatology*, Vol. 46, No. 6 (2006), p. 814-827, https://doi.org/10.1175/JAM2498.1

Florian Zickfeld et al., *Desert Power 2050. Perspectives on a Sustainable Power System for EUMENA*, Munich, Dii, June 2012, http://www.desertec-uk.org.uk/reports/DII/DPP_2050_Study.pdf

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T20 INDONESIA 2022 THINK

Policy Brief

MOVING TOWARDS A VIRTUOUS CLIMATE-WATER-ENERGY-FOOD NEXUS

Task Force 3

Governing Climate Targets, Energy Transition, and Environmental Protection

MOVING TOWARDS A VIRTUOUS CLIMATE-WATER-ENERGY-FOOD NEXUS

Task Force 3

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Abstract

Water, energy and food (WEF) nexus and climate change are strongly interlinked through multiple bidirectional interactions. So far, countries' approach to WEF policy-making has been largely supply-oriented, in silos, and completely disconnected from climate change issues, triggering a vicious circle that has favoured trade-offs rather than synergies across resources, sectors, and even societal and environmental goals. These challenges call for a paradigm shift to turn the conventional WEF nexus into a virtuous circle. Moreover, global warming and climate variability imply the need for adding to the nexus the climatic dimension, which requires a further inter-sectoral response. To face these challenges four main actions are identified: mainstreaming climate change into the WEF nexus; decouple water, energy and food production from fossil fuels; recognise the role of forests in water security, and thus food and energy security, through their ecosystem services; develop sustainable WEF intra-regional and inter-regional cooperation/integration models based on the principle of comparative advantages. Specific recommendations are drawn for the way forward.

Challenges

Water, energy and food (WEF) are strictly interrelated through different types of nexus linkages, which require different analytical tools to systematically analyse the interactions between natural and human systems, and innovative solutions to move towards a more coordinated management and sustainable use of natural resources across sectors and scales. The most visible kind of relationship in the WEF nexus are direct dependencies, as energy depends on water for power generation, the extraction, transport and processing of fossil fuels, and the irrigation of biofuel crops; water provision depends on energy for its abstraction, purification and distribution; and food production needs water, productive land and energy to grow crops, maintain livestock and process food. In addition to direct dependencies, the nexus is further complicated by the fact that WEF are affected by several dynamic exogenous variables (Burnett and Wada, 2018). Population growth, migration flows, socio-economic development, anthropogenic pressures and climate change impacts influence demand, distribution, availability and accessibility of the WEF resources over time and space. As the demand for resources increases with population growth and changing consumption patterns, in a context of resources scarcity and climate change impacts, not only the nexus interlinkages intensify, but also direct competitions or trade-offs between sectors increase, limiting countries' ability to meet the growing demand in a sustainable manner (Markantonis et al., 2019). Particularly, climate change both affects and is affected by the WEF nexus through multiple bidirectional interactions that intertwine within the web of WEF interconnections (Rasul and Sharma, 2016). Climate change drives a series of phenomena that have negative effects on WEF security, exacerbating nexus conflicts: rising temperatures, changes in precipitation patterns, extreme weather events and rising sea-levels may gradually alter the balance between the nexus resources, and even the nature of their interactions (Cramer et al., 2018). Moreover, current sectoral approaches to climate change mitigation and adaptation may amplify rather than reduce negative externalities and trade-offs within the nexus. While some sector-oriented mitigation and adaptation measures may have the potential to trigger synergistic "win–win" opportunities across one or more of the other components of the nexus, other measures, such as hydropower, first generation biofuels, the shift to non-conventional water resources and agricultural intensification, are not always nexus-smart. At the same time, WEF production may increase greenhouse gas (GHG) emissions contributing to climate change, while effective climate change mitigation and adaptation strategies require the efficient use of land, water and energy and coordinated efforts to minimise trade-offs and maximise synergies.

Although the raising awareness of the WEF nexus challenges and the priority given to climate change in the political agenda, little attention has been given so far to the linkages between the WEF nexus and climate change as well as to the opportunity of developing nexus-based mitigation and adaptation responses. The need to meet the rapidly growing demand for WEF in an increasingly resource-constrained climate change scenario, associated with WEF conventional policy and decision making in silos, have fueled a vicious circle. These challenges call for a paradigm shift to turn the conventional WEF nexus into a virtuous circle in line with the United Nations Sustainable Development Goals (SDGs) and the COP21 Paris climate change commitments.

Addressing climate change and turning the WEF nexus into a virtuous circle call for a number of actions, such as adding into the WEF nexus the climatic dimension; promoting renewable energy as a means of integrated solutions for enhancing security of supply across the three sectors, while simultaneously supporting global climate ambitions; recognising the role of forests in WEF security through their ecosystem services; applying the nexus thinking beyond national borders to encourage WEF exchanges between countries in an economically efficient and environmentally sound manner.

Proposal

Turning the WEF nexus from a vicious cycle of scarcity, competition and conflict into a virtuous cycle of resilience, sustainable resources management, cooperation and security is a prerequisite to allow countries to implement their commitments under the Paris Agreement and Agenda 2030 and to strengthen countries' ability to deal with the impacts of climate change. To face these challenges three main actions are identified:

1. mainstreaming climate change into the WEF nexus: identifying and quantifying the interactions between the WEF nexus and climate change as well as developing nexus-based mitigation and adaption approaches, which integrate a nexus perspective into climate change policy and plans;

2. decoupling WEF production from fossil fuels: increasing renewable energy as an effective tool to face countries' pressing WEF and climate change challenges;

3. developing sustainable WEF intra-regional and inter-regional cooperation/integration models based on the principle of comparative advantages: applying the nexus thinking beyond national borders to promoting economically efficient and environment-friendly WEF exchanges between countries.

MAINSTREAMING CLIMATE CHANGE INTO THE WEF NEXUS

Countries and governments' approach to WEF management has been largely supply-oriented, in silos and completely disconnected from climate change policy, leading to several incoherencies: between WEF planning and social and environmental objectives and between WEF and climate change actions. Bridging these disconnects requires a shift in decision-making processes to explicitly consider the interlinkages and interdependencies between sectors, detect the interactions between the WEF nexus and climate change and develop nexus-oriented climate change responses, which integrate a nexus perspective into climate change mitigation and adaptation strategies.

To ensure the mainstreaming of climate change into the WEF nexus, it is recommended to undertake the following measures and actions:

- Deepen the knowledge and understanding of the interlinkages between the WEF nexus and climate change. Internalise this knowledge into mitigation and adaptation strategies.

- Strengthen institutional capacity for coordinating the nexus and climate change issues in a holistic way. This calls for applying capacity building instruments, notably technical training and education, to provide institutions with human resources having a greater capability to correctly plan, manage and allocate the available resources among the competing sectorial uses and for effective mitigation and adaptation actions.
- Improve governance and collaboration among stakeholders and between stakeholders and governments, encouraging strong coordination mechanisms, implemented also through nexus-based policy dialogues, where key stakeholders can identify and prioritise solutions together, accepting decisions that, although not optimal from a single sector policy goal, can give benefits from an overall nexus perspective (Mohtar and Daher, 2016).
- Strengthen policy integration between the WEF nexus and mitigation and adaptation mechanisms. This approach may be managed by integrating the nexus perspective into mitigation and adaptation plans, as well as by mitigation and adaptation perspectives into development plans for better policy integration. For effective integration, it is critical to recognise the importance of the nexus perspective, promote system-wise mitigation and adaptation approaches, integrate multiple policy objectives so that different responses and measures support each other, synergies are enhanced, and trade-offs are minimised (Ringler et al., 2013).

The Group of 20 (G20) can take a number of actions to strengthen the integration between the WEF nexus challenges and climate change issues, such as including the knowledge dimension as a fundamental tool in providing the necessary scientific support for promoting rational and inclusive dialogue and decision-making processes; building capacity for policy-makers and designing mechanisms to ensure proper coordination, complementarities and harmonisation among different sectoral strategies, policies and plans to turn the “nexus thinking” into “nexus doing”.

DECOUPLE WEF FROM FOSSIL FUEL

Since the WEF nexus includes the main drivers of climate change and the main sectors affected by the impact of global warming, and energy represents both a critical input along different stages of the water and food supply chain and by far the largest source of GHG, renewable energy technologies should be considered the first step towards sustainable integrated solutions able to enhance security and sustainability across sectors, while supporting global climate ambitions. In the MENA region, for example, renewable energy technologies may provide access to a cost-effective, secure and environmentally sustainable supply of energy, simultaneously triggering spill-over effects in the water and food sectors. The MENA countries have a high potential in renewable energy development, especially solar, for the presence of vast desert lands with a solar radiation density ranging between 1,300 and 2,500 kWh/m2 per year (IRENA, 2015). Generally, renewable energy technologies are less water intensive than conventional options. Water needs for solar photovoltaics (PV) and wind are negligible compared to conventional thermoelectric generation, withdrawing up to 200 times less water to produce the same amount of electricity (IRENA, 2015). In addition to contributing to significant water savings, clean energy can be used to increase non-conventional water supply, such as desalinated water, whose production is still affected by high economic and environmental costs as a result of the considerable amount of fossil energy necessary to feed the reverse osmosis. Great opportunities emerge from those projects aimed at increasing renewable energy in order to optimize the link between clean energy, food, and unconventional water. The use of renewables would not only satisfy the energy demand of those countries that do not have sufficient oil reserves, but also improve the resilience and adaptive capacity of those countries that due to environmental constraints and the scarcity of two strategic resources for human well-being – water and food – are more vulnerable to the impact of climate change.

To enhance the transition towards both renewable energy and non-conventional water, it is recommended to undertake the following measures and actions:

- Reform the subsidy and tax system to “internalize” environmental and social externalities, promote more sustainable production and consumption patterns across sectors, make the polluter-pays principle operational, and take into account equity considerations (Burnett and Wada, 2018).

- Encourage the development of renewable energy technologies with the help of international financing, the development of non-conventional and innovative means of financing, and the removal of institutional, technical, regulatory and economic barriers (Halalsheh et al., 2018).

- Strengthen the nexus between non-conventional energy (renewable) and non-conventional water sources (treated wastewater and desalinated water) to address climate change mitigation and adaptation. Cross-sectoral projects still penalised by sectoral institutional landscape, should be encouraged to promote win–win options for nexus security and mitigation and adaptation objectives, bridging institutions, engaging stakeholders at different levels, and favouring unconventional funding mechanisms for nexus solutions.

- Incorporate the key principles of the green and circular economy into the WEF nexus through multi-functional production systems and cross-resources and cross-sector recycling. Incentivise green and circular economy adoption in WEF projects applying a mix of different policy instruments, including market and non-market instruments and strategies to harvest technological synergies, minimise waste and generate co-products and co-benefits.

The G20 should select and design effective economic instruments to minimise market distortions, incentivise conservation of resources, take into account equity considerations, and encourage private sector engagement; incentivise the development of renewable energy through non-conventional and innovative means of financing and the removal of institutional, technical, regulatory and economic barriers; scale up, replicate and fund projects based on the nexus approach and on the principles of the green and circular economy.

RECOGNISE THE ROLE OF FORESTS IN WEF SECURITY THROUGH THEIR ECOSYSTEM SERVICES

The increasing scarcity of natural resources and the rising competition among WEF in a scenario of population growth and climate change impacts pose serious threats to forests and their ecosystem services. Despite the relative abundance of soil and water resources which characterises tropical forest countries, because of increasing demand associated with pressures on resources from climate change and environmental degradation, the relevance of competition for natural resources is increasing, putting real challenges for reconciling development goals across WEF sectors and environmental protection. Policy gaps and conflicts between agricultural production and forest conservation targets call for breaking trade-offs over land and water for agriculture and energy production to achieve WEF security targets and meet forest-conservation concerns (Bellfield et al., 2017). Forests play a vital role in water security and thus food and energy security through their water regulation and purification services. While investing in water infrastructure such as irrigation networks and water storage is a shared goal across the WEF sectors, water security objectives clearly recognise the role of investment in forest conservation as “natural” infrastructure for improving downstream water supply for agriculture and energy production, generating co-benefits such as emissions reductions, biodiversity protection and forest-based employment and livelihoods.

The WEF nexus analysis carried out in tropical forest countries such as Brazil, Colombia, Peru and Indonesia, highlights the need to implement strategies able to both mitigate land use trade-offs and support multiple sectoral targets, including the prioritisation of degraded land for agricultural expansion, increases in agricultural productivity and energy-efficiency, and investment in forest conservation for improving downstream water supply (Sabogal, Bellfield and Bauch, 2016; Bellfield et al., 2017).

To reconcile WEF security targets and forest-conservation objectives it is recommended to undertake the following measures and actions:

- Reform the subsidy and tax system to "internalize" environmental and social externalities, promote more sustainable production and consumption patterns across sectors, make the polluter-pays principle operational, and take into account equity considerations (Burnett and Wada, 2018).

- Encourage the development of renewable energy technologies with the help of international financing, the development of non-conventional and innovative means of financing, and the removal of institutional, technical, regulatory and economic barriers (Halalsheh et al., 2018).

- Strengthen the nexus between non-conventional energy (renewable) and non-conventional water sources (treated wastewater and desalinated water) to address climate change mitigation and adaptation. Cross-sectoral projects still penalised by sectoral institutional landscape, should be encouraged to promote win–win options for nexus security and mitigation and adaptation objectives, bridging institutions, engaging stakeholders at different levels, and favouring unconventional funding mechanisms for nexus solutions.

- Incorporate the key principles of the green and circular economy into the WEF nexus through multi-functional production systems and cross-resources and cross-sector recycling. Incentivise green and circular economy adoption in WEF projects applying a mix of different policy instruments, including market and non-market instruments and strategies to harvest technological synergies, minimise waste and generate co-products and co-benefits.

The G20 countries should work together to protect and restore valuable ecosystems such as tropical forests, using blended finance structures to increase impactful investment in high-value nature locations. Institutional changes and adaptations should also be carried out towards integrated, bottom-up and co-governance approaches.

DEVELOP SUSTAINABLE WEF INTRA-REGIONAL AND INTER-REGIONAL COOPERATION/INTEGRATION MODELS BASED ON THE PRINCIPLE OF COMPARATIVE ADVANTAGES

As the WEF nexus approach helps to enhance complementarities and synergies across the three sectors, when it crosses national borders prompting countries to cooperate taking as reference their relative comparative advantages, the potential net benefits may increase. This approach should be adopted at both intra-regional and inter-regional level, considering the differences and variation in factor endowments at country level (IUCN ROWA, 2019). At regional level, the WEF nexus approach provides opportunity for building regional resilience to climate change, mitigating vulnerabilities through coordinated WEF infrastructure development, improved management of transboundary natural resources, and optimising regional comparative advantages for WEF production. The MENA region may gain from the mutual dependencies triggered by this model of regionally integrated water and energy sectors, enforcing interdependencies among countries and addressing water, energy and food security in an economically efficient and environmentally sound manner (Shannak et al., 2018). The Pre-Feasibility Study for Mid-East Water-Renewable Energy Exchanges carried out jointly by EcoPeace Middle East and the Konrad-Adenauer-Stifttung (2017) demonstrates the potential benefits when the nexus approach crosses national borders. At the interregional level, by incorporating the concept of comparative advantages into the WEF nexus framework, great opportunities may arise from hidden virtual flows of WEF embodied in international trade, with significant economic, political and environmental benefits. Fostering transboundary cooperation and enforce interdependencies among countries, may address WEF security in an economically efficient and environmentally sound manner and simultaneously help countries to meet their targets set by the Paris Agreement (Kennou et al., 2018; Shannak et al., 2018).

To foster sustainable WEF cooperation/integration models, it is recommended to undertake the following measures and actions:

- Incorporate the comparative advantages concept into the WEF nexus.
- Develop regional outlooks on WEF resources to highlight inter-variability among countries and make effective use of countries' comparative advantages.
- Elaborate footprint assessments of natural resources as effective tools for exploring options for resources reallocation among sectors and quantifying the impacts of policy measures on the WEF nexus and the environment.
- Promote a nexus approach as a strategic starting point for capacity-building activities and agreements to share data and information systems.
- Design trade policies to ensure the integration and complementarities of WEF policies.
- Invest and trade in green and efficient water, energy and agricultural technologies in order to contribute to the integrated and sustainable planning and management of resources.
- Promote trade agreements to improve cross-border cooperation to build WEF exchange models based on countries' comparative advantages.

The G20 can take a strong role in guiding both intra-regional and inter-regional cooperation based on the principle of comparative advantages, removing barriers and introducing incentives to cooperation mechanisms as well as associating countries in coordinating common WEF strategies, and harmonising regulatory and technical standards.

References

Helen Bellfield, David Sabogal, Jeni Pareira, Adi Gangga, and Matt Leggett, Achieving Water, Energy and Food Security in Indonesia, Global Canopy Programme in partnership with WCS Indonesia Program, January 12th, 2017.

Kimberly Burnett and Christopher A. Wada, “Accounting for Externalities in the Water Energy Food Nexus”, in Aiko Endo and Tomohiro Oh (eds), The Water-Energy-Food Nexus. Human-Environmental Security in the Asia-Pacific Ring of Fire, Singapore, Springer, 2018, p. 261–272.

Wolfgang Cramer et al. “Climate Change and Interconnected Risks to Sustainable Development in the Mediterranean”, in Nature Climate Change, Vol. 8, No. 10 (2018), p. 972–980.

Maha Halalsheh, Taha Ouarda, and Odeh Al-Jayousi, The Water-Energy-Food Nexus in the Arab Region. Nexus Technology and Innovation Case Studies, Policy Brief No. 6, Cairo, Egypt, League of Arab States (LAS), 2018.

IRENA, Renewable Energy in the Water, Energy and Food Nexus, Abu Dhabi, International Renewable Energy Agency, 2015.

IUCN ROWA, Nexus Comprehensive Methodological Framework: The MENA Region Initiative as a Model of Nexus Approach and Renewable Energy Technologies (MINARET), Amman, Jordan, IUCN, 2019.

David Katz and Arkadiy Shafran (eds), Water-Energy Nexus. A Pre-feasibility Study for Mid-East Water-Renewable Energy Exchanges, Amman, EcoPeace Middle East & Konrad-Adenauer-Stifttung, 2017.

Hachmi Kennou, Gert Soer, Emanuela Menichetti, Fattoum Lakhdari, and Desirée Quagliarotti, The Water-Energy-food Security Nexus in the Western Mediterranean. Development and Sustainability in the 5+5 Area, IEMed Policy Study No. 4, Barcelona, IEMed & Medthink 5+5, 2018.

Vasileios Markantonis et al., “Can the Implementation of the Water-Energy-Food Nexus Support Economic Growth in the Mediterranean Region? The Current Status and the Way Forward”, in Frontiers in Environmental Science, Vol. 7, art. 84 (2019).

Rabi H. Mohtar and Bassel Daher, “Water-Energy-Food Nexus Framework for Facilitating Multi-Stakeholder Dialogue”, in Water International, Vol. 41, No. 5 (2016), p. 1-7.

Golam Rasul and Bikash Sharma, “The Nexus Approach to Water–Energy–Food Security: An Option for Adaptation to Climate Change”, in Climate Policy, Vol. 16, No. 6 (2016), p. 682-702.

Ringler, C., Bhaduri A., and Lawford R., “The Nexus Across Water, Energy, Land and Food (WELF): Potential for Improved Resource Efficiency?”, in Current Opinion in Environmental Sustainability, Vol. 5, No. 6 (2013), p. 617–624.

David Sabogal, Helen Bellfield, and Simone Bauch, Amazonia Security Agenda. Assessing Policy Coherence in Brazil, Colombia and Peru using a Water-Energy-Food Nexus Approach, Policy Brief, The Global Canopy Programme, July 2016.

Sa'd Shannak, Daniel Mabrey, and Michele Vittorio, “Moving from Theory to Practice in the Water-Energy-Food Nexus: An Evaluation of Existing Models and Frameworks”, in Water-Energy Nexus, Vol. 1 (2018), p. 17-25.

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WATER ENERGY NEXUS

A PRE-FEASIBILITY STUDY FOR MID-EAST WATER-RENEWABLE ENERGY EXCHANGES

EcoPeace Middle East

Konrad Adenauer Stiftung

THE PROJECT PARTNERS

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1. INTRODUCTION

The Levant area of the Middle East suffers from scarce supplies of fresh water and lacks developed renewable energy supplies. The region is also facing rapid population growth and climatic change, placing additional pressures on limited natural resources. As such, the region's countries are in need of long-term strategic planning in the water, energy and land-use sectors.

Israel and Palestine have access to the Mediterranean, and thus, relatively easy access to desalination, but have relatively little open spaces necessary for large scale renewable energy facilities; whereas Jordan's access to the sea is far from its population centers, but it has a relatively large amount of unpopulated spaces that are very suitable for producing renewable energy, particularly solar. This report presents a pre-feasibility study of an initiative for water-energy exchanges between Israel, Jordan and Palestine as a means of addressing water and energy needs in an economically efficient and environmentally sound manner. The overarching idea is that Israel and/or Palestine could produce desalinated water and supply this to Jordan, while Jordan could supply Palestine and Israel with renewable energy. As such, all sides stand to gain from mutual dependencies of regionally integrated water and energy sectors.

As a pre-feasibility study, the objective is to present a workable framework for how such an arrangement could be implemented, to evaluate various technological options for achieving such an arrangement, to undertake initial economic analysis of such a project, and to identify political benefits and challenges to project implementation. The following sub-sections in this introduction will present a brief survey of some of the resource scarcity issues facing the region, followed by a description of some of the policies in place to address these issues, and finally a more detailed description of and rationale for the proposed water-energy exchanges.

1.1. Regional Resource Scarcity

Water

Annual renewable freshwater supplies (accessible net recharge) among Jordan, Palestine, and Israel collectively are less than 3000 million cubic meters (mcm).[1] Distributed across a population of over 22 million (including refugees and other non-citizens currently residing in Jordan), this means that the region's population has less than 150 cubic meters per capita annually (m^3/c/y). For reference, the commonly used Falkenmark index of water stress, indicates that countries with annual supplies of less than 1000 m^3/c/y suffer from water scarcity and those with less than 500 m^3/c/y suffer from chronic water scarcity.[2,3] Thus, the region as a whole (and each of the countries individually) must deal with severe chronic water scarcity.

Due to rapid population growth in the region coupled with predicted decreases in rainfall and increased evaporation due to climate change, the quantities of water available per capita are expected to drop even lower. All three countries still have growing populations due to high fertility rates, and, in the case of Jordan, a massive influx of refugees in recent years. In addition, precipitation in the region is predicted to decrease due to climate change

1 Allan, J.A., A.I.H. Malkawi, and Y. Tsur. 2014. Red Sea–Dead Sea Water Conveyance Study Program Study of Alternatives Final Draft Report Executive Summary and Main Report.

2 Falkenmark, M. and Lindh, G. (1976). Water for a Starving World. Westview Press: Boulder, CO, USA.

3 Lawrence, P., Meigh, J. and Sullivan, C.. (2002). The Water Poverty Index: an International Comparison. Keele Economics Research Papers 2002/19. Keele University. UK.

by over 20% in several climate scenarios,[4,5,6] and there are already indications that this process is already in effect, reducing average annual renewable water supplies.[7] These developments are adding to the existing pressures currently placed on natural water resources and thus, the countries are actively seeking the development of additional water sources.

Energy

At present all three nations are highly dependent on imported fossil fuels for their energy production. Energy usage in general, and electricity consumption in particular, have been rising at rates faster than the rate of population growth, due to economic growth and changes in lifestyle. This places heavy economic, political, and environmental costs on the countries of the region. Imports of fossil fuels represent a major drain on foreign currency reserves.[8] Palestine relies on Israel for over 90% of its energy (electricity and fuels). Jordan, which imports 96% of its energy, needs, spends the equivalent of roughly 20% of the nation's total Gross Domestic Product (GDP) for its energy imports.[9,10] Imports from outside the region have also been precarious and subject to disruption due to political events outside of the region, as was demonstrated by the cessation of natural gas supplies to the region from Egypt on multiple occasions following the outbreak of the Arab Spring.

Fossil fuel based energy sources also have numerous deleterious environmental impacts, including both local air pollution as well as contributing to global greenhouse gas emissions (GHG). Per capita GHG emissions in Israel are more than double world averages, and local air pollution in Israel alone, stemming in large part from fossil fuel use, was found to be responsible for 2,200 premature deaths annually.[11] Palestine, while contributing much less to GHG emissions, likely suffers from similar local pollution impacts. Jordan's GHG emissions are below world averages, however, the Kingdom has levels of energy intensity and carbon emissions per unit of economic production (as measured by GDP) far above world averages.[12,13,14]

Land

The region is also densely populated, which places continuous pressure on rapidly diminishing open spaces. In a United Nation's ranking of population density based on figures 2015, both Palestine and Israel were among the most densely populated nations.[15] The Gaza Strip is considered one of the most densely populated areas in the world, trailing only behind city states such as Hong Kong, Singapore, and Monaco. The West Bank also ranks among the world's most crowded areas.[16]

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4 Alpert, P.; Krichak, S.O.; Shafir, H.; Haim, D.; Osetinsky, I. (2008). Climatic trends to extremes employing regional modeling and statistical interpretation over the E. Mediterranean. Global Planetary Change 63: 163–170.

5 Paz, S.; Kutiel, H. (2003). Rainfall Regime Uncertainty (RRU) in an Eastern Mediterranean region—A methodological approach. Israel Journal of. Earth Science 52, 47–63.

6 The World Bank. (2012). The Little Data Book on Climate Change 11. The World Bank: Washington, DC, USA. (Climate Data Surveys for Israel, Jordan, and West Bank & Gaza).

7 Israeli Water Authority. 2012. Long-Term Master Plan for the National Part A - Policy Document Version 4 August 2012.

8 Younan, M.,and E. Popper. (2012). Regional Cooperation in Energy. In: Arnon,A, and S. Bamya (Eds.),The Arab Peace Initiative and Israeli-Palestinian Peace. Aix Group, pp.300–359.

9 El-Katiri, L. (2014). A Roadmap for Renewable Energy in the Middle East and North Africa. Oxford Institute for Energy Studies. OIES Paper MEP 6.

10 World Nuclear Association. (2017). Nuclear Power in Jordan. http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/jordan.aspz

11 Rinat, T. (2017). 2200 people die each year in Israel due to exposure to air pollution. Haaretz 15 March, 2017. (In Hebrew)

12 https://knoema.com/EIAIES2014Aug/international-energy-statistics-february-2015?location=1001200

13 Regional Center for Renewable Energy and Energy Efficiency (RCREEE). (2015a). Arab Future Energy Index (AFEX) 2015 – Energy Efficiency.

14 The World Bank. World Development Indicators website. http://data.worldbank.org/data-catalog/world-development-indicators

15 United Nations. (2017). World Population Prospects: The 2017 Revision. United Nations, Department of Economic and Social Affairs, Population Division.

16 The World Bank. (2017). World Development Indicators website. http://data.worldbank.org/indicator/EN.POP.DNST

Moreover, access to land is also an issue in the West Bank. Land use there is highly restricted due to regulations and policies put in place by the Israeli Civil Administration, inhibiting development there, including development of renewable resources.[17] In Israel, most of the remaining open spaces are in the southern desert, where much of the lands are either reserved for military use or are natural reserves and other protected areas.[18]

Jordan, on the other hand, while the most populated of the three countries, is much less densely populated. Much of Jordan's population is concentrated in the Amman metropolitan area and the Jordan Valley, with much of the eastern and southern portions of the country largely unpopulated with a relatively large amount of open spaces.

Table1 - Population Density

Territory	People per square kilometer	
	2015 estimates	2030 forecast
Gaza Strip	5,046	
West Bank	466	
Palestine (West Bank and Gaza)	775	1,124
Israel	409	481
Jordan	103	134

Sources:[15,17] and official government population growth estimates.

17 World Bank Group. (2017). Securing Energy for Development in West Bank and Gaza. Summary Report. June 13, 2017.

18 For example, in Israel's four largest regional councils all located in desert areas in the country's south, protected areas represent between 50-72% of the total land. http://moazot-green.com

1.2. Efforts at Addressing Scarcity

Water

In terms of addressing water scarcity, for years, policy in the region has been to withdraw unsustainable amounts of water, depleting and contaminating aquifers and desiccating streams and other aquatic ecosystems. Despite the development of alternative water sources, as will be discussed shortly, this policy continues till this day. While all three countries have stressed the importance of efficiency, there is growing recognition that the absolute scarcity they face, coupled with growing populations and climate change, necessitates additional water resources. Desalination has emerged as the primary source of such additional water supplies.

Israel is considered a world leader in developing and applying technologies to address limited water supplies,[19] including development of large-scale reverse osmosis (RO) sea-water desalination. Since the activation of the first large sea-water RO plant in Ashkelon in 2005, desalination has added a quantity equivalent to an additional 40% of Israel's natural renewable freshwater supplies. Desalination currently supplies almost 80% of all domestic consumption. While not solving water scarcity issues, desalination has at least allowed for Israel to maintain safe reliable water supplies for domestic purposes for a growing population. Given that roughly 80% of municipal water is reused in Israel, each cubic meter of desalinated water actually adds 1.8 cubic meters to the national water budget.

Development of desalination is also high on the agenda of the Palestinian Authority and the Kingdom of Jordan.[20] Small sea-water and brackish water desalination plants are currently functioning in the Gaza Strip, but supply a small share of the local con-

19 OECD (2011), *OECD Environmental Performance Reviews: Israel 2011*, OECD Publishing, Paris: p.104.

20 Grover, V. I., Darwish, A. R., & Deutsch, E. (2010). Integrated Water Resources Management in Jordan Economic Research Forum Working Paper. Cairo, Egypt: The Economic Research Forum.

sumption.[21,22] Furthermore, as desalination in Gaza is unregulated and lacking oversight, many unlicensed private suppliers are suspected of pumping water from illegal wells and delivering contaminated water.[23] Upgrading of an existing sea-water desalination plant and construction of a large-scale plant are being planned by the Palestinian Water Authority and, if/when operationalized, will add an additional 25% and eventually an additional 66% to current supplies.[24] This should both alleviate much of the severe local water scarcity there as well as the overpumping of the local groundwater.

The West Bank lacks access to the sea, and thus, to large-scale desalination. At present, it is restricted to the allotted quantities of water as per the Interim Peace Agreement of 1993 between the Palestine Liberation Organization and Israel (the Oslo Accords), and purchases additional water from Israel. The Oslo Agreement was designed as a five-year interim agreement, but has not been replaced with a permanent agreement. Currently, Palestinian options for developing local West Bank water resources are limited, as all development must be approved by the Joint Water Committee (JWC) established by the Oslo Accords. Meetings and approvals of the JWC have often been lacking or infrequent due to non-water related political issues between the parties. The PA is eager to negotiate a reallocation of shared resources which would give it a larger share of natural water sources, including both an increased shared of the Mountain Aquifer (both fresh and brackish water), as well as rights to Jordan River water. Regardless of any reallocation, however, additional water is likely to be needed to satisfy future Palestinian water needs. At this stage, there is no plan for transfer of desalinated water from Gaza to the West Bank, though this measure figures in some of the PA's long term water plans.

The primary element in Jordan's planning for addressing its water scarcity needs is the development of massive desalination in Aqaba, a regional water development program within the framework of a proposed Red-Dead canal. If built, this project, estimated to cost over $10 billion[25], and according to some estimates significantly more, would provide for up to 800-1000 mcm of desalinated water, primarily to Jordan, but also to Palestine and Israel, and a similar amount of brine would be delivered by pipeline through Jordan to the Dead Sea in an effort to stabilize the Sea's level. This project has undergone extensive feasibility studies, supported by the World Bank, and has the official support of all three governments, despite widespread concerns about cost-effectiveness and environmental impacts, such as impact on coral reefs in the Gulf of Aqaba, and the development of algal blooms and gypsum in the Dead Sea.

In 2013, representatives of the three governments signed a Memorandum of Understanding for construction of a desalination plant in Aqaba which would provide between 80-100 mcm of freshwater to southern Jordan and southern Israel. In exchange for desalinated water delivered to Israel from Jordan in the south, Israel would provide Jordan with water from the Sea of Galilee/Jordan River basin in the north, closer to Jordanian population centers and existing water infrastructure. In addition, the Palestinian Authority would be allocated 20-30 mcm to be purchased from

21 UNICEF. (2017). EU and UNICEF inaugurate Gaza's largest seawater desalination plant. Press Release. From 19 January, 2017. https://www.unicef.org/media/media_94423.html.

22 Mogheir, Y., Foul, A.A. Abuhabib, A.A.,and Mohammad, A.W. 2013. "Assessment of Large Scale Brackish Water Desalination Plants in the Gaza Strip." Desalination 314: 96–100.

23 Abou Jala, R.l. 2015. Gaza water desalination plants cause severe health risks. http://www.al-monitor.com/pulse/originals/2015/01/gaza-drinking-desalinated-water-contamination.html

24 Office of the Quartet, Report for the Meeting of the Ad-Hoc Liaison Committee, May 3-4 2017, Brussels.

25 Coyne-Et Bellier, Tractebel Engineering and Kema. 2014. Red Sea - Dead Sea Water Conveyance Study Program
Feasibility Study Draft Final Feasibility Study Report Summary.

Israeli desalination facilities. Such water exchanges set an important precedent for the potential for regional resource exchanges, such as the ones proposed in this study, to promote both regional cooperation and economic efficiency. The water exchange is planned to eventually be integrated into the Red-Dead project. At the time of the writing of this report, the government of Jordan was entertaining bids for small scale pilot of the Red-Dead Canal.

The Oslo Accords and the peace treaty between Israel and Jordan both call for joint development of desalination. To date, this has yet to be operationalized. The water-swap described above as part of the Red-Dead Canal project would be the first instance of joint development. Israel has offered to build desalination plants and sell desalinated water to the Palestinian Authority (PA) and Jordan, but these offers have largely been resisted, primarily for reasons of political and economic independence, and in the case of the PA due to a reluctance to pay for desalinated water, when they believe they deserve a greater share of natural shared waters.[26,27] However, while neither the PA nor Jordan are eager to increase their dependency on Israel for water resources, the pressing nature of water scarcity in both countries is such that both are, in fact, increasing their purchases of water from Israel.

Energy

In terms of energy, the parties have taken different approaches to address energy dependence, encourage energy efficiency and promote renewable energy. Israel has discovered large reserves of offshore natural gas and a transition from the current coal-natural gas fuel mix to an almost solely natural gas fuel mix for electricity consumption is the cornerstone of both Israel's goal of reduced dependence on imports (and evening becoming a net energy exporter) and of reducing its carbon emissions footprint. Israel is also planning on selling natural gas to Jordanian industry and electricity and, according to a recent agreement, to a power plant in Jenin, in the West Bank.

Palestine is almost completely dependent on Israel for its energy supplies, with a small amount supplied by Egypt and a small share of electricity provided to the Jericho region supplied by a link to the Jordanian energy grid. Natural gas reserves were discovered off the shore of the Gaza Strip, but have not been developed due to insistence by Israel that funds go through Israel and insistence by the international community that funds be deposited in an international account to which Hamas would not have access. Both of these restrictions have been rejected by Hamas, which controls Gaza.[28] Palestinian energy policy has concentrated primarily on developing and managing its own electricity distribution network (though supplies still come via Israel) and on increasing energy efficiency, by measures such as operationalization of a revolving fund for financing energy efficiency projects in the public sector, which began in 2014.[29]

Jordan has invested in energy efficiency, with policies to remove energy subsidies and to promote minimum energy efficiency standards for household products.[30] However, as these efforts are unlikely to be sufficient to provide for Jordan's growing energy consumption, Jordan has also looked to develop alternative energy sources, including contacts and international agreements with several countries, including Canada, France,

26 Fischhendler, I., S. Dinar, and D. Katz. (2011) The politics of unilateral environmentalism: cooperation and conflict over water management along the Israeli-Palestinian border. 11(1): 36-61.

27 Aviram, R., D. Katz and D. Shmueli (2014) Desalination as a game-changer in transboundary hydro-politics. *Water Policy* (16)4: 609–624.

28 Ahmad, N.M. (2012). "Israel's war for Gaza's gas." Le Monde Diplomatique 28 November 2012.

29 RCREEE, 2015a.

30 RCREEE, 2015a.

Korea, the United Kingdom and most recently Russia, to develop nuclear energy, including for use in desalination.[31] Various goals for incorporating nuclear energy have been published in several different government energy plans, however, to date, no infrastructure has begun to actualize such goals.

All three countries have declared policy goals of achieving various specific levels of energy production from renewable sources, and all three have signed and ratified the Paris climate accord of 2015. However, renewable energy represents a small share of overall energy production in all three countries.[32] None of the three are currently on track to meet their own self-defined renewable energy goals of up to 10% of energy from renewable sources that they set for themselves for 2020; this is despite all three having amble potential for renewable energy, especially from solar energy sources. All three also have more ambitious longer range commitments to developing renewable energy, and meeting these objectives will require large-scale investment in solar, wind and/or other renewable technologies, and not just incremental application of existing technologies.

Jordan has committed to developing solar energy for the purpose of covering water pumping needs, much as envisioned in this project. To date, however, the project is at a national, not regional level, and is meant to cover some of the costs of pumping groundwater from Jordan's south, rather than the needs of desalination.[33]

31 World Nuclear Association, 2017.

32 Specific statistics on the percentage of energy supplied by renewable sources differ according to source, but according to most sources, they at or below 2% for all three countries.

