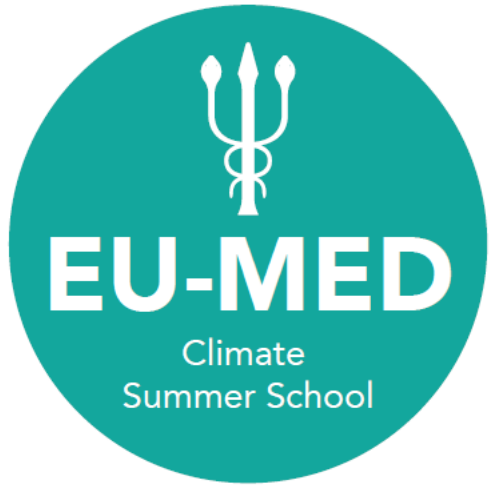




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IL NESSO TRA CAMBIAMENTO CLIMATICO E SICUREZZA NELLA REGIONE MEDITERRANEA

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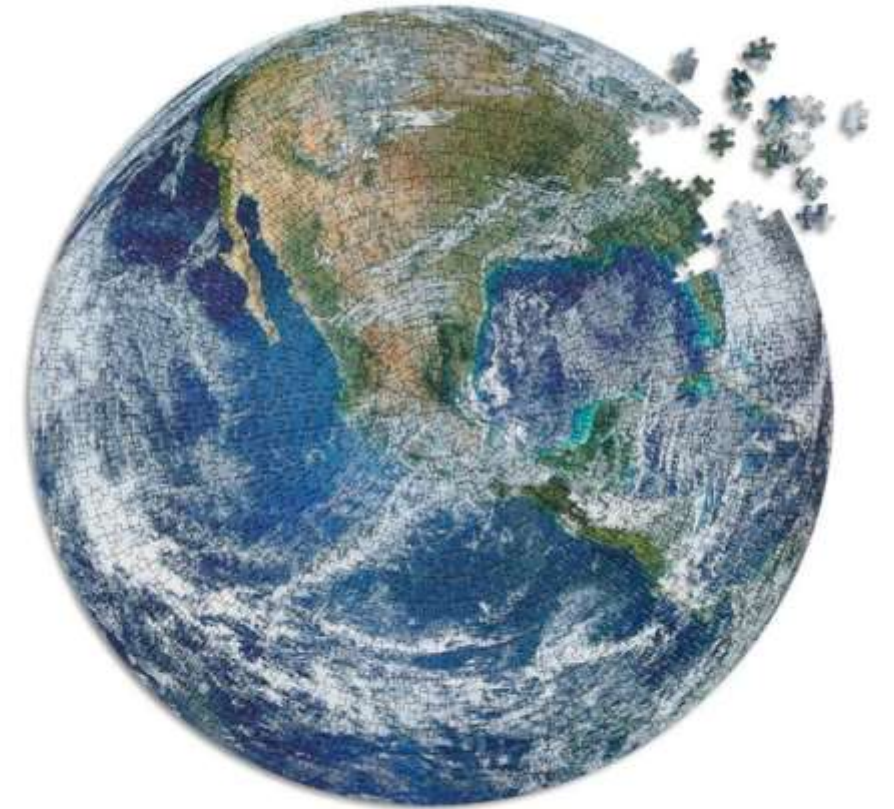


In collaborazione con



AGENDA:

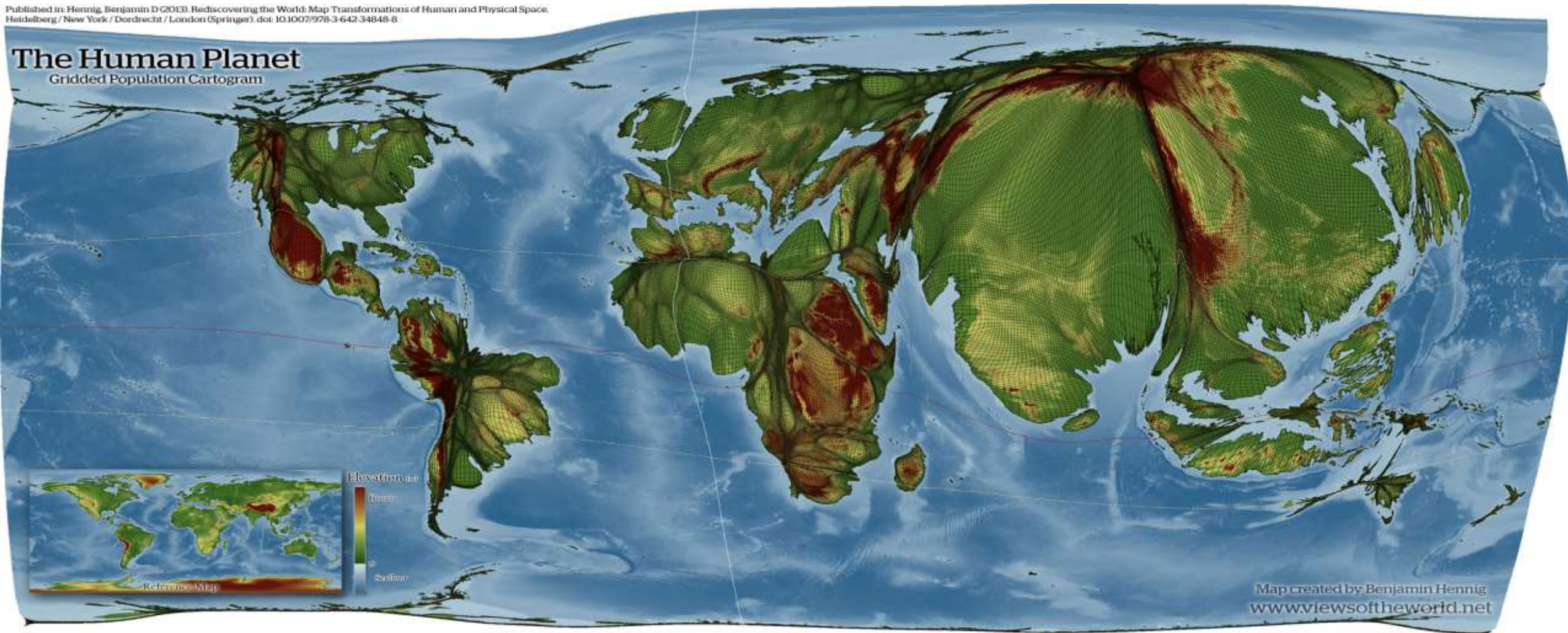
- Perché il nesso tra sicurezza e cambiamento climatico è così rilevante?
- Esiste un nesso tra cambiamento climatico e sicurezza?
- Dove, quando e come il nexus si può manifestare?
- Il nexus nella guerra civile siriana
- Conclusioni



RILEVANZA DEL NEXUS

Published in: Hennig, Benjamin D (2013): Rediscovering the World: Map Transformations of Human and Physical Space. Heidelberg / New York / Dordrecht / London (Springer). doi: 10.1007/978-3-642-34848-8

The Human Planet Gridded Population Cartogram



LA NUOVA ERA GEOLOGICA: ANTROPOCENE



Welcome to the
35TH INTERNATIONAL GEOLOGICAL CONGRESS

27 AUGUST - 4 SEPTEMBER 2016 | CAPE TOWN, SOUTH AFRICA

resourcing future generations

The image features a scenic view of a coastline at sunset, with mountains in the background. The text is overlaid on the right side of the image. The logo for the International Union of Geological Sciences (IUGS) is visible on the left side of the image. The text 'resourcing future generations' is written in a red banner at the bottom of the image.

LA NUOVA ERA GEOLOGICA: ANTROPOCENE



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Paill, J.P., Jouzel, J., Raynaud, D., Barkov, N.I., Barnola, J.M., Basile, I., Bender, M., Chappellaz, J., Delmotte, M., Dreyfus, G., Dupont, M., Fischer, A.S., Frey, P., Labeyrie, J., Legras, B., Louisa, C., Peuch, L., Ray, C., Stouffer, E. and Stievenard, M. (1998) Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. *Nature* 391: 429-433.

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The "Anthropocene" by Paul J. Crutzen and Eugene F. Stoermer

The name Holocene ("Recent Whole") for the post-glacial geological epoch of the past ten to twelve thousand years seems to have been proposed for the first time by Sir Charles Lyell in 1833, and adopted by the International Geological Congress in Bologna in 1885 (1). During the Holocene mankind's activities gradually grew into a significant geological, morphological force, as recognised early on by a number of scientists. Thus, G.P. Marsh already in 1864 published a book with the title "Man and Nature", more recently reprinted as "The Earth as Modified by Human Action" (2). Stoppani in 1873 rated mankind's activities as a "new telluric force which in power and universality may be compared to the greater forces of earth" [quoted from Clark (3)]. Stoppani already spoke of the anthropozoic era. Mankind has now inhabited or visited almost all places on Earth; he has even set foot on the moon.

The great Russian geologist V.I. Vernadsky (4) in 1926 recognized the increasing power of mankind as part of the biosphere with the following excerpt "... the direction in which the processes of evolution must proceed, namely towards increasing consciousness and thought, and forms having greater and greater influence on their surroundings". He, the French Jesuit P. Teilhard de Chardin and E. Le Roy in 1924 coined the term "noosphere", the world of thought, to mark the growing role played by mankind's brainpower and technological talents in shaping its own future and environment.

The expansion of mankind, both in numbers and per capita exploitation of Earth's resources has been astounding (5). To give a few examples: During the past 3 centuries human population increased tenfold to 6000 million, accom-

panied e.g. by a growth in cattle population to 1400 million (6) (about one cow per average size family). Urbanisation has even increased tenfold in the past century. In a few generations mankind is exhausting the fossil fuels that were generated over several hundred million years. The release of SO₂ globally about 160 Tg/year to the atmosphere by coal and oil burning, is at least two times larger than the sum of all natural emissions, occurring mainly as marine dimethyl-sulfide from the oceans (7); from Vitousek et al. (8) we learn that 30-50% of the land surface has been transformed by human action; more nitrogen is now fixed synthetically and applied as fertilizers in agriculture than fixed naturally in all terrestrial ecosystems; the escape into the atmosphere of NO from fossil fuel and biomass combustion likewise is larger than the natural inputs, giving rise to photochemical ozone ("smog") formation in extensive regions of the world; more than half of all accessible fresh water is used by mankind; human activity has increased the species extinction rate by thousand to ten thousand fold in the tropical rain forests (9) and several climatically important "greenhouse" gases have substantially increased in the atmosphere: CO₂ by more than 30% and CH₄ by even more than 100%. Furthermore, mankind releases many toxic substances in the environment and even some, the chlorofluorocarbons, which are not toxic at all, but which nevertheless have led to the Antarctic "ozone hole" and which would have destroyed much of the ozone layer if no international regulatory measures to end their production had been taken. Coastal wetlands are also affected by humans, having resulted in the loss of 50% of the world's man-

groves. Finally, mechanized human population ("Inherites") removes more than 25% of the primary production of the oceans in the upwelling regions and 35% in the temperate continental shelf regions (10). Anthropogenic effects are also well illustrated by the history of biotic communities that leave remains in lake sediments. The effects documented include modification of the geochemical cycle in large freshwater systems and occur in systems remote from primary sources (11-13).

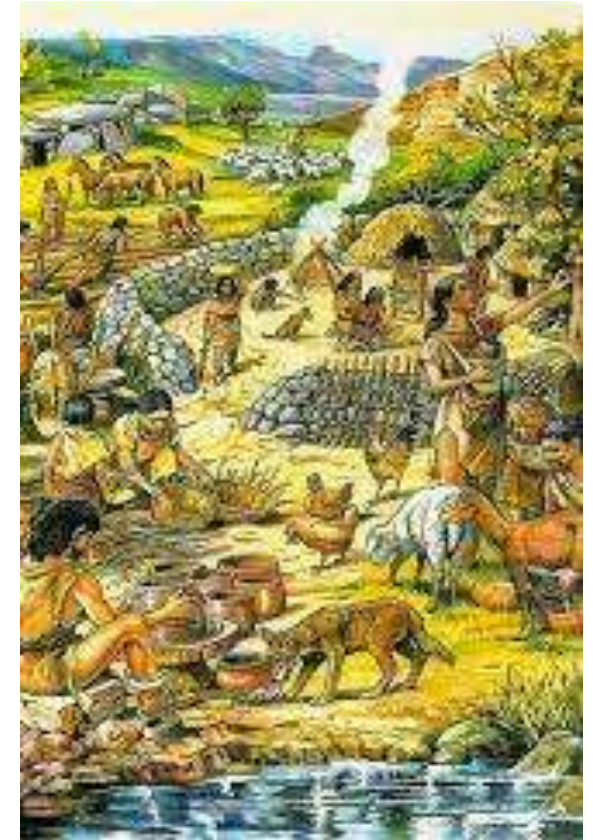
Considering these and many other major and still growing impacts of human activities on earth and atmosphere, and at all, including global, scales, it seems to us more than appropriate to emphasize the central role of mankind in geology and ecology by proposing to use the term "anthropocene" for the current geological epoch. The impacts of current human activities will continue over long periods. According to a study by Berges and Loure (14), because of the anthropogenic emissions of CO₂, climate may depart significantly from natural behaviour over the next 50,000 years.