33 Namrouqa, H. 2015. http://www.jordantimes.com/news/local/projected-solar-plant-south-cover-water-sector%E2%80%99s-energy-needs%E2%80%99 and Namrouqa, H. 2017. http://www.jordantimes.com/news/local/five-water-pumping-stations-operate-solar-power-%E2%80%94-water-ministry

Table 2 – Declared Renewable Energy Policy Goals

Country	Renewable Energy as % of Total Energy Production	
	2020	**2030**
Israel	10%	17%
Jordan	10%	14%
Palestine	5% of primary energy 10% (of electricity)	None declared

Sources: [34,35,36,37,38]

34 International Renewable Energy Agency (IRENA). 2014. Pan-Arab Renewable Energy Strategy 2030. IRENA.

35 Israeli Ministry of National Infrastructures. 2017. " Israel's Fuel Economy."

http://energy.gov.il/English/Subjects/Subject/Pages/GxmsMniIsraelsFuelEconomy.aspx

36 Israeli Ministry of Environmental Protection. 2015. "Israel Commits to Reducing GHG Emissions 26% by 2030." Press Release from on 14 January 2017. http://www.sviva.gov.il/English/ResourcesandServices/NewsAndEvents/NewsAndMessageDover/Pages/2015/Oct-10/Israel-Commits-to-Reducing-GHG-Emissions-26-percent-by-2030.aspx#GovXParagraphTitle1

37 Regional Center for Renewable Energy and Energy Efficiency (RCREEE). (2015b). Arab Future Energy Index (AFEX) 2015 – Renewable Energy.

38 Namrouqa, H. (2015). 'Paris deal to give momentum to Jordan's efforts to address climate change'. Jordan Times, 15 December, 2015. http://www.jordantimes.com/news/local/paris-deal-give-momentum-jordans-efforts-address-climate-change

1.3. Proposed Regional Water-Energy Exchanges – Description & Rationale

Desalination is likely to be a key element in meeting projected water needs for the region. Both Oslo Accords (Annex III, Article 40) and the Peace Treaty between Jordan and Israel (Article 6) call for bilateral and regional cooperation protection of existing water resources and development of future water supplies. As the Israel-Jordan Peace treaty states, "The Parties recognise that their water resources are not sufficient to meet their needs. More water should be supplied for their use through various methods, including projects of regional and international co-operation." The treaty goes on to state that " water issues along their entire boundary must be dealt with in their totality, including the possibility of trans-boundary water transfers… to alleviate water shortage".

Regional initiatives, such as the Memorandum of Understanding signed by representatives of the three countries in 2013 that calls for exchanges of desalinated Red Sea water as well as water from the Sea of Galilee / Jordan River system, show the potential economic and environmental benefits of integrated regional approach to development of water supplies.

Cooperation on energy, including integration of regional electricity grids and joint development of renewable energy supplies, is also a long-standing policy issue that is specifically called for in both the Oslo Accords (Annex VI, Article 5) and the Israeli-Jordanian Peace Agreement (Article 19), and which has been discussed by parties since the signing of these agreements. The benefits would potentially include increased diversification of sources, supply reliability, increased economic efficiency, and reduced environmental impacts.

As has been mentioned, Jordan has limited access to the sea, but has relatively plentiful open space with high radiation potential suitable for solar energy. Israel and Palestine, on the other hand, are relatively limited in terms of open spaces, needed for most commercially viable renewable projects, but have access to the Mediterranean. Thus, there is potential for mutual exchanges of water and energy between the parties.

This project looks at the potential for an exchange in which desalinated water from the Mediterranean Sea is provided by Israel and/or Palestine and in exchange Jordan supplies all three parties with renewable energy. In this report we look exclusively at solar energy provision. In future work, this may be expanded to include wind or other renewable sources and perhaps optimal mixes of renewable production from all three countries.

In addition to the provision of additional water supplies water and clean, renewable energy, significant achievements in themselves, such a project could have several other potential benefits. Given the common pool resource and public goods aspects of water and energy, cooperative arrangements are often economically and environmentally beneficial. Unilateral actions in this respect, while often taken for political reasons, can be sub-optimal both in terms of economic costs and benefits, and in terms of environmental protection.[39] A significant literature has demonstrated that shared management of natural resources can serve as a platform for increased collaboration in other spheres. Such spillover effects can be a basis for more cooperative and peaceful relations overall.[40]

39 Fischhendler, et al, 2011.

40 Such positive spillover effects are in line with functionalist theory in international relations. For examples of works documenting such potential see: Carius, A. (2006). *Environmental Cooperation as an Instrument of Crisis Prevention and Peacebuilding: Conditions for Success and Constraints.* Adelphi Consult.; Matthew, R. A., Brown, O., & Jensen, D. (2009). *From conflict to peacebuilding: the role of natural resources and the environment* (No. 1). UNEP/Earthprint.; Dabelko, G. (2014) An uncommon peace: Environment, development and the global security agenda. pp. 244-257 in Conca, K., & Dabelko, G. (Eds.). (2014). Green planet blues: Critical perspectives on global environmental politics. Westview Press.

It can be claimed that such a project would create even more international dependencies, a situation which is often politically challenging, especially when concerning basic inputs such as water and energy. However, an advantage to the proposed project is that it involves creating interdependence, rather than creating unidirectional dependence, as is currently the norm, with Israel being an increasingly important source of water and gas for both parties. That is, parties would be interdependent on one another, which reduces the potential for unilateral actions that could harm one party. This is a significant advantage over previous attempts at collaboration, such as Israel's offers to sell desalinated water or natural gas to its neighbors, which were seen as only increasing asymmetric dependency. Also, the project would also allow for a diversification of suppliers, for instance, enabling Palestine to reduce its dependence on Israel for both water and energy supplies.

Finally, the private sector plays a prominent role in much of the recent major infrastructure projects in the fields of desalination and renewable energy. As such, the project, while envisioned as regional cooperation, need not be primarily government led or financed. Allowing for private sector leadership may reduce political obstacles that may face government led projects.

1.4. Report Structure

The aim of this project is to investigate the potential feasibility for developing mutually beneficial exchanges of water and energy between the three countries. As a pre-feasibility study, we develop various possible scenarios for types of water and energy facilities and their requisite distribution infrastructure, and attempt to assess the initial technical, economic and political feasibility of their implementation. The following section presents the methodology of the report including scenario assumptions and data sources. Section 3 presents technical and social assessments of future water needs in the region. Section 4 presents technical and social assessments of energy needs and solar energy generation potential and distribution requirements. Section 5 presents an initial economic assessment of the costs of the water-energy exchanges. Section 6 presents an overview of the geopolitical challenges and opportunities entailed in such a project. Finally, Section 7 presents conclusions and outlines potential directions for further research.

2. METHODOLOGY

As this is a first and preliminary study, it was necessary to limit the number of scenarios for various scales and types of technologies. Also, several guiding assumptions were necessary. The following are the scenarios and primary working assumptions made in order to carry out this pre-feasibility study.

2.1. Scenarios

The study takes two scenarios for the scale of desalination envisioned and two scenarios for the scale of renewable energy used.

2.1.1. Basis Year

Given the scale of projects being investigated, implementation cannot be undertaken immediately. As such, the study will take as a focal point for calculations the year 2030. This choice of year was made as one that could be reasonable for implementation.

2.1.2. Population Estimates

In order to determine future water and energy demands, it is necessary to have estimates of populations. In terms of future population forecasts, the figures used are based on official reports published by the governments themselves, supplemented with United Nations' data. Jordan currently has the highest number of residents, due in large part to the recent influx of refugees and other immigrants from Syria and Iraq. In the case of Jordan, we used population estimates and medium range population growth forecasts from the national Department of Statistics.[41] In the case of Palestine, we use figures from the report *Palestine 2030*, published by the Prime Minister's Office and the UN.[42] In the case of Israel, we rely on the Israeli Central Bureau of Statistics' (CBS) medium range population projection.[43] As the CBS gives estimates for 2025 and 2035, we extrapolate a 2030 projection based on CBS numbers using a polynomial best-fit regression. These figures are presented in Table 3 and Figure 1.

Table 3. Populations and Population Forecasts

Country	Population Estimates	
	2015	2030
Jordan	9.4	12.0
Israel	8.3	10.6
Palestine	4.7	6.9
Total	**22.4**	**29.5**

Sources: [15, 38, 39,40]

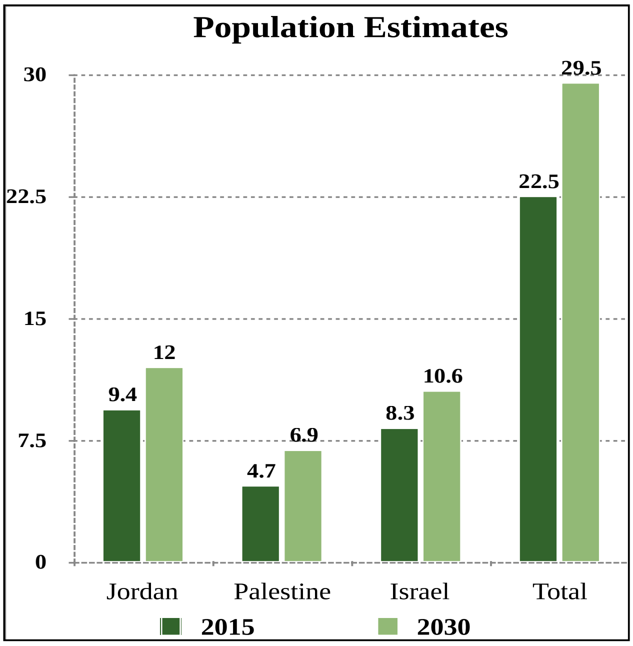

Figure 1. Current Populations and Future Population Forecasts (in millions)

41 Department of Statistics, 2016, *Population Projections for Kingdom for the Period 2015-2050* (In Arabic). Note: Figures for Jordan are somewhat uncertain, especially regarding the number of non-Jordanian residents. Other estimates, by the same source, as well as by the UN's World Population Prospects (2017), give a range of figures for the 2015 population from 9.1-9.5 million residents.

42 State of Palestine - Prime Minister's Office of Population & UNFPA, 2016. *Palestine 2030.* http://palestine.unfpa.org/publications/palestine-2030-demographic-change-opportunities-development

43 Central Bureau of Statistics. 2013. http://www.cbs.gov.il/www/hodaot2013n/01_13_17011.pdf

2.1.3. Water Supply Scenarios and Estimates

In terms of the scale of desalination to investigate, the study examines two scenarios.

a) The first scenario calculates the amount needed to keep current per capita domestic consumption at current levels, given the anticipated population growth, while leaving current levels of freshwater consumption by agricultural, industrial and other sectors undiminished.[44] This scenario was decided upon after receiving feedback on minimum needs from various roundtable discussions held in the three countries, and, in the case of Jordan, highly correlates with the Ministry of Water's declared target of providing roughly 120 liters per capita per day (roughly 43.8 m^3/c/y).[45] In the case of Israel, per capita domestic consumption levels were capped at 80 cubic meters per person annually (nearly 220 liters per capita per day), in line with its long-term masterplan for the water sector.[46] All additional water for the domestic sector is assumed to come from desalination. The amounts cover gross provision of water supplied for domestic purposes, and includes leakages and other non-revenue water. It is not a measure of actual end of pipe consumption by consumers.

b) The second scenario calculates the amount of water needed to provide each of the estimated populations in the year 2030 with 80 cubic meters of freshwater per capita per year for domestic consumption purposes. That is, it calculates the amount necessary to provide each resident in the region with the amount similar to that designated in Israel's long term masterplan for the water sector. This is substantially higher than current per capita consumption for Palestinians and Jordanians, and is presented for the sake of highlighting the scale necessary to achieve social equity in the water sector.[47] Again, it is assumed that all of this additional water for the domestic sector would come from seawater desalination and that there would be no overdraft of renewable supplies.

Neither scenario precludes significant water savings that could potentially be achieved through conservation campaigns, reduced leakage, pricing reforms, and other demand management measures, which should be encouraged regardless of this project.

In both cases future use needs estimates also do not allow for overdraft of renewable water reserves. Also, in both cases renewable water quantities are assumed to be equivalent to current levels; this despite the predictions of reduced rainfall and increased evaporation and runoff due to climate change, and despite the very real possibility that some water supplies may become unusable due to saltwater intrusion or other contamination.

44 Actual allocations to other sectors may increase under such a scenario should increased desalination result in increased reuse of treated wastewater or due to various conservation techniques.

45 This target was for the population of Amman, with other cities receiving somewhat less. Source: Hashemite Kingdom of Jordan - Ministry of Water and Irrigation. 2015. National Water Strategy 2016 2025.

46 Zaide, M. Presentation given 1.3.2017 in Tel Aviv.

47 Feedback received from roundtable discussions in Amman and Ramallah, however, indicated that such levels of water supply, are likely not realistic and affordable in the time-frame envisioned for this project.

2.1.4. Energy Supply Scenarios and Estimates

In terms of the amount of renewable energy to produce, two separate scenarios are evaluated:

a) The first scenario is one in which the desalinated water produced in the two scenarios above would be carbon neutral, i.e., the amount of new renewable energy produced would be equal to the amount needed to offset the energy consumption resulting from desalination of the projected quantities of water in each of the scenarios described above, including the transfer of this water to a main national water delivery system. It is not the intent that the energy produced would be directed specifically for the purposes of desalination, but rather, that it represents an equivalent amount to that consumed by the desalination aspect of the project.

b) In the second scenario the amount of renewable energy produced is equal to 20% of total projected electricity production for each country. This amount is significantly more than in the previous scenario. The figure of 20% was chosen as it is a relatively ambitious one, similar to that promoted by several developed countries, yet it is not so high as to dominate the energy market, as issues of intermittency and dispatchability currently limit market share for renewables.[48] While the 20% figure currently exceeds the declared commitments of any of the parties, as energy consumption grows, as it is projected to do, the 20% figure provided by the project will decrease over the project's lifetime. Thus it would only account for 20% of consumption at the project's inception and presumably a lesser share thereafter. The future energy needs for each country are taken from official government forecasts.

48 Intermittency refers to the fact that solar energy is not available 24 hours per day, but limited to sunlight hours, while the related concept of dispatchability, refers to the fact that producers do not have the capability of regulating the quantity of energy produced to meet demand at any given time.

2.2. Technical Assumptions

In both cases the study will look at technologies already commercially available. In the case of desalination, we will take into consideration only reverse osmosis (R/O), given that this is the dominant technology already in place in Israel, and the technology planned for desalination in Gaza and Aqaba, and given that it is considered the most energy efficient of the currently commercially viable desalination methods.[49] Currently, R/O desalination in Israel consumes between 3.4-3.7 kilowatt hours (kwh) per cubic meter. While a certain amount of improvement in energy efficiency is likely by 2030, it is difficult to project what that might be. As such we use a figure of 3.4 kwh per cubic meter.

For the electricity needs of pumping water, we use 1.26 kwh per cubic meter. This is slightly higher than average energy consumption of water delivery in Israel (Hoffman, 2014).[50] The figure is an estimate of the electricity needed to pump water from the northernmost existing desalination plant, located in Hadera, to Atar Eshkol, a large water reservoir in Israel, from which water could flow largely by gravity to the Jordan River Basin, and from there to Jordan.[51]

49 German Aerospace Center (DLR) et al., 2007. Concentrating Solar Power for the Mediterranean Region. http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/publications/MED-CSP_complete_study-small.pdf

50 Hoffman, D. 2014. Potential for energy savings in the Israeli water sector. Water Engineering, 91: 27-34. (In Hebrew)

51 The calculation was based on the following formula: TC = 4.2(ME+CE), where TC is total consumption in watts per cubic meter, ME is meters in elevation and CE is compensating elevation to cover the effects of friction. CE was calculated as 2.5 meters per kilometer distance. The study used an elevation of 150 meters (Eshkol Reservoir) and a distance of 60 km (the distance from Hadera to the Eshkol Reservoir).

The figure is meant to be representative and illustrative only. Actual energy consumption from pumping will depend highly on where the water is being produced and where it is consumed. For instance, pumping needs for Gaza and the Israeli coast would be almost negligible, while delivery from a desalination plant in Gaza to the West Bank would necessitate roughly double the electricity of the figure used here due primarily to high elevations. For Jordan, this figure only covers the pumping of water to the Jordan Basin, and not the actual delivery of the water to end consumers throughout Jordan.

An economically efficient solution would be to use desalinated water closer to the source and deliver natural fresh water to the extent possible to areas removed from the coast. Thus, for instance, to increase the supply of water in the West Bank from the mountain aquifer and the supply to Jordan from the Jordan River system, and increase Israeli's reliance on desalinated waters. Calculating actual optimization of production and delivery is left to the full feasibility study.

In the case of electricity supply, the study considers only transmission of electricity from Jordan to a single location within Palestine and Israel. It does not look at transmission of electricity within Palestine or Israel.

2.3. Economic Assumptions

Though prices for both water and energy are likely to change by 2030, however, as the extent to which they will is difficult to determine, this study bases calculations on current prices.

For solar electricity, current capital and operating and maintenance costs for large-scale photovoltaic energy production will be used, as cost estimates for emerging technologies such as concentrating solar power are still unreliable, especially in this region, as they have yet to be implemented at a commercial level. Further studies may wish to incorporate cost estimates for these alternative technologies.

2.4. Political Assumptions

The study assumes that there is the requisite political will for such a project. For the purposes of calculations, it also assumes that, by 2030, Palestine will be a fully independent state and will include the population of East Jerusalem within this state. This is in line with the vision of EcoPeace, and is not meant to be a pre-requisite for beneficial water-energy exchanges of the type explored in this pre-feasibility study. The study also assumes that exchanges of water and energy between Gaza, the West Bank, Israel and Jordan are politically acceptable to all parties. This is not the current reality in which political differences have led to restrictions on such transfers. These issues are elaborated upon later in Section 5, which addresses political feasibility.

3.WATER

This section presents a brief overview of the water sectors in each of the three parties and then presents calculations based on minimum supplies necessary to provide for future consumption in each country. Quantities presented herein represent currently managed supplies and in no way are meant to indicate a stance on rights to water or the legitimacy of claims to rights of water, which, in some cases, are contested. The section then presents a cost assessment for provision of such water via desalination.

3.1 Water Supplies and Consumption

Natural water supplies in the region are shared between the three countries as well as with Syria and Lebanon. Primary transboundary water bodies include the Jordan River / Sea of Galilee System (including the Dead Sea), which is shared by all five riparians, as well as the Mountain and Coastal Aquifers, which are shared by Israel and Palestine. The Mountain Aquifer is shared between Israel and the West Bank, while the Coastal Aquifer is shared between Israel and the Gaza Strip, though this latter aquifer is largely managed independently by the two different parties. In addition, Israel and Jordan have other, non-transboundary aquifers.

Both the Oslo Accords and the Israeli-Jordanian Peace Treaty set out terms for joint management of shared waters. As the Oslo Accords were meant to be an interim agreement, the issue of water rights between Israel and Palestine is still outstanding. Issues of water rights between Israel and Jordan are considered largely settled. Both agreements establish bodies for joint coordination and consultation in management of the shared waters. The functioning of these bodies, especially in terms of the Israeli-Palestinian case, is intermittent and often contested.

3.1.1. Jordan

The Kingdom of Jordan is supplied by the Yarmuk River (part of the Jordan River system) as well as by several aquifers, supplying both renewable and non-renewable (fossil) water supplies. Surface water supplies are concentrated in the north, close to population centers, while groundwater is distributed throughout the country, including fossil water in the south. Water supplies along the Yarmuk are highly dependent on policy in Syria, the upstream riparian. Following the 1994 Peace Treaty with Israel, Jordan is also allowed to store winter flows in the Sea of Galilee and receive additional supplies from Israel during the summer. Jordan has also recently agreed to purchase additional water from Israel in the Jordan River basin.

According to the Jordanian Ministry of Water and Irrigation, safe yields of groundwater in the Kingdom are estimated at 275 mcm annually and renewable surface water supplies an additional roughly 260 mcm. In addition, in recent years Jordan has been consuming approximately 140-150 mcm of non-renewable groundwater and 160 mcm of overabstraction (abstraction of water at levels exceeding annual recharge) from renewable aquifers. It also augments its supplies with roughly 125 mcm of reused treated wastewater and a small amount of desalinated water. All in all, renewable fresh water resources are estimated at between 550-600 mcm per year.[52,53]

Figures for quantities of water supplied in Jordan differ significantly from figures for water consumed by end-users as much water is lost to leakage and unlicensed connections. The poor state of much of the water delivery infrastructure has resulted in supplies being intermittent and unreliable in much of the

52 Hashemite Kingdom of Jordan. Ministry of water and Irrigation. National Water Strategy 2016 2025. Dec. 2015

53 Included in Jordan's water supplies are water supplied by Israel, as per the Israeli-Jordanian peace agreement. This is not listed separately. Rather, this report simply considers these as Jordanian water.

country. Water resource planning and supply is particularly complicated given the large influx of refugees and non-citizens from Syria and Iraq in recent years. This has necessitated development of new supply infrastructure, both temporary and permanent. The primary component of Jordan's strategy for addressing water scarcity is development of desalination. At present the only seriously considered option for this is via the proposed Red-Dead Canal.

3.1.2. Palestine

As mentioned, currently, Palestinian water supplies are regulated by the Oslo Agreement, which was intended to be an interim agreement. As such, the issue of Palestinian water rights is still unsettled, and is not reflected in current consumption. The official position of the Palestinian Water Authority (PWA) is that they be granted a larger share of water from the Mountain Aquifer, especially, the eastern portion, as well as rights to the Jordan River system. Furthermore, the PWA seeks additional access to brackish water from the Mountain Aquifer, which it could desalinate at rates much less expensive than the cost of desalinated sea-water.

According to official PA statistics, annual water supplied in Palestine, as of 2015, was 365 mcm, of which 188 mcm was for the West Bank and 177 mcm was for Gaza. This figure, however, includes unsustainable pumping of the aquifer in the Gaza Strip, estimated at 100-110 mcm annually.[54] It also includes roughly 70 mcm/y purchased from Israel, as well as 4 mcm/y of desalinated water.[55] It does not include unlicensed pumping in the West Bank and Gaza, as reliable data for this is unavailable.

As of 2015, the West Bank consumed roughly 187 mcm, of which 64 mcm was purchased from Israel, while Gaza consumed 177 mcm, of which 6 mcm was purchased from Israel and 4 mcm was from desalination.[55] It should be noted that the water in Gaza is of poor quality due to seawater intrusion in the aquifer as a result of long-term overpumping, and as a result of poor wastewater treatment, as facilities lack basic inputs (electricity, equipment, and funding). As such, it is not used for drinking purposes. Safe yields in Gaza are estimated at 50-60 mcm per year, though some estimates suggest that due to seawater intrusion and other water quality issues, virtually none of Gaza's water may be potable in the near future. A desalination plant for Gaza is planned, with funding from the international community. It is to initially produce 55 mcm/year, with an eventual capacity of 110-130 mcm/year.[20] At present, the issue of securing a reliable electricity supply for the plant is still unresolved.

Water supply in the West Bank is highly restricted due to regulations imposed by the Israeli Civil Administration and other Israeli governing bodies. According to the governance mechanisms established in accordance with the Oslo Accords, new infrastructure projects in the West Bank must gain approval of both Palestinian and Israeli officials. This gives both sides veto power over development in the area, but in practice, however, this puts the Palestinians at disadvantage, as West Bank Palestinians are dependent on the two parties achieving consensus, while Israel has numerous alternative options for water supply outside of the West Bank. Recent agreements (2017) between the Israeli and Palestinian water officials are to give Palestinian regulators somewhat more autonomy in water planning in the West Bank,[56] though it is too early to know how this will affect overall water management there. The PWA is eager to get rights to increased shares of the Mountain Aquifer, including rights to potentially large quantities of brackish water in the eastern portion of the aquifer, which could undergo relatively cheap desalination to become potable. As of now, however, Israel has not agreed to transfer water rights or to increased Palestinian withdrawals.

54 Palestinian Central Bureau of Statistics. http://www.pcbs.gov.ps/Portals/_Rainbow/Documents/water/water-E-main.htm

55 These figures are set to increase somewhat in 2017.

56 Times of Israel. "Israelis, Palestinians sign deal to jointly improve West Bank water supply" 15 January, 2017. http://www.timesofisrael.com/israelis-palestinians-sign-deal-to-jointly...

3.1.3. Israel

Estimated renewable resources used in Israel are thought to be between 1200-1500 mcm/ annually. In the past, they were estimated at slightly higher levels, but have been revised in recent years to reflect decreasing annual rainfall. In addition to the Mountain and Coastal Aquifers, Israel has access to several local aquifers as well as the Jordan River system, including the Sea of Galilee, the region's only large lake. In addition to the natural water resources, Israel has invested intensively in the reuse of treated wastewater. Currently roughly 80% of domestic wastewater is treated and reused in agriculture. This source adds an additional 500 mcm to the annual water balance, and this amount increases as the amount of wastewater from the domestic sector grows and the share of treated wastewater grows.

In addition to wastewater reuse, Israel's primary supply management (augmentation) policy has been development of large-scale seawater desalination. Large-scale desalination of Mediterranean seawater began in 2005. Currently there are 5 large desalination plants operating along the coast, all of which use the reverse-osmosis process. Collectively they have a production capacity of roughly 550 mcm per year. This amount is roughly equivalent to 70% of municipal/domestic annual consumption. Currently, desalination plants are located along the central and southern coast and supply water primarily to those regions. Supply of water in the north is primarily from local natural sources, though there are plans to build additional desalination plant along the northern coast to augment supplies there.

3.2. Calculation of Future Municipal Water Supplies

As stated earlier, for the purposes of this study, we calculate the estimated additional water needed for regional supplies in 2030. Because of population growth, municipal supplies for all parties will necessarily need to increase in order to maintain a reasonable standard of supply. As mentioned above, we examine two scenarios. The first maintaining current (2015) per capita consumption for the domestic sector (with Israeli consumption capped at 80 m^3/c/y), and the second achieving a level of 80 m^3/c/y for all residents of the region. These are gross figures for municipal supply, rather than per capita consumption, as it does not take into account water leakage and other non-revenue water.

Our assumption is that non-municipal (i.e., agricultural and industrial) uses will continue to receive at least their current shares of freshwater. In fact, however, with the increase in municipal supply will come an increase in sewage, which, if treated and reused, would likely lead to increased allocations to agricultural and environmental flows as well.

For each country we first calculate current (2015) per capita consumption for the domestic sector. For the first scenario, we multiply the 2030 population forecast given in Table 3 above by the 2015 domestic per capita consumption rate in order to get an estimate for total future desired municipal supply for the region. For the second scenario, we multiply the population estimates by the 80 m^3/c/y figure. This provides the total domestic supplies needed. In order to calculate the additional amount of water needed to meet such supplies we subtract current municipal consumption plus any current overabstraction or supply at beyond safe yields in order to calculate the additional water needed to achieve the target quantities.[57] For Israel, we assume that current supplies are sustainable, though in recent years scarce rainfall has resulted in overpumping, especially in the north of the country not currently supplied by desalination. These figures are presented in Table 4.

57 For sake of clarity the calculations for future water needs are represented by the following equation:

FN = (FP*PC)-(CS+OD), where FN is future needs, FP is future population, PC is annual per capita consumption (which varies between the two scenarios), CS is current domestic supplies, and OD is declared overdrafts.

Table 4. Current Domestic Water Consumption and Future Water Needs

		2015 Population (millions)	2015 Municipal Supply (mcm)	2015 Per Capita Consumption (m^3/y)	Declared Overdrafts from Renewable Sources	2030 Population (millions)	2030 Municipal Supply Needed (mcm)	Additional Water Needed (mcm)
Scenario A Maintain Current Domestic Per Cap Levels	Jordan	9.4	436[58]	46.4	160[59]	12.0	556.6	280.6
	Palestine	4.5[60]	214.9	47.9	107.2[61]	6.9	330.5	222.8
	Israel	8.3	777.8	93.7	0	10.6	848	70.2
	Total	**22.2**	**1,428.7**	**76.3**	**267.2**	**29.5**	**1,735.1**	**573.6**
Scenario B Provide 80 $m^3/c/y$ for domestic Use	Jordan						960	684
	Palestine						552	444.3
	Israel						848	70.2
	Total						**1,512**	**1,198.5**

Sources: [62,63,64]

58 The Jordanian figure is based on estimated supplied by officials at the Ministry of Water relating only to residential consumption, as the official figures for municipal water consumption include industrial supplies as well.

59 Represents the amount listed as overdraft according to the National Water Strategy (see footnote 56). Notably, it does not include withdrawals from non-renewable aquifers, which the Ministry includes as "Sustainable Resources"..

60 Represents those supplied by PWA, which does not include much of the East Jerusalem population, which are currently supplied by Israel.

61 Represents the calculated overdraft beyond safe yields from the Coastal Aquifer in Gaza as of 2015.

62 Israel Water Authority, http://water.gov.il/Hebrew/ProfessionalInfoAndData/Allocation-Consumption-and-production/20156/1998-2015.xls

63 Palestinian Central Bureau of Statistics. http://www.pcbs.gov.ps/Portals/_Rainbow/Documents/water/water-E-main.htm , Tables 6 and 8.

64 Hashemite Kingdom of Jordan. Ministry of water and Irrigation. National Water Strategy 2016 2025. Dec. 2015.

Of relevance for this study is the total amount of water needed to fulfil the gap between sustainable water resources and expected demand. In the case of Scenario A (maintaining current levels of water consumption), there is a projected need of 573.6 mcm/y, roughly half of which will be needed in Jordan (Figure 2). Scenario B, in which all residents consume at Israeli levels, would entail double the amount of water produced, at nearly 1200 mcm/y. For reference, currently, the largest reverse osmosis desalination plant in the world is in Israel with a capacity of roughly 150 mcm/y. Thus, there would be a need for the equivalent of 4 similar sized plants for scenario A, and 8 such plants for Scenario B by 2030. While some of this gap could be provided by efficiency improvements and reallocation of water from agriculture to the domestic sector, it is unlikely that such measures could accommodate the scale of water needed. Thus, desalination appears to be an expedient and necessary step.

Given that water rights between Israel and Palestine are still unresolved, pending a permanent final status peace agreement, for the purposes of this study we do not focus on the relative amounts of water needed by Israel and Palestine, as this may change in negotiations. Whether the relative needs are fulfilled by reallocation of existing natural water resources or not, the overall regional gap between current supplies and future needs will be the same. The total additional amount needed for Palestine and Israel collectively, some 293 mcm/y under scenario A and 514.5 mcm/y under Scenario B, will be reduced by 110-130 once the desalination plant planned for Gaza produces at full capacity.

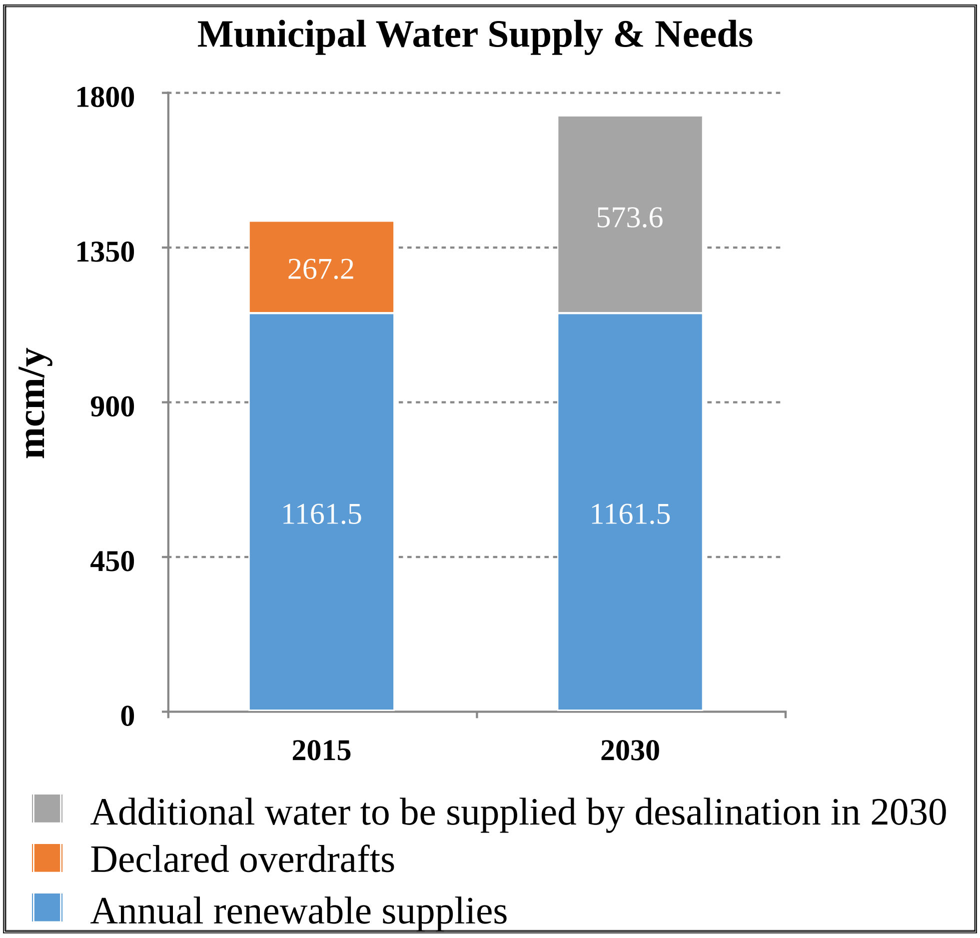

Figure 2. Estimated Municipal Water Supply & Needs (Scenario A)

4. ENERGY

This section provides a brief outline of current energy sources and electricity supply infrastructure in each of the three countries. It then provides an analysis of the technical feasibility of providing electricity sourced from renewable energy to the region as detailed in Section 2.2 above.

4.1. Current Sources & Supply Infrastructure

4.1.1. Jordan

Jordan is not known to have any significant domestic energy sources and is highly dependent on imported energy: 96% of its primary energy demand comes from imported fuels[65] Total generated electrical energy in Jordan amounted 19,011 MWh in 2015, while the imported electrical energy from Egypt amounted to 604 GWh. The total generation capacity of the Jordanian Power System amounted to 4,266 MW in 2015.

In 2015, Jordan's overall electricity generation of 19,011 MWh was generated in combined-cycle units, gas turbines and steam-powered stations. Power generation in Jordan is based on both private company power generation and public-private investment (PPI) partnerships. It is composed of one governmental generation company and four privately owned generation.

Jordan's annual electricity generation and consumption are detailed in Table 5. As can be seen, with average annual growth of consumption at around 5% per year, consumption nearly doubled over the decade 2005-2015.

According to reports by the National Electric Power Company (NEPCO), as of 2015 renewable energy is responsible for 0.9% of electricity generation in Jordan, while according to the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), renewables accounted for 0.5% of generation capacity in that year.[66]

Table 5. Key figures of the electricity sector of Jordan

Year	Capacity, MW	Peak Load, MW	Generation, GWh	Consumption, GWh	Consumption per capita, kWh	Annual Consumption growth (5 Year Avg.)
2005	1,995	1,751	9,654	8,713	1,592	n/a
2010	3,069	2,650	14,683	12,871	2,106	8.1%
2015	4,266	3,300	19,011	16,177	2,320	4.7%

Source: Annual report of the National Electric Power Company (NEPCO), 2015[67]

65 El-Katiri, L. (2014). A Roadmap for Renewable Energy in the Middle East and North Africa. Oxford Institute for Energy Studies. OIES Paper MEP 6.

66 Figures from other sources document total solar power installed capacity of 150-170 MW and generated energy from solar power at 376.6 GWh in 2016 (NEPCO Bulletin 2016 - http://www.nepco.com.jo/en/nepco_bulletin_en.aspx), which would account for 1.9% from the total electricity generation. This discrepancy is thought to be due to the inclusion of rooftop solar water heaters in the latter estimate. These do not generate electricity, but do reduce consumption.

67 Annual report of the National Electric Power Company (NEPCO), 2015 - http://www.nepco.com.jo/store/docs/web/2015_en.pdf

Electric Power Transmission and Distribution

The current installed electric grid in Jordan has a system capacity of 4,549MW,[68] with a 132kV and 400kV transmission network (Figure 3). The transmission network interconnects with Syria through 230kV and 400kV tie lines and with Egypt through 400kV tie lines. Total installed capacity of the substations 400/132/33kV is 3760 MVA.[69] As mentioned above, a 33kV line also supplies electricity to the West Bank via Jericho. The total length of the 400 kV network is 924 km, 230 kV – 17 km, 132 kV network, with 3511 kilometers (km) of overhead lines and 97 km of underground cables, which sums up to 4,249 km of total length for lines of 132 kV and more.