To assign a more specific date to the onset of the "anthropocene" seems somewhat arbitrary, but we propose the latter part of the 18th century, although we are aware that alternative proposals can be made (some may even want to include the entire holocene). However, we choose this date because, during the past two centuries, the global effects of human activities have become clearly noticeable. This is the period when data retrieved from glacial ice cores show the beginning of a growth in the atmospheric concentrations of several "greenhouse gases", in particular CO₂ and CH₄ (7). Such a starting date also coincides with James Watt's invention of the steam

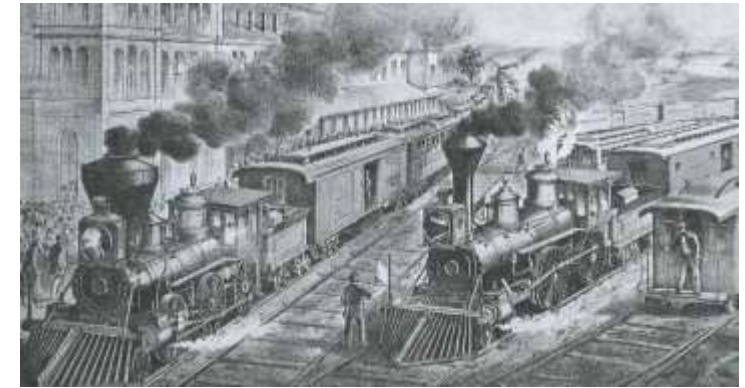
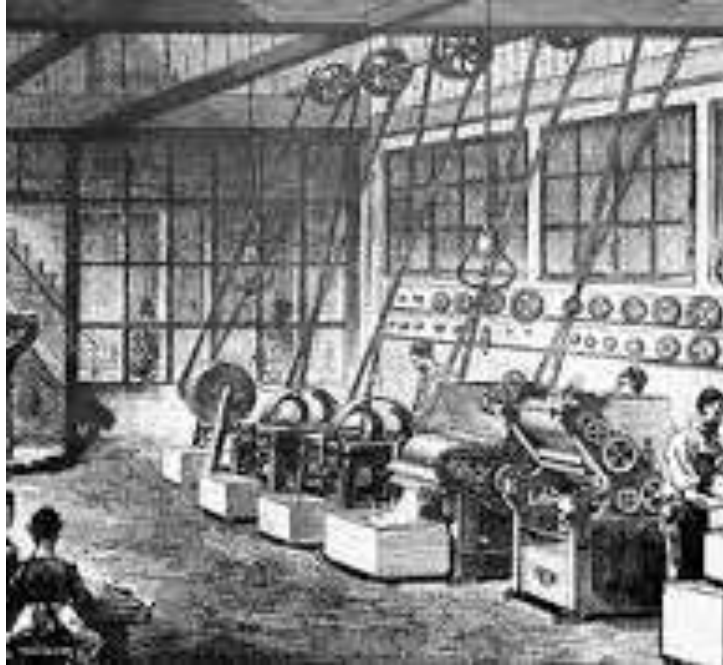
TABELLA DEI TEMPI GEOLOGICI

Eone	Era	Periodo	Epoca		
Fanerozoico	Cenozoico	Quaternario	Olocene	0	
			Pleistocene	0,01	
		Neogene	Pliocene	1,6	Compare l'uomo
			Miocene	5	
			Oligocene	23	
		Paleogene	Eocene	37	
			Paleocene	53	
			65	Diffusione dei mammiferi Estinzione Dinosauri	
	Mesozoico	Cretacico		135	
		Giurassico		192	Compaiono gli Uccelli
		Triassico		235	Compaiono i mammiferi
	Paleozoico	Permiano		284	Compaiono i rettili
		Carbonifero		348	Compaiono gli anfibi
		Devoniano		405	Compaiono le piante terrestri
Siluriano			440	Compaiono i pesci	
Ordoviciano			500	Diffusione degli invertebrati	
Cambriano			570		
Criptozoico	Precambriano	Proterozoico		2.600	Compaiono le cellule con nucleo
		Archeano		3.800	
				4.750	

OLOCENE VS ANTROPOCENE: NASCITA AGRICOLTURA

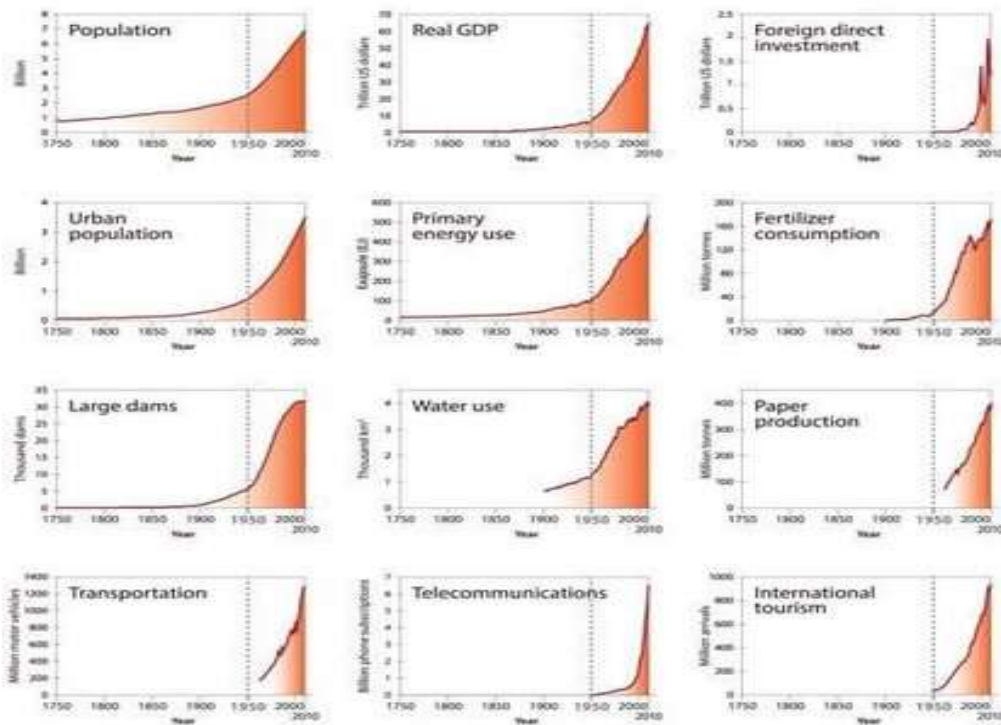


OLOCENE VS ANTROPOCENE: RIVOLUZIONE INDUSTRIALE

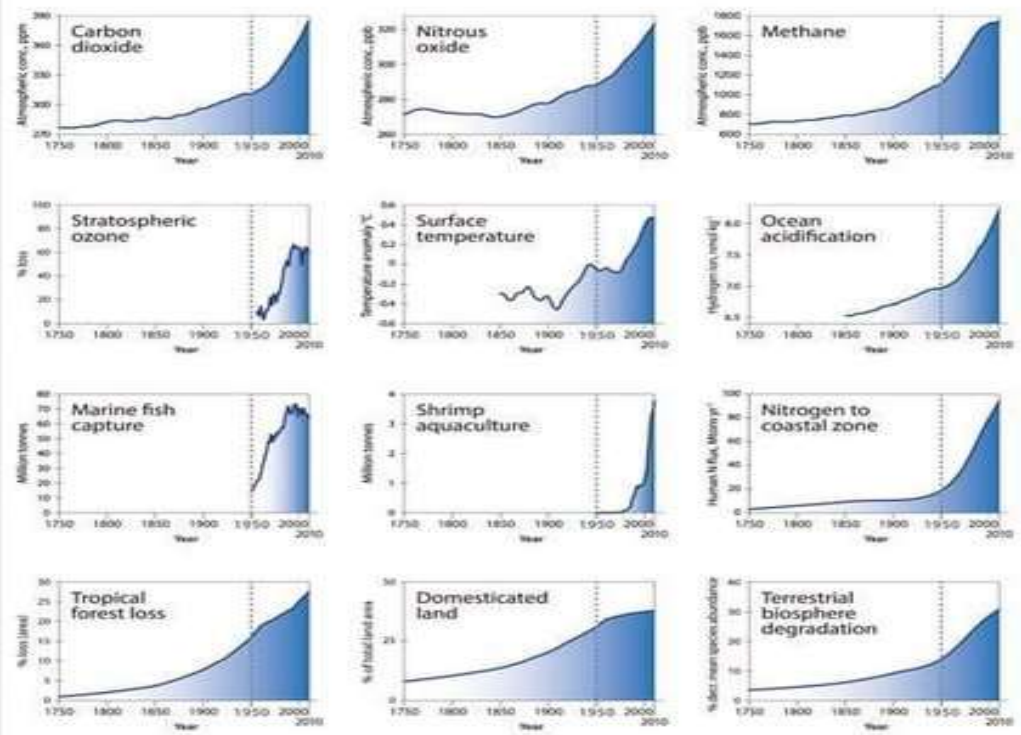


OLOCENE VS ANTROPOCENE: LA 'GRANDE ACCELERAZIONE'

Socio-economic trends



Earth system trends



Updated Great Acceleration Graphs

Source: Will Steffen et al. "The trajectory of the Anthropocene: The Great Acceleration." The Anthropocene Review, March 2015

I CONFINI PLANETARI

nature

Vol 461/24 September 2009

FEATURE

A safe operating space for humanity

Identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue **Johan Rockström** and colleagues.

Although Earth has undergone many periods of significant environmental change, the planet's environment has been unusually stable for the past 10,000 years¹. This period of stability — known to geologists as the Holocene — has seen human civilisations arise, develop and thrive. Such stability may now be under threat. Since the Industrial Revolution, a new era has arisen, the 'Anthropocene', in which human activities have become the main driver of global environmental change². This could see human activities push the Earth system outside the stable environmental state of the Holocene, with consequences that are detrimental or even catastrophic for large parts of the world.

During the Holocene, environmental change occurred naturally and Earth's regulatory capacity maintained the conditions that enabled human development. Regular temperatures, freshwater availability and biogeochemical flows all moved within a relatively narrow range. Now, largely because of a rapidly growing reliance on fossil fuels and



SUMMARY

- New approach proposed for defining preconditions for human development
- Crossing certain biophysical thresholds could have disastrous consequences for humanity
- Three of nine interlinked planetary boundaries have already been overstepped

industrialised forms of agriculture, human activities have reached a level that could damage the systems that keep Earth in the desirable Holocene state. The result could be irreversible and, in some cases, abrupt environmental change, leading to a state less conducive to human development³. Without pressure from humans, the Holocene is expected to continue for at least several thousands of years⁴.

Planetary boundaries

To meet the challenge of maintaining the Holocene state, we propose a framework based on 'planetary boundaries'. These

boundaries define the safe operating space for humanity with respect to the Earth system and are associated with the planet's biophysical subsystems or processes. Although Earth's complex systems sometimes respond smoothly to changing pressures, it seems that this will prove to be the exception rather than the rule. Many subsystems of Earth react in a nonlinear, often abrupt, way, and are particularly sensitive around threshold levels of certain key variables. If these thresholds are crossed, then important subsystems, such as a mountain system, could shift into a new state, often with deleterious or potentially even disastrous consequences for humans⁵.

Most of these thresholds can be defined by a critical value for one or more control variables, such as carbon dioxide concentration. Not all processes or subsystems on Earth have well-defined thresholds, although human actions that undermine the resilience of such processes or subsystems — for example, land and water degradation — can increase the risk that thresholds will also be crossed in other processes, such as the climate system.

We have tried to identify the Earth-system processes and associated thresholds which, if crossed, could generate unacceptable environmental change. We have found nine such processes for which we believe it is necessary to define planetary boundaries: climate change, rate of biodiversity loss (terrestrial and marine), interference with the nitrogen and phosphorus cycles, atmospheric ozone depletion, ocean acidification, global freshwater use, change in land use, chemical pollution, and atmospheric aerosol loading (see Fig. 1 and Table).

In general, planetary boundaries are values for control variables that are either at a 'safe' distance from thresholds — for processes with evidence of threshold behaviour — or at dangerous levels — for processes without

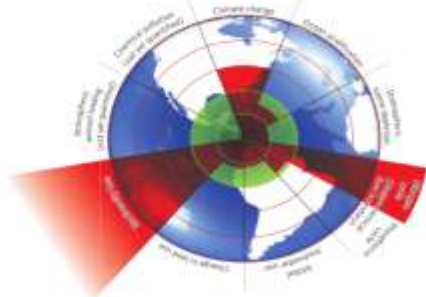
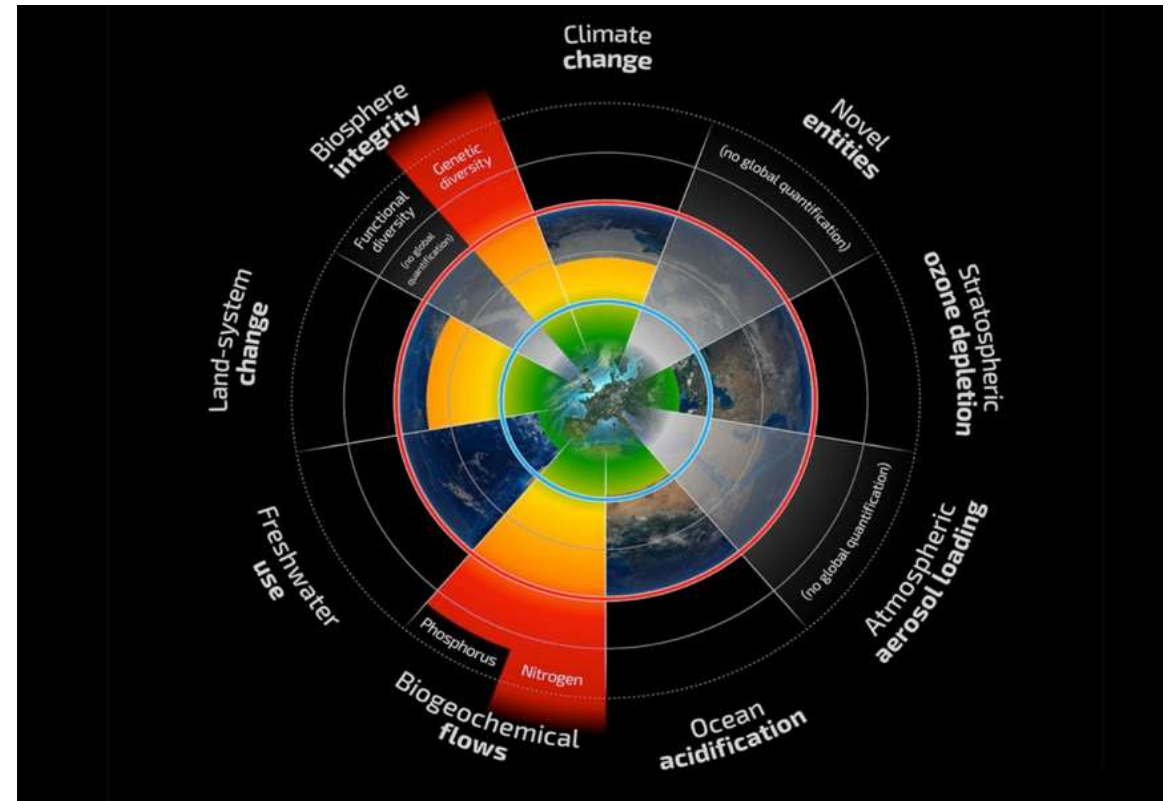


Figure 1 | Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red rings represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and ozone depletion with the nitrogen cycle) have already been exceeded.

472

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'HARD' E 'SOFT' SECURITY



Traditional and human conceptions of security		
	Traditional Security	Human Security
Object	The state	The individual
Core power	Sovereignty of the state	International community
Direction	Top-down defensive	Bottom-up integrative
Protects	Integrity of the state & territories	Dignity of the individual
Threats	Interstate war, revolution, nuclear arms (military)	Poverty, disease, natural disasters, riots (non-military)
Goals	Negative peace/non-violence	Positive peace/human development
Degree of action	Non-action acceptable	Action required in the name of prevention
Leaders	US, UK, Russia	Japan, Canada

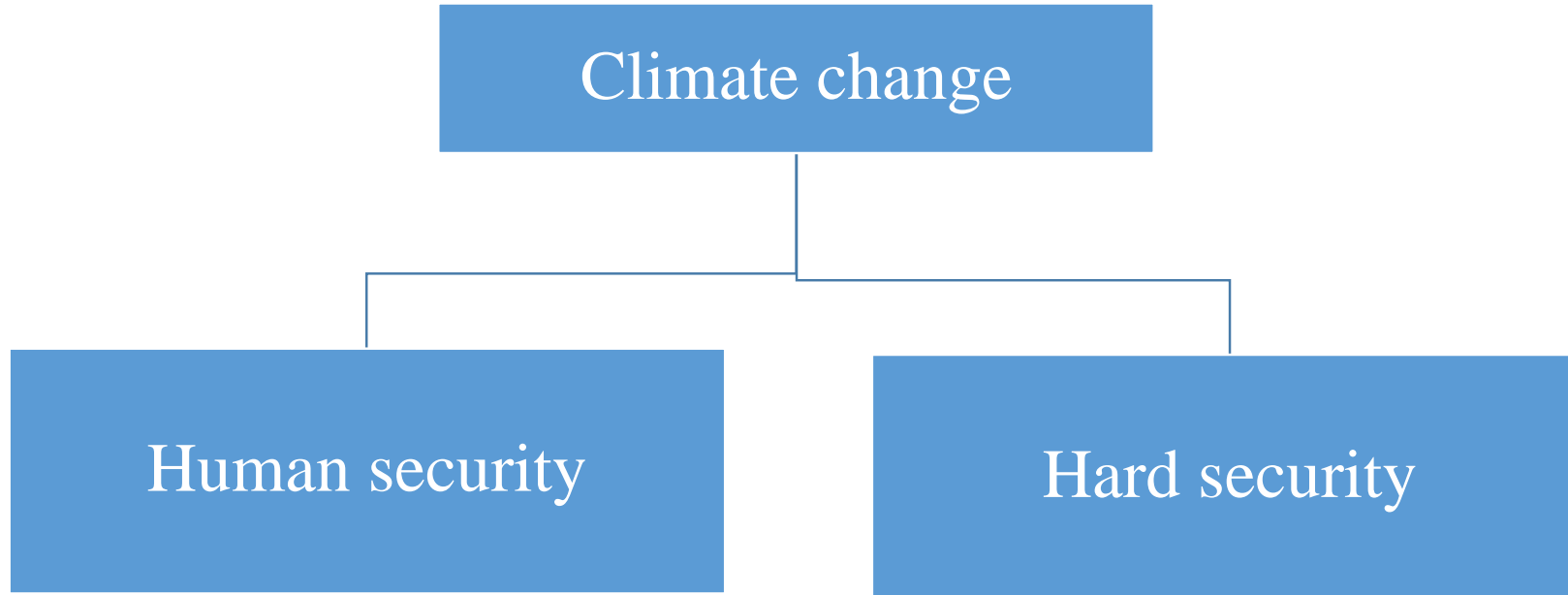
Source: Humanitarian Encyclopedia

SICUREZZA UMANA E POSSIBILI MINACCE

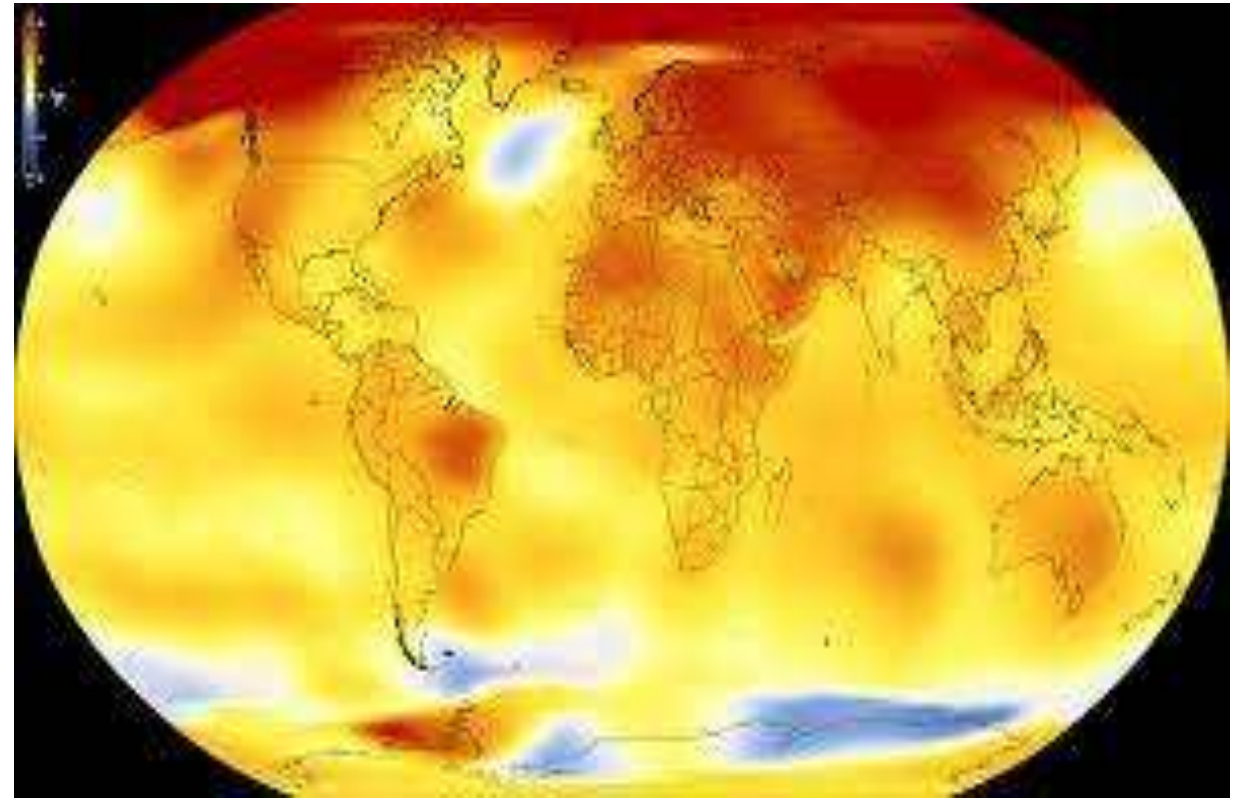
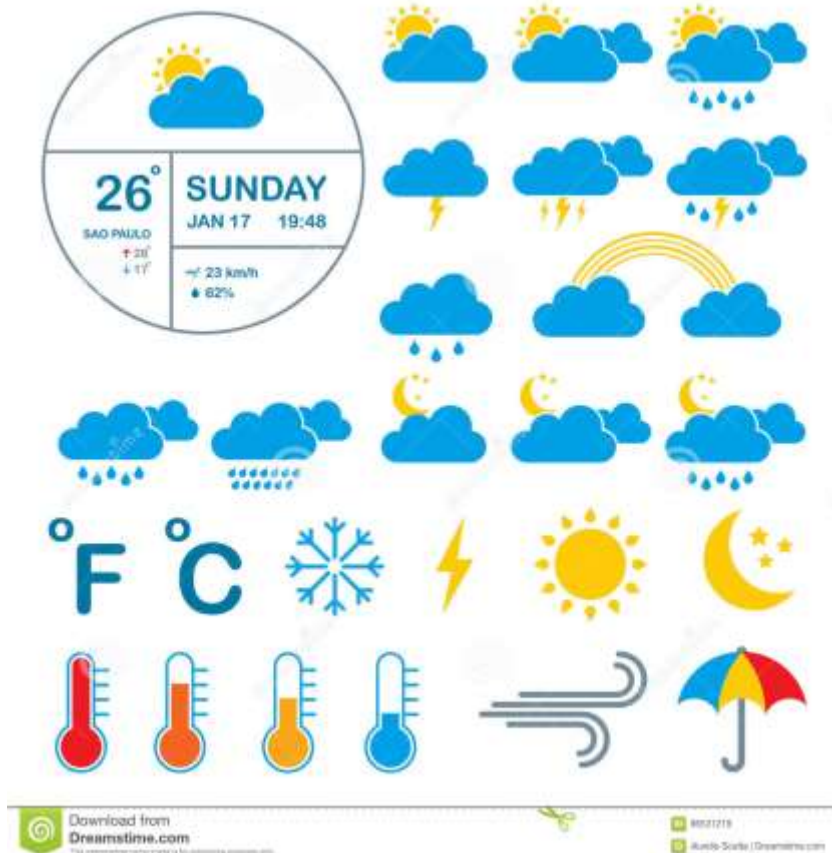
Possible Types of Human Security Threats	
Type of Security	Examples of Main Threats
Economic security	Persistent poverty, unemployment
Food security	Hunger, famine
Health security	Deadly infectious diseases, unsafe food, malnutrition, lack of access to basic health care
Environmental security	Environmental degradation, resources depletion, natural disasters, pollution
Personal security	Physical violence, crime, terrorism, domestic violence, child labor
Community security	Inter-ethnic, religious and other identity - based tensions
Political security	Political repression, human rights abuses

Source: Humanitarian Encyclopedia

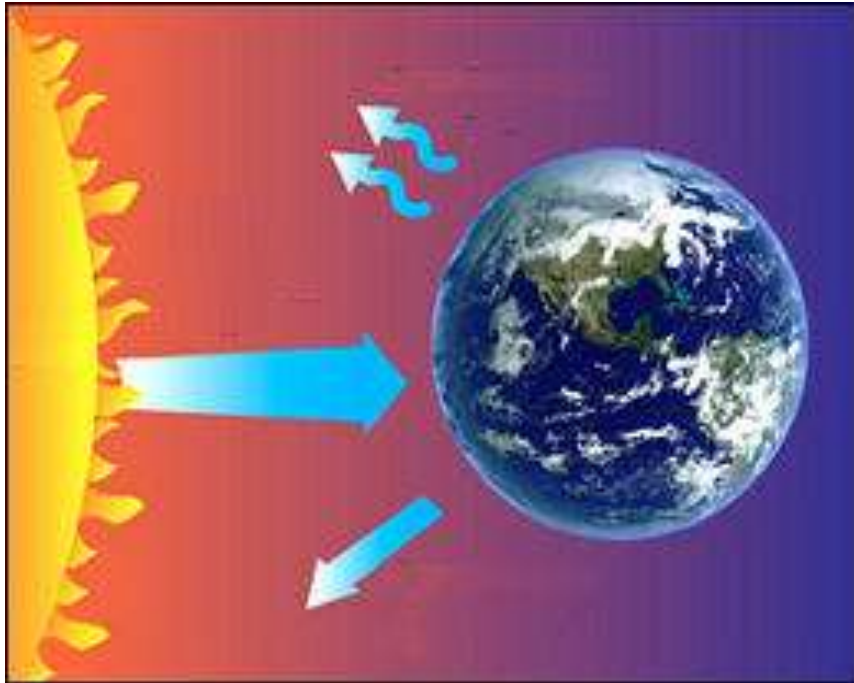
NEXUS



METEO E CLIMA



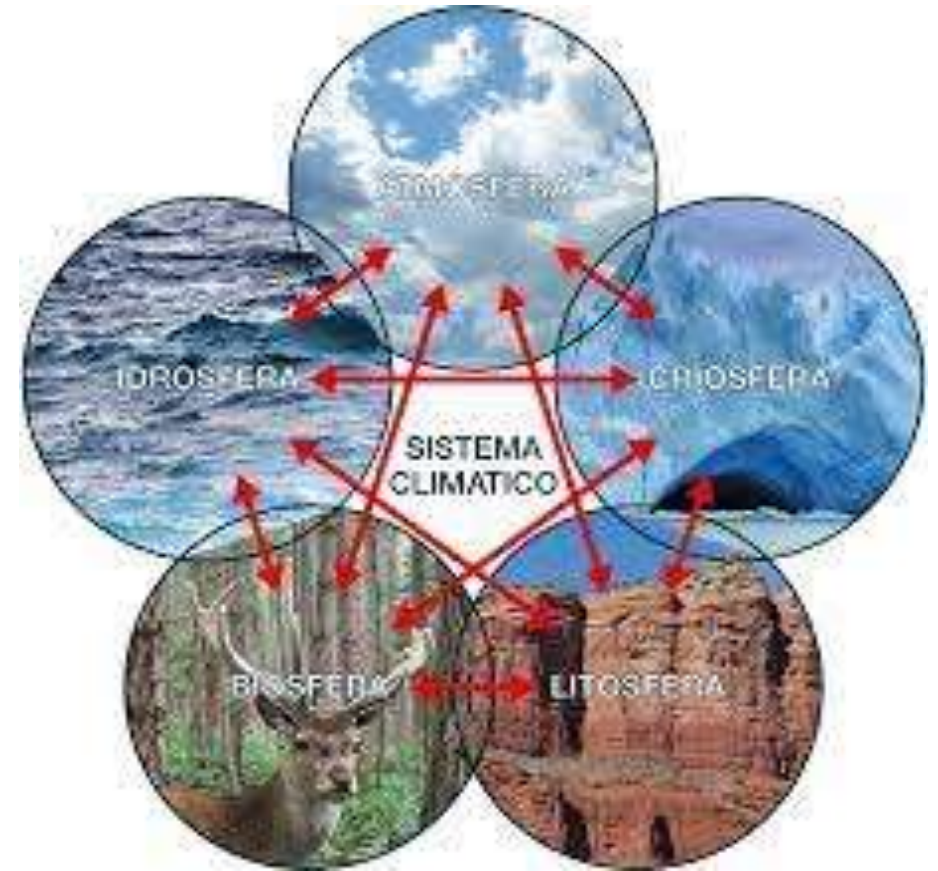
CLIMA



- Il clima della Terra non è altro che un bilancio energetico tra l'energia entrante ed energia uscente