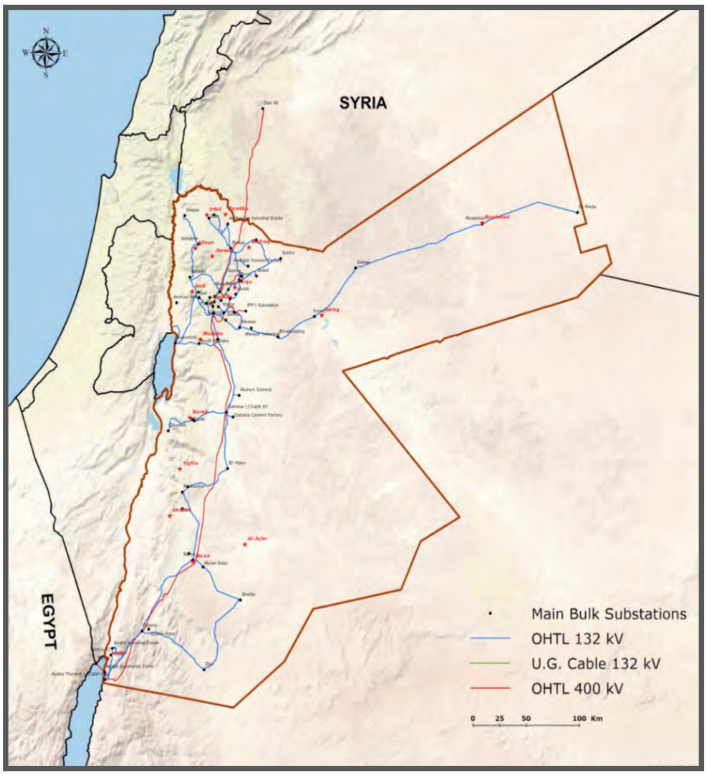

Fig. 3. Jordan National Transmission Grid[70]

4.1.2. Palestine

Palestine lacks conventional energy sources, and imports almost all its energy needs. All petroleum derivatives and natural gas are purchased from Israel, while electrical power in Palestine is imported from Israel (nearly 90% of total consumption), Egypt and Jordan (4-5%), with a small share (just over 6-8%) supplied by the Gaza Power Plant (see Table 6).[71,72] Currently, the Palestine Electric Company has plans to build two power plants in the West Bank, which would give the West Bank its own production capacity. There are also plans to expand capacity of connections to Jordanian and Egyptian grids as well as to connect Gaza directly to Israeli natural gas supplies. Significant natural gas reserves were discovered off the Gazan shore (estimated at 35 BCM) in the late 1990s, but have yet to be developed.

68 Annual report of the National Electric Power Company (NEPCO), 2015 - http://www.nepco.com.jo/store/docs/web/2015_en.pdf

69 Annual report of the National Electric Power Company (NEPCO), 2015 - http://www.nepco.com.jo/store/docs/web/2015_en.pdf

70 NEPCO web site - http://www.nepco.com.jo/en/maps_en.aspx#

71 Regional Center for Renewable Energy and Energy Efficiency (RCREEE). 2013. Palestine – Energy Efficiency Profile.

72 The Gaza Power Plant runs on diesel fuel which results in high costs of power generation.

While nearly all West Bank residents have continuous access to electricity, supplies within Gaza are particularly unreliable given restricted access to fuels and reductions due to a number of economic (primarily lack of payment) and political reasons.

Table 6. Quantity of Electricity Imported and Purchased (MWh) in Palestine (2015)

	Imports				**Domestic**	
	Israeli Electricity Company	Egypt	Jordan	**Total Imports**	Palestine Electric Company	**Total**
West Bank	4,240,225		41,390	**4,281,615**		**4,281,615**
Gaza Strip	941,282	190,191		**1,131,473**	354,970	**1,486,443**
Total	**5,181,507**	**190,191**	**41,390**	**5,413,088**	**354,970**	**5,768,058**

Source: Palestine Central Bureau of Statistics[73]

Table 7. Palestinian Electricity Consumption Growth Trends

Year	**Consumption, GWh**	**Annual Consumption growth (5 year avg.)**
2005	2.90	-
2010	4.57	9.5%
2015	5.77	4.7%

Source: Palestine Central Bureau of Statistics[74] and U.S. Energy Information Administration.

Imports from Israel via the Israeli Electric Corporation (IEC) occur through around 230 connection points on low voltage (LV) and medium voltage (MV) networks. The contracted power from Israel is 890 MW, from Jordan is 20 MW, and from Egypt is 32 MW.[75]

In terms of renewable energy, as of 2015, only 1.4% of overall installed energy capacity was renewable. Solar PV systems accounted for almost all of this capacity (nearly 98%), with a small amount of geothermal capacity as well.[76,77] These figures represent a small share of the estimated renewable energy potential (for solar, wind and biomass).[78,79]

73 Palestine Central Bureau of Statistics. Energy and Energy Balance Tables 2015. http://www.pcbs.gov.ps/Portals/_Rainbow/Documents/tables%202015.xlsx

74 Palestine Central Bureau of Statistics. Energy and Energy Balance Tables 2015. http://www.pcbs.gov.ps/Portals/_Rainbow/Documents/tables%202015.xlsx

75 Palestinian Energy and Natural Resources Authority. 2017. Energy Situation in Palestine.

76 Regional Center for Renewable Energy and Energy Efficiency (RCREEE). (2015a). Arab Future Energy Index (AFEX) 2015 – Renewable Energy. Palestine Country Profile.

77 http://www.rcreee.org/sites/default/files/palestine_fact_sheet_print.pdf

78 Juaidi, Adel, Francisco G. Montoya, Imad H. Ibrik, and Francisco Manzano-Agugliaro. 2016. "An Overview of Renewable Energy Potential in Palestine." *Renewable and Sustainable Energy Reviews* 65 (November): 943–60.

79 Abu Hamed, Tareq, Hannah Flamm, and Mohammad Azraq. 2012. "Renewable Energy in the Palestinian Territories: Opportunities and Challenges." *Renewable and Sustainable Energy Reviews* 16 (1): 1082–88.

Electric Power Transmission and Distribution

At the present moment, the PEA does not own any transmission grid, though there are currently agreements in place to transfer control over four substations and some of the delivery infrastructure to the PWA. In addition, Area C which is not under the control of the PA includes the areas in between the cities and villages and any transmission or distribution line that passes through Area C needs licensing and permissions from Israel. The West Bank depends almost entirely on IEC for electricity supply. It is served primarily by three 161/33 kV substations. Electricity is supplied to the center of the West Bank via 33kV and 11kV distribution transmission lines at several connection points with the IEC and to Gaza via 22 kV feeders. The PNA has agreed with Jordan to connect the Palestinian power grid to that of Jordan at Jericho through a 33kV line via King Abdullah Bridge. A request was submitted to upgrade the line to 132 kV, which is compatible with the voltage supplied by the Jordanian electricity company. The Jericho area will be disconnected from the Israeli power grid.

Currently electricity is provided to Palestinian end users by six regional electric utilities (5 in the West Bank and 1 in the Gaza Strip) and numerous municipalities and regional councils. Power imports from Israel are not controlled by a Purchase Agreement between PA and Israel; rather, they are regulated by bilateral contracts between IEC and the individual electric utilities, municipalities, or rural councils. This institutional arrangement causes the electric energy sector to be unreliable and unsecure. The establishment of the Palestinian Electricity Transmission Company (PETL), currently underway, aims to establish a single buyer model which will allow power imports from Israel to be controlled by a Purchase Agreement between PA and Israel.

4.1.3. Israel

Long dependent on imported coal and oil, Israel's energy sector is in the processes of transitioning towards increased dependence on natural gas, following the discovery and development of several offshore natural gas reserves in the Eastern Mediterranean. Electricity production from natural gas began in 2004 and as of 2014 overtook coal as the primary fuel source. Israel is currently operating or developing 7 gas fields, the total reserves of which are estimated at approximately 850-880 billion cubic meters (BCM).[80,81] According to the official forecast of the Ministry of National Infrastructure, Energy and Water resources, accelerated growth in the use of natural gas is expected to increase to 12.5 BCM per year by 2020, and to 18 BCM per year by 2030, of which 85% will be used for electricity generation and industry.[82]

In 2015 Israel produced 64,227 GWh (Table 8) of electricity, of which 50,627 GWh (almost 80%) was produced by the Israeli Energy Corporation (IEC), with the rest, 13,603 GWh (20 %), produced by private electricity producers. As of that date, total installed generating capacity in Israel was 16,895 MW.[83] The IEC owns and operates 17 power sites of power stations (all of which are gas or coal based power stations sites, some of them using fuel oil as a secondary fuel) with a total installed generation capacity of approximately 13,617 MW (79% of total capacity). The remainder, 3,278 MW (21%), belongs to the private electricity producers.

80 2C - Best estimate of contingent resources; 2P - Proven and probable reserves.

81 Israeli Gas Opportunities, official paper of the Ministry of National Infrastructure, Energy and Water resources - http://energy.gov.il/English/PublicationsLibraryE/Israeli%20Gas%20Opportunitties.pdf

82 http://www.energy-sea.gov.il/English-Site/Pages/Oil%20And%20Gas%20in%20Israel/Natural-Gas-Supply--Demand-.aspx

83 The Israel Electric Corporation Annual Report - https://www.iec.co.il/EN/IR/Documents/Financial_Reports_December_2015.pdf

Table 8. Key figures of the Israeli electricity sector

Year	Capacity, MW	Generation, GWh	Consumption, GWh	Consumption, Annual Growth (5 year avg)	Export, GWh	Peak Load, MW
2005	10,113	49,833	44,198		1,666	903
2010	12,771	56,102	49,904	2.5%	4,010	10,914
2015	16,895	64,227	52,700	1.1%	5,197	12,905

Source: The Central Bureau of Statistics of Israel[84]

Renewable energy sources represent roughly 2% of total energy production, not including passive sources, such as rooftop solar water heating. The principal source of renewable energy currently in use in Israel is solar (91% of total renewable production), primarily photovoltaic.2

Electric Power Transmission and Distribution

Electricity transmission and transformation activity is conducted by the IEC under a license received from the State of Israel. The IEC is acting as a monopoly in the field of electricity transmission and transformation and has no competitors. It is required to allow private electricity producers to use its transmission system. The transmission grid consists of extra high voltage lines (400 kilovot (kV)) and a high voltage grid (161 kV). Some large industrial users, such as the national water company Mekorot and some desalination facilities are connected directly to the extra high voltage lines. Most of the electricity, however, is converted to the distribution segment of the grid via substations. The distribution system consists of distribution lines of 33 kV, 22 kV and 6.3 to 12.6 kV tension levels (all of these are high voltage lines), low voltage lines and a distribution transformer that interconnects them.

84 The Central Bureau of Statistics, Energy section - http://www.cbs.gov.il/reader/?MIval=%2Fcw_usr_view_SHTML&ID=564

As of 2015, the distribution system consisted of approximately 26 961 km of medium-voltage grid lines; approximately 48 825 distribution transformers with a total output of approximately 24 476 megavolt-amperes and approximately 20 298 km of low-voltage grid lines.

4.2. Jordanian Renewable Energy Generation – Technical Feasibility

As mentioned, this study explores two scenarios of electricity demand: the first, evaluating the energy necessary to compensate for the estimated increased demand for desalinated water, as detailed in Section 3. The second scenario assumes simply that the project would produce the equivalent of 20% of total electricity consumption for each of the three countries from renewable sources. In this section, we analyze technical aspects for renewable power generation in Jordan and its transmission to Palestine and Israel. While both Palestine and Israel have domestic potential for renewable energy, including solar, wind, and others, access to open spaces necessary for large-scale production is very limited in both. This is due both to high population density, and to numerous land use restrictions. The following sub-section presents the calculations for energy needs in the different scenarios, while the section after presents the rationale for choice of renewable energy technology (solar) and presents calculations for the technical feasibility of several different solar technologies.

4.2.1. Calculating Energy Needs

The first scenario considers additional electricity generation equivalent to the energy needs of the desalination as detailed in Section 3, and as such, it has two sub-scenarios, based on the different water needs estimates.

Scenario 1

Scenario 1.A considers electricity needs necessary to maintain current per capita consumption for the countries in the region. According to the calculations presented in the previous chapter, the additional water needed in 2030 in the region will be 573.6 mcm for scenario 1.A. (maintaining current per capita domestic consumption rates) and 1198.5 mcm and for **scenario 1.B.** (providing all residents in each country with an average of 80m3/y). We assume that energy needs for both desalination and delivery are identical between Israel and Gaza.

We take the average figure for the energy consumption by water desalination plants in Israel of 3.4 kWh/m^3. This is likely to be a somewhat high-end estimate, as it is based on existing facilities, and does not account for efficiency improvements over time. To this we added 1.26 kWh/m^3 for water pumping, based on our calculations considering possible distances for the water pumping and elevation friction losses. This produced a figure of 4.66 kWh/m^3. We also take into consideration average losses in transmission and distribution in the Jordanian grid, which, according to NEPCO, are almost 14%.[85,86]

Scenario 2

In calculating electricity needs for 2030, for the three countries, our estimates for electricity consumption are taken from official governmental documents and reports.[86,87,88] These quantities are presented in Table 9 and Figure 4. All countries are planning for significant increases in consumption. Especially in the case of Israel, the projected growth is at a significantly higher rate than over the previous decade.

85 Currently losses in the Jordanian system are at 14%. Almost 50% of these losses are due to non-technical losses (thefts and non-metered consumption). There are programs being implemented by the distributors and even requirements by the regulator to reduce such losses. As it is difficult to make a reliable assessment of how successful these efforts will be, we apply a rate of 14% for future electricity losses.

86 NEPCO annual report, 2015. http://www.nepco.com.jo/store/docs/web/2015_en.pdf

87 PENRA (undated). "Energy Situation in Palestine."

88 Israeli Ministry of Energy & Water. http://energy.gov.il/Subjects/Electricity/Pages/GxmsMniAboutElectricity.aspx

Table 9. Estimated Electricity Consumption for 2030 (GWh)

Demand	2015	2030	Implied Annual Growth Rate	20% of 2030
Palestine	5,768	12,850	5.5%	5,570
Israel	52,700	94,500	4.0%	18,900
Jordan	16,177	42,419	6.6%	8,483.8
Total	**74,666**	**149,769**	**4.8%**	**29,953.8**

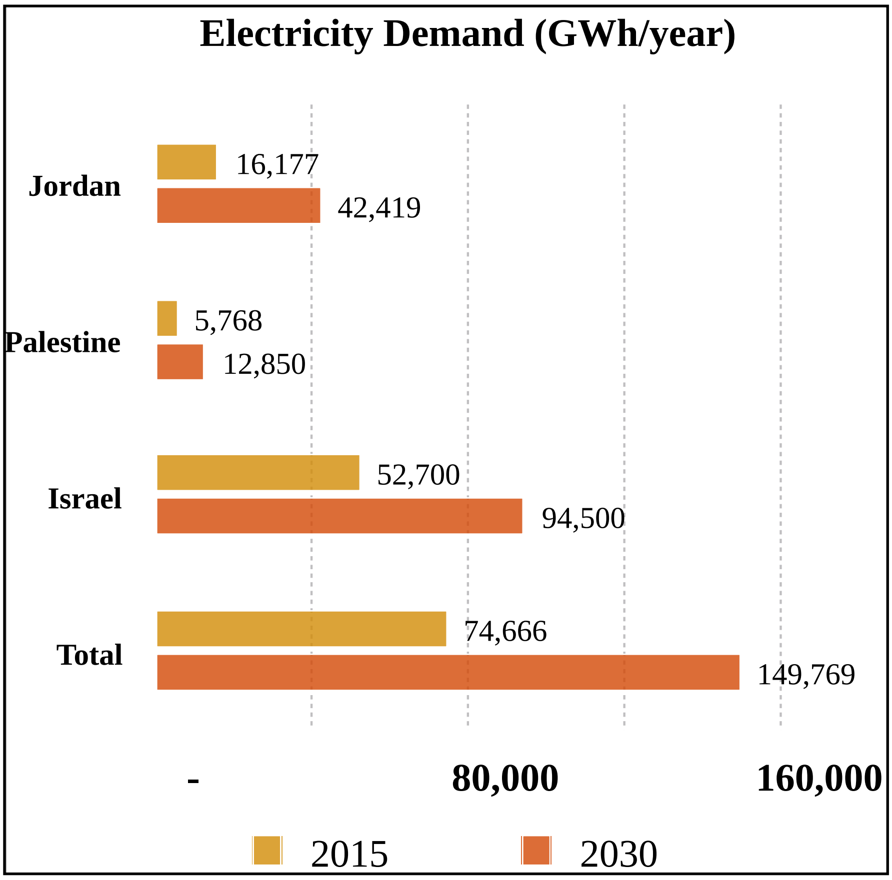

Figure 4. Current and Estimated Electricity Demand

Table 10 summarizes the energy production estimates used in each scenario in this study.

Table 10. Data inputs and outputs for electricity consumption needs from renewables calculation

Parameter	Value
Scenario 1.A – Desalination needs (current consumption rates)	
Additional water supply needs, total for the region (mcm)	573.6
Electricity need per 1 m^3 water desalination (kWh/m^3)	3.4
Electricity need per 1 m^3 water transmission (kWh/m^3)	1.26
Electricity transmission and distribution losses (%)	14
Electricity consumption needs in 2030 (GWh annually)	2,672
Electricity consumption needs with transmission and distribution losses in 2030 (GWh annually)	**3,108**
Scenario 1.B – Desalination needs (80 m^3/c/y)	
Additional water supply needs, total for the region (mcm)	1,198.50
Electricity need per 1 m^3 water desalination (kWh/m^3)	3.4
Electricity need per 1 m^3 water transmission (kWh/m^3)	1.26
Electricity transmission and distribution losses (%)	14
Electricity consumption needs in 2030 (GWh annually)	5,585
Electricity consumption needs with transmission and distribution losses in 2030 (GWh annually)	**6,495**
Scenario 2 – 20% of consumption	
Total electricity demand in 2030 (GWh annually)	149,769
20% of Total electricity consumption needs in 2030 (GWh annually)	29,953.80
Electricity consumption with transmission and distribution losses in 2030 (GWh annually)	**34,830**

4.2.2. Choice of Renewable Energy Technologies

In this study, we initially considered both solar and wind energy. Jordan has potential for wind energy production, having wind speeds of 7-8 meters per second in some regions, which is considered as exceptional.[89] However, preliminary calculations show that placing PV solar power stations on the same spots, taking the same area, can provide more power generation. Furthermore, solar can be cultivated in all parts of the kingdom, while Jordan's wind resource is localized, often on private property or in urban settings.[90] A study by the German Aerospace Center (DLR) concluded that Jordan's solar generation potential far outweighs that of wind and is more cost efficient per unit of land.[91] While this does not preclude the use of wind energy in Jordan, for the purposes of this pre-feasibility study, we consider only solar energy technologies. Specifically, we analyze two different types of solar energy production: photovoltaic (PV) and Concentrating Solar Power (CSP).

Solar Power

Jordan has excellent potential for solar production. According to the estimations of the National Center of Research and Development of Jordan, 5% of the surface of Jordan is suitable for developing solar plants.[92] An installed capacity of 100 GW over this area would allow production of approximately 250,000 GWh annually. Restricting solar generation capacity to 1% of the surface of Jordan would allow for 20 GW of installed capacity, with an electrical production capacity of 50,000 GWh. Roughly triple total electricity consumption in Jordan in 2015.

89 Azzam, Salah. (undated) Renewable Energy in Jordan. National Center for Research and Development.

90 http://www.greenpeace.org/arabic/PageFiles/481146/Jordan_Report2013.pdf

91 http://www.dlr.de/tt/Portaldata/41/Resources/dokumente/institut/system/publications/MED-CSP_complete_study-small.pdf

92 http://brawa.uest.gr/uploads/Salah_Azzam.pdf

Radiation levels zoning

Average solar radiation levels in Jordan are 5 – 7 kWh/m² per day with about 300 sunny days in a year (1500-2100 kWh/m² per year). For the purposes of our research we utilize the map of solar irradiation from the National Energy Research Center of Jordan, which is used by the government of Jordan (Figure 5). According to the map there are 10 zones with the different solar irradiation figures, which can be generalized into 5 regions[93]:

- The southern region representing the Ma'an and Aqaba area, has the highest solar isolation in the country and has the lowest values of diffuse irradiance. The annual average daily global irradiance is between 6-7 kWh/m²/day.
- The eastern region representing the semi-desert and the (Badia) remote area has an annual daily irradiance level of between 5.5-6 kWh/m²/day.
- The middle region has an average global irradiance of 4.5 – 5 kWh/m²/day, but with the highest annual daily average of diffused irradiance.
- The northern region has an annual average global irradiance of about 5.5 kWh/m²/day.
- The western region representing the Jordan Valley area, situated below sea level, has an average annual daily global irradiance below 4.5 kWh/m²/day.

93 http://www.nerc.gov.jo/Pages/viewpage.aspx?pageID=180

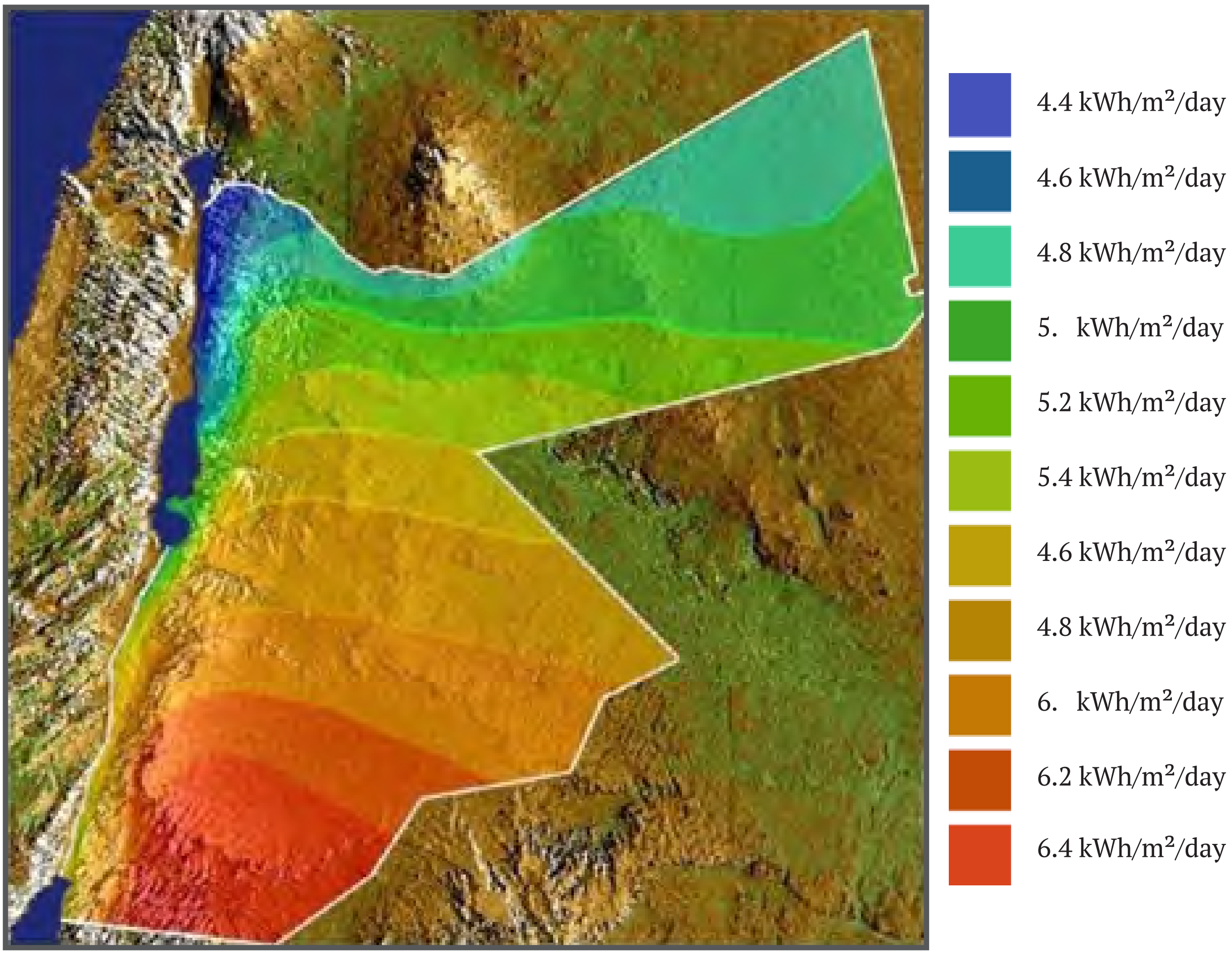

Figure 5. Global horizontal irradiation (GHI) in Jordan.

Source: Ministry of Energy & Mineral Resources of Jordan, National Energy Research Center of Jordan[94]

These figures show that the resources Jordan possesses are enough for solar power station to be placed in any part of the country. The lowest figures for irradiation potential on Jordanian territory are 1600-1800 kWh/m² (Figure 6), which corresponds to the irradiation levels in the regions providing the highest solar generation in China, Japan, Italy, and significantly more than the irradiated regions producing solar energy in Germany, United Kingdom, France, and Spain, 7 out of the world's top 8 countries in terms of installed solar power capacity[95] (Table 11). Southern Jordan has the highest solar irradiation potential, at levels up to 2800 kWh/m², levels much higher than even the highest of the world's top installed facilities.

94 http://www.nerc.gov.jo/Pages/viewpage.aspx?pageID=180

95 http://www.iea-pvps.org/fileadmin/dam/public/report/PICS/IEA-PVPS_-_A_Snapshot_of_Global_PV_-_1992-2015_-_Final_2_02.pdf

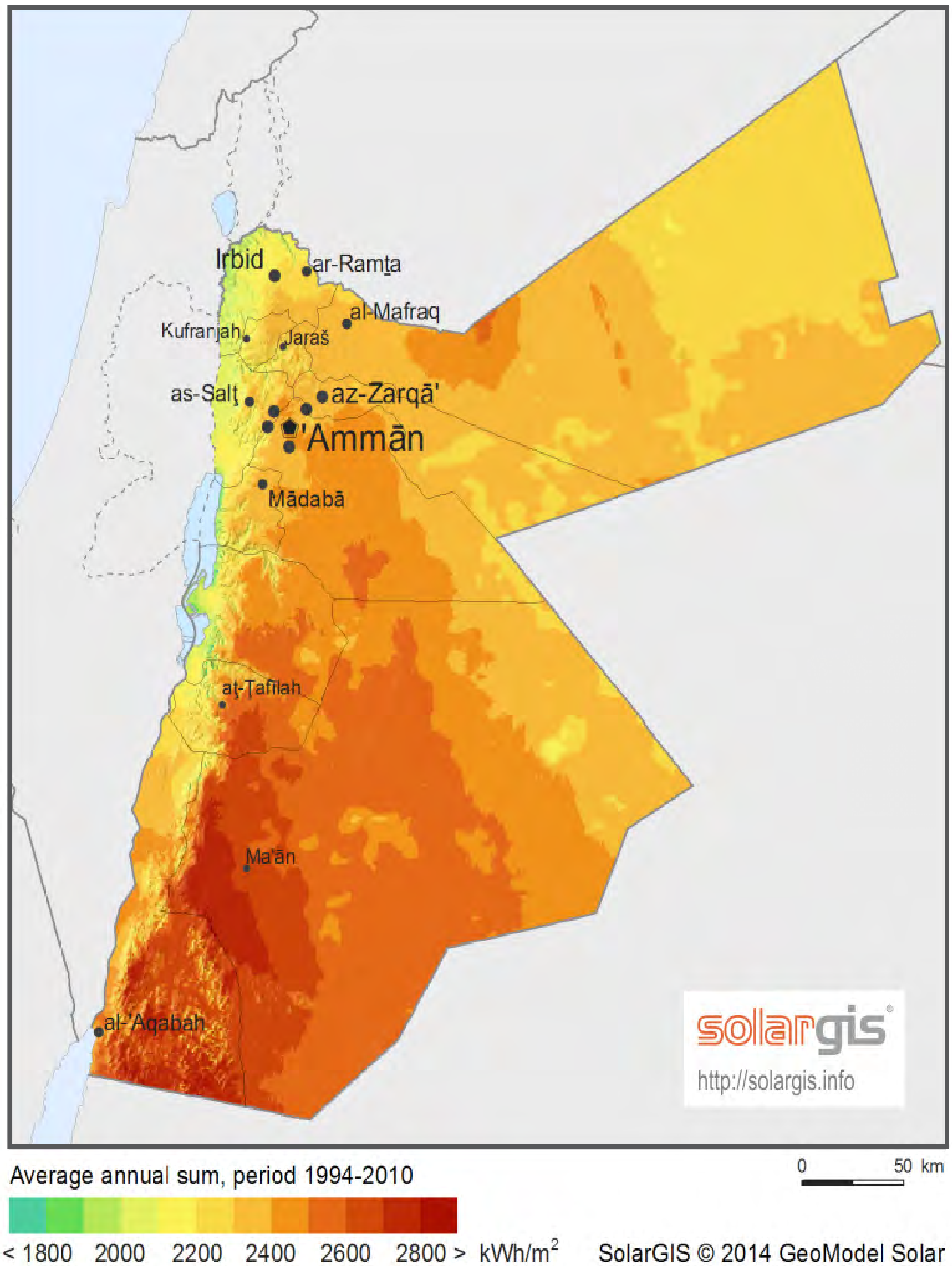

Figure 6. Direct normal radiation in Jordan
Source: SolarGIS

Table 11. The biggest installed capacity of PV countries.

Country	Cumulative installed capacity of photovoltaics in 2015, GW	The biggest photovoltaic power plant in the country			Solar irradiation for the areas with the biggest solar power plants, kWh/m²
		Name	Installed capacity, MW	Generation, GWh	
China	43.5	Longyangxia Dam Solar Park	850	824	1,700-1,900
Germany	39.7	Solarpark Meuro	166	n/a	1,000-1,200
Japan	34.4	Eurus Rokkasho Solar Park (Aomori)	148		1,200-1,300
USA	25.6	Solar Star	579	1,664	2,000-2,200
UK	8.8	Southwick Solar Farm	48	n/a	1,000-1,200
France	6.6	Cestas Solar Farm	300	380	1,200-1,400
Spain	5.4	Olmedilla Photovoltaic Park	60	87,5	1,600-1,800
Australia	5.1	Nyngan Solar Plant	102	233	1,900-2,100
India	5	Kamuthi Solar Power Project	648	n/a	1,800-2,000

Photovoltaic Power (PV)

Photovoltaic power converts sunlight directly into direct current electricity. With an installed capacity, greater than 137 GWs worldwide[96] and annual additions of about 40 GWs in recent years[97], solar PV technology has become an increasingly important energy supply option. Currently two types of panels dominate the PV market: crystalline wafers and thin-film. Crystalline wafers provide high efficiency solar cells but are relatively costly to manufacture. In comparison, thin film cells are typically cheaper due to both the materials used and the simpler manufacturing process. However, thin film cells are less efficient. They do, though, perform better in hot climates and have a better response to partial shading or soiling.[98] For this reason, thin film was chosen as the representative technology in this study.

The most significant factors for traditional power stations deployment are the position relative to the consumers and the energy resources, and the transmission grid availability. In case of the solar power there are additional factors as irradiation, weather and seasonal variations, and flatness of the surface.

According to the NERC data, the southern region represented by Ma'an and Aqaba have the highest solar isolation in Jordan and the lowest values of diffuse irradiance

96 Utility-Scale Solar Photovoltaic Power Plants. A Project Developer's Guide. - International Finance Corporation, 2015

97 IEA, "Trends 2014 in Photovoltaic Applications"

98 Typically efficiency of PV panels declines at temperatures above 25 degrees Celsius.

(6.2-6.4 kWh/m²/day). The area is connected to the existing 132kV transmission line and is 30 km from 400kV line from Egypt.[99] Also, the suggested area is characterized as flat, which is a beneficial for a large-scale PV power plant installation. As of 2016, the area already has an operational PV power station next to Ma'an town. For this reason, we chose to perform the analysis for PV potential in this region.

From a strategic perspective, distributing production across multiple locations, especially in the case of Scenario 2, for which quantities are considerable, would distribute loads (and risk) across transmission and distribution links, rather than concentrating them on particular lines. In fact, the difference between Maan and other regions in to the north in terms of generation capacity are relatively minor, as are the differences in transmission losses due to differences in distance. Therefore, it is recommended to distribute production. For the purposes of this study, however, we present calculations for the Maan region only.

Application to Project Scenarios 1 and 2 – Thin Film PV

Globally the PV solar power station output is calculated according to the formula:

$$E = A \times R \times H \times P \times R$$

Where:

E = Energy output (kWh)

A = Total solar panel Area (m²)

R = Solar panel yield (%)

H = Annual average irradiation on tilted panels

PR = Performance ratio, coefficient for losses in generation

99 At the present stage, it is difficult to estimate the existing transmission lines loads. We make an assumption, that the future power stations can be connected to the existing power grid, however, as in the case of water, capacities of existing infrastructure is something that will need to be investigated in a full feasibility study.

The following analysis is undertaken for thin-film technology (Cadmium telluride (CdTe)), with both fixed panels and one-axis tracking,[100] applied to the Maan region. Solar panel yield is estimated according to the First Solar technical datasheet.[101] A performance ratio is estimated as a coefficient for losses of different kinds, such as temperature losses, inverter losses, cables losses, dust, etc. Annual average irradiation on titled panels is estimated according to NASA Atmospheric Science Data Center database.[102] The results are presented in Table 12.

As the effectiveness of current PV systems declines over time, in order to ensure that Scenarios 1.A. and 1.B. are, in fact, carbon neutral for the life of the project (assumed to be 25 years), we added additional production to the estimates for these scenarios. Based on current technologies, we assume a reduction rate of 0.5% of output annually. Thus, for instance, instead of the figure of 3,108 GWh annual production calculated in Table 10 above for Scenario 1.A., we use a production capacity of 3,372 GWh for 2030, meaning that actual production will be greater than the 3,108 GWh demand in the early years of the project and less than actual demand in the later years.

100 Tracking is a technology in which the panel sits on a movable axis that allows orienting the solar panels relative to the position of the sun throughout the daylight hours such that the energy capture by the panels is maximized.

101 http://www.firstsolar.com/en-EMEA/-/media/First-Solar/Technical-Documents/Series-4-Datasheets/Series-4-Module-Datasheet---V3-103116-(1).ashx

102 Database of NASA Atmospheric Science Data Center - https://eosweb.larc.nasa.gov/cgi-bin/sse/sse.cgi?skip@larc.nasa.gov

Table 12. Inputs and Outputs of PV Technologies

Parameter	Scenario		
Input	**1.A**	**1.B**	**2**
Energy generation (GWh)	3,108	6,495	34,830
Energy generation (with annual production degradation of 0.5%) (GWh)	3,372	7,046	34,830
Solar panel yield (%)	17	17	17
Global horizontal irradiation (daily inputs) (total kWh/m²/year)	2,042	2,042	2,042
Performance ratio, coefficient for losses[103]	0.9	0.9	0.9
Output fixed at 29° tilt			
Annual average irradiation on titled panels (kWh/m²/year)	2,171	2,171	2,171
Total installed capacity of the system (MWAC)	**1,720**	**3,593**	**17,600**
The area of land required (km²)	10.2	21.2	104.5
Capacity factor (%)	22.4	22.4	22.4
Output one-axis tracking			
Annual average irradiation on tracking panels (kWh/m²/year)	2,714	2,714	2,714
Total installed capacity of the system (MWAC)	**1,513**	**3,161**	**15,630**
The area of land required (km²)	9	18.6	92
Capacity factor (%)	25.5	25.5	25.5

As can be seen from the above table, installing trackers would increase the total output. It would raise the capacity factor to 25%. Moreover, modern technologies with solar panels efficiency of 17%, allow higher energy output while decreasing the area of land required. In the given climate conditions, the area of land for a one-axis tracking system required for covering the needed capacities is 15% less, than the fixed tilt. This is possible due to two factors. First, the energy production at 30-degree latitude increase 25% over no tracking systems.[104] Second, according to NREL,[105] capacity and generation-weighted land-use requirements for one-axis tracking systems are just 10% higher over fixed-tilt panels.[106]

103 Estimated according to the theoretical works: http://www.nrel.gov/docs/fy13osti/57991.pdf, http://www.nrel.gov/docs/fy13osti/56487.pdf

104 http://www.dcesolar.com/docs/Single-Axis-Tracking-Systems.pdf

105 http://www.qualenergia.it/sites/default/files/articolo-doc/Studio_NREL_FV_e_consumo_suolo.pdf

106 Estimated for regions with similar weather conditions.

Concentrating Solar Power

Concentrating Solar Power (CSP) systems produce electricity by focusing sunlight to heat a fluid. The fluid then boils water to create steam that spins a conventional turbine and generates electricity or it powers an engine that produces electricity.[107] CSP plants consist of three major subsystems: one that collects solar energy and converts it to thermal energy; a second that converts the thermal energy to electricity; and a third that stores thermal energy collected from the solar field and subsequently dispatches the energy to the power block. The primary advantage of CSP over PV is the potential storage capacity, allowing for electricity production during periods without sunlight. In general, relative to PV systems, CSP technologies are not currently widely deployed worldwide. A total of 4356 MW[108] of capacity was installed in 2016, nearly all of which was in Spain and the USA.

Three primary CSP technologies exist: Parabolic Trough (PT), Central Receiver (CR) or Solar Tower (ST) and Linear Fresnel Reflector (LFR). PT is currently the most proven technology. It uses parabolic troughs to concentrate sunlight onto thin tubes carrying thermal oil, the heat from which is applied to water to produce steam, which then is used to rotate turbines to generate power. In ST systems, mirrors concentrate sunlight onto a boiler atop a tower, which produces steam from water, which, in turn, rotates turbines to generate power. LFR is similar to parabolic trough collectors, but use a series of long flat, or slightly curved, mirrors placed at different angles to concentrate the sunlight on either side of fixed receivers, through which water flows and is converted into steam. This system has advantages of low costs, but it is not commercially proven, and for this reason is not considered in this study, as performance data is unreliable.

Radiation levels zoning

CSP plants require abundant direct solar radiation in order to generate electricity, given that only strong direct sunlight can be concentrated to the temperatures required for electricity generation. This limits CSP to hot, dry regions, making the Middle East and Jordan in particular a perfect place for this technology application. To be economically efficient at present a CSP plant's direct normal irradiance levels (DNI) must be of 2 000 kWh/m²/year or more. As can be seen in the above maps (Figures 5 & 6), Jordan has much territory suitable for CSP production. The solar power capacity zones for CSP can be generalized into 3 regions.

- The northern region – to the north and north-east of Amman, with annual irradiation levels of 2000-2200 kWh/m²;
- The central region – south of Amman to al Tafilah town, with levels of 2200-2600 kWh/m² annually;
- The southern region – south of al Tafilah town (this region includes Ma'an), with levels of 2600-2800 and more kWh/m² annually.

The decision factors for choice of CSP deployment are the same as for the PV power. The southern region represented by Ma'an and Aqaba has the largest potential due to the highest solar isolation in Jordan and the lowest values of diffuse irradiance, existing 132kV transmission line and is 30 km from 400kV line from Egypt.

107 Richter, C.; Short, R.; Teske, S. (2009). "Concentrating Solar Power Global Outlook 09: Why Renewable Energy is Hot." ESTELA, Green Peace International, and Solar Paces. Amsterdam, Netherlands

108 http://cspworld.org/cspworldmap?field_country_map_tid=All&field_purpose_tid=All&field_status_tid=244&order=field_power&sort=desc

Application to Project Scenarios 1 and 2 - CSP

The configuration of a CSP plant is a function of what is called Solar Multiple (SM). A steam cycle power station with SM1 has one solar field just large enough to provide turbine capacity under nominal irradiation conditions. A CSP plant with a solar multiple SM2 would have a solar field twice as large and a thermal energy storage system large enough to store the energy produced by the second solar field during the day. Thus, one solar field directly drives the turbine, while the other solar field fills the storage for night time operation.[109,110]

The solar field is defined by the collector area in square meters, which can be estimated by the simplified equation:[111]

$$CA = \frac{G}{e \times I}$$

Where:

CA = collector area (m²)

G = amount of energy generation (kWh)

e = net annual efficiency, Solar to Electric

Table 13 presents the calculations for the land use requirements for the various solar energy technologies evaluated in this study.

Table 13. Efficiency and Land Use Requirements for Concentrated Solar Energy

Parameter	Scenario		
Input	**1.A**	**1.B**	**2**
Energy generation (GWh)	3,108	6,495	34,830
Annual efficiency (trough)[112] (%)	15	15	15
Annual efficiency (tower) (%)	20	20	20
Annual average insolation (kWh/m²) [113]	2,500	2,500	2,500
Output			
Total installed generator capacity (MWAC)	1,420	2,966	15,905
Trough			
The area of land required SM1 (km²)	8.3	17.4	92.9
The area of land required SM2 (km²)	16.6	34.7	185.8
Tower			
Total installed generator capacity (MWAC)	888	1,854	9.941
The area of land required SM1 (km²)	6.3	13	69.7
The area of land required SM2 (km²)	12.5	26	139.4

109 Franz Trieb, Christoph Schillings, Marlene O'Sullivan, Thomas Pregger, Carsten Hoyer-Klick. Global Potential of Concentrating Solar Power, German Aerospace Center, Institute of Technical Thermodynamics. - http://www.solarthermalworld.org/sites/gstec/files/global%20potential%20csp.pdf

110 Storage capacity and collector field size can be increased to SM3 and SM4. Increasing solar fields further does not make sense, as during high irradiation periods they would increasingly produce unused surplus energy.

111 Assessment of Parabolic Trough and Power Tower Solar Technology Cost and Performance Forecast, Sargent and Lundy LLC, NREL, 2003

112 Database of NASA Atmospheric Science Data Center - https://eosweb.larc.nasa.gov/cgi-bin/sse/sse.cgi

113 https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf

I – annual insolation (kWh/m^2)

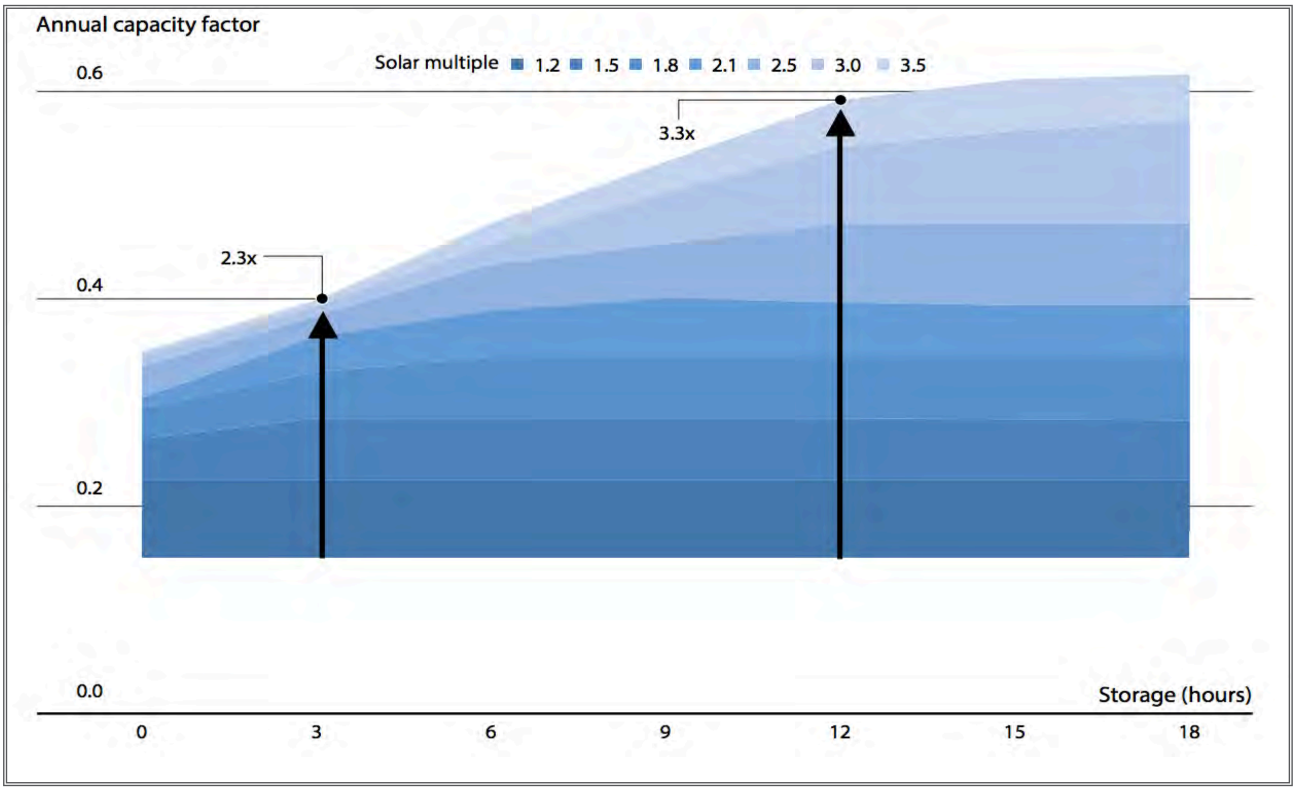

Figure 7. Capacity factor for a 100 MW parabolic trough plant as a function of solar multiple and thermal energy storage (Based on IRENA Renewable Cost Database and Trieb et al., 2009. Source: [114])

As shown in Figure 7 capacity factor grows only with the solar multiple. If the field stays the same size, the storage does not influence the efficiency. The best way to increase the power yield with the capacity factor is to increase the field size. In the model we assumed, that the capacity factor for SM 1 for both technologies is 25% and 40% for SM 2 giving an opportunity for 9-hours of storage.

114 https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf

5. ECONOMIC ASSESSMENT OF WATER-ENERGY EXCHANGES

5.1. Economic Analysis of Water Supplies

In this study we assume that all additional water for domestic purposes will be supplied using reverse-osmosis technology, as this is currently the most energy efficient of the commercially available desalination technologies. Because this is the technology currently in place in Israel, it is also the technology for which we have the most reliable cost figures.

Estimates of capital costs for seawater desalination plants in Israel with a capacity of 100-150 mcm/y are in the range of US $200-450 million.[115] Capital costs for construction of the desalination plant in Gaza, intended to be of similar capacity (111-120 mcm/y) in its final stage, are significantly higher, and are estimated at $660 million.[116] This higher cost in Gaza relative to Israel is likely due to several issues including the lack of functioning port, the poor state of existing infrastructure, and additional security measures needed. Should the political climate change for the better, construction costs in Gaza might decrease substantially.

This translates into a figure of roughly $2-$3 per m^3 capacity in Israel, and $5.5 per m^3 in Gaza. Taking the low end figure of $2 per m^3 capacity, the cost of constructing facilities to supply the necessary 574 mcm from Scenario A, would be nearly $1.2 billion, while a high-end estimate, using the cost figures from Gaza, would place the cost at nearly $3.2 billion. The cost estimates for Scenario B would be approximately double that, or roughly $2.4 billion and $3.6 billion respectively.

It is likely that these per unit figures will be lower for larger capacity facilities, as there are likely economies of scale. However, as the current plants in Israel are the largest capacity reverse-osmosis plants in the world, we lack data on how these costs are likely to change. In addition, it is likely that much of the needed capacity could come from expanding the capacity of existing desalination plants, rather than constructing new facilities. This would likely reduce capital costs significantly. Additionally, given that one large-scale desalination plant is already being planned for Gaza, provision of additional water from there is likely to be less costly than for the initial facility.

Most large-scale seawater desalination plants in Israel were built by the private sector under Build Operate Transfer (BOT) contracts. As such, they bore the capital and operating expenses (primarily energy costs), which were reflected in the cost of water according to long-term contracts (typically for a period of 25 years). Costs for desalinated water from BOT contracts in Israel range from 2.0-2.9 shekels per cubic meter of water supplied. This price in US dollars has fluctuated with exchange rates. As of the writing of this study, the cost in US dollars ranged from $0.55 to $0.80 per cubic meter. Taking the low-end estimate, assuming cost savings due to economies of scale and technological improvement over time, regional annual costs would be in the range of $316 million for Scenario A and $660 million for Scenario B.

115 Spiritos, E. and Lipchin, C. 2013. Desalination in Israel. In Becker, N. (ed.) Water Policy in Israel. Springer Press. pp.101-123.

116 Palestinian Water Authority. 2017. Gaza Central Desalination & Associated Works Program - Executive Donor Information Handbook.
Office of the Quartet, Report for the Meeting of the Ad-Hoc Liaison Committee, May 3-4 2017, Brussels.

The above calculation assumes that all additional water supplied is priced at the marginal cost of desalinated water, as it assumes that current renewable sources are fully exploited and that additional water will come from desalination. In practice, current water transfers from Israel to Jordan are of water from the Sea of Galilee and therefore are at a cost lower than that of desalination. Given that any international transfers will be compensated for by increased desalination, however, the marginal cost is representative of the actual cost of provision.

To these costs one needs to add the cost of delivery. For Gaza and Israel's coastal region, this amount would be minimal, as consumption is local. In the case of the West Bank and the rest of Israel, the cost of delivery would be dependent on the location of the desalination plants supplying the water. As explained in Section 2.2 above, for this study a figure of 1.26 kwh per cubic meter was used as a representative average figure. Assuming a cost of US$0.082 per kwh (current prices paid by the water sector in Israel), pumping costs would add an additional US$0.103 per cubic meter or US$59 million annually for Scenario A and US$124 million for Scenario B.

The pumping figure was based on delivering the water to the Jordan River system. For Jordan, there is the additional cost of delivery from the Jordan River system. A study on the delivery of 50 mcm/y of water from Israel to Jordan indicated additional pumping and operation costs of between $0.077 and $0.115 per cubic meter for delivery from the Sea of Galilee region to the King Abdullah Canal, Jordan's primary national water carrier system.[117] In the case of flows of the scale envisioned in this report, actual costs are likely to be lower, as there are economies of scale in the delivery. For this reason, this study assumes the lower-bound estimate, which, when applied to the share of water designated for Jordan, would entail an additional $22 million annually for Scenario A and $53 million for Scenario B. This does not include the costs of pumping from the King Abdullah Canal to the eventual end users throughout the Kingdom.

Summarizing the costs, water provision within Israel and Palestine would cost roughly US$0.65 per cubic meter, while it would cost US$0.73 per cubic meter to deliver it to Jordan. The above calculations assume that capacity in the delivery system within Israel/Palestine are sufficient to deliver the specified amounts. Should additional piping or other infrastructure be needed, this would increase the cost somewhat, but likely not at a scale that would dramatically affect overall prices. Furthermore, we assume that the infrastructure to deliver this amount of water in these countries would occur regardless of whether or not water-energy exchanges such as those investigated here tale place.

It is difficult to calculate the cost of delivering the water throughout Jordan, however, assuming the same pumping coefficients as in Israel, pumping from the King Abdullah Canal to Amman, for instance, with an elevation difference of 1000m and a distance of approximately 100km would entail an extra 5.25 kwh per cubic meter. The cost of electricity in Jordan is variable and subsidized making direct calculations complicated. According to a "Master Strategy for the Energy Sector in Jordan for the Period 2007 – 2020," prepared by the electric utility NEPCO the projected marginal cost of electricity in 2030 is projected to be US$0.071.[118] Using this cost would entail a price of US$0.37/m^3 for delivery.

117 Shaham, G. 2015. Options for Supply of Additional Water to the Kingdom of Jordan. The Kinneret Drainage and Rivers Authority – Sea of Galilee Administration.

118 Coyne-Et Bellier, Tractebel Engineering and Kema. 2014. Red Sea - Dead Sea Water Conveyance Study Program
Feasibility Study Draft Final Feasibility Study Report Summary.

Adding this to the cost of delivery up to the King Abdullah Canal gives a cost of US$1.10/ m^3 (Figure 8). This is very similar to the lowest-end costs estimate for the Red-Dead canal examined within the context of the World Bank sponsored feasibility study,[119,120] as well as to the costs of bringing water from the Disi Aquifer in southern Jordan (a major source of current water supply),[121] and is significantly lower than the high end estimates of such sources. In contrast to water from Aqaba or Disi as a source, the actual distance water would need to be pumped in this project would be less, and so would associated costs, as much of Jordan's population is located in the North, closer to the King Abdullah Canal.

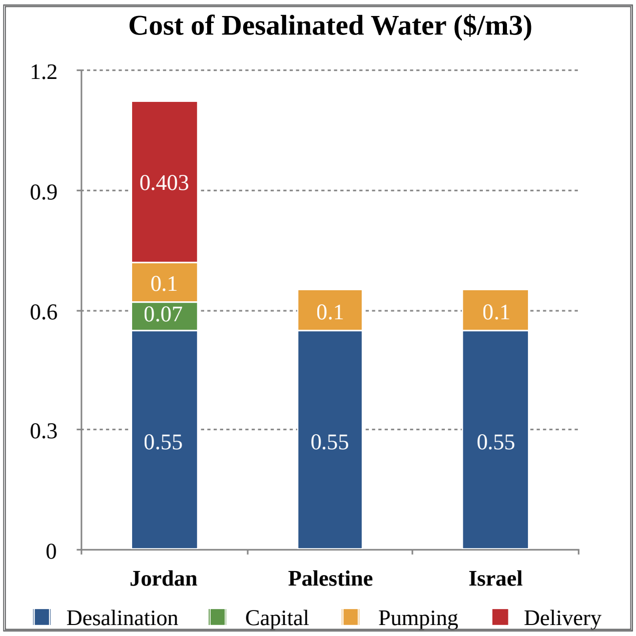

Figure 8. Estimated Costs of Desalinated Water per Country

Water subsidies in Jordan are extensive. Between 2005-2011 they were estimated to be 0.4% of Kingdom's total GDP.[122] This is a serious drain on government coffers, and phasing out of these subsidies is a significant part of the Jordanian Ministry of Water and Irrigation's strategic plans.[123] Therefore, attaining water in a cost efficient manner is an important economic and national priority.

Summarizing the costs of the water project, annual costs would be US$500 million for Scenario A, of which over 60% are for water supply to Jordan. In the case of Scenario B, annual costs are US$1088, of which nearly 70% is for water supply to Jordan (See Table 14). Taking a 25 year framework with no discount rate[124] applied this works out to be US$9.9 billion and US$20.9 billion respectively. Applying a 5% discount rate would produce a net present value (NPV) of project costs of US$5.9 and US$12.4 billion respectively, while applying a discount rate of 10% would reduce the respective NPVs further to US$4.0 billion and US$8.3 billion (Table 15). Taking a 25 year framework with no discount rate[125] applied this works out to be US$12.5 billion and US$27.2 billion respectively. Applying a 5% discount rate would produce a net present value (NPV) of project costs of US$7.4 and US$16.1 billion respectively, while applying a discount rate of 10% would reduce the respective NPVs further to US$5.0 billion and US$10.9 billion (Table 15).

119 Ibid 2014 and Allan, J.A., A.I.H. Malkawi, and Y. Tsur. 2014. Red Sea–Dead Sea Water Conveyance Study Program Study of Alternatives *Final Draft Report Executive Summary* and Main Report.

120 One need be careful regarding comparisons of costs from this project with those of the Red-Dead Canal, as they are not designed to achieve the same purposes and therefore include different types of infrastructure and calculations were undertaken with somewhat different assumptions. Thus, the comparison is for illustrative purposes only.

121 USAID. 2012. Review of Water Policies in Jordan and Recommendations for Strategic Priorities.

122 Ibid, 2012.

123 Jordan Ministry of Water and Irrigation. 2016. Water Sector Capital Investment Plan – 2016-2025.

124 Various discount rates are used in order to compare costs over time and in order to present figures from different time periods in terms of net present value. The choice of an "appropriate" discount rate is largely a function of actual cost of capital at the time of construction. Therefore, the choice of 0%, 5%, and 10% are for illustrative purposes only.

125 Various discount rates are used in order to compare costs over time and in order to present figures from different time periods in terms of net present value. The choice of an "appropriate" discount rate is largely a function of actual cost of capital at the time of construction. Therefore, the choice of 0%, 5%, and 10% are for illustrative purposes only.

Table 14. Annual Costs of Desalination and Pumping

Scenario		Additional Water Needed	Desalination Costs	Pumping Cost	Additional Pumping Cost for Jordan to KAC	Pumping within Jordan	Total
		(mcm)	(US$ million)				
A	Israel	70.2	38.6	7.2			**45.8**
	Palestine	222.8	122.5	22.9			**145.5**
	Jordan	280.6	154.3	28.9	21.6	103.8	**308.7**
	Total	**573.6**	**315.5**	**59.1**	**21.6**	**103.8**	**500.0**
B	Israel	70.2	38.6	7.2			**45.8**
	Palestine	444.3	244.4	45.8			**290.1**
	Jordan	684	376.2	70.5	52.7	253.1	**752.4**
	Total	**1,198.5**	**659.2**	**123.4**	**52.7**	**253.1**	**1,088.4**

Table 15. Net Present Value of Water Project Costs (in billions of US$) (25 year time period)

	Applied Discount Rate		
	0%	**5%**	**10%**
Scenario A	12,500	7,399	4,992
Scenario B	27,209	16,106	10,867

Critically, this analysis assumes that no additional infrastructure is necessary for delivery and that the additional amounts of water could be delivered within the current and planned national delivery systems. Future analysis will need to clarify estimated capacity limits and the potential need for infrastructure improvements and expansion necessary to accommodate the scale of flows envisioned in this study.

It is important to note that in the case of Palestine and Israel, the calculated costs are likely to be identical to the costs of water delivery regardless of whether they are undertaken within the framework of a regional water-energy exchange or not. In the case of Jordan, the costs would have to be compared to alternative means of accessing such water. Currently the only existing plan for doing so is the Red-Dead Canal. While detailed cost estimates have been made for the Canal, it would be inappropriate to compare these costs directly with those in this analysis, as the scales, goals and projected outcomes of the projects are not identical. Analysis of alternatives to the Red-Dead Canal, however, like this study, found that supply of water from a Northern route, i.e.,. via Israel would be cheaper than the Red-Dead route eventually chosen.[126] Furthermore, the cost of delivery from the King Abdullah Canal to the end users would be substantially less than from the Dead Sea, given the difference in elevation, the proximity to end users, and the existing infrastructure already in place.

126 Allan, J.A., A.I.H. Malkawi, and Y. Tsur. 2014. Red Sea–Dead Sea Water Conveyance Study Program Study of Alternatives *Final Draft Report Executive Summary* and Main Report.

5.2. Initial Economic Analysis of Renewable Energy Supplies

5.2.1. Electricity Production

Analysis of the economic feasibility of the energy production portion of the project can be undertaken in a number of different ways, each bringing its own insights. Typical costs examined include equipment costs (e.g. PV modules, solar reflectors), financing costs, total installed cost, fixed and variable operating and maintenance costs (O&M), fuel costs and the levelized cost of energy (LCOE). Due to the lack of accumulated experience with utility scale PV power plants and CSP plants construction in Jordan, this analysis uses average costs of some of the parameters from around the world.

High and low-end costs for photovoltaics are based on the assumptions for capital costs from theoretical works and expert consultations – USS1/W for a low-end and US$1.5/W for the high-end scenario for stationary tilt panels. For moveable one-axis technology, the costs are 10 cents higher, or US$1.1/W and US$1.6/W respectively. High and low-end costs for CSP are based on the assumptions of capital costs for power plants construction taken from the International Renewable Energy Agency (IRENA).[127] The land use costs were based on expert consultations regarding experience of solar power plants construction in Jordan. For Jordan this amounted to 120 Jordanian Dinar per dunam per year (US$168,000/km^2/y).[128] This figure is likely an overestimate as it is based on projects of a much smaller scale than the ones evaluated herein, and thus the per dunam rate would likely be less for larger scale projects. Operation and maintenance costs calculations were based on current experience in Jordan, expert opinions, and IRENA estimates.[129]

127 https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-CSP.pdf, https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf

128 Using an exchange rate of 1JD = US$1.4

129 https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-CSP.pdf, https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf

The calculations shown below are for the assumptions of a 25 year project life, 100% equity financing, a 5% discount rate and no inflation rate. For purposes of sensitivity analysis, similar calculations were made by varying all three parameters in various permutations using values 50% debt financing, no discount rate, and a 3% inflation rate. These are not shown herein, but did not change the rankings of technology options in terms of economic preference.

Tables 16-18 display calculations of investments for the projects for the different scenarios, for both high and low-end costs. Given the current level of PV and CSP technologies development the lowest cost option in terms of capital expenditures is a PV system with one-axis tracking system. This technology needs around 5% less capital investment than the next cheapest option and requires less area for covering same electricity needs. CSP options are significantly more expensive, but offer the possibility of energy storage, and thus, reduce the problem of supply intermittency.

Table 16. Parameters for economic analysis. Scenario 1A

	PV, tilt panels	PV, one-axis tracking	CSP, tower, no storage	CSP, tower, storage	CSP, trough, no storage	CSP, trough, storage
Installed generator capacity, MW	1,720	1,513	1,420	888	1,420	888
CAPEX, low estimate, million US$	1,720	1,665	8,515	5,766	5,677	6,032
CAPEX, high estimate, million US$	2,579	2,421	9,934	7,983	10,644	8,870
CAPEX, low estimate, US$/Wp	1	1.1	6	6.5	4	6.8
CAPEX, high estimate, US$/Wp	1.5	1.6	7	9	7.5	10
Land use cost (annual), million US$	1.7	1.5	1.1	2.1	1.4	2.8
Land use cost (rent for all period), million US$(undiscounted)	42.5	37.4	26.5	52.5	34.9	69.7
Land use cost (rent for all period), million US$ (5% discount rate)			15.7	31.1	20.6	41.3
Operation and maintenance, c/kWh	1.3	1.5	3	3	2	3

Table 17. Parameters for economic analysis. Scenario 1B

	PV, tilt panels	PV, one-axis tracking	CSP, tower, no storage	CSP, tower, storage	CSP, trough, no storage	CSP, trough, storage
Installed generator capacity, MW	3,593	3,161	2,966	1,854	2,966	1,854
CAPEX, low estimate, estimate, million US$	3,593	3,478	17,792	12,047	11,862	12,603
CAPEX, high estimate, estimate, million US$	5,389	5,059	20,758	16,680	22,240	18,534
CAPEX, low estimate, US$/Wp	1	1.1	6	6.5	4	6.8
CAPEX, high estimate, US$/Wp	1.5	1.6	7	9	7.5	10
Land use cost (annual), estimate, million US$	3.6	3.1	2.2	4.4	2.9	5.8
Land use cost (rent for all period), estimate, million US$ (undiscounted)	88.8	78.1	54.6	109.2	73.1	145.7
Land use cost (rent for all period), estimate, million US$ (5% discount rate)			32.3	64.6	43.3	86.3
Operation and maintenance, c/kWh	1.3	1.5	3	3	2	3

Table 18. Parameters for economic analysis. Scenario 2

	PV, tilt panels	PV, one-axis tracking	CSP, tower, no storage	CSP, tower, storage	CSP, trough, no storage	CSP, trough, storage
Installed generator capacity, MW	19,270	16,957	15,905	9,941	15,905	9,941
CAPEX, low estimate, estimate, million US$	19,269	18,653	95,425	64,610	63,616	67,592
CAPEX, high estimate,estimate, million US$	28,904	27,131	111,329	89,461	119,281	99,401
CAPEX, low estimate, US$/Wp	1	1.1	6	6.5	4	6.8
CAPEX, high estimate, US$/Wp	1.5	1.6	7	9	7.5	10
Land use cost (annual),estimate, million US$	19	16.1	11.1	23.4	15.6	31.2
Land use cost (rent for all period), estimate, million US$(undiscounted)	476.1	418.9	292.7	585.5	390.2	780.4
Land use cost (rent for all period),estimate, million US$ (5% discount rate)			173.3	346.6	231	461.9
Operation and maintenance, c/kWh	1.3	1.5	3	3	2	3

One important finding from the analysis is that land costs represent a relatively minor share of total project costs, regardless of technology choice. In no cases are they more than 2.5% of total capital expenditures, and in most cases substantially less. This seems to imply that lower land use costs in Jordan, relative to Palestine and Israel, are unlikely to be a factor in locating the facilities. More important are the lack of available open spaces for such facilities in Palestine and Israel and the regulatory and bureaucratic obstacles to obtaining approval for construction of such facilities there.

Capital investments, however, is not the only, nor the most representative measure of project costs or preferability. Levelized cost of electricity measures the per unit costs of electricity production over the lifetime of a project. As such, it allows for comparison of projects of different technologies, scale, duration, capital costs, etc. The approach used in the analysis presented here is based on a discounted cash flow analysis.[130]

The formula used for calculating the LCOE of renewable energy technologies is:

$$LCOE = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

Where:

$LCOE$ = the average lifetime levelized cost of electricity generation;

I_t = investment expenditures in the year t;

M_t = operations and maintenance expenditures in the year t;

F_t = fuel expenditures in the year t;

E_t = electricity generation in the year t;

r = discount rate; and

n = life of the system.

The results of the analysis for LCOE are presented in Figure 9. Again, a PV system with a one-axis tracker produced the lowest cost option, at 5.25 US cents per kWh using the low-end assumptions and 6.85 US cents using the high-end estimates. These values are comparable to current state of the art renewable energy projects and are competitive with fossil fuel produced electricity.

The values listed in Figure 9 are for a 5% discount rate and a 0% inflation rate. Using a 0% or 10% discount rate changes the values for all technologies by an average of 35%, but does not change their relative ranking in terms of LCOE. Similarly, introduction of an annual inflation rate of 3% raises the LCOE by 4-10% depending on the technology, but again, does not affect the relative ranking.

130 Calculations were made using the LCOE Calculator of the National Renewable Energy Laboratory of the U.S. Department of Energy https://www.nrel.gov/analysis/tech_lcoe.html, and its Cost of Renewable Energy Spreadsheet Tool (CREST) https://financere.nrel.gov/finance/content/crest-cost-energy-models.

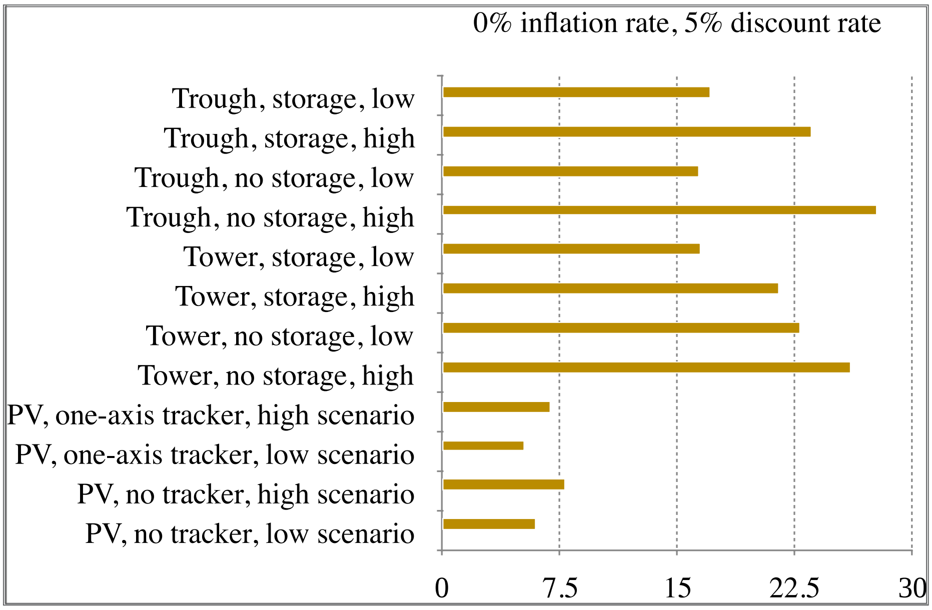

Figure 9. Levelized cost of electricity for different kinds of electricity generation

A primary disadvantage of PV systems is their lack of storage capacity. CSP technologies have the advantage of storage capacity, but do not appear to be cost competitive at present. Currently there is a number of technologies to integrate storage capacity into PV systems. For instance, pumped hydro storage, wherein electricity is used to pump water to a specified elevation during the day, and the water is released at night to provide hydro-electric power, is one such means. The water requirements for the scale of project evaluated in this study, however, are such magnitude that this option was not investigated in depth. Compressed air energy storage (CAES) systems store energy by compressing air, and require large, low-cost natural buffers (e.g. caverns) to store compressed air, which is then used in gas-fired turbines to generate electricity on demand. As this technology is still being developed, it was not analyzed in this study, but may be considered in a full feasibility study.

The most proven storage technologies at present are batteries, such as lithium ion based ones. At present, however, these are limited in terms of hours of production, and thus, do not substantially mitigate the problem of intermittency. Furthermore, the batteries' efficiency and functionality decline in hot weather conditions, such as those in Jordan. Finally, as can be seen from the calculations provided in Table 19 below, the LCOE from the batteries is still not commercially viable.

Table 19. Performance of Storage Technologies

Storage type	Discharge time	Lifetime (year)	Ovearall storage cost (USD/MWh)	Capital cost (USD/ kW)
VRB8[131]	2-8 h	10	250-300	3,000-4,000
Li-ion battery	15 m – 4 h	8-12	250-500	2,500-3,000
Lead battery	10 s – 4 h	4-8	n/a	1,500-2,000
NaS battery	4 h	15	50-150	100-2,000

Source: IRENA (2012)[132]

In conclusion, PV systems produce at a lower cost than CSP ones. CSP with storage is more cost-efficient than a similar system without storage capacity, but it is still not competitive with PV, which seems to be a more economically reasonable choice. The importance of solar becoming a dispatchable power source (i.e., providing energy at the quantity and timing desired) should not be underestimated. An advantage of CSP over PV is more balanced distribution of capacity throughout the day, which leads to a certain decrease of power transmission grid growth.

5.2.2. Electricity Transmission

In addition to production costs, it is necessary to consider costs of transmission as well, including construction of new transmission capacity. As the purpose of this analysis is to compare an energy exchange between Jordan and Palestine and Israel, we look at the transmission from the production source in Jordan to the connection to the national grids in Palestine and Israel. The assumption being that the internal transmission and distribution would be similar if the countries were to produce the electricity themselves, and therefore their costs should not be attributed to the project.

Obtaining reliable costs regarding necessary transmission infrastructure was exceedingly hard to obtain. Our assumptions regarding power lines and substation costs were based on recent construction of such systems in the region and conversations with experts. We estimate a cost of 250,000 JD (US$354,000) per km of extra high-voltage alternating current (EHVAC) overhead lines (OHL) and about US$10,000,000 for 132/33 substation and US$28,000,000 for 400/132/33 substation. Losses were taken into consideration in the model calculating electricity needs (14%). We assumed transmission capability for EHVAC to be 500-700 MW per circuit. As experts pointed out that the currently existing transmission grid is totally loaded, having little or no additional capacity to meet the project needs, our assumption was, that only new capacities will be needed to transmit the electricity produced in the power plants.

We assume that crossborder electricity transmission in the region will not face considerable difficulties as both Israel and Jordan have the electricity frequency of 50 Hz and power lines of extra high voltage of 400 kV. The connection of Palestine to Jordan would necessitate either an extra high voltage connection line or, less optimally, a substation to convert to lower voltage. In reality, grid integration issues remain an important obstacle and a detailed assessment of grid integration should be undertaken in a full feasibility study.

131 Vanadium redox flow cells or batteries (VRB) are electro-chemical energy storage systems based on the vanadium ability to exist at four different oxidation levels. Rather complex systems having relatively low energy density by volume.

132 Electricity storage. Technology brief. IRENA. 2012. - https://www.irena.org/DocumentDownloads/Publications/IRENA-ETSAP%20Tech%20Brief%20E18%20Electricity-Storage.pdf

Table 20 presents rough calculations for the additional transmission network necessary for Scenarios 1A and 1B, while Table 21 represents calculations for Scenario 2. Transmission network cost estimates for Scenario 2 were based on the assumption that the electricity produced in Jordan covering the needs of Palestine and Israel will be transmitted straight to the Jordan-Palestine and Jordan-Israel borders respectively by OHL without its integration into the Jordanian transmission grid. It should be noted that the estimates for Scenario 2 are very approximate, as the scale is larger than the entire existing electricity market. A more in depth evaluation of needs and costs should also be undertaken in a full feasibility study.

Table 20. Transmission Network Cost Estimates for Scenario 1

Scenario	1A	1B
Distance for the extra high voltage power lines (generated in Jordan), km	221 – in Jordan before the border with Palestine;	
	44 – in Jordan, before the border with Israel	
Number of substations	1	2
Number of double circuit OHL needed	1	2
Transmission construction cost, double circuit OHL (Jordan), US$/km	354,000	354,000
Capital cost estimation for electricity from Jordan to Jordan-Palestine border, million US$	106.3	212.5
Capital cost estimation for electricity from Jordan to Jordan-Israel border, million US$	43.6	87.2

Table 21. Transmission Network Cost Estimates for Scenario 2

	Transmission line to Israel	Transmission line to Palestine
Distance for the extra high voltage power lines (generated in Jordan), km	44	221
Transmitted power, MW	10,000 (6,500 for CSP with storage)	900 (1400 for CSP with storage)
Number of substations	7 (5 for CSP with storage)	1
Number of double circuit OHL needed	7 (5 for CSP with storage)	1
Capital cost estimation for electricity transmission, million US$	305.1 (218 for CSP with storage)	106.3

Several points are important to stress in terms of transmission costs. The first is that, while these cost are very rough estimates, from the above calculations, it seems that the costs of transmission infrastructure will be a relatively small share of relative project costs.

Secondly, the calculations were made assuming all production was undertaken in southern Jordan near Maan. In fact, as mentioned earlier, production would not change dramatically if distributed throughout Jordan. This would have the advantage of lessening loads on any given transmission line and would distribute risk. For this reason, the above calculations likely do not reflect what would be actual infrastructure costs.

Thirdly, because of the above reasons, it is difficult to infer from these costs a per kWh cost for the project, which would be useful both in determining overall energy costs and the value of water energy exchanges. For this reason, no attempt was made in this study to do so. Analysis of US electrical utilities showed that transmission costs averaged between 6-9% of production costs between 2011-2015, while transmission, distribution and maintenance collectively averaged 22-28% of production costs.[133] While it is tempting to apply such ratios to the LCOE calculated above, to do so would risk being extremely inaccurate, as costs are highly dependent on location, fuel type, production facilities and existing capital and infrastructure. We therefore leave estimation of actual costs for building and operating the necessary transmission and distribution infrastructure to the full feasibility study.