SISTEMA CLIMATICO

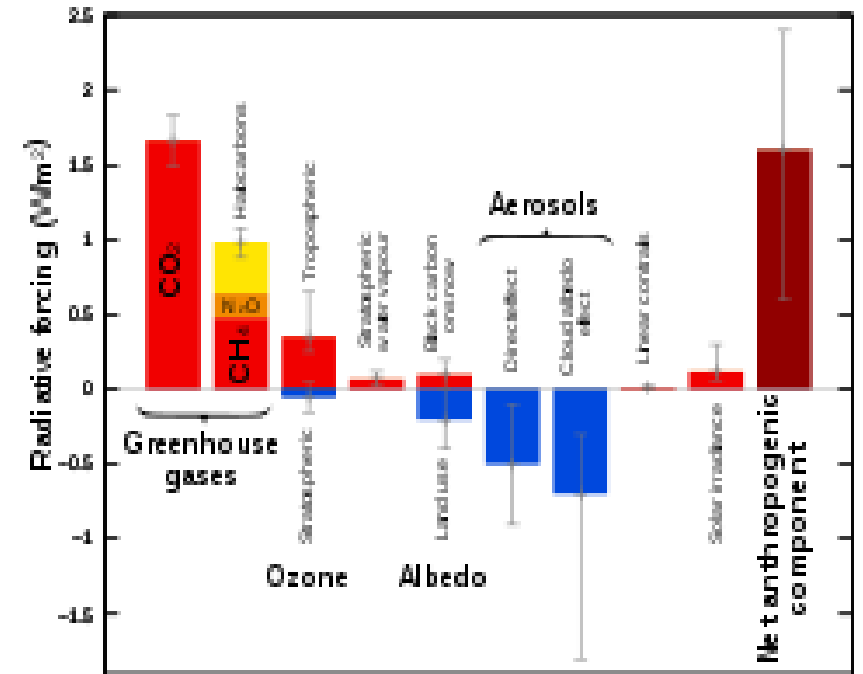
- Il sistema climatico: sistema complesso, dinamico, caratterizzato da una certa inerzia e da una propria variabilità intrinseca
- E' un insieme di sottosistemi:
- **ATMOSFERA:** lo strato di gas che circonda la superficie terrestre.
- **IDROSFERA:** l'insieme di tutta l'acqua allo stato liquido che si trova sulla terra (oceani, mari, laghi, fiumi e acqua sotterranea).
- **BIOSFERA:** la totalità degli esseri viventi presenti sulla Terra, compreso l'uomo e la materia organica non ancora decomposta.
- **CRIOSFERA:** tutte le masse di ghiaccio e gli accumuli di neve della Terra.
- **LITOSFERA:** tutte le terre emerse, più il fondo degli oceani e i primi strati dell'interno del pianeta.
- Questi sottosistemi sono totalmente aperti tra loro (per scambio di energia e materia), concatenati da complessi feedbacks (o cicli) positivi e negativi



I FATTORI ESTERNI: FORZANTI

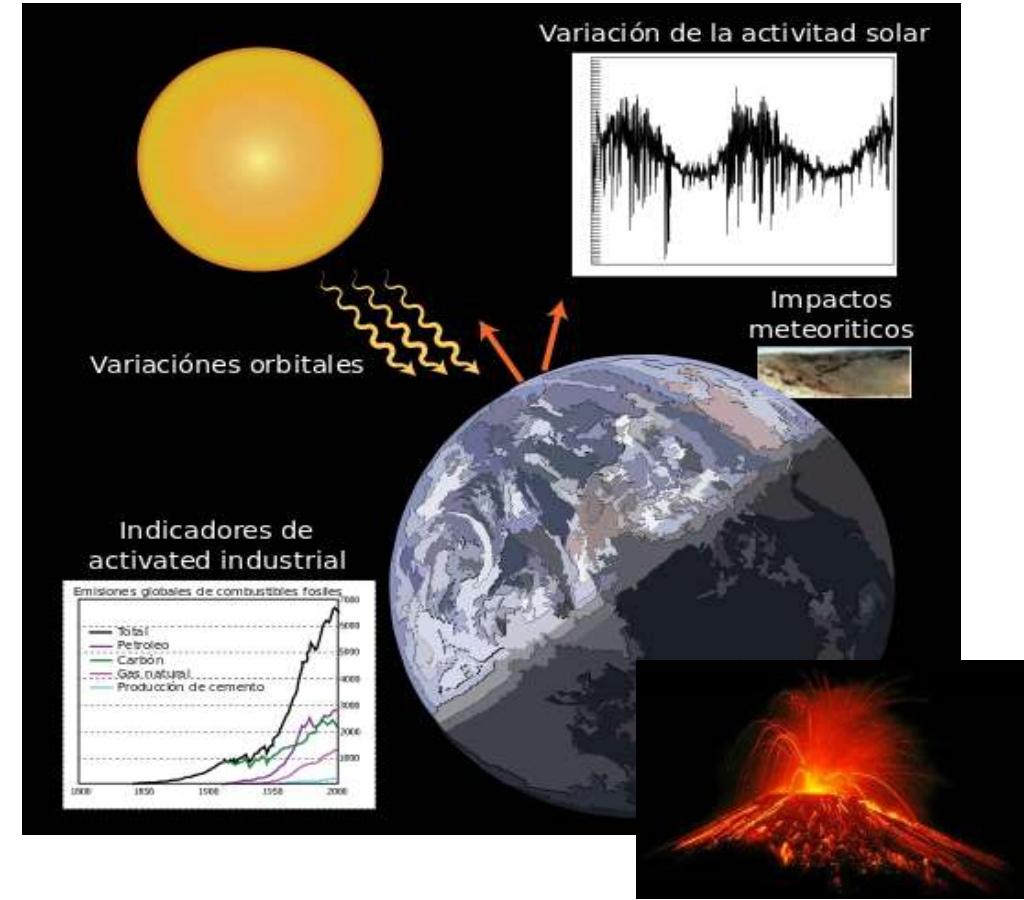
- Il sistema climatico è un sistema dinamico perché evolve nel tempo non solo sotto l'influenza di proprie dinamiche interne, quindi, attraverso una propria variabilità intrinseca, ma anche per effetto dell'azione di fattori esterni detti forzanti
- Le forzanti possono essere positive o negative
- Il forzante radiativo misura la potenziale capacità di alterazione del bilancio energetico terrestre, all'interno di un certo intervallo di tempo, da parte di un determinato fattore, ossia la potenziale capacità di indurre un cambiamento nelle dinamiche del sistema climatico

Radiative-forcing components

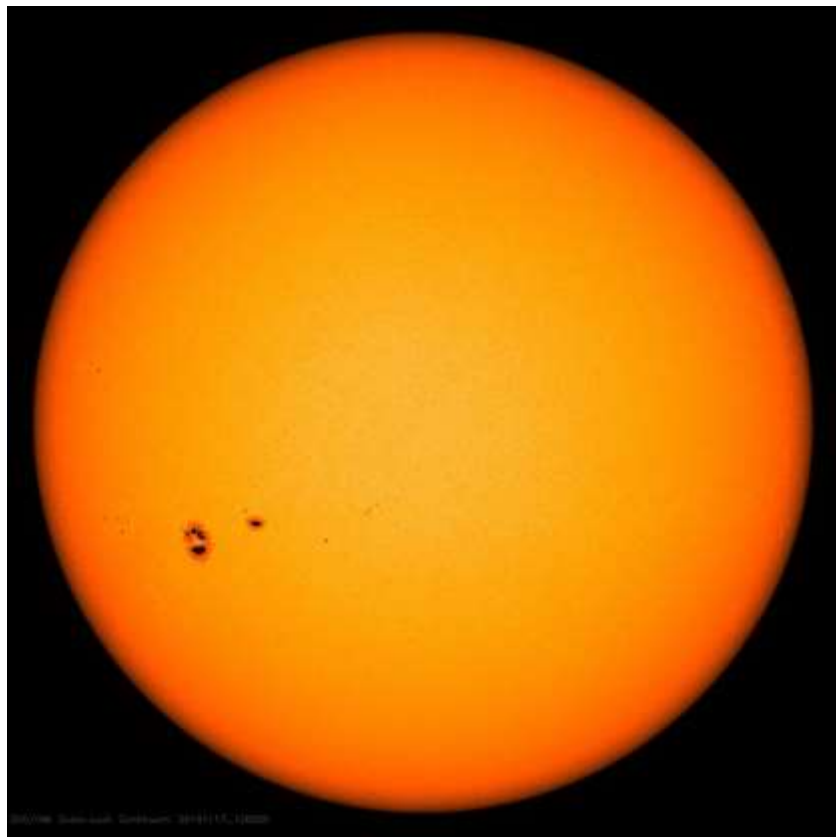


I FATTORI ESTERNI: FORZANTI

- Le forzanti possono essere: esterne o interne al sistema Terra; di origine naturale o antropica
- *Esogene sono di origine naturale:*
 - attività solare
 - impatto di asteroide
 - cicli di Milankovitch
- *Endogene possono essere di origine naturale o antropogenica:*
 - eruzioni vulcaniche
 - emissioni di gas serra
 - emissioni di aerosol
 - cambiamenti di uso del suolo



FORZANTI ESOGENE: VARIAZIONE DELLA RADIAZIONE SOLARE



- Il Sole alterna periodi di maggiore e di minore attività
- L'attività solare viene misurata in base al numero di macchie solari che compaiono, in maniera ciclica e più o meno intensa, sulla superficie solare
- Il numero medio di macchie solari presenti sul Sole non è costante, ma varia tra periodi di minimo e di massimo
- Il ciclo solare è il periodo, lungo in media 11 anni, che intercorre tra un periodo di minimo (o massimo) dell'attività solare e il successivo (la lunghezza del periodo non è strettamente regolare, ma può variare tra i 10 e i 12 anni)
- Quando la superficie solare mostra un ampio numero di macchie, il Sole sta attraversando una fase di maggior attività ed emette maggior energia nello spazio circostante

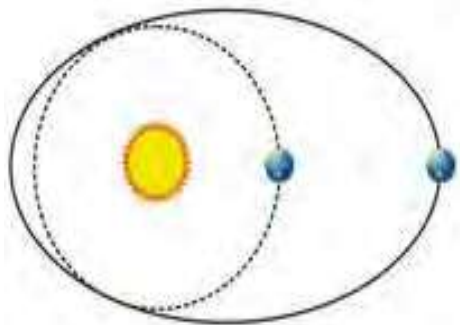
FORZANTI ESOGENE: CICLI DI MILANKOVITCH



- La teoria di Milankovitch lega le variazioni climatiche avvenute negli ultimi 3 milioni di anni al cambiamento nei parametri dell'orbita terrestre:

- eccentricità
- obliquità dell'asse
- precessione

Milankovitch Cycles



Eccentricity



Obliquity



Precession

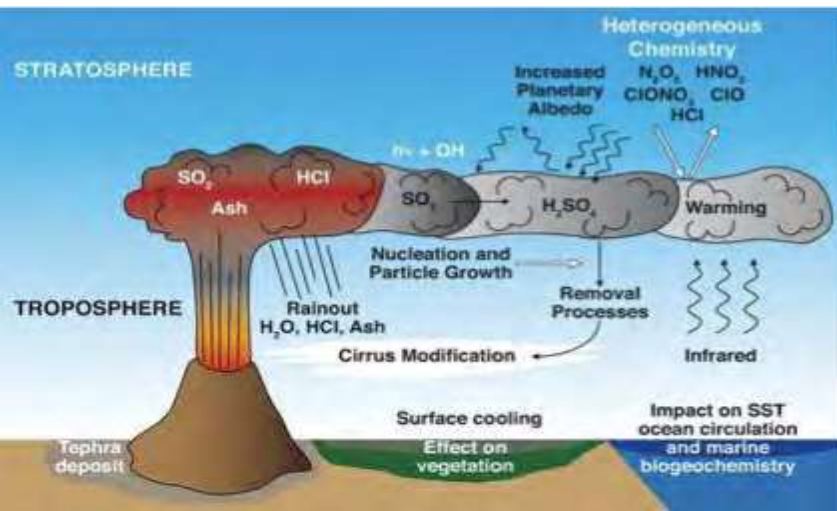
- Questi cambiamenti sono ciclici e determinano una variazione nella quantità di energia ricevuta da sole e nella sua distribuzione geografica e stagionale
- Alcuni cambiamenti nel moto e nell'orientamento modificano la quantità di radiazione solare che raggiunge la Terra, oltre alla sua distribuzione sulla superficie terrestre