5.2.3. Renewable vs. Fossil Fuels

Using similar assumptions to those made for calculating solar, the LCOE of a natural gas power plant in the region produced a figure of 7.35 US cents per kWh. That is, it was equal to the high end estimate for a one-axis PV solar facility and substantially more than the low end estimate for PV solar. This seems to indicate that solar energy would make economic sense, regardless of the environmental benefits. This finding that PV compares favorably with fossil fuels is corroborated by actual market trends in the region. Recent tenders for renewable energy in Israel, for instance, produced a price of 0.199 shekels (5.5 US cents) per kWh,, while the most efficient natural gas production was estimated at 0.21-0.23 shekels (5.8-6.4 US cents) per kWh.[134] Actual production costs based on a coal natural fuel mix are even higher, at roughly 0.27 shekels (7.4 US cents) per kwh. Though we do not have actual production cost figures for the current solar facility in Maan, it is believed to be in the same range as the figures calculated herein.

133 Based on figures provided in US EIA. 2017. Revenue and expense statistics for major U.S. investor-owned electric utilities. https://www.eia.gov/electricity/annual/html/epa_08_03.html

134 Globes. 2017. "Revolution: Solar energy is the cheapest alternative in Israel" 20 March, 2017 (In Hebrew).. http://www.globes.co.il/news/article.aspx?did=1001181744

Direct cost comparisons between solar and conventional power systems, such as natural gas, using parameters such as LCOE are problematic, however, given that electricity produced at gas-powered stations can produce at all hours and production can be scaled to fluctuating consumption patterns, while solar is produced intermittently and not necessarily in concert with fluctuations in demand.[135] In addition, such stations can be built in geographic proximity to consumers, which would reduce the costs for new transmission and distribution capacities, together with technical and economical transmission and distribution losses.

The problems of such cost comparisons are mitigated somewhat given that the share of renewable energy in overall demand is limited and that production is likely to be highest during hours of peak demand, e.g., during summer when air conditioning units are employed. Also, any economic analysis should take into consideration not only direct costs, but also the cost of environmental externalities, which are significant in the case of fossil fuel production. According to the Israeli Ministry of Environmental Protection, as of 2016, average externalities per kwh of electricity production from fossil fuels were 0.1 shekel, or roughly 2.8 US cents.[136] While this is likely to decrease somewhat as the power production shifts more towards natural gas, adding such costs to the direct costs of gas-generated electricity would improve solar energy's relative competitiveness even further. Furthermore, costs for solar energy production are on a rapidly declining downward trend, meaning that their relative cost effectiveness is likely to improve by the time the project would be implemented.

5.3. Water-Energy Exchanges

As mentioned, without detailed data on the costs of transmission and distribution infrastructure, both for water and for energy, it is difficult to estimate the actual costs of the water-energy exchanges that this study is examining. What can be done, however, is to compare production costs. For the purposes of comparison, we assume that regardless of whether the envisioned exchanges occur, the parties would consume the quantities of water and electricity as detailed in Sections 3 and 4. Therefore, this analysis evaluates only the cost of the exchange; that is, it looks at the costs to Jordan of importation of desalinated water from Israel and/or Palestine less the revenue it would receive from selling electricity to Israel and Palestine.

Because the issue of water rights between Palestine and Israel is still contested, and because no declaration was made on where the proposed desalination would occur, for this section we treat Palestine and Israel as a single water exporter for Scenarios 1.A. and 1.B. In the case of Scenario 2, each party is assumed to import 20% of its anticipated electricity consumption (plus losses). For this analysis, the water and electricity are sold at cost. Water costs are those taken from Table 14 above, while electricity prices are based on the LCOE for the low and high end estimates of one-axis PV systems multiplied by relative shares of electricity consumption in each of the scenarios. The results for Scenario 1.A. and for Scenario 2 are presented in Table 22.

135 See, for example, Joskow, P.L. 2011. "Comparing the Costs of Intermittent and Dispatchable Electricity Generating Technologies." *The American Economic Review* 101(3): 238–41. Or Edenhofer, et al. 2013. "On the Economics of Renewable Energy Sources." *Energy Economics* 40: S12–23.

136 Based on figures provided in: http://www.sviva.gov.il/subjectsEnv/SvivaAir/Pages/AirExternalCost.aspx

Table 22. Annual Net Revenue for Jordan

Scenario		Quantity	Revenue (million US$/y) (at US$0.0525/kWh)	Revenue (million US$/y) (at US$0.0685/kWh)
1A	Jordanian Water Imports & Pumping within Jordan	280.6 (mcm)	-$309	-$309
	Jordanian Electricity Exports	1587.6 (MWh)	83	$109
	Net Revenue for Jordan		**-$225**	**-$200**
	Jordanian Electricity Exports*			
2	To Palestine	3,000 (MWh)	$158	$206
	To Israel	22,000 (MWh)	$1,155	$1,507
	Total	**25,000 (MWh)**	**$1,313**	**$1,713**
	Net Revenue for Jordan		**$1,004**	**$1,404**

* Values round to nearest 100 MWh

While the figures above are merely illustrative, as they indicate that the net costs to Jordan of water importation are reduced significantly (by roughly half for Scenario 1A and by 30-40% for Scenario 1B. Because of the large scale of electricity production in Scenario 2, Jordan would become a major exporter of energy. Revenues from exports are estimated at between US$ 1.3-1.7 annually. To put this in perspective, this would be 3-4% of Jordan's 2016 Gross Domestic Product (GDP) of US$ 38.6 billion,[137] and would be 11-15% of industry's share of GDP.

137 The World Bank. 2017. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=JO

5.4. Project Finance

Several options exist for project finance. Should the governments themselves choose to finance it, each side brings with it relative advantages. Israel, as a member of the OECD, has a relatively high credit rating which can attract lower cost financial terms on the open market. Jordan and Palestine, as developing countries, are eligible for financial assistance on favorable terms from institutions such as the World Bank. Other development banks, such as the European Investment Bank or Islamic Development Bank may also be possible sources of funding for the Jordanian and Palestinian portions of the project. In addition, given that the project is promoting renewable energy, various carbon finance instruments may be available, both through development banks and various private carbon markets. These could include low finance loans or grants for carbon offset credits.

As mentioned, there are several reasons to involve the private sector in such a project. All major desalination projects in Israel have been private sector led and/or public-private partnerships, based on BOT project finance models. This has the advantage of deferring upfront costs and much of the risk away from the government and on to the private sector. It also galvanizes private sector knowledge and experience.

Regardless of the source of funding, certain information is critical to investment decisions, most importantly a detailed assessment of project risks. While a detailed assessment of such is beyond the scope of this study, it is clear that a project of the nature and scale envisioned entails several types of risk. First and foremost, given the region in question, there is political risk, e.g., that the partner countries cease or impede project development, cooperation and/or trade of resources, either intentionally or because of regulatory delays and obstacles. Given the volatile history of the region, there is also risk that large infrastructure projects of this nature become the intentional targets of attacks or are damaged during the course of violent exchanges between parties or citizens of the various parties. Sabotage of Egyptian gas lines supplying Israel and Jordan provides clear and stark precedent for such risk.

There are also technical risks, e.g., that technologies do not work as anticipated. And finally, there are real issues of economic risk, including construction cost overruns, purchase commitments and ability to pay. These are especially relevant considering that the electricity sector in all three countries is in deep arrears and many of both the water and electric utilities suffer from difficulties with cost recovery from their consumers. While water and power purchase agreements would be mandatory, there would still be questions of how to deal with an ability by one or more party to live up to the terms of such agreements.

Given these risks careful attention will have to be paid to drawing up clear, detailed and binding contractual relations between the partners, specifying the obligations and rights to each party involved, and perhaps developing some type of institutional framework for resolving conflicts and/or instances of abrogation of commitments.

6. ENVIRONMENTAL IMPLICATIONS

The envisioned project would have clear benefits for the environment relative to business as usual and even relative to the case of each country pursuing its own unilateral desalination and renewable energy strategy. As mentioned, currently overall per capita annual water supplies for the entire region are at well below 150 m^3 for all purposes, considered chronically scarce by international standards. Given anticipated population growth, this figure is likely to drop to 100 m^3 by 2030. Overdrafts resulting in depletion and contamination of aquifers, already serious problems in places such as Gaza and Jordan, and will only intensify if additional water supplies are not found. Furthermore, allocation of water to nature and ecosystems will be more difficult unless additional water is found. While policies such as increased conservation, reduce losses, and reclaimed sewage are to be encouraged, desalination is likely to be the only solution to the scale of water needed.

Desalination, however, is an energy-intensive process, and thus, wide-scale desalination, a primary climate adaptation strategy for the region, could end up being an important source of greenhouse gases (GHGs), making it harder for the countries to meet their emission reduction commitments under the Paris Agreement. Supplying water via desalination within the context of the water-energy exchanges described herein, would allow for significant reduction in the environmental impacts of water supply, reducing not only greenhouse gases, but also local air pollutants as well.

Table 23 shows the potential air pollution emissions for scenarios 1A and 2 were they to be supplied by natural gas, as it is assumed to be the primary fuel source for electricity consumption by 2030. It should be noted, too, that natural gas is by far the cleanest of the fossil fuels currently used for production, and thus, is itself probably a lower end estimate of real emissions savings from such a project.

Table 23. Avoided Air Pollution Emissions

		Scenario	
		1.A.	2.
Type of Emission	**Emissions (grams/ KWh)**[138]	**Total Pollution (tons/year)**	
Sulfur Dioxide (SO_2)	0.02	62	697
Nitrous Oxides (NO_x)	0.3	932	10,449
Particular Matter (PM10)	0.01	31	348
Carbon Dioxide (CO_2)	436	1,355,088	15,185,880

As can be seen, from the above table, making the water provision carbon neutral would reduce over a million tons of CO2 annually, as well as hundreds of tons of NOx and tens of tons of SO2 and particulate matter. For Jordan, which represents nearly half of Scenario 1.A. water consumption, the actual savings would be even higher than its proportional share, given that its only other viable option for desalinated water is the Red Sea, which is further and would entail more pumping. Increasing the amount of renewable energy to 20% of total regional consumption (Scenario 2) would multiply the emissions savings by a factor of over 11, given the larger scale of production.

In addition to the environmental impacts of water and energy production, the project would likely have a positive net impact on wildlife habitat and ecosystems, especially if compared to each country pursuing a unilateral strategy of renewable energy production. For Palestine and Israel, the project would allow them to produce renewable energy without adding to pressures on their already limited and highly fragmented open spaces, which provide habitat for numerous endangered species of flora and fauna. While it would add to the pressures on Jordanian lands, these lands are much more plentiful and with much less competition for development, such that the impacts are comparatively minor. Even producing 20% of the region's total projected energy demand would necessitate only 100 square kilometers, or roughly 0.1% of Jordanian territory.

In the case of water production, it is Jordan's environment that would benefit. To the extent that desalination from the project would displace desalination in Aqaba, it would benefit the Red Sea aquatic ecosystem, which, as a narrow closed gulf, with coral reefs, is a much more sensitive than the open Eastern Mediterranean. Jordan's open spaces would also benefit by not having to construct the pipeline to transfer water from Aqaba to population centers in Amman and elsewhere.

138 Source: Coheh, G. and M. Korner. 2016. Israeli Oil & Gas Sector Economic and Geopolitical Aspects: Distinguish between the Impossible, thePotential and the Doable. Samuel Neaman Institute. Haifa, Israel.

7. POLITICAL FEASIBILITY & GEOPOLITICAL CONSIDERATIONS

The proposed project would generate a number of geopolitical advantages to each of the parties involved. As with any project involving regional cooperation, potential benefits of cooperation and integration include economic efficiency and improvement of overall political relations. The project would face some political obstacles before implementation would be possible. In this section we review the specific geo-strategic pros and cons for each of the parties. As will be shown, some issues are common to all parties, such as issues of regional cooperation, the potential that the international community will assist in financing such a project, and concerns over autonomy, while others are particular to each country.

7.1. Jordan

Advantages

The project would provide two primary advantages to Jordan. It would provide the Kingdom with a reliable supply of fresh water close to population centers and existing water infrastructure. Lack of reliable, high quality fresh water is currently both a constraint to economic development and a source of political strife.[139] Purchase of desalinated water via the Mediterranean would also almost certainly be cheaper than the cost of supplying from the Red Sea, Jordan's only option for desalinated water at present.

The second primary benefit to country would be that Jordan, long dependent on energy imports, would become a major exporter of energy to the region. By becoming a regional supplier of electricity Jordan reduce its need for energy imports which currently are a major drain on foreign currency reserves. Under the carbon neutral scenario, electricity exports would provide Jordan with enough revenue to defray much of the cost of obtaining needed water supplies. In the scenario in which it provides 20% of the region's overall electricity, revenues from such exports would be a major contribution to government coffers and to national GDP.

In addition, as opposed to simply being a purchaser of water and gas from Israel and/or Palestine, in which Jordan increases its dependence on outside sources, the project would give Jordan leverage as an electricity supplier.

To the extent that the international community would support the project, this would also defray the costs of developing its water and energy infrastructure and reaching its own objectives of reducing carbon emissions.

Jordan would also boost its regional influence, both as a supporter of the Palestinian economy and as a moderate country that can cooperate with all parties.

Challenges

Jordan may be leery of increasing its dependence on foreign sources for its water supplies, as is evident, inter alia, in its support for the Red-Dead canal, which would give it control over its own water supplies, albeit at a high economic cost. Given the

139 The obligation to supply water to recent refugees, for instance, has become a source of tension among local Jordanian citizens, some of whom view water allocation as a zero-sum game and are resentful of reduced supplies, which they view as water going to refugees at the expense of local communities. Sources: Farishta, A. 2014. The Impact of Syrian Refugees on Jordan's Water Resources and Water Management Planning, Master's Thesis. Columbia University Academic Commons, http://dx.doi.org/10.7916/D80K26P3. Al-Jazeera.com. 2015. Syrian refugee crisis strains Jordan's water supply. 27 August, 2015.

http://www.aljazeera.com/news/2015/08/syrian-refugee-crisis-strains-jordan-water-supply-150827011123701.html water scarcity issues in Jordan, however, the country has clearly indicated that provision of water is of higher priority than the fear of dependence on supplies from outside sources, as is evident from recent agreements to purchase water from Israel. While this proposed water-energy project would create interdependency rather than unilateral dependency, the level of interdependency is not necessarily symmetric. Arguably, dependence on foreign water supplies entails a bigger risk than dependence on foreign electricity. Jordan could also face critique both internally and from other Arab nations at cooperation with Israel, including a possible repeat of objections to integration in the existing regional electric grid.

Jordan has signed various agreements with international partners to develop nuclear power. Should these be actualized, the country may deprioritize renewable energies, as large-scale nuclear would allow it to meet its carbon emission reduction commitments (though not its commitments to renewable energy) without development of renewables. To date, little progress is evident in operationalizing such plans, and should they progress they are likely to face opposition based on safety and security concerns.

Because, as noted, solar energy, especially PV systems, have problems with storage, Jordan would need firm commitments regarding the purchase of specific quantities of electricity by Palestine and Israel.

7.2. Palestine

Advantages

For Palestine, the primary benefits of the project would be advancing water and energy security, while at the same time diversifying its sources of both resources and reducing its dependence on Israel, both of which are part of the Palestinian Authority's long term strategic objectives.

Production of desalination in Gaza would both reduce Palestine's dependence on Israel and would reduce payments to Israel, which deducts the full cost of water production and delivery from water delivered to the West Bank and Gaza from tax funds collected and transferred to the PA. The project may even advance Palestinian goals of achieving greater rights to natural water sources. While currently water allocation between Palestine and Israel are viewed by many as a zero-sum game, Israel may be more willing to compromise on water issues within the framework of a major regional water agreement such as this. Allowing Palestinians to withdraw more water from areas closer to population centers (i.e., increasing allocations to the West Bank from the Mountain Aquifer) would also be consistent with goals of economic and environmental efficiency.

Though the proposed project would not necessarily promote greater energy independence for Palestine, it would diversify its sources of energy, one of the stated goals of PENRA. It would also do so with minimal demands on land, which, as mentioned, is at a premium in the densely populated West Bank and Gaza Strip. This would avoid the regulatory and bureaucratic obstacles and delays that would be involved in developing land for energy production, which are likely to be significant, especially to the extent that the projects would be built in Area C, which represents the majority of open spaces in Palestine. Payments for electricity would also be to Jordan and would not be subject to Israeli control, as is currently the case.

An additional important benefit would be advancing integration of Palestine with the rest of the Arab world. Though it is integrated in many cultural and political forums, physical integration via shared or connected infrastructure is at present, extremely limited.

Finally, should the project receive the blessings of all parties, the international community would be likely to help support Palestine in developing the necessary infrastructure. This would substantially reduce economic burdens currently on Palestine.

Challenges

The most basic political challenge is simply that the project envisioned would entail both cooperation between Israel and the PA, and between regimes in the West Bank and in the Gaza Strip. The project is likely not feasible from a Palestinian perspective given the current restrictions by the Israeli government on the West Bank and Gaza. Therefore, some political accommodation would be necessary to move such a project forward.

Furthermore, the project would have to overcome the calls to reject cooperation with Israel as long as a permanent political settlement is yet to be enacted. However, given that even under the current political climate, there are increased purchases of water and energy from Israel, there may be little objection to a project that would actually reduce dependence on Israel.

Currently Israel has placed tight restrictions on materials, fuels, energy and currency going into Gaza, for fear of the resources supporting the Hamas regime and possibly being used against Israel. Natural gas offshore of Gaza, for instance, have yet to be developed for this reason, as have, various projects in the water sector. This, despite, various arrangements to address these concerns discussed with the international community. In order for the proposed project to succeed, some type of security arrangement acceptable to all parties would be necessary.

In the past Palestinians were hesitant to develop desalination, as many believed that they deserved a bigger share of the natural fresh water shared with Israel and Jordan. They feared that development of desalination would be seen, in effect, as an abandonment of their claims to fresh water. This is one reason desalination was not developed earlier. The reversal in position by water officials who now support development of large-scale desalination in Gaza, was, in large part, due to the sense that negotiations were not progressing and they could not afford to wait to negotiate a new allocation of natural fresh water.[140] Thus, nothing in this proposal should be seen as in any way impacting the legitimacy of Palestinian claims for reallocation of naturally occurring fresh water.

Finally, while the project would reduce Palestinian dependency on Israel for energy supplies, it would not necessarily increase Palestinian energy independence. Palestinian leaders may prefer to concentrate on developing its own sources in order to promote locally based energy production capacity. In this regard, the project is not intended to be put in place of local capacity development, but, rather, to supplement it.

7.3. Israel

Advantages

Israel's primary benefits from such a project include advancing regional cooperation and reducing sources of regional instability. Secondary, but still important benefits, promoting its international leadership in desalination, diversifying its energy sources, and meeting its renewable energy goals with minimal pressures on its open spaces and with potential financial assistance from the international community.

Israel has long been eager to promote regional cooperation, especially by means of enhanced economic development activities. It sees such a strategy both as a means of ensuring political stability as a means of gaining wider acceptance in the region. This is evident in its support for projects such as the Red-Dead Canal.[141]

140 Fischhendler, I. and D. Katz (2013) The impact of uncertainties on cooperation over transboundary water: the case of Israeli-Palestinian negotiations. Geoforum 50: 200-210.

141 Cooperation with Jordan on a high profile international project was a large part of the rationale for Israel supporting a Red-Dead route, primarily, if not wholly located within Jordan, despite potentially less expensive options for a similar canal originating in the Mediterranean Sea and flowing wholly within Israel. Sources: Allan, J.A., A.I.H. Malkawi, and Y. Tsur. 2014. Red Sea–Dead Sea Water Conveyance Study Program Study of Alternatives Final Report Executive Summary and Main Report. And Aviram, R., D. Katz and D. Shmueli (2014) Desalination as a game-changer in transboundary hydro-politics. Water Policy (16)4: 609–624.

Lack of supplies of water and electricity can lead to political unrest, with destabilizing effects that are in none of the parties' interests.[142] Therefore, advancing water and energy security among its neighbors reducing security threats to Israel and the associated costs of addressing them.

Israel has often been described as an "energy island", and integration into a regional grid would provide it with additional supplies and serve as both a useful diversification of sources and a possible safety net, especially in terms of addressing peak demands.

In terms of meeting its commitments to reduce greenhouse gases and meet renewable energy goals, the project would allow Israel to do so without using up valuable open spaces and without going through the cumbersome and costly land use planning and regulatory processes that are often a source of long delays for infrastructure projects in Israel.

Finally, Israel has long declared a willingness to take advantage of its expertise in desalination and sell water to both Jordan and the PA. Even selling water at cost would help defray the substantial upfront costs of developing the desalination plants and would showcase Israeli technology in a rapidly growing field.

Challenges

Any project that requires regional cooperation or dependence on other countries, especially in the region, is regarded with hesitation in Israeli political circles. Israel has often preferred unilateral actions to cooperation in order to preserve autonomy, including in the field of water and environment.[143] Israel has long been dependent on energy imports. Prior to relatively recent discoveries of offshore oil and gas reserves in the Mediterranean, Israel was importing nearly all of its energy supplies. As recently as 2003, 96% of energy was supplied by imported fuels.[144] The repeated disruptions of natural gas from Egypt following the "Arab Spring" uprising highlighted the risks of dependency on foreign supplies, especially from suppliers with significant populations that are antagonistic towards Israel. As such, Israeli policymakers have continually stressed the importance of reducing dependence on outside supplies.[145]

Israel has also committed to purchasing agreements with off-shore gas developers and so any arrangement within the framework of the proposed project would have to be coordinated with such agreements.

Previous attempts to integrate Israel with the Jordanian electric grid have failed for a variety of geo-political reasons.[146,147] One such reason has been that Jordan is already connected to a regional Pan-Arab grid, and other Arab countries connected to the grid would have to approve of the connection. In the past, other countries objected to such initiatives. For this reason, Egypt and Jordan's electric grids are connected via marine cables through the Red Sea, rather than an overland connection via Israel. The Israeli officials, as well as the Israeli Electric Company, attempted to promote other land connections, but were refused. The existing connection between Jordan and Jericho, which, in effect represents an integration also with Israel, as Israel is connected to Jericho, was approved as it was limited in scale and meant primarily for

142 For this reason, for instance, Israel has increased water supplies in recent years to Jordan in order to assist the Kingdom in supplying water to recently arrived refugees from Syria and Iraq. Israel is also on record as supporting economic development in Palestine, as a means of reducing discontent there, though it has been criticized by some for emphasizing economic development as a substitute for political compromise.

143 Fischhendler, I., S. Dinar, and D. Katz. (2011) The politics of unilateral environmentalism: cooperation and conflict over water management along the Israeli-Palestinian border. *Global Environmental Politics* 11(1):36-61.

144 The World Bank. (2017c). World Development Indicators website. http://data.worldbank.org/indicator/EG.IMP.CONS.ZS?locations=IL

145 Shaffer, Brenda. 2011. "Israel—New Natural Gas Producer in the Mediterranean." *Energy Policy* 39(9): 5379–87.

146 Younan and Popper, 2012

147 Fischhendler, Itay, Lior Herman, and Jaya Anderman. 2016. "The Geopolitics of Cross-Border Electricity Grids: The Israeli-Arab Case." *Energy Policy* 98 (November): 533–43.

Palestinian use.[148] It remains to be seen if developments since the Arab Spring, and it light of the perceived common threat of Iran, if such objections would still be posed. Recent regional cooperation on scientific projects, such as the participation of Israelis in the Synchrotron-Light for Experimental Science and Applications in the Middle East (SESAME) project located in Jordan would seem to indicate that there is potential for regional cooperation, despite political opposition.

In terms of development of desalination in and supply of energy to the Gaza Strip, while in principle Israel has stated its support, it has raised numerous concerns regarding ensuring that materials and energy are used for peaceful purposes. Restrictions and stipulations by Israel on this matter have been a source of delay in developing desalination in Gaza so far. Israel has also attempted to restrict the flow of funds that could potentially support Hamas in Gaza. Thus, an arrangement would have to be found that would allow for financing the export of desalinated water and import of electricity to and from Gaza that would be acceptable to Israel.

7.4 General

Each of the parties has interests not to increase transboundary interdependencies and rather, to develop local capacity. Furthermore, in the case of both Jordan and Palestine there may be objections to any project that involves cooperation with Israel. In this respect, such positions stand in stark contrast to the actual developments occurring on the ground. Both Palestine and Jordan have recently signed agreements to purchase additional water and energy from Israel. Furthermore, the water-energy project analyzed herein is not meant to serve as an alternative to local capacity development, but rather a supplement to it, and, perhaps an economically efficient and politically expedient one. As stated above, it will promote interdependencies, rather that unilateral dependencies that put countries at greater exposure.

148 Tsur, M. Former Deputy Head of Israel Electric Corporation. Personal communication. 2 April, 2017.

Also, objections to "normalization" are often more directed at intergovernmental relations than at private sector ones. As stated, this project involves regional cooperation, and any large-scale infrastructure projects will necessitate government approval and facilitation. However, it need not be primarily government led or financed. Private sector leadership, and participation by the international community both in funding and by private sector developer, may reduce political obstacles that may face government led projects and increase public acceptability. The project clearly is one that entails and promotes regional cooperation, and can be presented as such to the international donor community. It is also a commercial enterprise that can be justified on market rationales alone.

The international community is likely to assist in planning and funding a regional cooperation project, whereas it would be much less likely to fund unilateral national projects. Furthermore, the terms of assistance are likely to be better for regional cooperation projects rather than unilateral ones (e.g., grants as opposed to loans). The international community might be willing to help fund the aspects of the project that specifically relate to international cooperation, such as transmission grids and connections.

Finally, the integration of water sectors and of electricity sectors in a mutually dependent and mutually beneficial manner may have positive spillover effects in terms of promoting cooperation, information exchange, and other joint initiatives in other fields. The European Union had its start as a regional agreement on two resources – coal and steel – and ended up with the grand economic and political cooperation that has become the EU, covering numerous fields and interests. A regional cooperation project on water and electricity would be a tremendous achievement in its own right; it may, though, lead to even greater outcomes.

8. CONCLUSIONS

This study evaluates the technical, economic, and political potential for integrating water and energy supplies across the three countries of Israel, Jordan and Palestine. The region suffers from a scarcity of both water and energy, and pressures on both are increasing due to population growth, economic development, and climate change. The countries of the region will need to provide fresh water to their populations, whether through unilaterally developed infrastructure, or through joint projects such as the one investigated herein. Likewise, the countries have committed to production of renewable energy, which necessitates relatively large tracts of lands given current technologies and the scale of demand anticipated.

Israel and Palestine have high population density, and thus, high demands on scarce opens spaces. This presents a challenge for developing renewable energy domestically. Both, however, have access to the Mediterranean Sea, and thus a source of water for desalination. Jordan, on the other hand, has a lower population density, and an abundance of open space appropriate for generation of solar energy, but is limited in its access to seawater, with its only access point at Aqaba on the Red Sea, far from its population centers.

The motivation for integration of water and energy in all three countries was undertaken for a number of reasons. In addition to the distribution of water and open spaces, as mentioned, since the water sector is a large consumer of energy, and one of the largest consumers of electricity, in the region, there is an obvious rationale to investigate this "water-energy" nexus, especially as meeting additional water needs will almost certainly entail desalination, an energy intensive process.

An additional motivation was to ensure that there is mutual interdependence, however, there is nothing that mandates that water need be exchanged for energy, or vice versa. Hopefully, this study provides initial information and analysis that could be useful to decision-makers even, if, for technical, economic or political reasons, parties would like to advance cooperation on either only on water or only on energy. Likewise, if, for political or other reasons, integration and exchanges involving all three parties is untenable, bilateral exchanges would also be possible and could also make use of the framework set out in this study.

The study outlines numerous benefits of water-energy exchanges for all parties involved. In addition to providing for basic resource needs that would promote a decent standard of living and potential for economic growth and prosperity, the project could reduce regional costs of resource provision and strengthen regional ties. The primary advantages for Palestine are decreased reliance on Israel as a source of water and energy, increased diversification of energy supplies, and the ability to achieve renewable energy goals without adding pressure on scarce open spaces, access to which currently faces numerous restrictions. The latter two benefits would also be shared by Israel, which also would value regional integration in a large scale project in its own right. Jordan would benefit from sale of electricity to its neighbors, and by replacing current dependent relations with Israel with mutual interdependence.

The project would also face numerous political challenges as well. As such, it would be dependent on a fair amount of good will and trust of the parties themselves.

As a pre-feasibility study, this work set out to present a possible framework for regional water-energy exchanges and evaluate the technical needs of such an exchange, as well as attempt to evaluate overarching economic parameters, as well as highlight the idea's geo-political pros and cons. A qualitative assessment of the major pros and cons of the project for each party is presented in schematic form in Table 25 below.

As with any initial study much of the value herein is in identifying knowledge gaps and needs for future study. This initial draft presented working assumptions regarding the scale of the anticipated desalination and electricity and regarding technologies for achieving the objectives laid out. A full feasibility may wish to alter some of these assumptions and/or add additional scenarios. For instance, the choice of 20% of total energy from renewable sources was a somewhat arbitrary one, and the parties may seek to choose their own individual targets.

Regarding technical issues, this study considered a relatively narrow range of technologies, primarily ones that are current commercial available. A full feasibility study could evaluate a broader range or technological approaches, especially as technologies evolve as do their relative costs. Given that what is envisioned is a long-term project, parties will wish to avoid committing to technologies that may no longer be commercially optimal in the near future.

Furthermore, this study did not find reliable information regarding the capabilities of existing and planned infrastructure to accommodate the scale of water and electricity envisioned. A full feasibility study will have to work closely with the relevant government ministries and national utilities to better understand the capacity to integrate and the challenges of integrating such resources.

Regarding geographic assumptions, this study was relatively ambiguous regarding the relative location of desalination facilities, and used a single point source (the Maan region) for calculations of solar potential, this despite acknowledging the benefits of distributed production. A future study should evaluate specific locations, perhaps based on optimization based on proximity to existing or planned infrastructure and/or to end consumers. Also, this study limits itself to Jordan, Palestine, and Israel for reasons of political pragmatism. In the past, various sources have put forth proposals to develop desalination capacity for Gaza within Egypt, based on the lack of open spaces in Gaza and the relative wealth of such areas in Sinai.[149] A full feasibility study may wish to expand the scope of areas evaluated.

149 See, for example, Bashitialshaaer, R. and Persson, K.M. 2011. A joint power and desalination plant for Sinai and the Gaza Strip. *Water Science and Technology: Water Supply* 11(5): 586-595.

Table 25. Distribution of Project Benefits

Economic

	Reduced Cost of Water Delivery	Reduced Cost of Achieving Renewable Energy	Reduced Regulatory Hurdles for Reducing Emissions	Income from Selling Electricity	Income from Selling Water	International Financial Support
Jordan	++	–	–	++	–	++
Palestine	*0*	*0*	++	–	+	++
Israel	*0*	*0*	++	–	++	+

Environmental

	Reduced GHG Emissions	Reduced Local Air Pollution	Reduced Pressure on Open Spaces	Reduced Pressure on Freshwater Aquatic Ecosystems	Reduced Pressure on Marine Ecosystems
Jordan	++	++	–	*0*	++
Palestine	++	++	++	+	–
Israel	++	++	++	+	–

Geo-Political

	Achieving Water Security	Achieving Energy Security	Diversification of Energy Sources	Reduced Dependence on Israel	Promoting Regional Stability	Integration with Arab world	Improved International Standing	Improved Chance of Achieving Reallocation of Water Rights
Jordan	++	++	*0*	–	++	+	+	*0*
Palestine	++	++	++	++	++	++	+	++
Israel	*0*	+	++	*0*	++	++	++	*0*

++	Major benefits
+	Benefits
0	Neutral/no impact
–	Minor disadvantage
– –	Major disadvantage

The biggest unknowns remain in the economic analysis, especially regarding infrastructure and transmission and delivery costs. Furthermore, the economic analysis conducted in this study was done under a limited set of assumptions regarding key parameters such as future price trends, discount rates, inflation rates, equity shares and cost of capital, land use costs, and other issues, including the anticipated time frame of the project. This was done in order to present rough estimates of costs to allow for evaluation of scale and compare between technologies under similar conditions. A full study will need to tailor these assumptions to likely market conditions. As such, it would benefit from doing so in consultation both with private sector actors currently active in the desalination and renewable energy market, as well as with potential funders. It may also benefit from using a broader range of assumptions for purposes of greater sensitivity analysis. A full study should also do a comparative cost assessment of alternative options available to the parties to achieve their various water and renewable energy objectives. As the security risks for such a large scale project are significant, the study may also wish to incorporate estimates of the costs of securing the infrastructure as well as related insurance costs.

Given the scale of such a project a full environmental impact assessment should be undertaken as part of a full feasibility study, including life cycle analyses of all options considered.

Finally, a full feasibility study will have to assess the regulatory issues inherent in implementing such a project, as may wish to examine the legal and contractual issues that would be needed to ensure project execution.

Clearly this study leaves many important questions regarding the viability of a regional framework for water-energy exchanges unanswered. This prefeasibility study, however, shows that the project is technically feasible and would have potentially tremendous environmental and political benefits. Given the scale of these potential benefits to the parties involved, investigation of these outstanding questions deserves to be investigated in depth.

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A Green Blue Deal for the Middle East

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EcoPeace Middle East.

A Green Blue Deal for the Middle East

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EcoPeace Middle East is a unique organization that brings together Jordanian, Palestinian, and Israeli environmentalists. Our primary objective is the promotion of cooperative efforts to protect our shared environmental heritage. EcoPeace has offices in Amman, Ramallah, and Tel-Aviv.

Foreward and Acknowledgments

This report incorporates earlier texts of EcoPeace Middle East including “An Agreement to Share Water between Israelis and Palestinians” (2012), “Regional NGO Master Plan for Sustainable Development in the Jordan Valley” (2015), “Can Water Bring The Political Process To A Safer Shore?: Water Issues from a Source of Conflict to Vehicle for Regional Cooperation and Stability” (2016), “Governance Structures for Transboundary Water Management in the Jordan Basin” (2016), “Water Energy Nexus: A Pre-Feasibility Study for Mideast Water-Renewable Energy Exchanges” (2017), “River out of Eden: Water, Ecology and the Jordan River in the Abrahamic” (2017), “Israeli Water Diplomacy and National Security Concerns” (2018), “Report on the Status of the Hebron-Besor-Wadi Gaza Basin” (2018), “Climate Change, Water Security, and National Security for Jordan, Palestine, and Israel” (2019), “Health Risks Assessment for the Israeli Population following the Sanitary Crisis in Gaza” (2019).

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1. INTRODUCTION

The climate crisis is often described as a threat multiplier, where the weak adaptive capacity of a state or a region to deal with the negative implications of climate change can threaten stability and national security interests. In the Middle East, the failure to resolve already existing water scarcity challenges is a national security issue, which under conditions of climate change will be multiplied to a level that threatens regional stability. However, climate change can equally be seen as a multiplier of opportunities, where a nation or a region could see the threats posed by climate change as a chance to reconsider existing policies and decide to work across borders, in order to increase adaptive capacities so that challenges can not only be overcome but more sustainable, equitable and prosperous results can be achieved. The "Green Deal" concepts in both the US and Europe are designed precisely for this purpose, where to date Europe is leading the global climate effort by adopting a set of targets related to climate adaptation and mitigation, including zero total carbon emissions, investment in green jobs and infrastructure, and advancing social equity by 2050. With the recent election in the U.S. of a Biden-Harris Presidency, the U.S. and European Union (EU) will seek to return to working together productively to advance climate issues and this should help attract new investment opportunities including Arab Gulf funding towards Middle East Green Deal endeavors. Due to the COVID-19 pandemic crisis, many OECD countries have further added the term to "build back better" focusing on climate adaptation and mitigation measures as their priority issues as a means to stimulate the economy and advance societal progress.

This report seeks to inform the policy considerations of Israeli, Jordanian and Palestinian policymakers and the understanding of international stakeholders as they work to meet the challenges posed by climate change in our region. The authors' assessment is that a "Middle East Green Blue Deal" – one that gives additional emphasis to the particular importance of water and water scarcity issues in the region -- is a practical, feasible and effective policy approach to an urgent challenge, and one that can serve to address conflict drivers, advance a two state solution based on 1967 borders, and promote trust-building and cooperation in a conflict-mired region.

The recommendations in this paper build on learning from several programs and concepts developed and implemented by our organization, EcoPeace, over these last 26 years. In the deeply complex conflict environment in which we work and live, and at a time of climate crisis, our shared consideration is that these recommendations represent solutions to urgent problems that are also "low-hanging fruit," - practical and solvable issues in the Arab-Israeli conflict context.

Our "Green Blue Deal" proposes harnessing the sun and the sea to create region-wide desalinated water and energy security for all; highlights the need and opportunity to solve Israeli / Palestinian natural water allocations today to achieve water equity; proposes climate-smart investments and green job development around the Jordan Valley; and recommends public awareness and education programs that can engage the stakeholder publics, especially the younger generations, to understand the importance of diplomacy in the water and climate fields as an effective tool for conflict resolution and peace building.

This report does not seek to propose a holistic policy program for the Middle East covering all issues related to climate mitigation and adaptation. On the contrary, the purpose of this report is to highlight regionally focused low-hanging fruit: opportunities that can serve as entry points for policymakers seeking to maximize fulfilment of their own countries' interests, spurring momentum toward governments creating their own holistic "green blue" plans, and providing opportunities for mutual gain and dialogue on region-wide integrated programs.

No less important, these recommendations provide relevant context for international community stakeholders, to weigh the foreign policy implications of their own varied programs and policy deliberations related to the environment. The EcoPeace report therefore also makes recommendations applicable to international community actors for paths that could not only contribute to climate security, cooperation, and development in the Middle East but simultaneously provide entry points for advancing Israeli-Palestinian and broader Middle East peace issues.

2. BACKGROUND: GREEN DEAL CONCEPTS IN THE US AND EUROPE AND LOCAL EFFORTS TO DATE

2.1) US Green New Deal

In recent months, the US has seen its own debates around "Green Deal" concepts, with members of the progressive wing of the Democratic Party proposing a plan formulated to tackle this century's climatic, economic, societal and technological challenges.[1] [2] Rooted in U.S. President Franklin D. Roosevelt's New Deal during the Great Depression, the Green New Deal focuses on issues such as stimulating the U.S. economy by investing in environmental jobs, upgrading to more efficient infrastructure and power sources, and implementing climate adaptation measures. The ultimate stated goal of the plan is the transition of the US to 100% renewable energy and by 2030 cutting greenhouse gas emissions in half.[3] [4] In addition, and differing from Roosevelt's New Deal, social equity has a high profile in the Green New Deal of the Democratic Party.[5] While President-elect Joe Biden has stated that he does not endorse the Green New Deal, and it is unlikely to be adopted should the Republican Party retain control of the U.S. Senate, there exists a real opportunity to see policies associated with the Green New Deal adopted under the new Administration, including US return to and leadership in the post-Paris Climate negotiations based on the "Biden Plan" for a clean energy revolution and environmental justice.[6]

2.2) European Green Deal

In 2019, the European Commission released a communication that set out a European Green Deal for the EU and its citizens on the basis of resetting their commitment to what they claim is this generation's defining task – tackling climate and environment-related challenges.[7] This new growth strategy aims for a just and inclusive societal and economic transition with the aim to "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use."[8]

As part of Europe's endeavor to become the world's first climate-neutral continent by 2050, heads of European governments convened in Brussels in July 2020 for a 5-day marathon summit where an unprecedented climate action plan of more than 500 billion euros was agreed upon.[9] This recent commitment to combating climate change is the largest ever in terms of EU budget allocation and is considered the world's greenest stimulus plan, which will be dedicated to the development of clean energy resources, stimulation of the market for emission-free cars, investments in budding technologies, and energy efficiency promotion.

The "European Green Deal" lays out the challenges and opportunities of transforming the EU economy and society on to a more sustainable path. It additionally recognizes the global implications of climate change and biodiversity loss and grounds its proposal in an affirmation of EU responsibility to use its influence, expertise, and finanicial resources to mobilize and coordinate similar international efforts. Unlike the U.S. Green Deal described above, which is a conceptual document of just one of the country's two primary political parties (the Democratic Party), the European Green Deal has become the official policy of all EU member states with a clear timetable in place and budget allocated to finance implimentation.

2.3) Israel 2050

In 2020, Israel's newly appointed Environmental Protection Minister, Member of Knesset (MK) Gila Gamliel, unveiled an "Israeli Green Deal" to address climate change and kick start the economy sustainably during the COVID19 pandemic and resulting economic crisis.[10] The proposal calls for increased investments in the clean-tech and renewable energy industries, nature and ecosystem restoration, and improved environmental performance across various sectors with associated greenhouse gas reductions and job creation. The plan, deemed “Israel 2050,” unfortunately does not commit Israel to a specific percentage of carbon emission cuts. Rather, it puts forth goals and visions for a “transition to a competitive, low-carbon, thriving economy by 2050.”[11] [12]

Notably the plan is that of the Israel Ministry of Environmental Protection and has yet to be adopted by the Israeli cabinet to become a plan of the State of Israel. The plan, however, was very much welcomed by the Head of Delegation of the European Union to the State of Israel, Emanuele Giaufret, and presented at the first EU-Israel forum on climate policy held simultaneously in Tel Aviv and Brussels in 2020.[13] In recent years, the Israeli Ministry of Energy has committed to reducing carbon emissions by transitioning the energy sector away from coal and diesel fuels and toward natural gas and renewable energies, with plans to stop using coal for electricity generation within the next decade.[14] [15] Israeli Energy Minister Yuval Steinitz presented a plan in 2019 to raise the Israeli renewable energy target to the Paris Agreement commitments, from 17% to 30% by 2030.[16]

2.4) Jordan 2025

In 2017, the Jordanian Ministry of Environment released a national green growth plan called “Jordan 2025.” The plan is focused on a green growth economy, decoupling growth from carbon emissions.[17] [18] [19] The plan of the Ministry of the Environment charts a path for Jordan for water security, energy security, and food security as mechanisms of resource security and management. Like the Israel Environment Ministry plan, the Jordanian plan too is not a plan adopted by the government as a whole and lacks clear targets, a timeline, and financing for implementation.

The Government of the Hashemite Kingdom of Jordan has conditionally committed in the Paris Agreement to reducing greenhouse gas emissions by 14% by 2030, depending on availability of international financial aid and support for means of implementation.[20] Jordan is ahead of the schedule outlined in the Energy Ministry’s 2020-2030 comprehensive strategy for the energy sector and will supply 31% of its electricity from renewable sources by 2030.[21]

2.5) Palestinian Cross-Sector Strategy of 2017-2022

The Palestinian Environmental Cross-Sector strategy of 2017-2022 aims at integrating environmental issues and sustainability factors throughout the policies and programs of various sectors; setting out its framework to meet the national developmental goals and within the framework of 2030 SDG goals.[22] The strategy mainly addresses: low and controlled levels of pollution; protected natural environment and biodiversity; and most importantly in relevance to a proposed Green Blue Deal, climate change adaptation and prevention of desertification, as supported by the National Climate Change Adaptation Plan 2016. Since the strategy and associated action plans have been adopted, the vision for cross-sector implementation still requires revision and extensive investments.

In 2012, the Palestinian Energy Authority set a goal of achieving 10% renewables by the end of 2020.[23] So far only 3% renewables has been achieved of the total energy demand. The new National Renewable Energy Action Plan 2020-2030, again sets the target at 10%, consisting of solar, wind and biomass.[24] For this to be achieved, approximately US$734 million of investment by private sector, only in solar, is required over the coming 10 years.[25] According to His Excellency (H.E.) Zafer Melhem, Chairman of the Palestinian Energy Authority, investing in renewables is financially and environmentally feasible and necessary, however they require certain prerequisites to be attained, including policy incentives to be developed in order to attract investors, presenting guarantees and overcoming security concerns.[26] In a recent speech of H.E. Prime Minister Mohammed Shtayyeh, regarding a PA COVID-19 response plan, environmental sustainability issues are requested to be mainstreamed across the economy.[27]

3. RATIONALE: WHY A MIDDLE EAST GREEN BLUE DEAL

3.1) Water Security Risks

Worldwide, there is a growing understanding that we have entered a climate crisis. In the Middle East, the impact of climate change is predicted to be particularly extreme. The Intergovernmental Panel on Climate Change (IPCC) has identified the Eastern Mediterranean as a climate hotspot.[28] While the rest of the world is seeking to avoid a 1.5 degrees centigrade increase in temperature, the Middle East is forecast to see a 4 degrees increase.[29] Large parts of the Middle East will become unliveable for the long summer period. Latest research from Tel Aviv University indicates that in the Levant, by the end of the century, summer months will increase by 50%, with rainfall forecast to drop by up to 40%.[30]

The Middle East is already the most water-scarce region in the world, and intermittent water supply is the norm for much of the region. In 2015, shared water bodies of Israel, Jordan and Palestine were being overdrawn by some 300 million cubic meters (MCM) of water annually, just to meet domestic drinking water needs.[31] If climate adaptation Green Blue Deal policies are not adopted, by 2030, the region will be overdrawing from natural sources double that amount just to meet domestic needs, threatening the very viability and sustainability of our natural water resources and jeopardizing the water of future generations.[32]

Today, Palestinians in the Gaza Strip are living in an untenable water reality due to conflict, the Israeli / Egyptian blockade, overpopulation, and mismanagement. Access to drinking water is a daily struggle for the 2 million Palestinians in Gaza.[33] Years of overdrawing from the underlying coastal aquifer, coupled with groundwater pollution and seawater intrusion, has led to irreparable damage to the aquifer and rendered 96% of the water in Gaza unsafe to drink.[34] With climate change significantly decreasing natural water availability region wide, if there is no change in policies and politics to increase adaptive capacities, the populations of the West Bank and Jordan are likely to face in the coming decades the same reality as Palestinians in Gaza.

The interim agreement on water of the Oslo Accords[1] allocated 75% of the shared ground water of the Mountain Aquifer to Israel, with only 25% allocated to Palestinians in the West Bank.[35] The Joint Water Committee established under the interim agreement has proven to be an inefficient mechanism managing water resources, driving the PA towards further purchasing of manufactured water from Israel to meet water demands. Though the accord has Israel recognize Palestinian water rights, what quantity of water would fulfil those rights, including access to a rightful share of the waters of the Jordan River, were left to be negotiated as part of a final peace accord that was supposed to be completed within 5 years. Despite the demographic changes and increased demand, 26 years following the signing of Oslo Accords, allocated water quantities of natural water resources remain the same. Due to a combination of factors, about 15% of the Gaza population and 47% of the West Bank population have access to piped water supply for fewer than 10 days a month.[36] During the hot summer months, the situation exacerbates, leading to many communities in the West Bank receiving municipal water on average, once or twice during the entire season.[37]

In Jordan, natural population growth and the flood of Syrian refugees, have cut weekly water supplies to residents of Amman by more than 50% from two days a week to just eight hours a week.[38] On the Jordanian side of the Jordan Valley, farmers are increasingly seeing their fresh water allocations

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[1] (The Oslo Accords are a pair of agreements, known as Oslo I and Oslo II, between the Government of Israel and the Palestinian Liberation Organization, which were intended as the initial phase of a negotiation process that would lead within 5 years to the final resolution of all contentious issues in a peace treaty. The Palestinian Authority (PA) was established then as a self-governing interim institution. In 1995, Oslo II was signed, including the provisions on water in Article 40 of Annex III and related Schedules 8–11.)

reduced for the benefit of urban domestic water needs. With few opportunities other than agriculture for livelihood, many rural communities in Jordan live below national poverty levels. Ecological demise of the Jordan River denies local communities' opportunity to diversify incomes through tourism.[39]

3.2) Youth Risks

Ecological demise, underdevelopment, and high poverty rates create opportunities for extremist groups to brainwash youth to participate in violent actions that threaten not only national regimes, but, as ISIS has proven, whole regions of the Middle East, North Africa and the Sahel.[40] Pockets of 40% unemployment in Jordan have created in those same areas over 50% youth unemployment, resulting in Jordanian youth being the third largest contributor to ISIS volunteers from the Arab world and one of the top five contributors globally. [41] [42] [43]

Twenty-six years after signing the Peace Treaty between Israel and Jordan and signing the interim Oslo Accords between Israel and the Palestinian Liberation Organization (PLO), not only has a culture of peace not been forged, but school text books on all sides at best continue to either ignore the existence of the other and in some cases deny the very right of the other to exist at all.[44] [45]Even on critical issues of common concern such as water insecurity and the climate crisis, an understanding of the shared nature of our environment and the necessity to work together to protect our scarce natural waters is rarely taught, with youth on all sides exposed to youth on the other side only through stereotypes based on fear and prejudice.

3.3) Adaptation and Mitigation to Risks

The growing evidence that climate change-induced drought, flooding, and other extreme weather events threaten Israeli, Palestinian and Jordan national security interests individually and regionally is at the heart of why EcoPeace is proposing a Green Blue Deal for the region.[46] [47] The threats range from water, food, and energy insecurity, to civil unrest, migration, and full-scale civil uprisings, all contributing to the possibility of more failed states in our region. While the impact of climate change on the national security of a given country is much dependent on the adaptive capacity of that l country to adapt to changing climatic circumstances, the failure of a neighboring country to adapt to the climate crisis can lead to national security threats for all other states in the same region. The Syrian uprising is often cited as a case in point.[48] Israel feels confident that it has the adaptive capacity to deal with many of the threats associated with climate change, including water security. However, worsening water insecurity in neighboring Palestine and Jordan could contribute directly or indirectly to unrest and even uprisings not dissimilar to the ongoing conflict in Syria, with security implications for all in the region.[49] [50] [51]

4. CLIMATE CHANGE AS A MULTIPLIER OF OPPORTUNITIES

Climate change could be seen as a multiplier of opportunities if Israeli, Jordanian and Palestinian political and civil society leaders were to take a proactive stance on 1) cooperation to improve their adaptive capacities on water and energy security, 2) advancing Israeli/Palestinian natural water reallocations, 3) developing the Jordan Valley through investments in region-wide climate-smart initiatives and green jobs and 4) promoting public awareness and education programs - particularly directed toward youth - on diplomacy in the water and climate fields as a means of conflict resolution and peace building. Through rigorous needs assessment, analysis and lessons learned from years of on-the-ground implementation, the authors have identified these four programs as the low-hanging fruit that can help produce sustainability and shared prosperity as a practical foundation towards a Green Blue Deal for the Middle East, in line with a two-state solution based on 1967 borders and regional integration. This report describes in further detail the four programmatic opportunities and makes priority policy recommendations to our own national governments and the international community. This paper highlights the self-interest and mutual gain for Israelis, Palestinians and Jordanians to move forward on the political will needed to advance these programs and the leadership that the international community should take as part of the consideration and implementation of their own environmentally-focused foreign policies.

4.1) On Water and Energy Security

The Water-Energy Nexus (WEN) is EcoPeace's flagship project for climate change adaptation and mitigation, designed to create a regional desalinated water - solar energy community among Jordan, Israel and Palestine that would result in healthy and sustainable regional interdependencies. Israel and Palestine would produce desalinated water and sell it to Jordan, while Jordan sells Palestine and Israel renewable energy, thereby enabling each partner to harness its comparative advantage in the production of renewable energy and water.

The results of a prefeasibility study commissioned by EcoPeace and the Konrad Adenauer Foundation to explore the technical, economic, and geopolitical viability of the proposed exchanges concluded that this concept could indeed offer substantial economic, environmental, and geopolitical benefits to all three sides, with strong incentives for sustained cooperation.[52] Once fully implemented, it would be a game-changer for the entire region; Israel would meet its Paris climate commitments to increasing renewable energy capacity, at cheapest cost, and see regional cooperation strengthened; Jordan would achieve water security at cheapest cost through the purchase of Israeli and Palestinian desalinated water and become a major exporter of green energy, to not only power Mediterranean desalination plants, but also sell enough solar energy to supply a substantial part of total regional energy consumption; and Palestine, in addition to becoming a water exporter to Jordan and perhaps the Negev in Israel, would become more independent from Israel to meet its water and energy needs.

EcoPeace is currently taking the WEN vision, researched at a pre-feasibility level, to the point of political decision and implementation. Following years of preparatory work, three more steps are needed to set the stage for the substantial political support, regulatory commitments, and financial investments required for full scale implementation: 1) Demonstrating the WEN concept with a cross-border solar pilot project; 2) Conducting WEN's full feasibility and investment case; 3) Outreach and education to policy and civil society stakeholders.

4.1.1) WEN Pilot Project

As part of the Israel / Jordan Peace Treaty, water is already flowing from Israel to Jordan in a pipe that takes water from the Sea of Galilee, to the King Abdullah Canal and then on to Irbid and Amman. Following a billion new Israeli shekel (NIS) (US$ 296 million) investment currently being implemented to reverse the Israeli National Water Carrier, Israel plans to pump up to 300 mcm of desalinated water into the Sea of Galilee.[53] The quantity of water supplied to Jordan can increase substantially with not only Israeli desalination plants linked to the national water carrier but also future plants to be built in Gaza.

As to the proposed exchange of renewable energy from Jordan, electricity has never crossed the border from Jordan to Israel. EcoPeace proposes to implement a proof-of-concept WEN pilot project that will seek to establish this precedent by building a solar PV plant in Jordan, near the border, that will sell solar electricity directly to the Israeli grid. The project will reveal the challenges that might be placed by technical and regulatory authorities to such cross-border linkages and enable the governments and private sector to identify "the devil in the details," providing insight into technical and regulatory challenges and exposing what regulatory and perhaps legal changes would be required for the scaling of energy exchanges in the region. These and additional challenges raised in the pilot could then be studied and addressed with appropriate solutions in a full feasibility study, shared with investors, and used to inform business-case development, commercial arrangements and formal agreements between the relevant governments.

4.1.2) A Full Feasibility Study

A Full Feasibility Study will identify all areas and issues that require in-depth investigation, resolution, and planning for successful implementation of the WEN. This would include developing alternative scenarios; considering environmental, socioeconomic and geopolitical considerations and options for decision makers; and crafting an advocacy plan targeting all stakeholders needed for successful implementation of the WEN Project. It will analyze and form recommendations for financial mechanisms for mobilizing public and private investments, commercial arrangements for sale, purchase and transmission of power and water between the three jurisdictions; the regulatory framework for the exchanges; and broader legal issues such as corporate governance, risk allocation and mitigation. The full feasibility study will fill knowledge gaps, analyze political and other risks to potential investors and the mechanisms to mitigate them, and assess WEN's social and environmental impact. A full study will assess likely market conditions in consultation with private sector actors currently active in the desalination and renewable energy market as well as with potential funders. It will include a financial plan with fully developed recommendations, alternative action plans and priority investments, identifying the kind of finances needed and developing investment cases that show the economic sense of the proposed investments. As the security risks for such a large-scale project are significant, the study will also incorporate estimates of the costs of securing the infrastructure as well as related insurance costs. In addition, it will include a full environmental impact assessment, including life cycle analyses of all options considered, and a thorough assessment of the regulatory issues inherent in implementing such a project needed to examine the legal and contractual issues that would be involved in project execution.

4.1.3) Outreach and Education on the Water Energy Nexus.

For a project such as WEN to succeed, Jordanian, Palestinian and Israeli national leadership would need to create an enabling environment for project-related investments, private sector investors would need to move forward on public/private partnership and private sector investments in WEN-related projects. Ultimately, this would be best achieved through mutual memoranda of understanding by each government and discussions on purchasing agreements.

The WEN program has met resistance and hesitation on all three sides, due to concerns of dependency on another state and concern that radical elements might seek to damage cross-border infrastructure, as occurred in the case of natural gas sales from Egypt to both Israel and Jordan. However, it appears that the tides have started to turn. Key relevant authorities are recognizing the advantages of the WEN program, with the overarching national security and climate security interests now more clearly understood and accepted.[54] [55] [56] [57]

Most recently, on June 8, 2020, Israel’s Minister of Energy, Yuval Steinitz, issued a letter to EcoPeace Middle East welcoming a pilot project where solar electricity produced in Jordan could supply electricity to the Israeli grid and help meet Israel’s commitment to 30% renewables by 2030.[58] The interest of the Israeli Energy Ministry is to benefit from Jordan’s comparative advantage of large land availability, which is lacking on the Israeli side. According to Israel’s Planning Administration, Israel lacks 50,000 dunams of land to meet its 30% solar power targets. The new position of the Energy Ministry builds on an earlier letter of support for the full WEN program issued by the Israel Ministry of Regional Cooperation in 2018.[59]

The Palestinian Authority has undertaken serious steps towards diversifying energy from external sources. In June 2020, an agreement was signed with the Jordanian Government to increase energy supply through upgrading an existing electricity line connecting Jordan with Jericho, and supply electricity to Ramallah and Jerusalem by increasing capacity and connectivity by 200% by 2023, funded through a World Bank program.[60]

In addition, business interests in Jordan, Palestine, Israel and internationally have come to appreciate the economic advantages of the WEN and are expressing an interest to invest not only in a pilot solar cross-border sale, but also in the full WEN concept. The economic gains to all sides could be very significant. As an example, the EcoPeace study concluded that by 2050, Jordan’s supplying 20% of the energy needs of Israel and Palestine would increase Jordan’s GDP by 3-4%, with total revenue flows allowing Jordan to purchase Mediterranean desalinated water at quantities enabling Jordan to fully meet its own water needs and still be left with US$1 billion annually.

Jordan is today producing solar electricity at under 3 cents a kilowatt hour, while in Israel and Palestine electricity is sold at 10 cents a kilowatt hour or more, making Jordanian solar energy not only more sustainable, but also much cheaper.[61] Jordan, on the other hand, does not have convenient access to seawater for desalination, with its only sea located far from its capital and main centers of population. Bringing desalinated water from the Red Sea is three to four times more expensive than the cost of pumping desalinated water from the Mediterranean coast.[62] [63] [64]

Through investment in the WEN, our three countries can meet regional security challenges and utilize the climate crisis as a multiplier of opportunities. While dependency brings with it the political concern of domination, interdependency can be a stabilizing factor. The creation of the European Union was designed precisely to create conditions of interdependency and joint economic benefits and has turned into a stabilizing political factor in Europe. Just like the EU started as a very limited economic agreement between former enemies focusing on only two resources -- coal and steel -- cooperation on water and energy has the potential to be a springboard for broader cooperation, greater stability, and better living conditions for all in the Middle East.

Priority recommendations to the Israeli, Palestinian and Jordanian governments:

- The Government of Jordan could consider issuing the necessary permits that would allow the private sector to sell solar electricity produced in Jordan to Israel.
- Implement the Jordanian / Palestinian agreement to increase electricity sales from Jordan to the West Bank through an existing linkage to Jericho with a focus on electricity sourced from renewable sources.
- Agreements already reached between the Palestinian Authority, Israel and the donor community in favor of large-scale desalination in Gaza and increased electricity transmission from Israel to Gaza should move towards implementation.
- Desalination plants, proposed to be built in Gaza, should be designed to meet not only Palestinian needs but include potential water export to Israel and Jordan, through linkage to Israel's national water carrier.[2]
- Commit to undertaking a full feasibility plan for the WEN, including the creation of a tri-lateral commission to manage the sale and supply of desalinated water and renewable energy.

Priority recommendations to the international community:

- Parallel investments currently made by international financial institutions (IFIs), such as the European Investment Bank (EIB) and European Bank for Reconstruction and Development (EBRD), should align with European Green Deal foreign policy objectives. EBRD investments in solar plants in Jordan should encourage cross-border sales to Israel and Palestine. EIB investment in desalination facilities in Israel and Gaza should be powered by renewable energy sources, preferably sourced from Jordan. (See further details in section 4).

4.2) On Israeli / Palestinian Natural Water Allocation and Sustainable Management

Twentieth century assumptions that dictated water diplomacy led the Levant down a path of conflict and competition over water. Then the Levant was indeed wholly dependent on natural water, and therefore Israelis and Palestinians were in dispute over how to allocate the scarce natural water supply shared between them. This was the mind-set of how water was negotiated in the Oslo Accords in the

[2] The full feasibility study proposed by EcoPeace would substantiate the economic viability and geo-political attractiveness of such a deal.

mid-1990s. Water was left unresolved as one of five final status issues because coming to an agreement over sharing scarce natural water was difficult and would produce winners and losers.

Today advancements in water technologies, often led by Israeli innovation, present the opportunity for Palestinians to obtain their rights to natural water sources, without reducing water availability for the Israeli side. Depending on negotiations between the parties, Palestine could fully access its water rights by increased Palestinian pumping from the three basins of the Mountain Aquifer, with Israel correspondingly reducing its pumping from those basins and increasing its own supply through desalination. As regards riparian water rights from the Jordan River, Palestine, like Jordan, cannot presently access its water rights from the river directly due to water diversion and river pollution. Here one suggestion could be that Palestinian water rights be sourced through increased Palestinian pumping from the Mountain Aquifer or from the Sea of Galilee, in line with the precedent of the Israel / Jordan peace treaty. [65] The ground-breaking work of M.I.T. Professor Franklin Fischer further shows that from an economic and sustainability perspective, optimal water management could take place through the creation of water markets between Israel and Palestine, with even greater efficiencies achieved if Jordan is also included.[66]

Israel's leadership in the utilization of treated wastewater for agriculture and the development of reverse osmosis desalination technology means that water is under fewer constraints as a resource. Presently 70% of the drinking water in Israel comes from desalination, and half the agriculture is grown with treated wastewater.[67] [68] The availability of large quantities of manufactured water, complementing natural water, makes the fair share of natural water between Israelis and Palestinians attainable. Reaching a deal on water would result in more water in every Palestinian home, dramatically improving the lives of every Palestinian, and meaningfully benefit the Palestinian economy.

Compared to the other Israeli-Palestinian conflict "final status issues" -- Jerusalem, refugees, borders/settlements and security -- water is today the least controversial and most solvable of final status issues. For the last 25 years, both Israelis and Palestinians have negotiated on the basis of having to agree to all final status issues as a single package. At the time of the Oslo Accords, all five final status issues were seen as difficult and solvable only as part of a deal, where each side would compromise on each issue as part of a single package. The failure to agree on all final status issues simultaneously has meant that there has been no advance on any of the final status issues. EcoPeace proposes a policy paradigm that prioritizes solvable issues, like water, to revive peace negotiations. This approach does not ignore the deep connection that water allocation has with other final status issues, such as borders, refugees and settlements. Both Palestinian and Israeli negotiators link the water issue to sovereignty and borders and to the water quantity needs of refugees and settlements. The fungible nature of water as a resource, however, means that water quantities can be agreed upon in a manner which takes into account these complexities and still represents agreement to full Palestinian water rights, paving the path towards solving the other final status issues too.

Moving forward on water issues would create a middle way; improving the conditions on the ground for the disadvantaged Palestinian side through allocation of their full water rights, while maintaining Israeli water security through increased desalination. Advancing on water as one of the core issues of the two-state peace process would show the public on both sides that there is a partner for peace and help rebuild the necessary trust between the two parties to advance the other final status issues associated with a two-state solution to the Israeli-Palestinian conflict. No less important under a climate crisis, the need to act on water is more urgent than ever, and its resolution will serve the climate security needs of both peoples.

Despite population growth and development over the past 25 years, Palestinian withdrawals of water from the Mountain Aquifer remain limited to the terms of Oslo II, often enforced through Israeli military control. This has created significant water scarcity affecting large areas of the West

Bank, where municipal water services are provided in cities like Yatta, in the south of the West Bank, only one day per three months during the hot summer period.[69] Additionally, due to its geological characteristics, most of the Mountain Aquifer's recharge area is vulnerable to groundwater pollution and is degraded by inadequately treated sewage and unsanitary solid waste dumps, often caused by the limited ability to move forward in timely manner on projects in Area C communities.[70] An estimated 47 million cubic meters of Palestinian-sourced raw and poorly treated sewage are released into the shared environment each year.[71]

The Coastal Aquifer, under the Gaza Strip, is in a state of extreme overuse. As a result, 96% of the groundwater is no longer potable.[72] Seawater infiltrates the aquifer, and salinity levels have thus risen well beyond World Health Organization (WHO) guidelines for safe drinking water. This situation is compounded by contamination from the discharge of the mostly untreated sewage of 2 million people. The continued blockade on Gaza and the failure to reach internal Palestinian reconciliation result in the water and sanitation crisis being a core cause of Gaza's not being a liveable place.[73]

Israel too is severely affected by the water and sanitation crisis in the West Bank and Gaza. West Bank sewage is carried by cross-border streams into major Israeli cities and contaminates the ground water of the Mountain Aquifer that Israel takes the lion's share of. A 2009 UN report estimated that 50,000 to 80,000 cubic meters of untreated or partially treated wastewater was flowing from Gaza into the Mediterranean Sea daily since January 2008. By 2018 it was estimated that more than 108,000 cubic meters of raw sewage flow from Gaza into the Mediterranean Sea every day through 9 sewage outlets distributed along the Gaza coastline, directly threatening the viability of Israel's coastal desalination plants, which constitute 70% of the country's drinking water, threatening Israeli water security and national security interests.[74] [75]

By not resolving water issues, both sides are paying a heavy price that under conditions of climate change will further threaten the national security of both peoples. The COVID19 pandemic should be a wake-up call to both governments that sustainably managing shared water resources is essential to maintain basic standards of hygiene that are essential to the health and economic welfare of Israelis and Palestinians alike. Maintaining the status quo at a time when technological advances have altered the very rationale for why water was considered a final status issue in the first place only highlights that water issues are today being held hostage to other final status issues of the Israeli-Palestinian conflict.[76] EcoPeace's efforts towards achieving a fair water agreement between Israel and Palestine emphasize equitable rights and equal responsibilities related to joint management of shared water. 'Equitable rights' does not mean that all sides will receive equal volumes of natural water. Rather, it means that they will have equal standing in the institutions for joint management and equal opportunity to participate in decision-making processes, criteria that indicate that it is not water but water management of all shared water bodies that is really shared.[77]

Priority recommendations to the Israeli, Palestinian, and Jordanian governments:

- Give political support to change the all-or-nothing paradigm and agree to negotiate water issues first.
- Negotiate a water agreement to replace article 40 of the 1994 Oslo Accords.
- Create an action plan to address Palestinian water and environmental projects in order to solve urgent issues like water supply and sanitation in Gaza and the West Bank.
- Create a Joint Israeli-Palestinian Water Commission to manage all shared waters.[3] [78]

Priority recommendations to the international community:

[3] A Joint Commission is proposed after water negotiations are completed and based on lessons learned from the failed Joint Water Committee as analyzed in the Brooks Trottier report: https://old.ecopeaceme.org/wp-content/uploads/2020/09/Water_Agreement_FINAL.pdf

- Encourage the sides to break away from the all-or-nothing political paradigm in line with meeting Middle East and foreign policy climate security priorities.
- Create a "Friends of Water Group" as a coalition of states with influence on one or both of the Israeli and Palestinian governments, taking international leadership on the resolution of water issues in the Israeli-Palestinian conflict in the framework of a two-state solution based on internationally agreed parameters.

4.3) On River Rehabilitation, Biodiversity and Sustainable Agriculture and Tourism

The Jordan River Valley, stretching from the Sea of Galilee to the Dead Sea, is a border area with a region-wide population of 800,000 people, Israelis, Palestinians, and Jordanians. The valley's wetland ecosystem, the biological heartland of the region and one of the world's most important crossroads for migratory birds, is threatened by excessive water diversion and pollution. The Jordan River has seen some 95% of its fresh water diverted, half by Israel and the other half by Syria and Jordan, leaving Palestinians since 1967 without any access to river water and with its remaining flow polluted from Jordanian, Israeli and Palestinian sources resulting in 50% biodiversity lost.[79] [80] Competition for scarce water, misuse of natural resources, and lack of regional cooperation have led to the demise of the river valley and caused underdevelopment and poverty, especially on the Jordanian side of the valley. Due to the fact that the river itself is the border, rehabilitation of the river can only take place under conditions of cooperation. The climate crisis and resulting reduced precipitation makes rehabilitation of the Jordan River and its valley so much more difficult today. With the climate crisis leading to further reductions in water availability and increased temperatures reducing soil fertility, failure to act towards rehabilitation will deepen existing levels of poverty and animosities that as described earlier could directly contribute to instability. Alternatively, a Green Blue Deal that sees the climate crisis as an opportunity to promote Jordan Valley cooperation can restore the river to a clean, fast-flowing body of water, revitalize the valley's biodiversity, and attract tourism and pilgrimage that can help diversify incomes and raise people out of poverty, not only for the benefit of the region but for half of humanity that sees the Jordan River as a holy river.

Our own organization's efforts to promote the rehabilitation of the river have borne fruit and served as proof of concept. Such projects have resulted in Israel releasing some 9 mcm of fresh water from the Sea of Galilee into the Lower Jordan River annually since 2013 and is expected to increase to 30 mcm annually.[81] [82] [83]Though a minor quantity to be released compared to historic flows, it does mark a change in policy given that for 49 years no fresh water was released other than a once-in-a-decade flood year.[84] EcoPeace advocacy also helped leverage investment of over US$100 million in the construction of waste-water treatment plants, Israeli, Jordanian and Palestinian, in the Jordan Valley which are starting to remove pollutants from the Jordan River.[85] Also, an investment of a billion NIS in the reversal of Israel's national water carrier that will bring desalinated Mediterranean seawater to the Sea of Galilee creates opportunities to increase flow levels into the lower Jordan. From 2010 to 2015, EcoPeace, the Stockholm International Water Institute (SIWI) and the German Global Nature Fund convened stakeholders from all sides and completed the first-ever integrated Regional Jordan Valley Master Plan (JVMP) for the rehabilitation and sustainable development of the Jordan Valley.[86] The rehabilitation of the Jordan River would allow the river to be utilized again as the natural regional water carrier, meeting the water needs of all three populations along its banks, not supplied through human-made water carriers on either side but accessed as needed from the river itself, allowing other important economic activities to take place the full length of the river. The Master Plan devised an investment strategy which would rehabilitate not only the Jordan River but the whole valley, with the potential to raise the prosperity of the Jordan Valley from a GDP of US$4 billion at present to US $73 billion annually if carried out.[87]

Following the release of the JVMP, the Jordanian Government adopted the master plan on the Jordanian side, but due to outstanding final-status peace process issues, the Israeli and Palestinian governments have refrained from doing the same. Given the political stalemate, EcoPeace negotiated with all three governments the selection of particular master plan projects that were less politically controversial to be advanced despite the political stalemate, as part of a Memorandum of Understanding (MoU) between the three governments to enable the creation of a World Bank Trust Fund to start implementation on agreeable projects. Deteriorating relations between Israel and Jordan however and the Israeli Government's proposal to annex the Jordan Valley have thus far impeded the signing of a trilateral MoU.

EcoPeace, therefore, created a parallel strategy to work with the private sector, connecting projects in the field of climate-smart agriculture with potential investors. Half a dozen such projects, including closed-system fish farming, high protein grasshopper breeding, solar-powered refrigeration for communal agricultural produce, and a palm fronds paper pulp factory -- all led by local entrepreneurs -- are several of the projects in various stages of seeing light. EcoPeace has secured financing for other climate-smart investments such as installing solar panels to power a Jordan Valley wastewater treatment plant, improving the effluent produced so as to replace fresh water for agriculture. In addition, EcoPeace has designed and distributed residential grey water systems in Jordan Valley homes to promote grey water reuse for fruit trees. All of the above projects focus on investments in the Jordanian and Palestinian side of the valley, with green job creation as a key objective. Local female plumbers have been trained to build and install the grey water reuse systems, and climate-smart agricultural training takes place for Palestinian and Jordanian farmers to improve water efficiency through the adoption of relevant practices developed on the Israeli side of the Jordan Valley.

In addition, plans for a protected ecological corridor, on both sides of the Jordan River between Israel and Jordan, have been developed in cooperation with architects from Yale University's Urban Design School. A set of design ideas has been proposed to develop ecotourism that is designed to provide opportunities for the preservation of biodiversity, joint environmental management, collaborative research programs, cross-border environmental education, and expanded economic opportunities for regional cooperation in ecotourism.[88] A pre-feasibility study conducted by the Jordanian company, EcoConsult, detailed how an investment of US$10 million in the infrastructure mentioned above could draw over 250,000 visitors to the site annually, attracting strong private sector investment and significant green employment opportunities for local residents through eco-tourism.[89]

With the support of SIWI, a governance strategy for the valley has also been proposed to create a trilateral Jordan River Commission. A river commission would act as a coordinating body fostering cooperation around the Jordan River under the principle of "one river, one management."[90] [91] [92] A Jordan River Commission would help institutionalize long-term and strategic Jordanian, Palestinian and Israeli cooperation around the Jordan Valley needed to meet the challenges that climate change presents. In the future, the proposed commission should also include Syria and Lebanon as additional riparians to the river basin.The overall goal of EcoPeace's work in the Jordan Valley is to promote peace, prosperity, and security in the Jordan River Valley by promoting sustainable economic development that will safeguard and restore the valley's environmental and ecological values. All of the actions proposed by EcoPeace under a Green Blue Deal strategy increase the resilence of the local populations to not only adapt to climate change but, by improving their livelihood reality on the ground, help create trust among the parties to move forward on outstanding peace process issues.

Priority recommendations to the Israeli, Palestinian and Jordanian governments:

- Move forward on the creation of a World Bank Trust Fund advancing climate-smart, select, JVMP projects.
- Facilitate and advance permitting, where necessary, for regional and national climate-smart private sector investments identified in the Jordan Valley.

- Prioritize plans for further fresh water releases to the Jordan River and investments in the removal of pollutants so that the river can be used as a multipurpose natural carrier as proposed in the JVMP.

Priority recommendations to the international community:

- Support politically and financially the creation of a World Bank Trust Fund for the Jordan Valley.
- Encourage the sides to support investments that will improve climate resilience on the ground, in line with meeting Middle East and foreign policy climate security priorities and the peace process based on two-state solution principles.
- Support further research and joint learning required on international best practices for river rehabilitation and transboundary river governance for the Jordan Valley.