FORZANTI ESOGENE: IMPATTO ASTRONOMICO



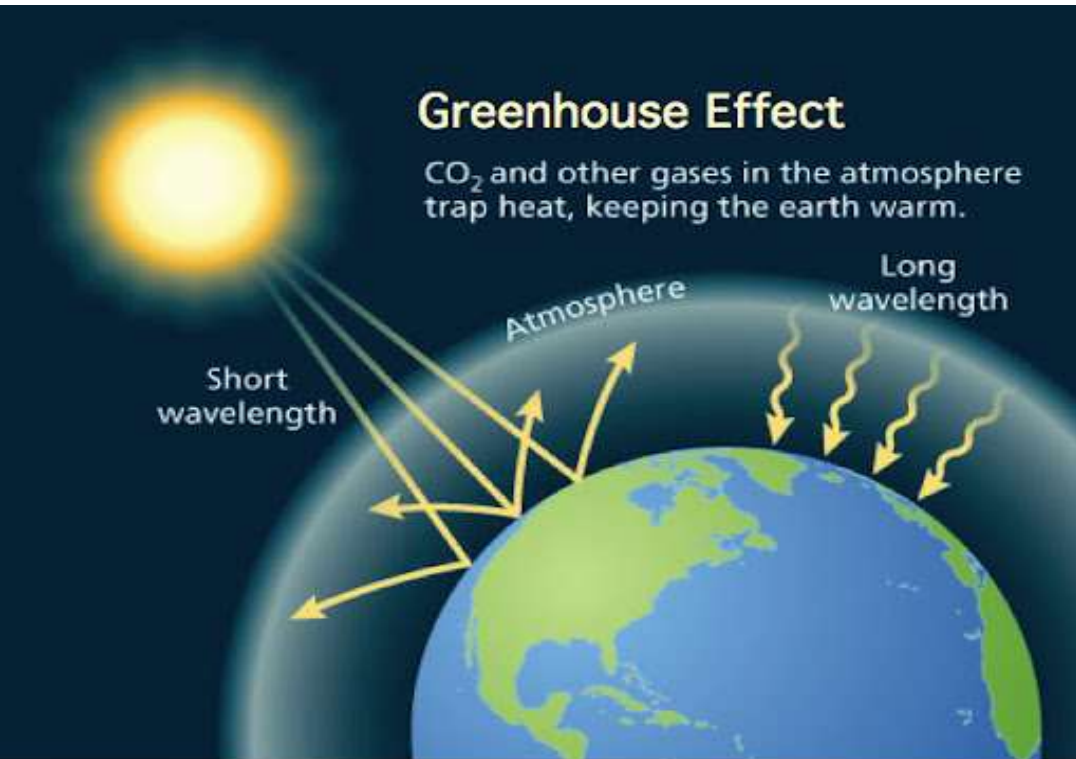
- La caduta di un asteroide può avere effetti molto forti sul sistema climatico
- Se il corpo ha dai 10 km di diametro in su, l'impatto può sprigionare un'energia da milioni a miliardi di volte superiore a quella della bomba atomica di Hiroshima
- Espulsione di grandi quantità di polveri, ceneri, aerosol nell'atmosfera in grado di oscurare quasi totalmente la luce solare in entrata
- Risultato: un significativo abbassamento della temperatura

FORZANTI ENDOGENE:ERUZIONI VULCANICHE



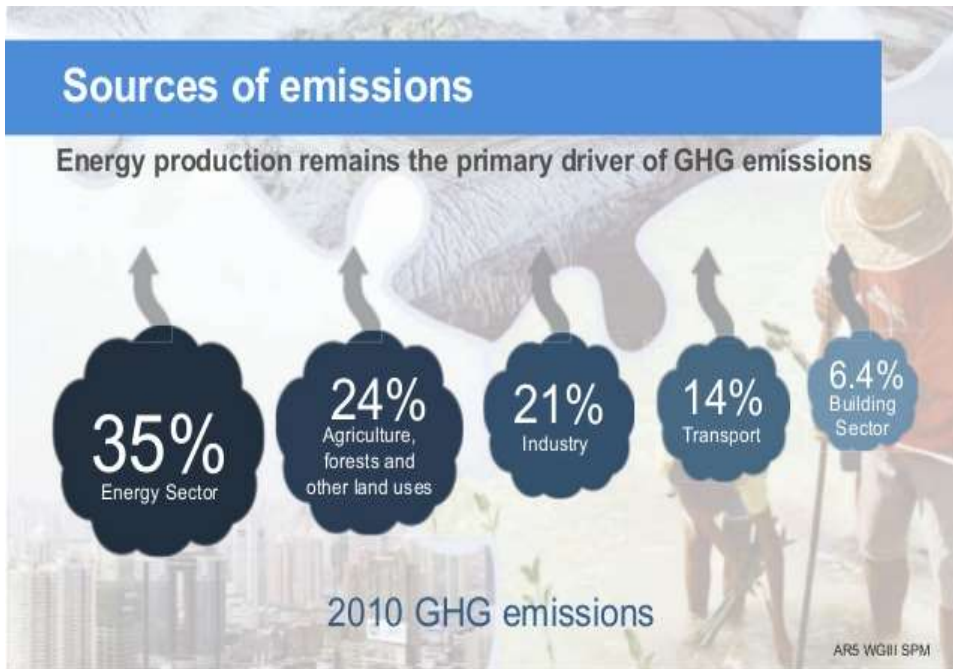
- Le eruzioni iniettano in atmosfera gas, ceneri e frammenti minerali detti *tefra* (dal greco significa cenere)
- I tefra sono classificabili in base alle loro dimensioni:
 - *Cenere vulcanica*: particelle di meno di 2 mm di diametro
 - *Lapilli o tizzoni vulcanici*: tra 2 e 64 mm di diametro
 - *Bombe vulcaniche o massi vulcanici*: maggiori di 64 mm di diametro
- Le ceneri, a causa della loro dimensione e massa, si depositano generalmente vicino al cono del vulcano
- La cenere di piccole dimensioni, invece, spesso viaggia per migliaia di chilometri e può rimanere sospesa nella stratosfera per diverse settimane
- Se lo strato di cenere sospesa è particolarmente denso ed esteso, può schermare la radiazione solare influenzando così anche sul clima terrestre
- La loro azione è poi amplificata dagli aerosol solfati
- Gli aerosol solfati si formano a partire dai gas contenenti zolfo (SO_2) e, poiché si tratta di particelle chiare che riflettono la luce del sole, aumentano l'albedo determinando un effetto radiativo di raffreddamento della superficie terrestre

FORZANTI ENDOGENE: GAS-SERRA



- L'effetto serra è un fenomeno naturale determinato dalla capacità dell'atmosfera di trattenere sotto forma di calore parte dell'energia che proviene dal Sole
- Il fenomeno è dovuto alla presenza di alcuni gas, detti 'gas serra' che intrappolano la radiazione termica che viene emessa dalla superficie terrestre riscaldata dal Sole
- Proprio come i vetri di una serra, l'atmosfera è 'trasparente' alla radiazione solare che proviene dal Sole, mentre è parzialmente 'opaca' alla radiazione termica (radiazione infrarossa) emessa dalla superficie terrestre
- Questo significa che parte della radiazione infrarossa viene assorbita dai gas serra che agiscono come una coperta termica impedendo la completa dispersione verso lo spazio del calore infrarosso
- A loro volta i gas serra riemettono l'energia assorbita in ogni direzione riscaldando ulteriormente la Terra e l'atmosfera.
- Questo fenomeno naturale consente alla superficie della Terra di mantenere una temperatura media di circa 14 °C anziché di -18 °C

FORZANTI ENDOGENI: GAS-SERRA



- L'effetto serra di origine naturale può essere amplificato dalle emissioni di gas serra di origine antropica legate alle attività umane
- Il maggiore contenuto atmosferico dei gas serra, implica una maggiore quantità di energia termica re-irradiata e, quindi, un incremento di temperatura

FEEDBACK POSITIVI E NEGATIVI

- Quando una qualsiasi forzante altera il bilancio energetico del sistema terrestre provocando un aumento o una diminuzione della temperatura terrestre si innescano nel sistema climatico una serie di meccanismi di retroazione o feedback
- Si definiscono feedback climatici quei processi in grado di amplificare o ridurre gli effetti di una forzante climatica
- Un feedback che accresce il processo iniziale è detto “feedback positivo”
- Un feedback che riduce il processo iniziale è detto invece “feedback negativo“



GRUPPO INTERGOVERNATIVO SUL CAMBIAMENTO CLIMATICO (IPCC)

Il principale organismo internazionale per la valutazione dei cambiamenti climatici. È stato istituito dal Programma delle Nazioni Unite per l'ambiente (UNEP) e dall'Organizzazione meteorologica mondiale (OMM) nel 1988 per fornire al mondo una visione scientifica chiara sullo stato attuale delle conoscenze nel cambiamento climatico e sui suoi potenziali impatti ambientali e socio-economici.

Esso è organizzato in tre gruppi di lavoro:

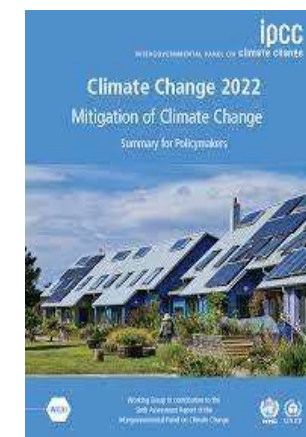
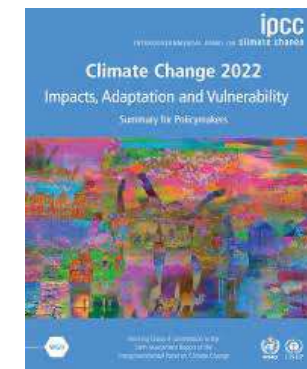
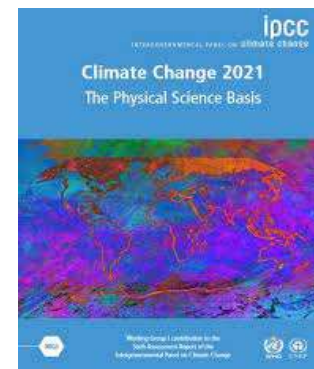
- il gruppo di lavoro I si occupa delle basi scientifiche dei cambiamenti climatici;
- il gruppo di lavoro II si occupa degli impatti dei cambiamenti climatici sui sistemi naturali e umani, delle opzioni di adattamento e della loro vulnerabilità;
- il gruppo di lavoro III si occupa della mitigazione dei cambiamenti climatici, cioè della riduzione delle emissioni di gas a effetto serra.

L'IPCC fonda le sue analisi sulla letteratura scientifica e pubblica a intervalli regolari dei rapporti di valutazione per comprendere le cause del cambiamento climatico, dei potenziali impatti e delle possibili strategie di mitigazione e adattamento.

RAPPORTI IPCC

I rapporti di valutazione finora pubblicati sono i seguenti:

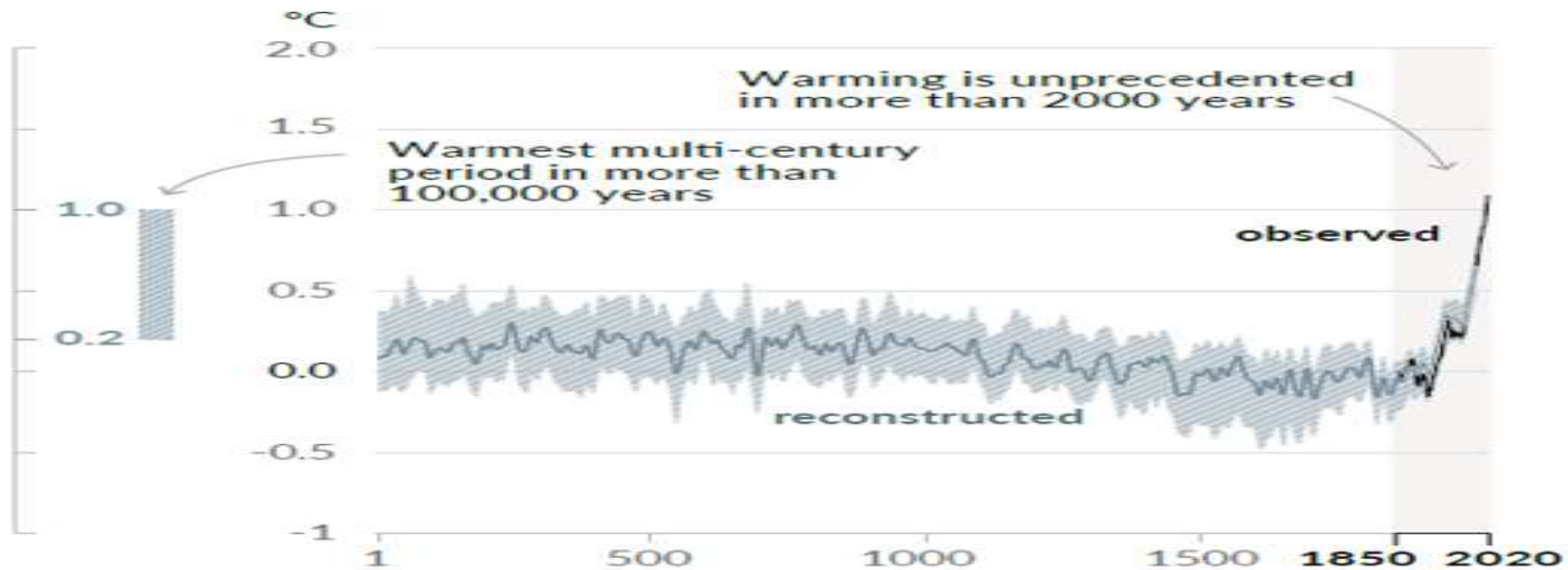
- Primo Rapporto di Valutazione (1990), a cui è seguito un rapporto supplementare nel 1992
- Secondo Rapporto di Valutazione (1995)
- Terzo Rapporto di Valutazione (2001)
- Quarto Rapporto di Valutazione (2007)
- Quinto Rapporto di Valutazione (2013-2014)
- Sesto Rapporto di Valutazione (2021-2023)
- Gli ultimi tre rapporti di valutazione sono stati suddivisi in tre parti che rispecchiano le attività di tre distinti gruppi di lavoro + un rapporto di sintesi per i decisori politici.