4.4) On Educating for Peace and Sustainability

Investment in mainstreaming educational programs that focus on the relationship between climate change and peace building is particularly needed in areas of protracted conflict like the Middle East, an area recognized as a climate hot spot. Environmental peace building is increasingly recognized as a unique peace-building practice that focuses on common threats and opportunities, such as those created by the climate crisis, to help create the political will needed for governments to act towards climate mitigation and adaptation. The 26 years of experience of EcoPeace Middle East is that an essential ingredient needed to create top-down political will is a long term investment in bottom-up community-based environment and climate education and public engagement programs. Mainstreaming educational programs that link peace and sustainability issues, both at the national and regional level, help create the needed public constituencies that support leaders to move towards cooperation and reject unilateralism. When communities living on either side of a shared water basin come to understand that their future is dependent on the actions of their neighbors, as much as it is dependent on their own behavior, then they can become powerful actors calling on their leaders to cooperate across the border, as a matter of self-interest, if not survival, of their own communities.

For this reason, EcoPeace developed a cross-border education and community-based awareness program called Good Water Neighbors. Instead of ‘good fences’ creating good neighborly relations, the experience of EcoPeace has been that the fences and other security barriers dividing communities not only contribute to ecological demise but are often the source of attitudes that blame the other side for all of the problems and prevents each side from taking responsibility for its behavior contributing to ecological demise. The bottom-up education and public awareness programs of EcoPeace have therefore focused on the shared interests in good water for all, as the entry point of mainstreaming peace and sustainability issues into education programs.

EcoPeace's award-winning community-based Good Water Neighbors (GWN) project has encouraged young people for nearly two decades to support concrete environmental solutions and become agents of change for regional cooperation.[93] GWN includes a school program that educates thousands of Palestinian, Israeli and Jordanian youth about the interdependent nature of water resources and environmental impact and the need for cooperation. "Neighbors Path" tours expose thousands of youth to their own water realities and that of their neighbors across the border and inspire them to plan and implement concrete community projects. Additionally, select groups of youth and young professionals are invited to cross-border activities that are designed to build networks of knowledgeable, empowered and regionally sensitive young leaders and professionals who forge vibrant cross-border connections to advance regional water and environment solutions. Teaching water and climate diplomacy to high school students encourages them to enroll in relevant programs at university, which then prepares them to choose a career path as young professionals and entrepreneurs who have the needed skill sets and comprehension to implement the critical programs earlier mentioned that would lead to such solutions as a water energy nexus, sustainable water allocation and cross-border river and stream management. These are the tools required if we are to meet Green Blue Deal climate mitigation and adaptation goals. For those who do not adopt these issues as a career path, the investment made in water and climate diplomacy in schools and universities nevertheless significantly impacts mind-sets and helps create the public constituency needed in favor of cooperative rather than unilateral decisions.

The "Good Water Neighbors" project, significantly funded for close to a decade by the Swedish International Development Agency (SIDA), includes two main components: 1) National School Programs and 2) Regional Leadership Programs.

4.4.1) National School Programs

EcoPeace has developed national programs targeting youth (ages 16-18) in Jordanian, Palestinian and Israeli high schools, with EcoPeace helping to develop lesson plans that either expand existing official school curricula or introduce new curriculum, and provide national and regional teacher training, site tours, summit days and support for student-led projects. In Israel, EcoPeace has developed a water diplomacy program that annually reaches over 3,000 high school students in 80 high schools, representing all sectors of Israeli society. In Palestine and Jordan, EcoPeace has similarly helped develop unique interdisciplinary lesson plans that enable youth to become better informed and equipped to deal with environmental, water, and climate challenges, while offering educators up-to-date, practical training to provide relevant, interesting lessons and activities to their students about these issues.

4.4.2) Regional Leadership Programs

In parallel to the school programs, which are designed to target thousands of participants, EcoPeace has developed three leadership programs that identify and engage a select group of emerging young environmental leaders and young people with potential to serve as impact multipliers in regional cross-border people-to-people activities. Through these programs, EcoPeace seeks to create a network of empowered young leaders and professionals who will forge cross-border connections to advance regional water and environment solutions.

4.4.2.1) Youth Water Trustees

Each year, 36 youth (ages 16-18) from Jordan, Israel and Palestine (12 from each country) are selected in a competitive process to join the regional Youth Water Trustees track. Trustees meet each other in person at regional camps in Jordan and participate in trainings, simulations, master classes, and delegations that deepen their knowledge about climate change and regional security and help them plan and implement different kinds of climate-change initiatives, focusing particularly on developing ways to create dialogue with decision makers and other stakeholders, while they develop local, regional and global networks. The trustees are also deeply involved in the national school programs as local organizers and guest speakers.

4.4.2.2) Young Professionals

The Water Diplomacy for Young Professionals (ages 21-35) track has developed a regional leadership group of young leaders who cooperate to solve transboundary environmental issues by learning and practicing diplomacy skills and participating in cross-border encounters for networking and joint problem solving. The program targets young professionals in the early stages of their careers: university students, young water professionals, young political leaders, etc. from Palestine, Israel and Jordan. The program involves capacity-building activities in a series of national and regional workshops on water and environmental issues, track II diplomacy and negotiation skills. Working together with the PATHWAYS Institute for Negotiation Education, EcoPeace developed a Climate Change Toolkit for use in training and preparing the Young Water Diplomats across the region to interact directly to explore and brainstorm new region-wide cooperative solutions to shared environmental challenges through the prism of climate change as well as being exposed to international cases, trends, and developments to position them as global agents of change.

4.4.2.3) Green Social Entrepreneurship

The Green Social Entrepreneurship track (ages 21-35) will be launched in late 2020 and targets students and graduates of environmental science and environmental engineering faculties, young entrepreneurs, and young water professionals. The program aims to advance innovative green enterprises that generate social value and create a cohort of young Israeli, Jordanian and Palestinian entrepreneurs who cooperate to build shared prosperity and sustainable development in the region. The program will start with pre-incubation activities focused on the initial development of green initiatives, followed by regional workshops, the building of a regional network of entrepreneurs, and a long-term continuation program consisting of an incubator and a regional center of excellence.

4.4.3) Digital Activities and Virtual Technology

With the outbreak of COVID-19 in early 2020, EcoPeace accelerated and expanded the scope of its digital strategy, adding a variety of virtual and online educational activities that have been integrated into existing programs. The EcoPeace strategy is not just to mitigate current challenges, but to develop innovative virtual activities that offer added value in any scenario. This has led EcoPeace to develop a virtual immersive meeting environment for cross-border (people-to-people) activities. Based on gaming technology, enabling the design of highly realistic open worlds, EcoPeace is currently building a virtual Lower Jordan Valley that would enable participants, as virtual avatars, to freely explore the Jordan Valley, crossing borders and entering usually off-limit areas, while interacting freely and engaging together in quests and challenges built and managed by the EcoPeace education team, and learning about our shared environment. The content incorporates a combination of virtual and zoom meetings, presentations and video clips that can be experienced while in the virtual world, and virtual versions of the neighbors' path tours.

A virtual world brings value that can be used beyond the scope of the current crisis and offers access to a compelling vision of what our region could become. For example, the concept of building an ecological corridor connecting both sides of the Jordan River, long hampered by political constraints, is realized in a virtual world and creates a meaningful shared space for regional meetings and events.

Priority recommendations to the Israeli, Palestinian and Jordanian governments:

- Support national programs for Green Blue Deal education such as water and climate diplomacy and integrate them into nationwide programming across the national education system.
- Integrate Green Blue Deal concepts and priorities into national entrepreneurial programs.

Priority recommendations to the international community

- Increase support for the regional Good Water Neighbors' education and public awareness activities that could not take place without donor support.
- Support national government education programs that mainstream Green Blue Deal concepts and objectives.

5. CONCLUDING WORDS

Opportunities exist to better align Green Deal international foreign policy with Middle East Green Blue Deal objectives. As an example, Europe's declared leadership to advance climate security is an opportunity to see important European-led investments in Middle East desalination and solar electricity production, taking place at the moment on a bilateral basis, to harness regional Green Blue Deal linkages. The EIB recently announced financial support in Israel to build the largest reverse osmosis desalination plant in the world.[94] [95] While the investment is strategically significant for climate adaptation and water security, the energy source is fossil fuel (natural gas) and represents a missed opportunity to promote the use of renewables and help Israel achieve its Paris Agreement goals.

Equally, Europe is leading the effort to build a critically needed desalination plant in Gaza whose energy source would also be largely fossil. At the same time, Europe, through both the EBRD and EIB, is heavily invested in supporting Jordan's leadership in solar energy production. [96] [97] The opportunity on the table is to link these European-led investments in a manner that would facilitate the water energy nexus described above, so that Jordanian solar energy powers desalination plants along the Mediterranean that could then sell desalinated water from Israel and Palestine back to Jordan, to meet Jordan's critical water security needs.

Similarly, with the newly elected Biden Administration likely to reinstate Palestinian funding and increase peace-building funding opportunities, US government funding in the region, mainly through the US Agency for International Development, should be aligned not only with environmental objectives but also with the objective that such funding helps to create cross border regional synergies. As an example, US Congress 2020 deliberations to advance "The Middle East Partnership for Peace Act" provides an opportunity to align investment in people-to-people and economic activity with environmental goals.[98] The authorization of $50 million for five fiscal years to establish the People-to-People Partnership for Peace Fund and the Joint Investment for Peace Initiative, which will provide investments in people-to-people exchanges and economic cooperation with the goal of supporting a negotiated and sustainable two-state solution, initiated by the Alliance for Middle East Peace (ALLMEP), is a prime opportunity to align environmental foreign policy objectives with Middle East Green Blue Deal objectives. Both EU and US cases demonstrate the potential for international actors to combine their influence in financial support with their climate action objectives through regional and international cooperation.

Finally, to harness and coordinate international political leadership in support of a Middle East Green Blue Deal, we propose the creation of a **"Middle East Green Blue Deal Coalition of the Willing"** that could bring together foreign ministers of interested states that support advancing a Middle East Green Blue Deal program. A Green Blue Deal combined with **post COVID-19 recovery** priorities, which are likely to remain on top of the agenda of international donors active in the region for upcoming years, would further help attract international investors including from Arab Gulf countries. To support such goals, we envision and recommend a series of Track II preparatory meetings to encourage countries to join such a coalition, public outreach, and pursuit of research and analysis that can further inform such conversations. In that vein, the US Institute of Peace is partnering with us on a report to be published in early 2021 that will explore the evidentiary and analytical basis of the recommendations made by the authors in this report. We additionally propose that an international conference be convened on a Green Blue Deal for the Middle East. The conference would seek to attract high-level business, think tanks, civil society, and academia. Behind the scenes, a "Green Blue Deal Coalition of the Willing" could lead Track I diplomacy with the governments of Israel, Palestine and Jordan to advance a detailed program with timelines and financing towards the implementation of a Green Blue Deal for the Middle East, to be announced in the proposed international conference. The European Union is well placed to initiate such an effort, inviting interested EU foreign ministers to lead and then broadening such a coalition with interested foreign ministers from non-EU states.

[1]Resolution Recognizing the duty of the Federal Government to create a Green New Deal, H. Res. 109 116th Congress, (February 7, 2019).https://www.congress.gov/116/bills/hres109/BILLS-116hres109ih.pdf

[2] Resolution Recognizing the duty of the Federal Government to create a Green New Deal, S. Res. 59, 116th Congress, (February 7, 2019).
https://www.markey.senate.gov/imo/media/doc/Green%20New%20Deal%20Resolution%20SIGNED.pdf

[3] Office of Energy Efficiency and Renewable Energy, "Retrofitting Exisitng Buildings", *Energy,* Office of Energy Efficiency & Renewable Energy https://www.energy.gov/eere/buildings/retrofit-existing-buildings#:~:text=Often%20retrofit%20involves%20modifications%20to,efficiency%20or%20decrease%20energy%20demand.&text=Energy%2Defficiency%20retrofits%20can%20reduce,and%20gain%20a%20market%20edge.

Office of Energy Efficiency and Renewable Energy, "Incentives and Financing for Energy Efficient Homes", https://www.energy.gov/energysaver/services/incentives-and-financing-energy-efficient-homes. energy.gov, US Department of Energy, August 24, 2020, https://www.usa.gov/green

[4] U.S. Bureau of Labor Statistics, "Green Jobs", *US Bureau of Labour Statistics*, 2011, https://www.bls.gov/green/

[5] Andrea Flynn and Susan R. Holmberg, "The Green New Deal's Supporters Should Take a Crucial Lesson From FDR's Original New Deal", *Time*, February 26 2019, https://time.com/5538022/green-new-deal-warning/

[6] "THE BIDEN PLAN FOR A CLEAN ENERGY REVOLUTION AND ENVIRONMENTAL JUSTICE.", *Biden Harris*, https://joebiden.com/climate-plan/#

[7] European Commission, "COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The European Green Deal COM/2019/640 final", *European Commission,* December 11, 2019, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2

[8] Ibid.

[9] Ewa Kruskowska and Laura Millan Lombrana, "EU Approves Biggest Green Stimulus in History With $572 Billion Plan", *Bloomberg Green*, July 21 2020, https://www.bloomberg.com/news/articles/2020-07-21/eu-approves-biggest-green-stimulus-in-history-with-572-billion-plan

[10] Sue Surkes, "Environment minister unveils 'green deal' to kickstart economy sustainably", *The Times of Israel*, June 1 2020. https://www.timesofisrael.com/environment-minister-unveils-green-deal-to-kickstart-economy-sustainably/#gs.gafwmb

[11] OECD, "Accelerating Climate Action in Israel: Refocusing Mitigation Policies for the Electricity, Residential and Transport Sectors", *OECD*, July 2020, https://www.oecd.org/israel/accelerating-climate-action-in-israel-fb32aabd-en.htm

[12] Ministry of Environmental Protection, "Israel 2050" [Policy Paper], *Ministry of Environmental Protection,* August 13 2019,. https://www.gov.il/en/departments/policies/israel_2050

[13] Jerusalem Post Staff, "Innovative green tech at focus of first EU-Israel climate conference", *The Jerusalem Post*, June 28, 2020, https://www.jpost.com/israel-news/innovative-green-tech-at-focus-of-first-eu-israel-climate-conference-632927

[14] Phillip Gordon, "Israel accelerates transition from coal-fueled power: 2025 targeted", *Smart Energy International,* November 18, 2019,. https://www.smart-energy.com/industry-sectors/energy-grid-management/yuval-steinitz-accelerates-israels-transition-from-coal-fuelled-power/#:~:text=Israel%20accelerates%20transition%20from%20coal%2Dfuelled%20power%3A%202025%20targeted&text=Israel's%20energy%20minister%20Yuval%20Steinitz,consumption%20having%20halved%20since%202015.

[15] D Hanin, “Years of Awakening: From the Public Arena to the Beginning of Government Action”, *INSS,* (To be published in 2020).

[16] Yuval Steinitz, “Yuval Steinitz, Minister of Energy of Israel - Statement Delivered at UNFCCC COP 25.”, Israel Ministry of Energy, press release, December 10, 2019, https://www.gov.il/en/departments/news/madrid_101219

[17] Elizabeth Whitman, “A land without water: the scramble to stop Jordan from running dry.”, *Nature*, September 4, 2019, https://www.nature.com/articles/d41586-019-02600-w

[18] Suleiman Al Khalidi, “Jordan energy plan seeks major reduction in foreign fuel imports, minister says”. *Reuters,* July 8, 2020. https://in.reuters.com/article/jordan-energy-idINL8N2EE611

[19] Ministry of Environment, *A National Green Growth Plan for Jordan, Amman, Hashemite Kingdom of Jordan* (2017) https://www.greengrowthknowledge.org/sites/default/files/A%20National%20Green%20Growth%20Plan%20for%20Jordan.pdf

[20] Government of the Hashemite Kingdom of Jordan, “Hashemite Kingdom of Jordan Intended Nationally Determined Contribution (INDC)” *UNFCCC*, (n.d), https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Jordan%20First/Jordan%20INDCs%20Final.pdf

[21] Waylon Fairbanks, “Jordan Eyes 50% Powergen From Domestic Sources By 2030”, *MEES* 63 (31), July 31, 2020, https://www.mees.com/2020/7/31/geopolitical-risk/jordan-eyes-50-powergen-from-domestic-sources-by-2030/06b377b0-d338-11ea-b5b5-d1b402621ecf

[22] Zaghloul Samhan, “Environment Sector Working Group Cross-Sectoral Environmental Strategy 2017-2022.”, *Environment Quality Authority*, powerpoint presentation, December 13, 2016, https://slideplayer.com/slide/12821187/

[23] Mohammad Ziad Yamin, “Renewable Energy in Palestine.”, *EcoMENA*, February 23, 2020, https://www.ecomena.org/renewables-palestine/

[24] H.E. Zafer Milhem, “Paving the Way for a Renewable Energy Future in Palestine.”, *This Week in Palestine*, August 31, 2020, https://www.thisweekinpalestine.com/paving-the-way-for-a-renewable-energy-future-in-palestine/

[25] H.E. Zafer Milhem, “Paving the Way for a Renewable Energy Future in Palestine.”, *This Week in Palestine*, August 31, 2020, https://www.thisweekinpalestine.com/paving-the-way-for-a-renewable-energy-future-in-palestine/

[26] Ahmad Abu Amer, “How this solar energy project will meet Palestinians’ electricity needs.”, Al Monitor, November 10, 2019, https://www.al-monitor.com/pulse/originals/2019/11/palestine-solar-energy-power-stations-israel-economic-ties.html#ixzz6aY5SPM9U

[27] https://www.un.org/en/pdfs/FFD%2029%20SEPT/Palestine.pdf

[28] O. Hoegh-Guldberg et al., “Impacts of 1.5ºC global warming on natural and human systems” in *Special Report: Global Warming of 1.5°C*, ed. IPCC (IPCC, 2018), https://www.ipcc.ch/sr15/chapter/chapter-3/

[29] EcoPeace Middle East, 2019, Climate Change, Water Security, and National Security for Jordan, Palestine, and Israel, Amman, Jordan; Tel Aviv, Israel; Ramallah, Palestine: Carry, Inga (Ed.) https://ecopeaceme.org/wp-content/uploads/2019/01/climate-change-web.pdf

[30] Tel Aviv University, “Mediterranean summer will be months longer by century’s end”, *Tel Aviv University,* March 6 2018. https://english.m.tau.ac.il/news/summer_longer

[31] EcoPeace Middle East / Konrad-Adenauer-Stiftung, 2017, Water Energy Nexus. A Prefeasibility Study for Mid-East Water-Renewable Energy Exchanges, p 12, Amman, Jordan: Katz, David and Shafran, Arkady (Eds.). https://ecopeaceme.org/wp-content/uploads/2018/03/WEN_Ex_Sum_Final_Web.pdf

[32] EcoPeace Middle East / Konrad-Adenauer-Stiftung, 2017, Water Energy Nexus. A Prefeasibility Study for Mid-East Water-Renewable Energy Exchanges, p 13 Amman, Jordan: Katz, David and Shafran, Arkady (Eds.). https://ecopeaceme.org/wp-content/uploads/2018/03/WEN_Ex_Sum_Final_Web.pdf

[33] Abeer Abu Shawish and Catherine Weibel, "Gaza children face acute water and sanitation crisis" *UNICEF*, September 1, 2017. https://www.unicef.org/stories/gaza-children-face-acute-water-sanitation-crisis

[34] I24 News, "Israel estimates 96% of water in Gaza undrinkable, warns of worsening crisis.", *i24 News*, April 9, 2017, https://www.i24news.tv/en/news/israel/142275-170409-israel-estimates-96-of-water-in-gaza-undrinkable-warns-of-worsening-crisis

[35] Oded Eran, Gidon Bromberg, Giulia Giordano, "Israeli Water Diplomacy and National Security Concerns.", *EcoPeace Middle East*, pp 12-14, January 2018, https://ecopeaceme.org/wp-content/uploads/2018/01/Water_Diplomacy.pdf

[36] World Bank. 2018. "Securing Water for Development in West Bank and Gaza." World Bank, Washington, DC, p 9, http://documents1.worldbank.org/curated/en/736571530044615402/Securing-water-for-development-in-West-Bank-and-Gaza-sector-note.pdf

[37] B'tselem, "180,000 residents of Nablus suffering acute water shortage since June.", B'tselem, September 17, 2020, https://www.btselem.org/water/20170913_acute_water_shortage_in_nablus

[38] Kayla Ritter, "Amman Faces Water Squeeze as Refugees Rush into Jordan" *Waternews*, Circle of Blue, May 3, 2018, https://www.circleofblue.org/2018/middle-east/amman-faces-water-squeeze-as-refugees-rush-into-jordan/

[39] EcoPeace Middle East, "Regional NGO Master Plan for Sustainable Development in the Jordan Valley.", *EcoPeace Middle East*, p 14, June 2015, https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[40] Adelphi, "Insurgency, Terrorism and Organised Crime in a Warming Climate.", *Adelphi*, October 2016, https://uploads.guim.co.uk/2017/04/20/CD_Report_Insurgency_170419_(1).pdf

[41] EcoPeace Middle East, 2019, Climate Change, Water Security, and National Security for Jordan, Palestine, and Israel, Amman, Jordan; Tel Aviv, Israel; Ramallah, Palestine: Carry, Inga (Ed.), p 16, https://ecopeaceme.org/wp-content/uploads/2019/01/climate-change-web.pdf?

[42] World Bank, "Unemployment, youth total (% of total labour force ages 15-24) (modelled ILO estimate)- Jordan", *World Bank*, June 21, 2020 https://data.worldbank.org/indicator/SL.UEM.1524.ZS?locations=JO

[43] International Crisis Group, "How the Islamic State Rose, Fell and Could Rise Again in the Maghreb.", *International Crisis Group*, Middle East and North Africa Report N°178, July 24, 2017, https://d2071andvip0wj.cloudfront.net/178-how-the-islamic-state-rose_0.pdf

[44] Benjamin Kerstein, "Study: Jordanian Textbooks Have Greatly Improved in Promoting Moderate Islam, Tolerance, but Still Reject Israel.", *The Algameiner*, July 9, 2019, https://www.algemeiner.com/2019/07/09/study-jordanian-textbooks-have-greatly-improved-in-promoting-moderate-islam-tolerance-but-still-reject-israel/

[45] Yael Teff-Seker (2020): Peace and conflict in Israeli state-approved textbooks: 2000-2018, Journal of Curriculum Studies, DOI: 10.1080/00220272.2020.1716392, https://doi.org/10.1080/00220272.2020.1716392

[46] EcoPeace Middle East, 2019, Climate Change, Water Security, and National Security for Jordan, Palestine, and Israel, Amman, Jordan; Tel Aviv, Israel; Ramallah, Palestine: Carry, Inga (Ed.), https://ecopeaceme.org/wp-content/uploads/2019/01/climate-change-web.pdf?

[47] Oded Eran, Gidon Bromberg, Giulia Giordano, "Israeli Water Diplomacy and National Security Concerns.", EcoPeace Middle East, January 2018, https://ecopeaceme.org/wp-content/uploads/2018/01/Water_Diplomacy.pdf

[48] World Bank, "The Ripple Effects of the Syrian Conflict in the Mashreq Region" *World Bank* June 18, 2020, https://www.worldbank.org/en/news/press-release/2020/06/17/fallout-of-war-in-syria

[49] Gidon Bromberg & Shelby Kaplan, "The Climate Crisis as a Multiplier of Opportunities: Cross-border Sale of Solar Photovoltaic (PV) Electricity and Desalinated Water as a Means for Advancing Israeli and Region-Wide National Security.", *INSS*, To be published in 2020.

[50] Fares Akram, "Rare protests erupt against Hamas' 12-year rule over Gaza.", *AP News*, March 19, 2019, https://apnews.com/article/8fdc192372ed472d8043498f077d1dc0
[51] Rand Sawalha, "Why I joined the protests in Jordan.", *Al Jazeera*, June 6, 2018, https://www.aljazeera.com/opinions/2018/6/6/why-i-joined-the-protests-in-jordan/
[52] EcoPeace Middle East / Konrad-Adenauer-Stiftung, 2017, Water Energy Nexus. A Prefeasibility Study for Mid-East Water-Renewable Energy Exchanges, Amman, Jordan: Katz, David and Shafran, Arkady (Eds.). https://ecopeaceme.org/wp-content/uploads/2018/03/WEN_Ex_Sum_Final_Web.pdf
[53] Melanie Lidman, "Plan to pump desalinated water to Sea of Galilee may open diplomatic floodgates", *Times of Israel* June 27, 2019, https://www.timesofisrael.com/plan-to-pump-desalinated-water-to-sea-of-galilee-may-open-diplomatic-floodgates/
[54] Oliver Holmes, "Israel moots plan to buy solar power from former enemy Jordan.", *The Guardian*, August 23, 2020, https://www.theguardian.com/world/2020/aug/23/israel-moots-plan-to-buy-solar-power-from-former-enemy-jordan
[55] Sue Surkes, "Government body wants taxpayers to subsidize half of new gas pipeline", *The Times of Israel* February 18, 2020, https://www.timesofisrael.com/government-body-suggests-taxpayers-should-subsidize-half-of-new-gas-pipeline/
[56] Itay Fischhendler, Shlomi Dinar, and David Katz, "The politics of unilateral environmentalism: cooperation and conflict over water management along the Israeli-Palestinian border." *Global Environmental Politics* 11, no. 1 (2011): 36- 61, https://www.researchgate.net/publication/239857141_The_Politics_of_Unilateral_Environmentalism_Cooperation_and_Conflict_over_Water_Management_along_the_Israeli-Palestinian_Border
[57] Brenda Shaffer, "Israel—New Natural Gas Producer in the Mediterranean." *Energy Policy* 39 no. 9 (2011): 5379–87, https://doi.org/10.1016/j.enpol.2011.05.026
[58] Yuval Steinitz, "RE: Regional Cooperation and Cross-Border Purchase of Electricity" Received by Mr. Gidon Bromberg, June 8, 2020. Letter can be accessed at request from EcoPeace Middle East
[59] Joseph Draznin, "Subject: Support for Middle East Water / Renewable Energy Nexus" Received by Mr. Gidon Bromberg of EcoPeace Middle East and Mr. Marc Frings of Konrad-Adenauer-Stiftung, January 21, 2018. Letter can be accessed at request of EcoPeace Middle East
[60] Alwatan Voice, "Zafer Melhem: The Energy Development and Enhancement Program Agreement in Palestine is the First.", Alwatan Voice, July 1, 2020, https://www.alwatanvoice.com/arabic/news/2020/07/01/1349063.html
[61] David Katz and Arkady Shafran, "Water-Energy Nexus: A Pre-Feasibility Study for Mid-East Water-Renewable Energy Exchanges", *EcoPeace Middle East and Konrad Adenauer Stiftung,* November 2017, https://ecopeaceme.org/wp-content/uploads/2018/03/WEN_Full_Study_Final_Web.pdf
[62] The Times of Israel, "Plan to pump desalinated water to Sea of Galilee may open diplomatic floodgates.", *The Times of Israel*, n.d., https://www.timesofisrael.com/plan-to-pump-desalinated-water-to-sea-of-galilee-may-open-diplomatic-floodgates
[63] Melanie Lidman, "Red Sea-Dead Sea pipe dream isn't worth its salt.", *The Times of Israel*, August 17, 2017, https://www.timesofisrael.com/experts-want-pols-to-pipe-down-over-red-seadead-sea-link
[64] EcoPeace Middle East / Konrad-Adenauer-Stiftung, 2017, Water Energy Nexus. A Prefeasibility Study for Mid-East Water-Renewable Energy Exchanges, Amman, Jordan: Katz, David and Shafran, Arkady (Eds.), https://ecopeaceme.org/wp-content/uploads/2018/03/WEN_Full_Study_Final_Web.pdf
[65] Oden Eran, Gidon Bromberg, Giulia Giordano, "Israeli Water Diplomacy and National Security Concerns.", *EcoPeace Middle East*, p. 10, January 2018, https://old.ecopeaceme.org/wp-content/uploads/2018/01/Water_Diplomacy.pdf
[66] Franklin M. Fisher et. al., "Optimal water management and conflict resolution:The Middle East Water Project.", *Water Resources Research* (38) 11, September 10, 2001, https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2001WR000943

[67] Israel Mission to the EU and NATO, "From sea water to drinking water" October 31, 2018. https://embassies.gov.il/eu/NewsAndEvents/Newsletter/Pages/From-sea-water-to-drinking-water.aspx#:~:text=Today%2C%2070%25%20of%20Israel's%20domestic,to%20meet%20its%20population's%20needs.

[68] Fiona Harvey, "Is there a beautiful, briny solution to the world's clean water crisis?" *The Guardian* April 10, 2019. https://www.theguardian.com/world/2019/apr/10/desalination-world-clean-water-crisis

[69] EcoPeace Middle East, INSS and Konrad Adenauer Stiftung, "Can Water Bring The Political Process To A Safer Shore? : Water Issues from a Source of Conflict to Vehicle for Regional Cooperation and Stability", ed. Giulia Giordano, *EcoPeace Middle East, INSS and Konrad Adenauer Siftung*, December 8, 2016. https://ecopeaceme.org/wp-content/uploads/2017/07/KAS_Digital_Publication_Water_v2.pdf

[70] Zecharya Tagar, Tamar Keinan and Gidon Bromberg, "A Seeping Timebomb: Pollution of the Mountain Aquifer by Sewage" in *Water Resources in the Middle East* (Berlin: Heidelberg, 2007), 417-426.

[71] Gidon Bromberg, Yana Abu Taleb, Nada Majdalani, "COVID 19, Human Waste and Wastewater: A Discussion Paper for Cooperation on Water and Wastewater Management in Israel, Jordan and Palestine.", *EcoPeace Middle East*, pp. 5-7, April 2020, https://ecopeaceme.org/wp-content/uploads/2020/05/Coronavirus-and-Water-Wastewater-Cooperation-30-April-2020.pdf

[72] Palestinian Water Authority, "Gaza Water Status Report 2017" June 2018, https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/gaza_water_resources_status_report_2017.pdf

[73] Barak Hermesh, Ma'ayan Maya and Nadav Davidovitch, "Health Risks Assessment for the Israeli Population following the Sanitary Crisis in Gaza", *EcoPeace Middle East* March 2019, https://ecopeaceme.org/wp-content/uploads/2019/05/Gaza-Health-Report_ENG.pdf

[74] EcoPeace Middle East, 2018. Report on the Status of the HebronBesor-Wadi Gaza Basin: De Bruyne, Charlotte, p 25, https://ecopeaceme.org/wp-content/uploads/2019/01/nahal-hevron_web_ENG.pdf

[75] UNSCO, "Gaza: Ten Years Later" July 2017, https://unsco.unmissions.org/sites/default/files/gaza_10_years_later_-_11_july_2017.pdf

[76] Sharon Udasin, "Environmentalists, security strategists caution: Water can't wait for a peace agreement" *The Jerusalem Post*, April 1 2014, https://www.jpost.com/enviro-tech/environmentalists-security-strategists-caution-water-cant-wait-for-a-peace-agreement-347096

[77] David B. Brooks & Julie Trottier, "Moving water from last to first in the Middle East peace process", *International Journal of Water Resources Development* (2020) https://doi.org/10.1080/07900627.2020.1787126

[78] David B. Brooks & Julie Trottier, "An Agreement to Share Water with Israeli and Palestinians: The FoEME Proposal.", *EcoPeace Middle East*, March 2012, https://old.ecopeaceme.org/wp-content/uploads/2020/09/Water_Agreement_FINAL.pdf

[79] Royal HaskoningDHV and EcoPeace Middle East, *Regional NGO Master Plan for Sustainable Development in the Jordan Valley*, (EcoPeace Middle East: 2015), https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[80] EcoPeace Middle East, "Lower Jordan River", *EcoPeace Middle East*, https://ecopeaceme.org/projects/lower-jordan-river/lower-jordan-river/

[81] Tamar Pileggi & Melanie Lidman, "Water flow into Sea of Galilee at lowest level in a century.", *The Times of Israel*, June 4, 2017, https://www.timesofisrael.com/water-flow-into-sea-of-galilee-at-lowest-level-in-a-century/

[82] Alon Tal, "Will demography defeat river rehabilitation efforts? The Case of the River Jordan", *Water Research* 111, March 15 2017: 404-419, https://doi.org/10.1016/j.watres.2016.11.047

[83] Zafrir Rinat, "For first time, Israel's Water Authority to pump Kinneret water into Jordan River", *Haaretz* May 17, 2013, https://www.haaretz.com/.premium-jordan-river-to-drink-up-kinneret-water-1.5243117

[84] EcoPeace Middle East, "RIVER OUT OF EDEN: WATER, ECOLOGY AND THE JORDAN RIVER IN THE ABRAHAMIC TRADITIONS.", *EcoPeace Middle East*, March 2017, https://ecopeaceme.org/wp-content/uploads/2017/04/River_Out_of_Eden_Multifaith_web.pdf

[85] EcoPeace Middle East, "Achievements", *EcoPeace Middle East,* https://ecopeaceme.org/projects/lower-jordan-river/achievements/

[86] Royal HaskoningDHV and EcoPeace Middle East, Regional NGO Master Plan for Sustainable Development in the Jordan Valley, (EcoPeace Middle East: 2015), https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[87] Royal HaskoningDHV and EcoPeace Middle East, *Regional NGO Master Plan for Sustainable Development in the Jordan Valley*, (EcoPeace Middle East: 2015), https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[88] EcoPeace Middle East, "Jordan River Peace Park", *EcoPeace Middle East* https://ecopeaceme.org/projects/lower-jordan-river/jordan-river-peace-park/

[89] Royal HaskoningDHV and EcoPeace Middle East, *Regional NGO Master Plan for Sustainable Development in the Jordan Valley*, (EcoPeace Middle East: 2015), https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[90] Elizabeth Yaari, Marian Neal (Patrick), Zaki Shubber, "Governance structures for transboundary water management in the Jordan Basin." 2016 https://www.siwi.org/wp-content/uploads/2016/08/Partner-publication-Basin-Structure-TWM-web.pdf

[91] Royal HaskoningDHV and EcoPeace Middle East, *Regional NGO Master Plan for Sustainable Development in the Jordan Valley*, (EcoPeace Middle East: 2015), https://ecopeaceme.org/wp-content/uploads/2020/09/Regional_NGO_Master_Plan_Final.pdf

[92] Elizabeth Yaari, Marian Neal (Patrick), Zaki Shubber, "Governance structures for transboundary water management in the Jordan Basin." 2016, https://www.siwi.org/wp-content/uploads/2016/08/Partner-publication-Basin-Structure-TWM-web.pdf

[93] EcoPeace Middle East, "Awards", *EcoPeace Middle East*, n.d., https://ecopeaceme.org/ecopeace/awards-2/

[94] Amiram Barkat, "IDE wins Sorek 2 desalination tender amid US pressure" *Globes*, May 26, 2020, https://en.globes.co.il/en/article-ide-wins-sorek-2-desalination-tender-after-us-pressure-1001330178

[95] The Jerusalem Post Staff "European Investment Bank invests in Israeli water desalination project" *The Jerusalem Post* June 16, 2020, https://www.jpost.com/israel-news/european-investment-bank-invests-in-israeli-water-desalination-project-631715

[96] Nibal Zgheib, "ERBD finances largest private-to-private solar project in Jordan yet" *European Bank for Reconstruction and Development*, July 31 2019, https://www.ebrd.com/news/2019/ebrd-finances-largest-privatetoprivate-solar-project-in-jordan-yet.html

[97] NS Energy Staff Writer "EBRD and partners offer £28.8m loan to build 37MW solar project in Jordan" *NS Energy*, August 1, 2019, https://www.nsenergybusiness.com/news/ebrd-solar-project-jordan/

[98] https://www.allmep.org/congress-introduces-bipartisan-partnership-fund-for-peace-act/

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PHOTOVOICE LABORATORY PARTICIPANTS PRESENTATION

SCUOLA ESTIVA DEL MEDITERRANEO | ROMA 2022

IL CAMBIAMENTO CLIMATICO (NON) ESISTE

LABORATORIO PHOTOVOICE

ROMA TRE
UNIVERSITÀ DEGLI STUDI

PROGETTO CONDOTTO DA SIMONE PADOVANI

IL LABORATORIO

Il laboratorio visuale “IL CAMBIAMENTO CLIMATICO (NON) ESISTE” è un laboratorio di insegnamento della tecnica di ricerca qualitativa partecipativa chiamata Photovoice, che attreaverso immagini prodotte dai partecipanti, gli studenti della Scuole Estiva del Mediterraneo tenutasi presso l’Università ROMA 3. I partecipanti, 11 in totale, sono stati prima educati sulla tecnica del Photovoice e sulla tecnica fotografica dal docente Simone Padovani, e poi hanno realizzato un progetto di Photovoice. Dopo aver realizzato e ricercato le immagini sul territorio di Roma, hanno poi sviluppato le didascalie, e divisi in due gruppi hanno discusso e realizzato una selezione e una lista di proposte sulla tematica del cambiamento climatico a Roma.