I CAMBIAMENTI OSSERVATI E LE LORO CAUSE

Changes in global surface temperature relative to 1850-1900

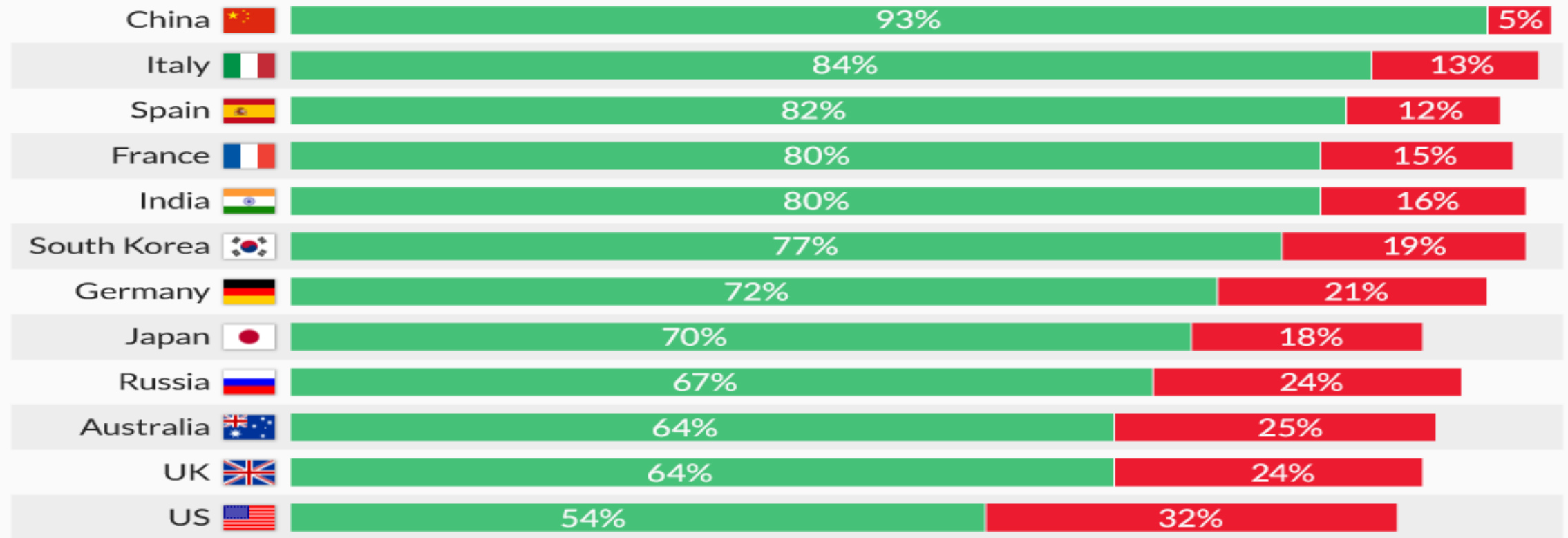
a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and **observed** (1850-2020)



Is climate change the result of human activity?

"The climate change we're currently seeing is largely the result of human activity"*

Agree Disagree



RISCALDAMENTO GLOBALE: SÌ O NO?

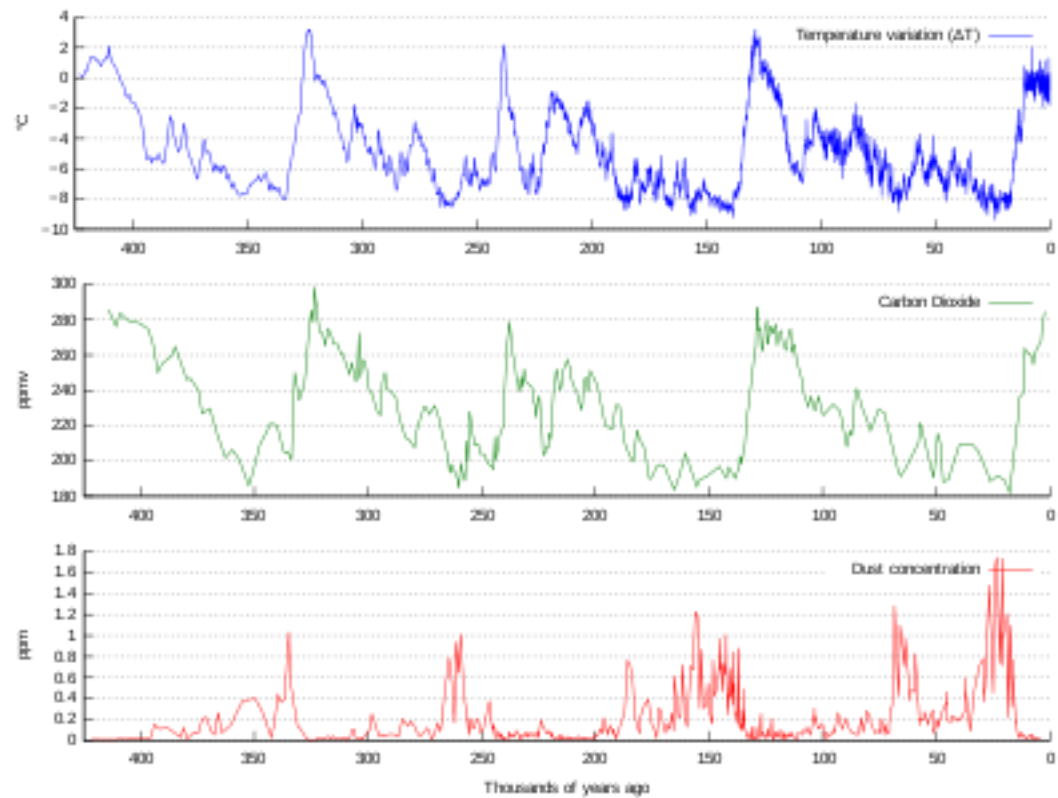
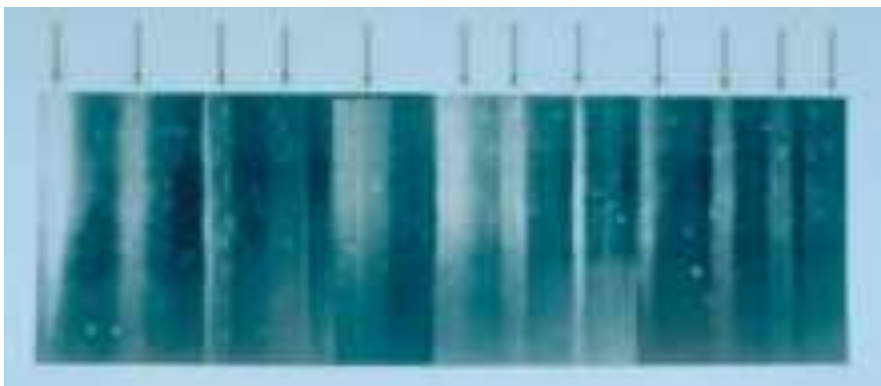


Grafico raffigurante i dati ricavati da una carota di ghiaccio estratta nei pressi di Vostok. In blu è indicata la temperatura, in verde la quantità di anidride carbonica ed in rosso le polveri vulcaniche

I CAMBIAMENTI OSSERVATI E LE LORO CAUSE

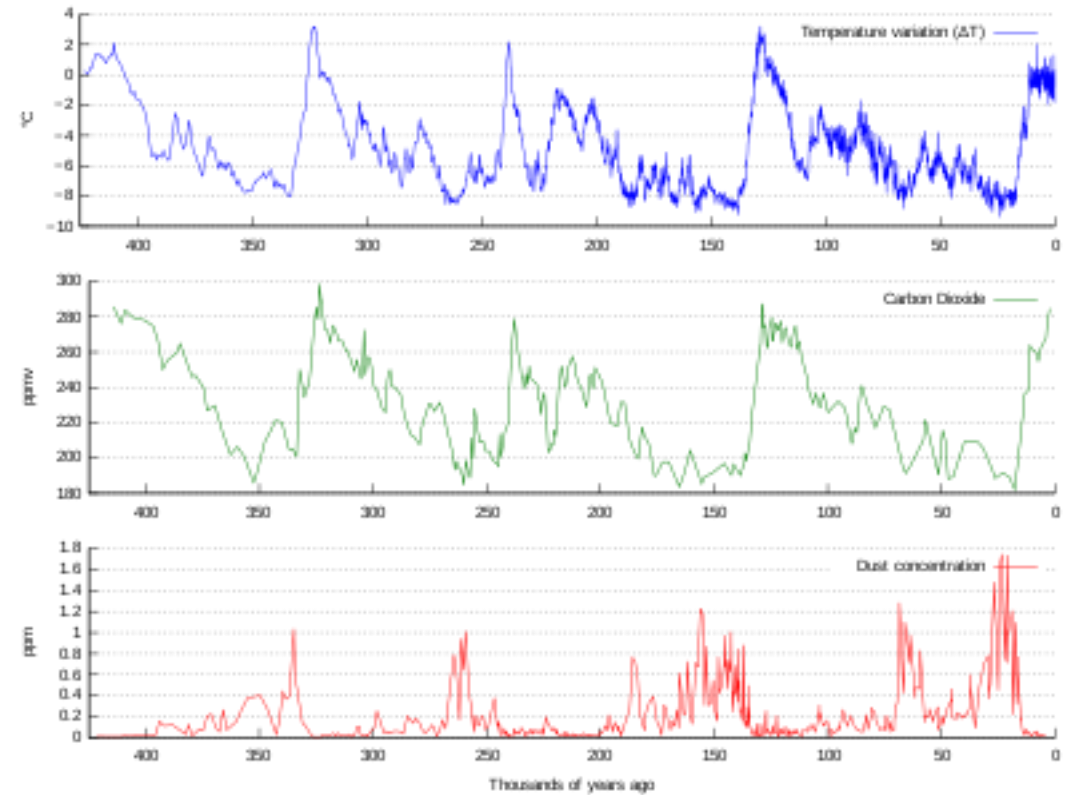
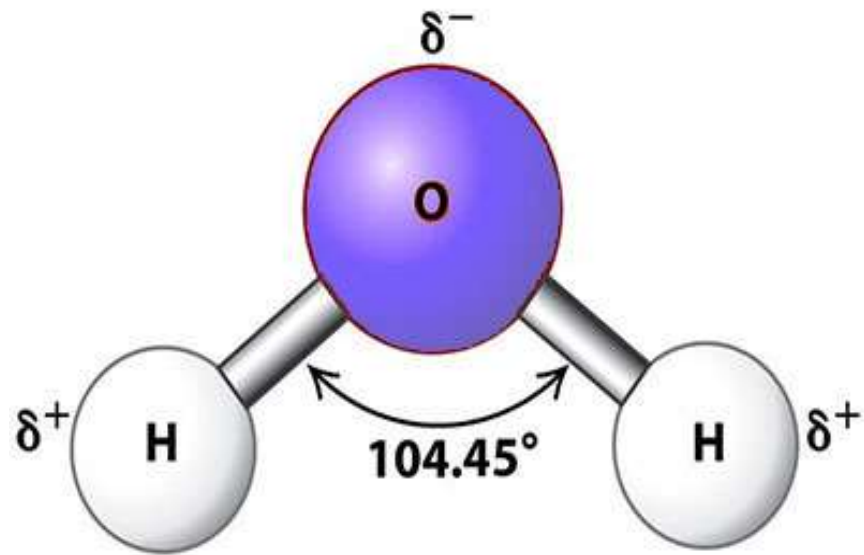
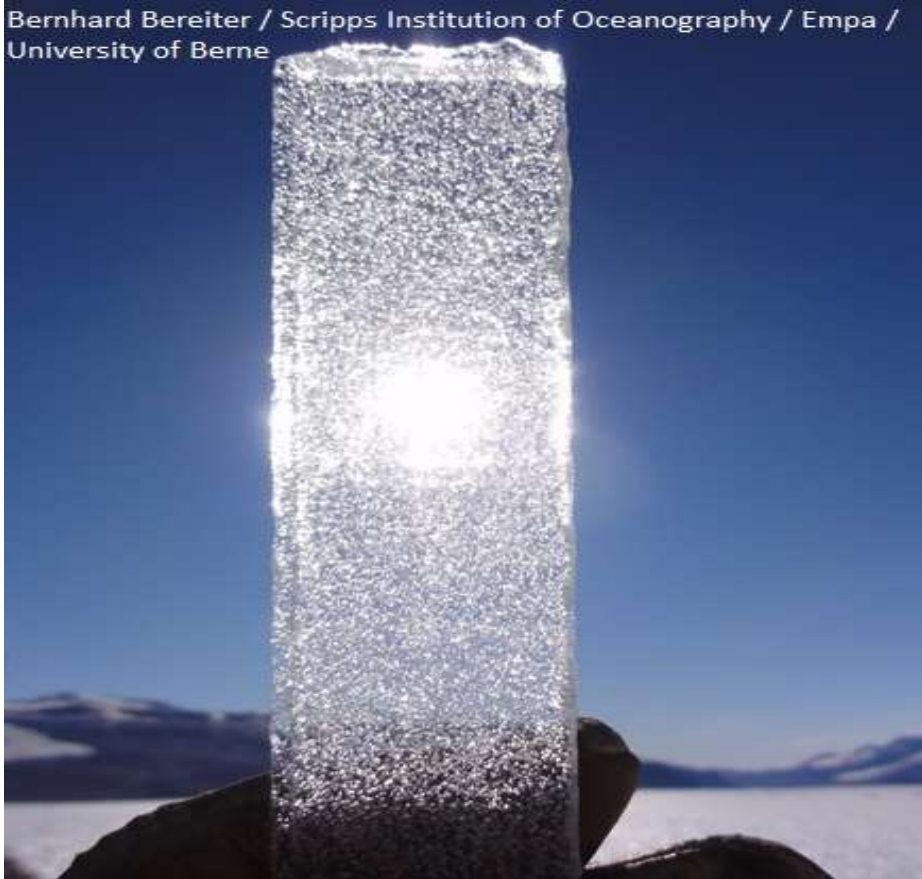


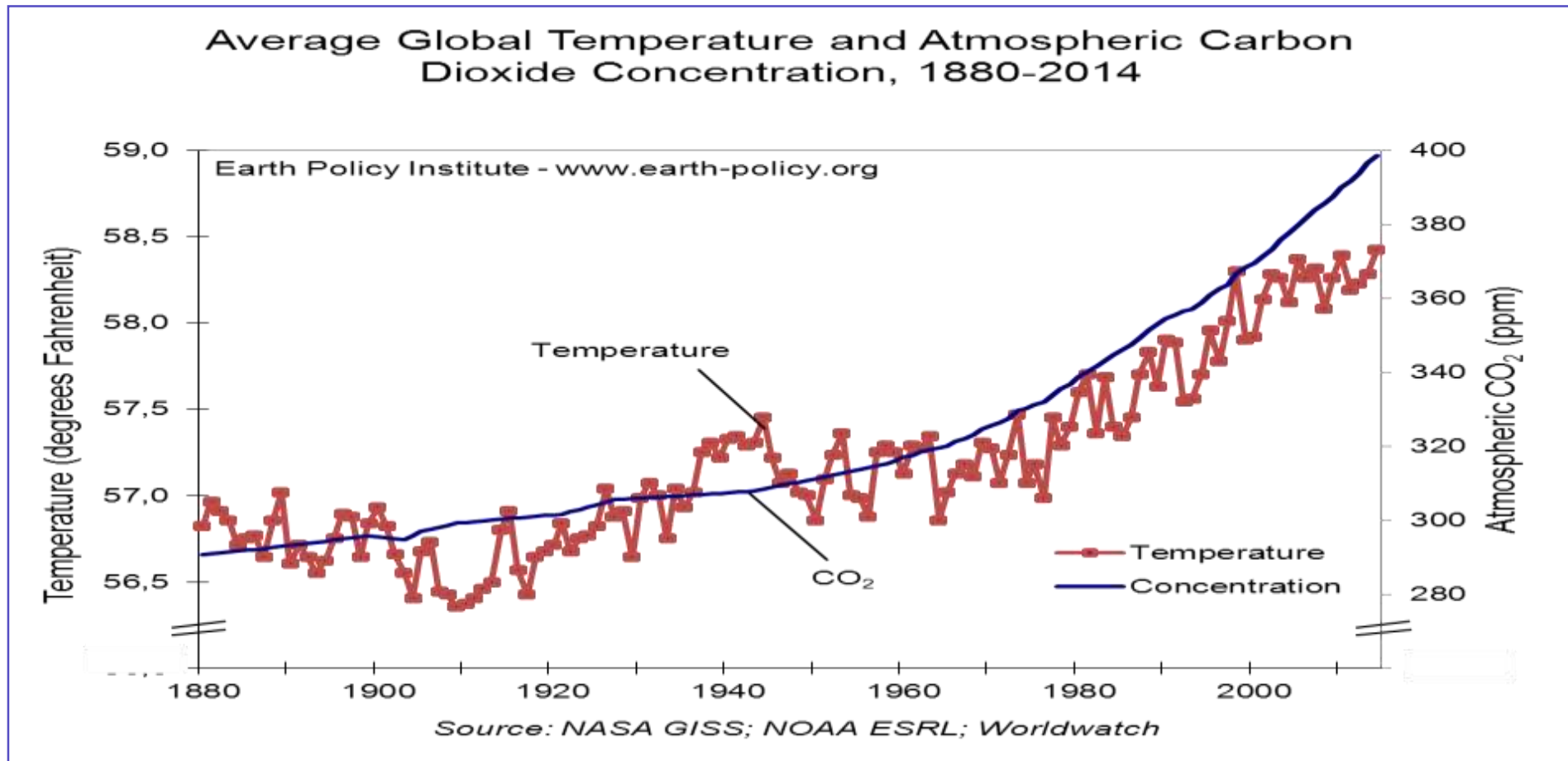
Grafico raffigurante i dati ricavati da una carota di ghiaccio estratta nei pressi di Vostok. In blu è indicata la temperatura, in verde la quantità di anidride carbonica ed in rosso le polveri vulcaniche


I CAMBIAMENTI OSSERVATI E LE LORO CAUSE

Bernhard Bereiter / Scripps Institution of Oceanography / Empa / University of Berne



RISCALDAMENTO GLOBALE E CAUSE





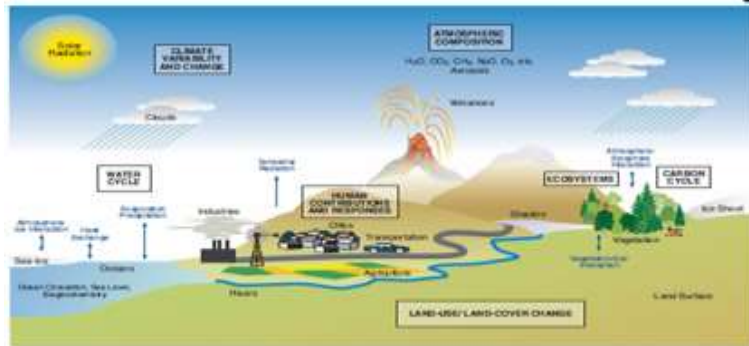
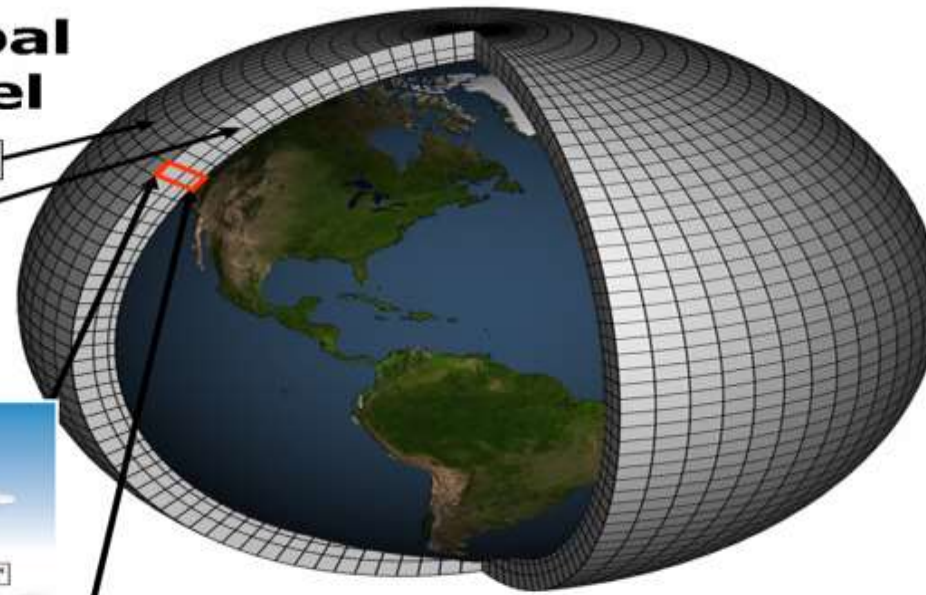
**STUDIO
SOTTOSISTEMI
CLIMATICI**

I MODELLI E LA QUESTIONE DELL' 'ATTRIBUTION' CLIMATICA

Schematic for Global Atmospheric Model

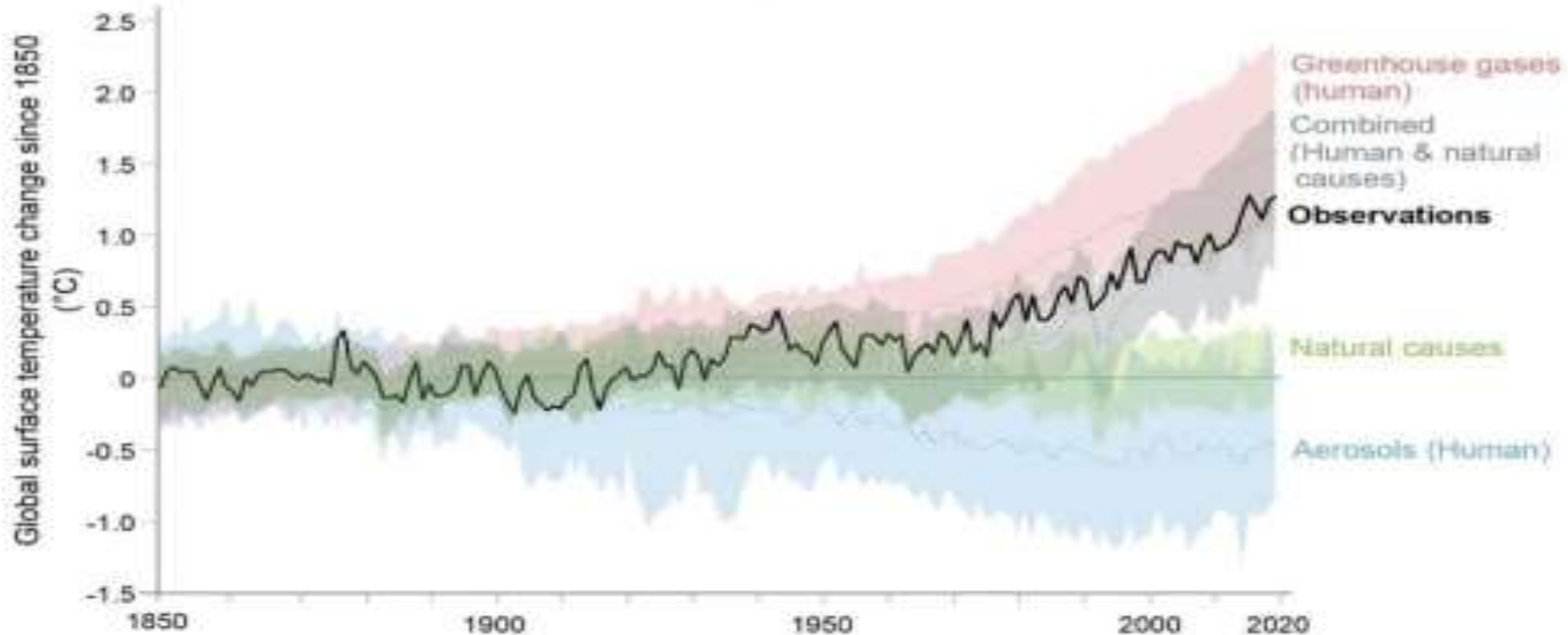
Horizontal Grid (Latitude-Longitude)

Vertical Grid (Height or Pressure)

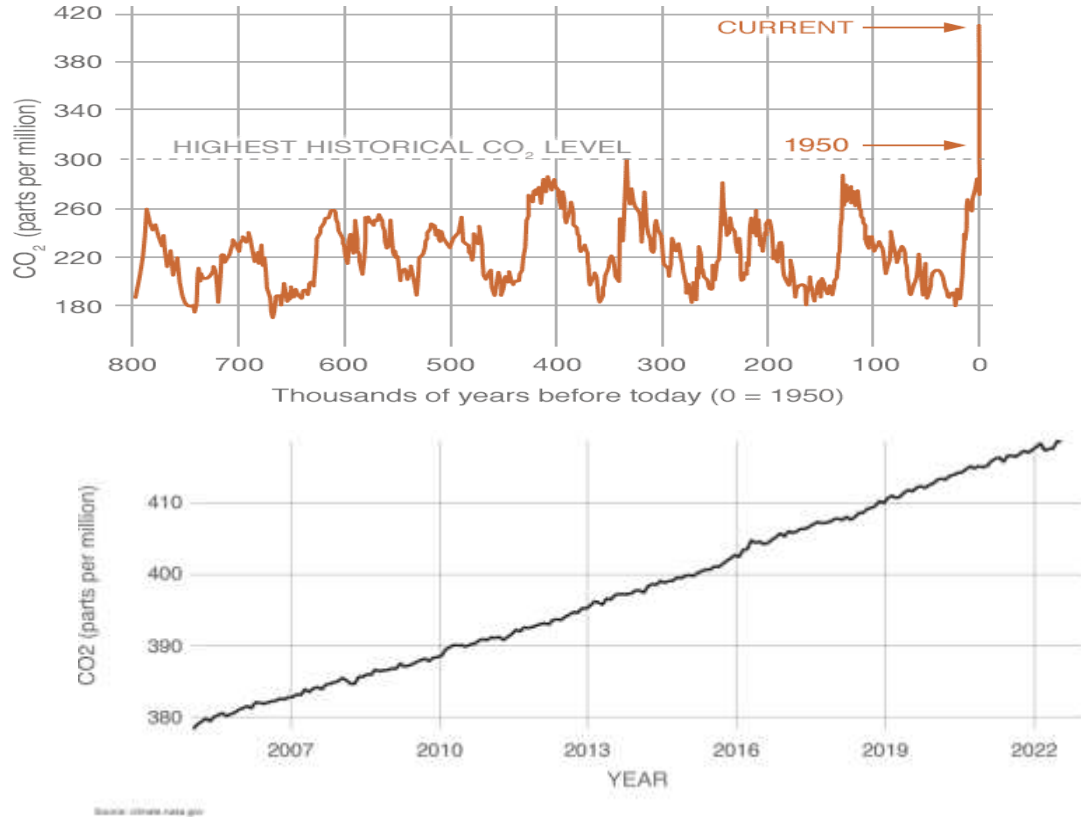


I MODELLI E LA QUESTIONE DELL' 'ATTRIBUTION' CLIMATICA

How do we know humans are causing climate change?