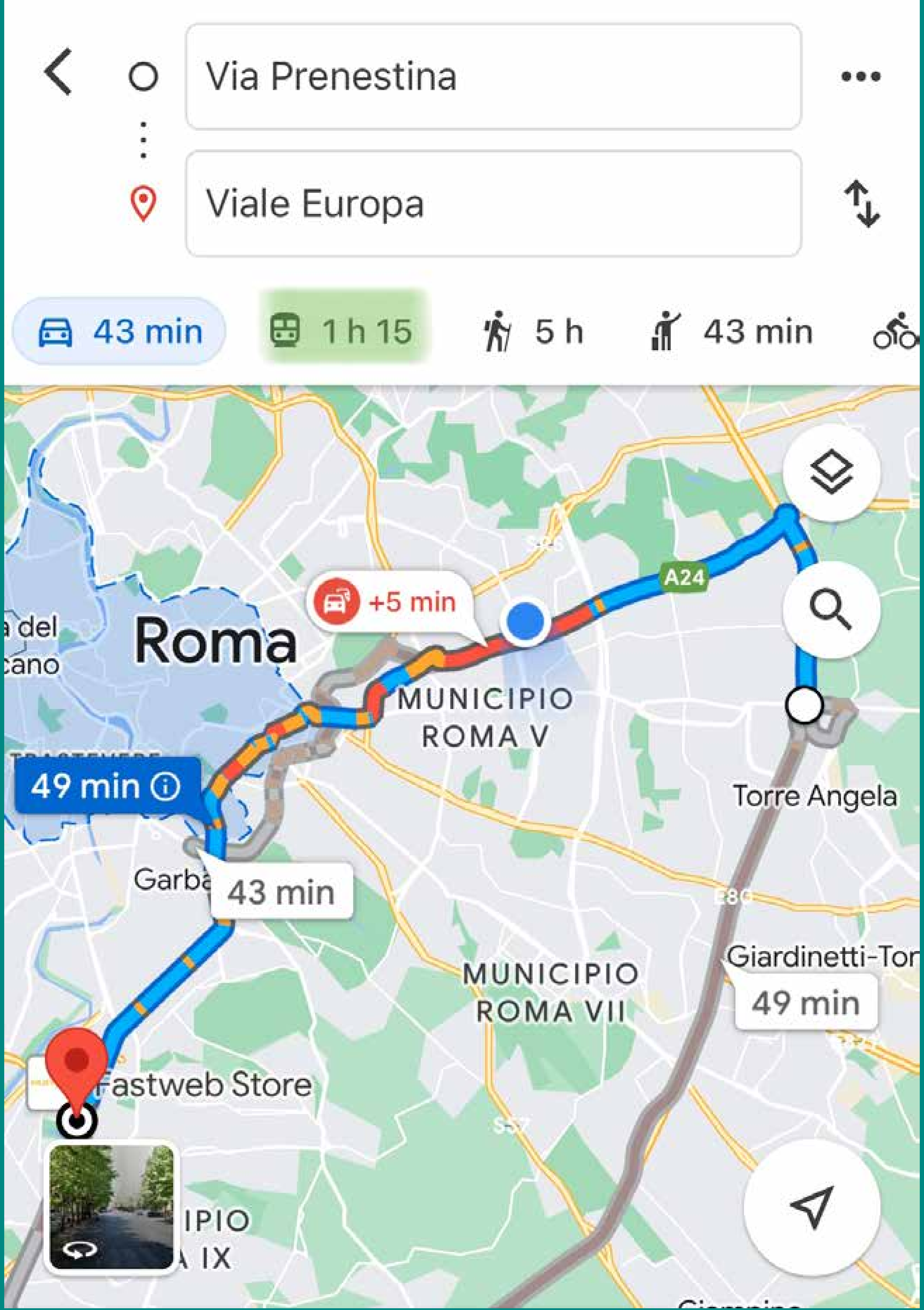
In questo documento è raccolto tutto il materiale da loro prodotto nei 4 giorni di laboratorio.

LE IMMAGINI

DEI PARTECIPANTI AL LABORATORIO

TRASPORTO PUBBLICO F->A+

NICOLETTA BANINI



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BetterPoints

BICI O NON BICI...

ALESSANDRO BELMONTE & ALESSANDRO VITIELLO


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IL SUOLO URBANO: PARTE DEL PROBLEMA

GILDA GAROFALO


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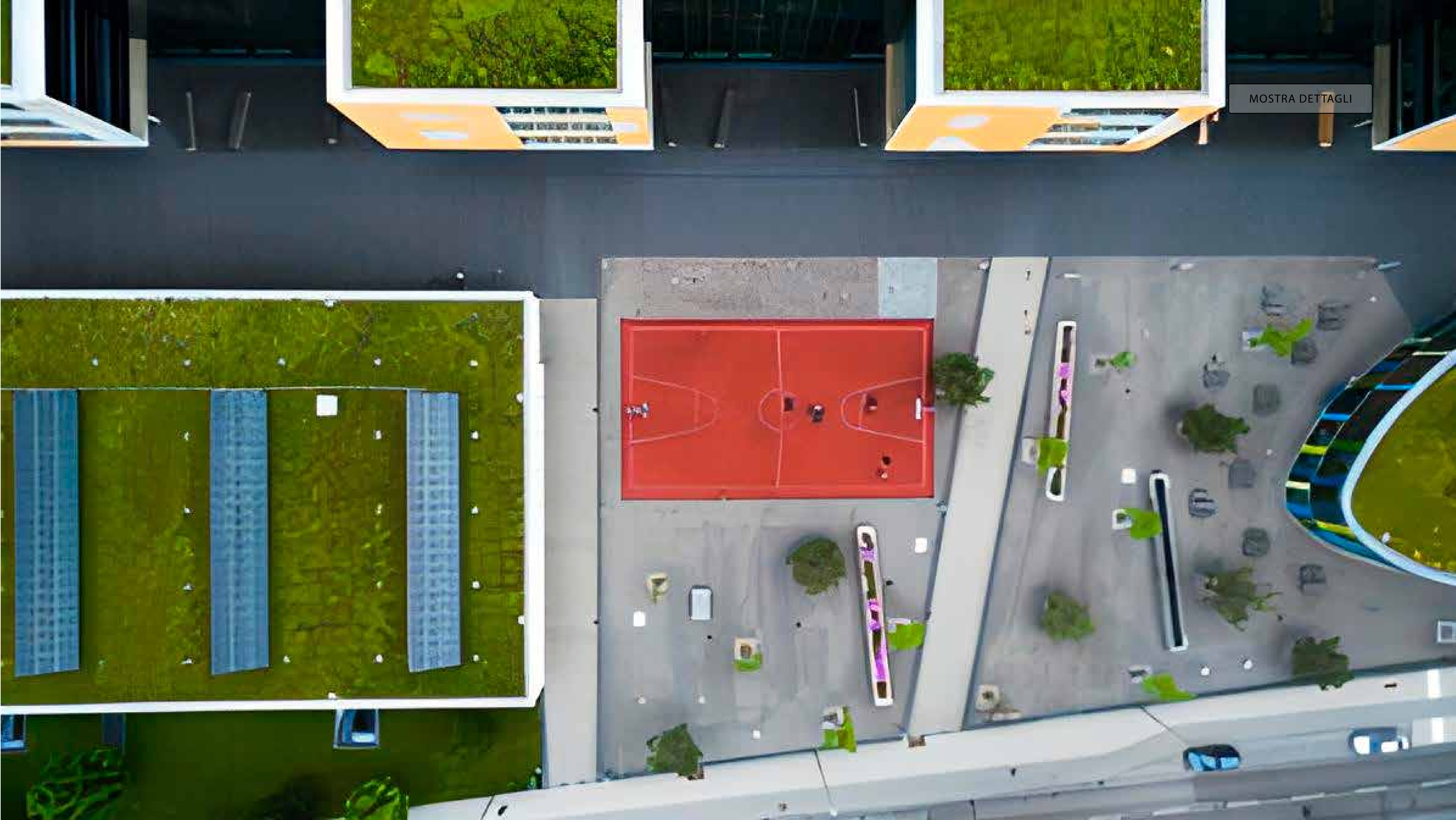

MOSTRA DETTAGLI

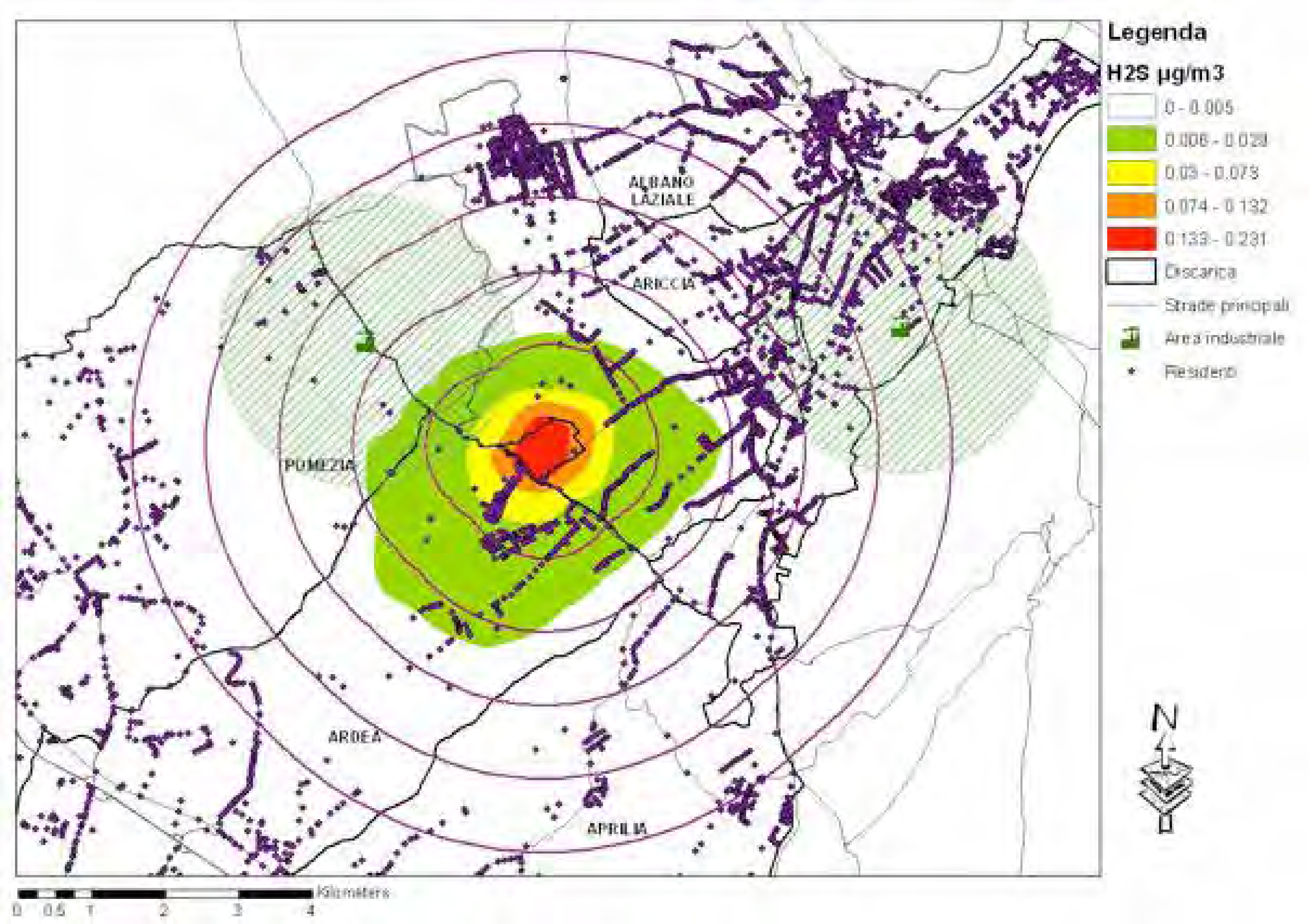
Bibliografia e sitografia

Asdrubali, F., Lelo, K., Monni, S., Roncone, M., Tomassi F., “Le isole di calore nei quartieri di Roma”, economiaepolitica, 30 Marzo 2022, https://www.economiaepolitica.it/indagini/le-isole-di-calore-nei-quartieri-di-roma/.
Benfenati, Stefano, “Trappole di cemento e ferrovie: quali sono le isole di calore di Roma”, AGI – Agenzia Italiana, 12 luglio 2022, https://www.agi.it/cronaca/news/2022-07-12/trappole-cemento-ferrovie-isole-di-calore-roma-17412995/#:~:text=AGI%20%2D%20Roma%20%C3%A8%20un%20arcipelago,32%20del%20Parco%20della%20Vittoria.
Bioedil Progetti, “La sfida del futuro: combattere l’innalzamento delle temperature e il caldo urbano partendo dalle strade e dai tetti”, https://www.bioedilprogetti.com/magazine/la-sfida-del-futuro-combattere-linnalzamento-delle-temperature-e-il-caldo-urbano-partendo-dalle-strade-e-dai-tetti/.
Di Rienzo Giovanni, Moccia Andrea, “Cos’è un’Isola Urbana di Calore? Vediamo perché in città fa sempre più caldo”, 22 luglio 2022, https://www.geopop.it/video/cose-unisola-urbana-di-calore-vediamo-perche-in-citta-fa-sempre-piu-caldo/.
Wikipedia, “Isola di calore”, https://it.wikipedia.org/wiki/Isola_di_calore.

RIFIUTI

ALESSANDRA PASSERI

MOSTRA DETTAGLI



APPROFONDIMENTO:

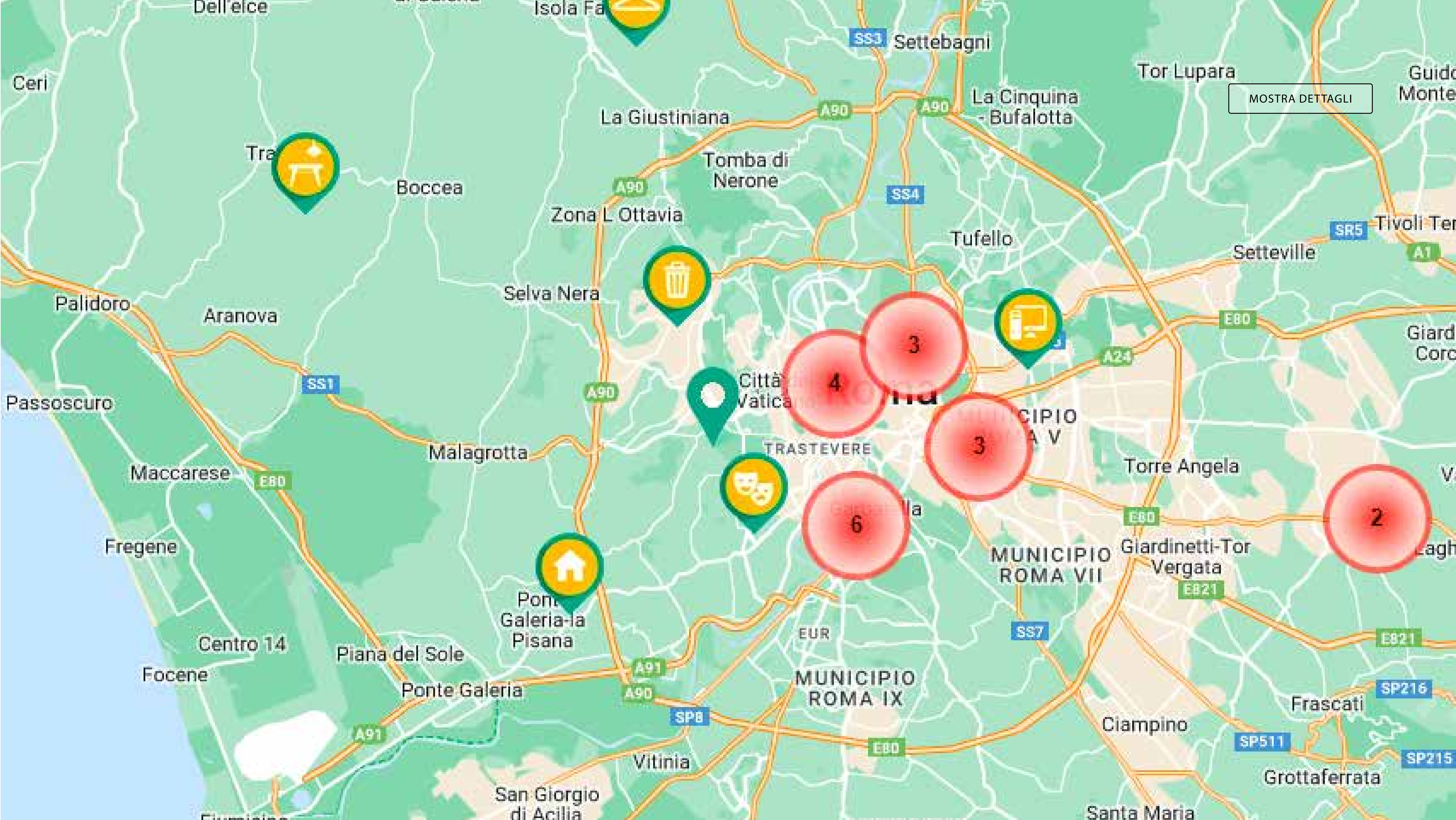
Il cambiamento climatico non impatta sui territori e sulle popolazioni allo stesso modo. Fuori Roma, lontano dagli occhi di chi ne vive solo il centro, le periferie stanno pagando il prezzo della malagestione dei rifiuti. I cassoni dell'immondizia straripante per le vie di Roma sono il riflesso di una politica che concepisce il rifiuto solo come risorsa energetica e di profitto, e dunque non ha interesse ad incentivare la differenziata che renderebbe obsoleti impianti quali i TMB, gli inceneritori e le discariche. La mappa elaborata dallo studio epidemiologico dimostra come i residenti entro i 5 Km dalla discarica di Albano Laziale siano più esposti a sostanze inquinanti quali l'idrogeno solforato, un gas tossico incolore che pure gli abitanti hanno imparato a riconoscere per il caratteristico odore di uova marce che tormenta quotidianamente le loro vite. Lo studio epidemiologico riconosce la correlazione tra la prossimità agli impianti di smaltimento dei rifiuti e la marginalità socio-economica della popolazione residente, votata al sacrificio di un sistema che scarta anche e soprattutto vite e territori marginali.


MOSTRA DETTAGLI

APPROFONDIMENTO:

Recarsi in negozio con una sportina e i propri contenitori da riempire, consumare e tornare a riempire nuovamente riduce drasticamente la produzione di materiale di scarto domestico, rendendo superflua anche la raccolta differenziata, a Roma già compromessa dalla sua malagestione.

Sebbene sia un esempio positivo, sul territorio romano rappresenta una minoranza deprimente. Inoltre, queste realtà spesso si configurano in una narrazione commerciale che mercifica le scelte green e dunque non garantiscono né una reale genuinità dei prodotti né l'abbattimento del costo degli imballaggi. Infine, è una pratica che riguarda solo le scelte individuali, andando a responsabilizzare solo l'ambito domestico e mai quello industriale.


MOSTRA DETTAGLI
Ceri
Settebagni
Tor Lupara
La Cinquina - Bufalotta
La Giustiniana
Tomba di Nerone
Boccea
Zona L Ottavia
Tufello
Setteville
Selva Nera
Palidoro
Aranova
Passoscuro
TRASTEVERE
Malagrotta
Maccarese
Torre Angela
Fregene
MUNICIPIO ROMA VII
Giardinetti-Tor Vergata
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Centro 14
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Ponte Galeria
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Grottaferrata
San Giorgio di Acilia
Santa Maria
SS3
A90
SS4
SR5
A1
E80
A24
SS1
E821
SS7
A91
SP8
SP216
SP511
SP215
3
4
3
6
2

APPROFONDIMENTO:

Soluzioni propositive per Roma dovrebbero essere l'implementazione della raccolta porta a porta per recuperare i materiali differenziati e rendere inutili impianti energivori come i TMB, gli inceneritori e le discariche; la riduzione della produzione di materiali destinati ad essere un rifiuto, seppur riciclabile, incentivando pratiche di riuso, scambio, divieto di imballaggi; considerare non solo il processo di vita del rifiuto solido, ma anche le relazioni di scarto necessarie per produrlo, ossia l'impatto socio-ambientale dell'estrazione delle materie prime e dei processi produttivi.

L'Atlante italiano dell'Economia Circolare è una piattaforma consultabile sul web realizzata dal CDCA - Centro Documentazione Conflitti Ambientali con il sostegno di Erion che raccoglie le realtà aziendali e associative italiane che praticano un'economia circolare. "La circolarità di ogni esperienza è valutata attraverso una serie di indicatori che tengono conto di tutte le fasi del processo produttivo: dalla scelta delle materie prime alla progettazione, dall'efficienza energetica alla logistica, dalla gestione degli scarti alla creazione di valore sociale condiviso, dalla valorizzazione territoriale all'analisi dell'intera filiera." https://economiacircolare.com/metodologia/

VERDE URBANO

FLAVIA PETRACCONE

MOSTRA DETTAGLI


REGIONE LAZIO
MOSTRA DETTAGLI
ORTI URBANI
GARBATELLA


MOSTRA DETTAGLI

(CONTRO) NARRAZIONE

GIULIO SASSOLI

MOSTRA DETTAGLI

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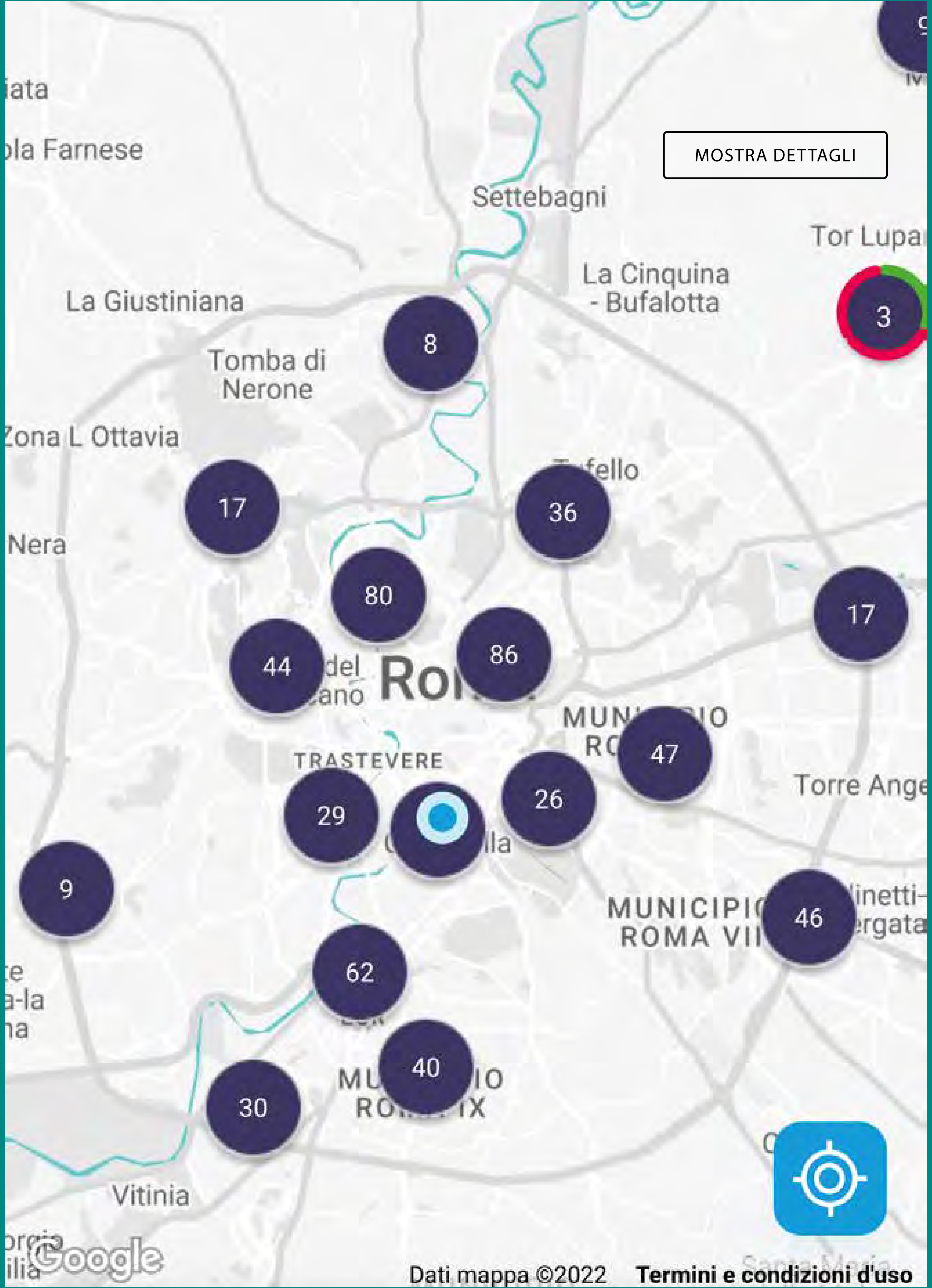
MOSTRA DETTAGLI

TRASPORTO PRIVATO F->A+

MATILDE STIVOLI


MOSTRA DETTAGLI

MOSTRA DETTAGLI


MOSTRA DETTAGLI
Settebagni
Tor Lupa
La Cinquina
- Bufalotta
La Giustiniana
Tomba di
Nerone
Zona L Ottavia
Nera
TRASTEVERE
Torre Ange
MUNICIPIO
ROMA VII
Vitinia
8
3
17
36
80
17
44
86
47
29
26
9
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62
40
30
Dati mappa ©2022
Termini e condizioni d'uso

SCARTI COME RISORSE

ELISA VIGANO'


MOSTRA DETTAGLI

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MOSTRA DETTAGLI

GRUPPO 1 | URBANA-MENTE:

CITTA' VERSO LA

NEUTRALITA' CLIMATICA


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GRUPPO 2 | NARRAZIONI TOSSICHE

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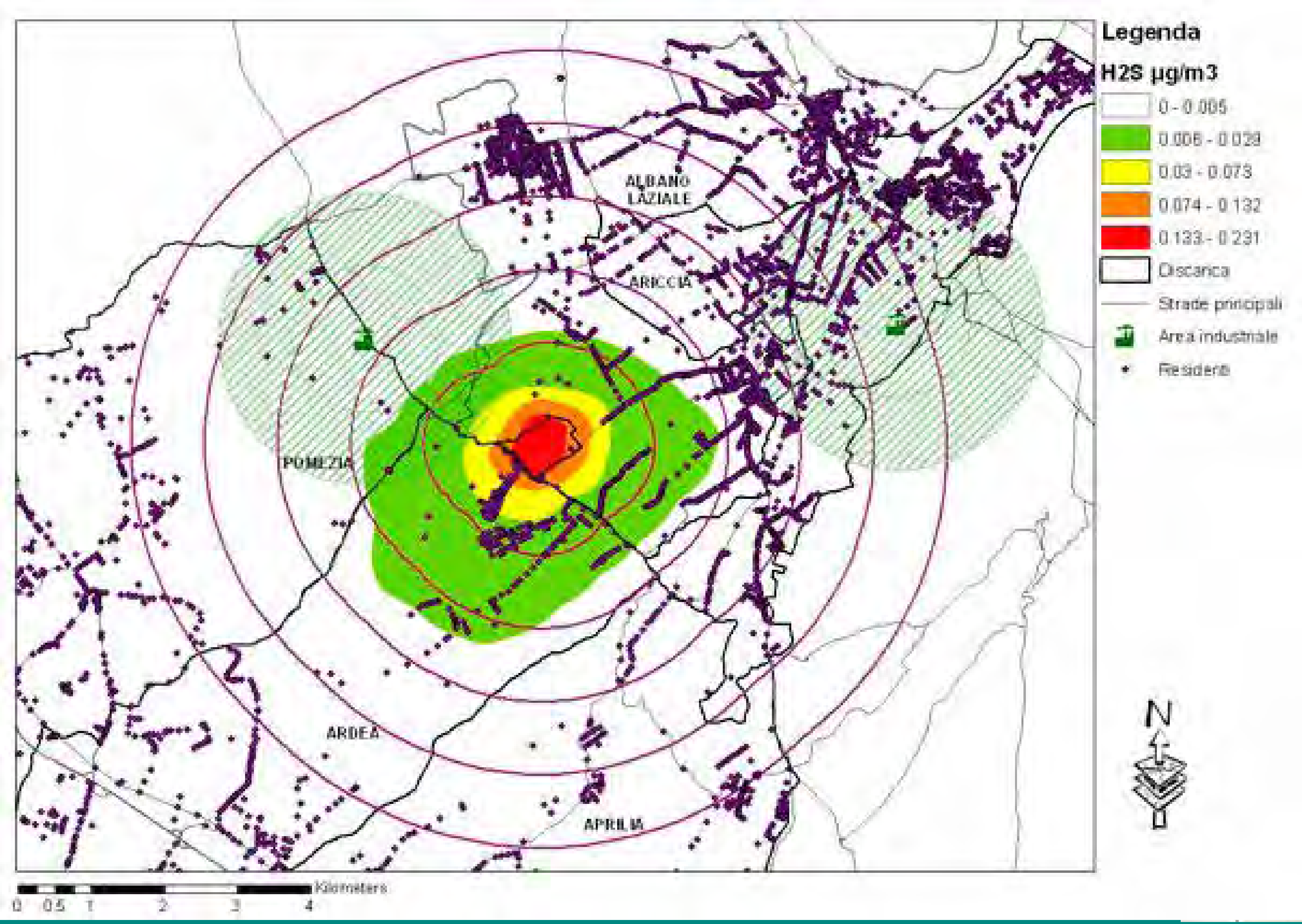

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IL CAMBIAMENTO CLIMATICO (NON) ESISTE

PROPOSTE DEI PARTECIPANTI

COSA PROPONGONO I PARTECIPANTI

Dalle immagini propositive si ricavano in modo evidente le seguenti proposte:

Implementare l'impianto di colonnine elettriche anche nelle zone più periferiche della città ed incentivare il supporto tecnico nel processo di installazione, attenuando l'iter burocratico farraginoso che lo caratterizza ed agevolino la transizione energetica del trasporto privato. Quest'ultima renderebbe le persone più consapevoli di quali siano i benefici dell'utilizzo della macchina elettrica: per esempio costo e manutenzione inferiore, esenzione da divieti di circolazioni imposti dai comuni. L'azienda lombarda T-Green ne è un esempio: aiuta a trovare la soluzione più adeguata ai propri consumi energetici.

L'idea sarebbe quella di incentivare l'utilizzo di mezzi di trasporto individuali sostenibili, come potrebbero essere bici o monopattini, tra studenti universitari e docenti. Per far ciò, però, bisogna aumentare quelli che dovrebbero essere gli spazi a disposizione, appunto per l'utilizzo di bici, come ad esempio i parcheggi, le piste ciclabili ed i punti di raccolta. O ancora iniziative, come premi ed agevolazioni, che porterebbero ad un maggiore utilizzo di mezzi di trasporto sostenibili e condivisibili.

Le istituzioni devono da un lato prendersi carico delle aree verdi ancora vive, tutelandole dalla cementificazione, e dall'altro incentivare il rinselvatichimento spontaneo senza ostruzioni, con l'obiettivo di sottrarre alla speculazione privata spazi per necessità pubblici, includendo e dando voce alle storie di emarginazione sociale. Solo a partire da una pianificazione territoriale inclusiva è possibile sostenere e generare processi partecipativi del vivere urbano.

Una delle sfide più urgenti per le città è la necessità di ridurre l'effetto isola urbana di calore, tramite l'aumento delle zone verdi e la presenza di alberi ai lati delle strade, fino ad arrivare all'impiego di materiali riflettenti nella ripavimentazione urbana, in modo tale da rendere le strade più "fresche". L'auspicio è che tali piani possano essere implementati anche nelle città italiane, per proteggere le categorie di cittadini più vulnerabili alle ondate di calore e, dunque, agli effetti del cambiamento climatico. Roma è una tra le città più verdi d'Europa, come dimostra la buona pratica dei viali alberati dei quali un esempio è Via della Magliana, ma questo non esclude che compaia ai primi posti negli studi sulle isole urbane di calore. Questo paradosso ci suggerisce che tanto ancora va fatto per rendere le città davvero sostenibili.

La gestione dei rifiuti a Roma deve essere pubblica e sostenibile attraverso l'implementazione della raccolta differenziata, la riduzione a monte di materiali di scarto e l'incentivazione di pratiche di recupero che, se adottate in modo sistemico, possono rendere inutili impianti inquinanti come i TMB, gli inceneritori e le discariche che stanno esponendo le periferie in cui si collocano a pagare il prezzo maggiore della crisi socio-ambientale.

L'impatto delle ondate di calore sempre più crescenti nelle città è una minaccia urgente a cui bisogna rispondere con prontezza. Una delle soluzioni per mitigare tale emergenza potrebbe essere implementare e incentivare l'utilizzo di coperture vegetali, "cappotti verdi", per la riqualificazione di tutte quelle abitazioni ed edifici che in partenza – nel progetto – nonprevedevano la salvaguardia di spazi verdi. Questi sistemi comporterebbero una mitigazione del surriscaldamento urbano nei quartieri dove la presenza vegetale di alberi e piante scarseggia edeviterebbe alla presenza di cemento di fungere da elemento triplicante del calore, prodotto sia dall'attività antropica (consumo di energia ed emissioni) sia dal cambiamento climatico in atto.

Dunque, incrementare la presenza di spazi verdi all'interno della città, sotto forma di copertura vegetale, di parchi o orti urbani, per consentire ai cittadini di mantenere un contatto – seppur parziale – con la natura aumentando la consapevolezza dei benefici che essa comporta, sia in termini di benessere per gli individui sia per l'azione riparatrice che essa svolge per la lotta al cambiamento climatico.

La filosofia del Km0 può farsi promotrice di virtuose iniziative volte all'implementazione di comportamenti ecocompatibili al fine di ridurre gli impatti ambientali generati dall'impiego della plastica.
Le "case dell'acqua pubblica" si propongono come una valida strategia sostenibile da adottare con maggiore diffusione all'interno dei differenti contesti urbani del territorio nazionale. Dal canto suo, la Regione Lazio ha già da tempo avviato la costituzione di tali strutture per l'erogazione di acqua gratuita per i cittadini, i quali possono, senza alcuna difficoltà, usufruirne tagliando il costo personale sostenuto legato all'acquisto di bottiglie di plastica monouso.
Strutturare efficaci campagne di comunicazione permetterebbe ad un target più ampio di venire a conoscenza di simili opportunità al fine di supportare non solo politiche volte al sostegno del risparmio personale dei singoli e delle famiglie, ma anche di quelle dedite a limitare degrado ed inquinamento.

Punto di partenza - aumentare i mezzi pubblici messi a disposizione dei cittadini per:
- limitare l'uso delle auto private
- evitare ore di traffico
- diminuire al massimo le emissioni di CO_2.

Questo è possibile attraverso la realizzazione di piste ciclabili, come è stato fatto in via Nomentana, che rendono più libero e sicuro l'uso di biciclette in città; oppure attraverso iniziative che promuovono il trasporto pubblico coinvolgendo i cittadini in "sfide giornaliere" per ricevere premi con app o riducendo il costo dei trasporti.. orientandoci sempre verso un elettrico a zero emissioni!
Possiamo e dobbiamo fare di più per liberarci dalle auto, migliorare la qualità della vita e la mobilità nella nostra città!

L'acqua, come ogni risorsa sul nostro pianeta, ha una disponibilità limitata nel breve e lungo termine. La siccità persistente in determinati periodi dell'anno risulta essere un problema fondamentale non solo per gli habitat colpiti che stanno radicalmente cambiando, ma anche per la società e per i fabbisogni delle persone che ne fanno parte. L'acqua è un bene necessario alla nostra sopravvivenza e lo svuotamento delle risorse idriche disponibili è un problema a cui far fronte attraverso l'impiego di un economia più circolare. Affinché ciò sia possibile si devono attuare politiche d'incentivazione all'impiego di tecniche utili ai fini di un'economia circolare (es. colture acquaponiche) da parte dei privati, scoraggiando al contempo l'utilizzo di tecnologie obsolete non ecosostenibili.

Dalle foto propositive scelte emerge la necessità di sviluppare e mettere a sistema tavoli di lavoro condivisi sulle tematiche della crisi climatica che sviluppino un approccio critico e formativo sul tema delle narrazioni in ambito ambientale. Le necessità tecniche, economiche e politiche devono legarsi con le istanze, i desideri ed i bisogni situati nelle comunità incrociandosi con le competenze di comitati e attivisti con il fine di formare e stimolare un dibattito che porti alla legittimazione di tutti gli attori presenti. Spesso soluzioni autoproclamatesi "green" se non studiate secondo le esigenze dei territori in cui vengono istallate rischiano non solo di non produrre cambiamento e di non dare fornire le risposte adatte ma di reiterare dinamiche socio-economiche che hanno contribuito alla formazione delle problematiche attuali. Creare consapevolezza ambientale significa quindi sviluppare una presa di coscienza collettiva che responsabilizzi i media nazionali, gli attori istituzionali, le aziende e i cittadini nella formazione di un dibattito equilibrato che in tema ambientale abbandoni tanto le retoriche catastrofiste quanto quelle del qualunquismo e dell'indifferenza e che affronti la tematica triangolando aspetti sociali, economici e politici e le disuguaglianze che da essi derivano.

ROMA
TRE
UNIVERSITÀ DEGLI STUDI