EMISSIONI CO₂ E SURRISCALDAMENTO GLOBALE

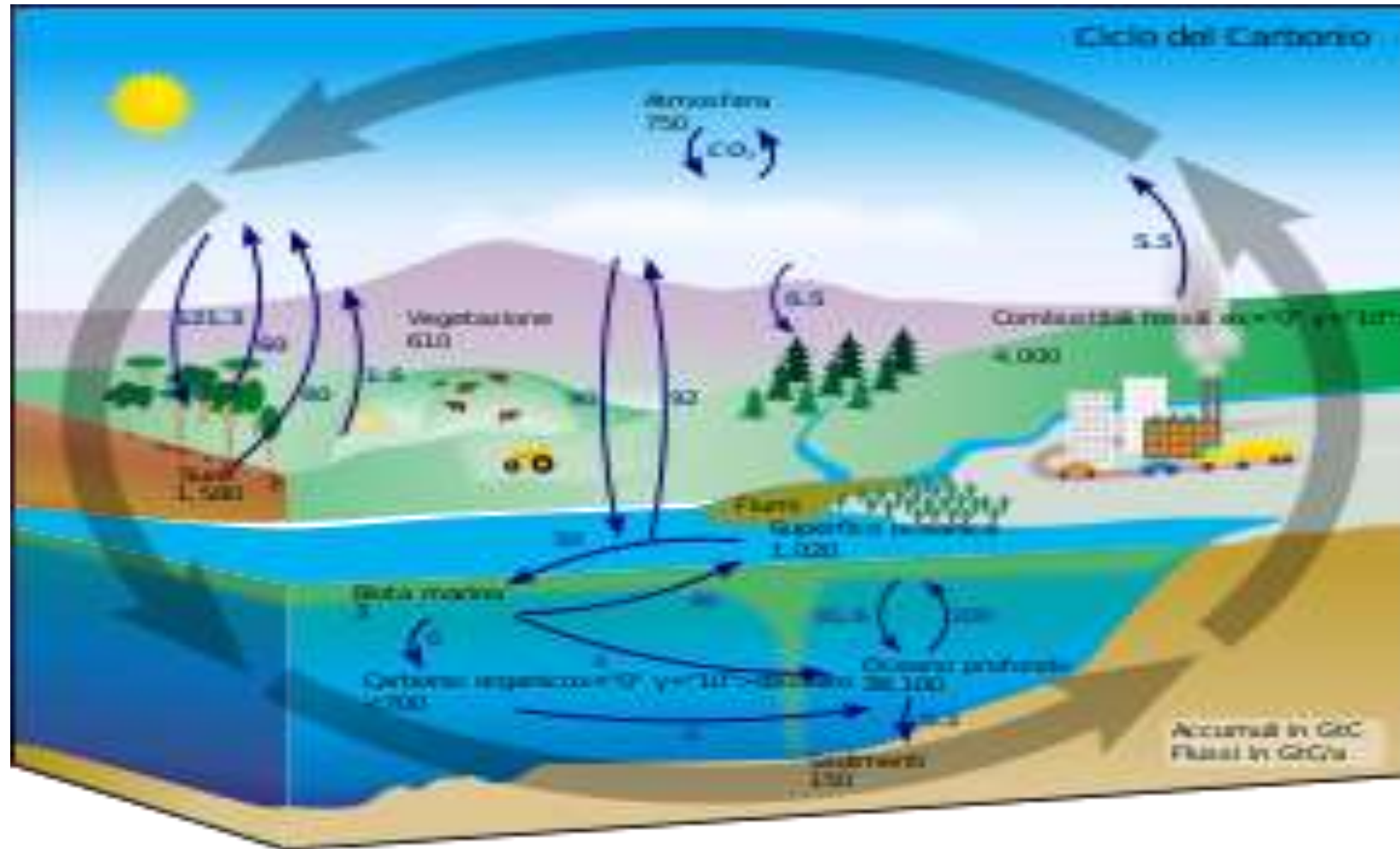


Nasa, 2022

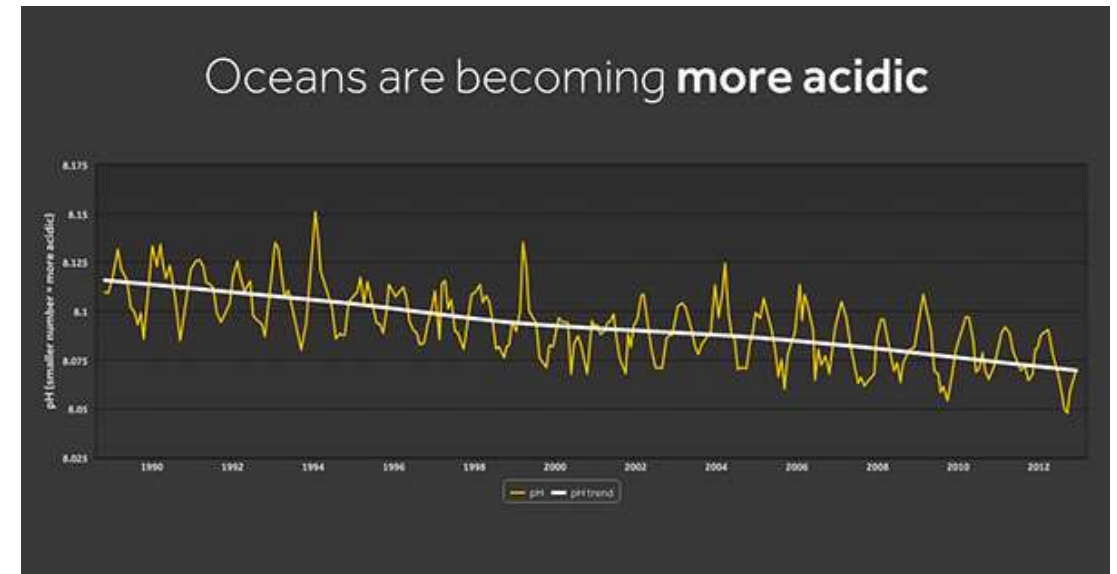
GLI EFFETTI DEL SURRISCALDAMENTO GLOBALE



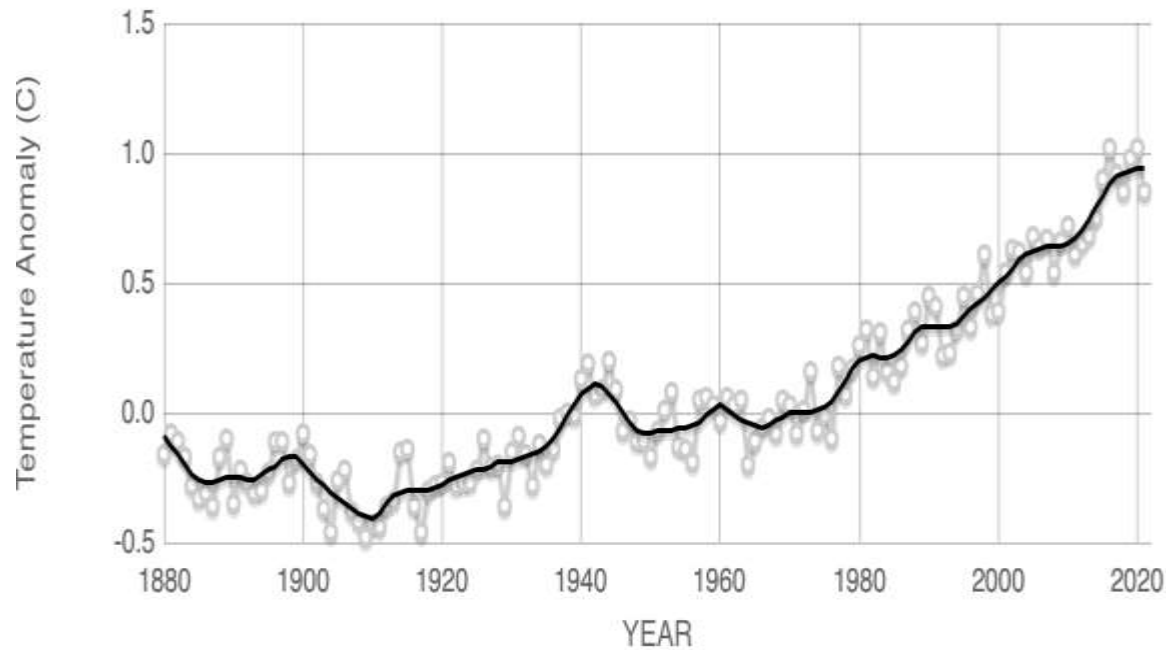
CICLO DEL CARBONIO



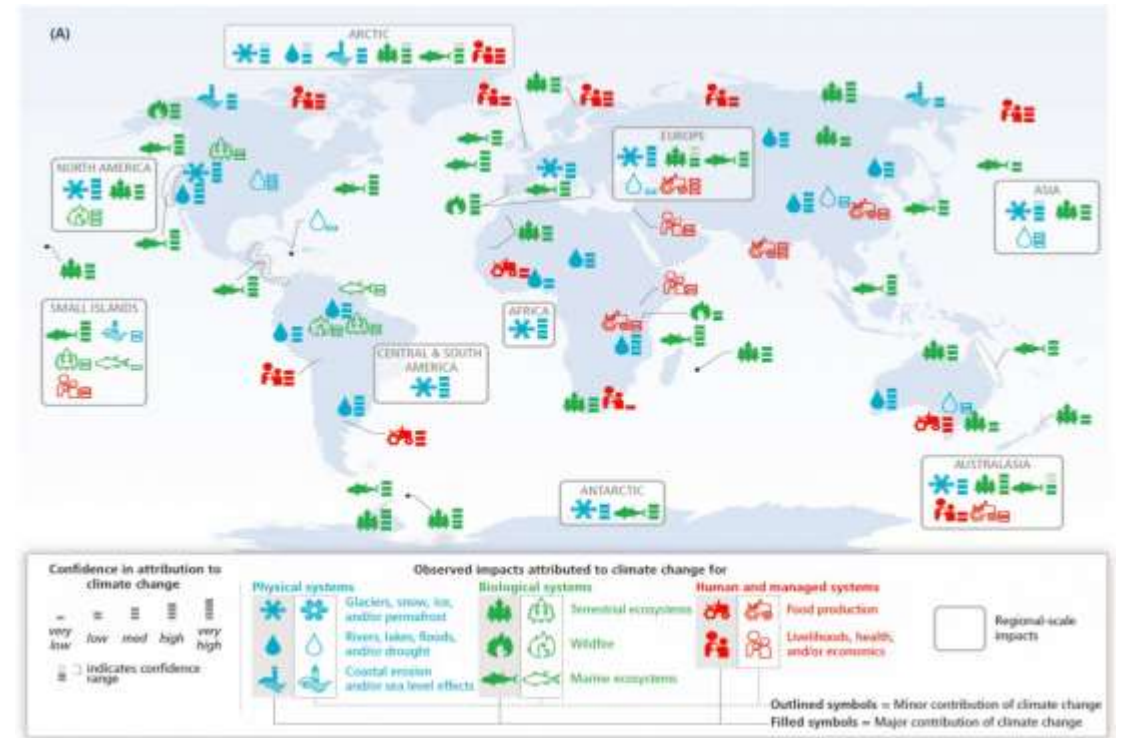
CO₂ E ACIDIFICAZIONE DEGLI OCEANI



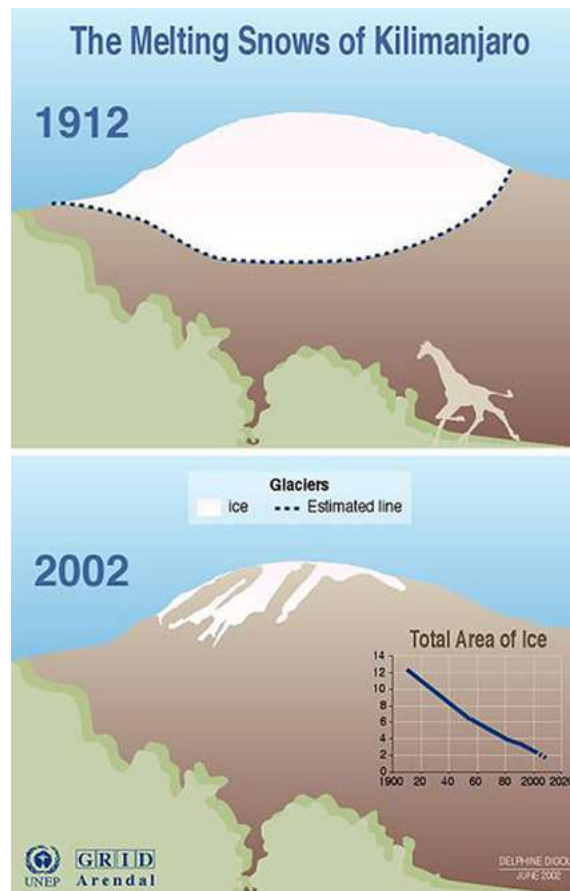
INCREMENTO TEMPERATURA MEDIA GLOBALE E IMPATTI



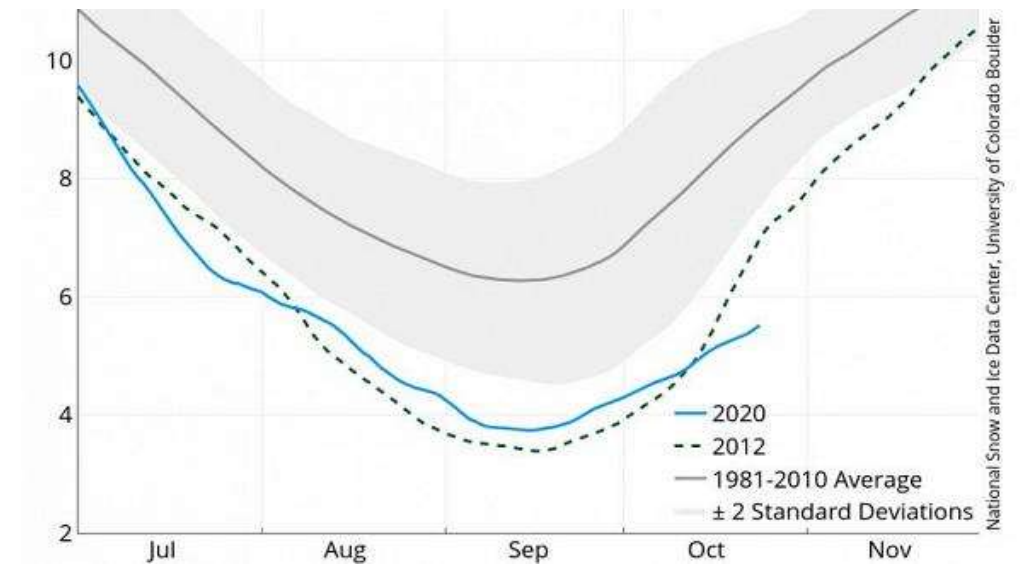
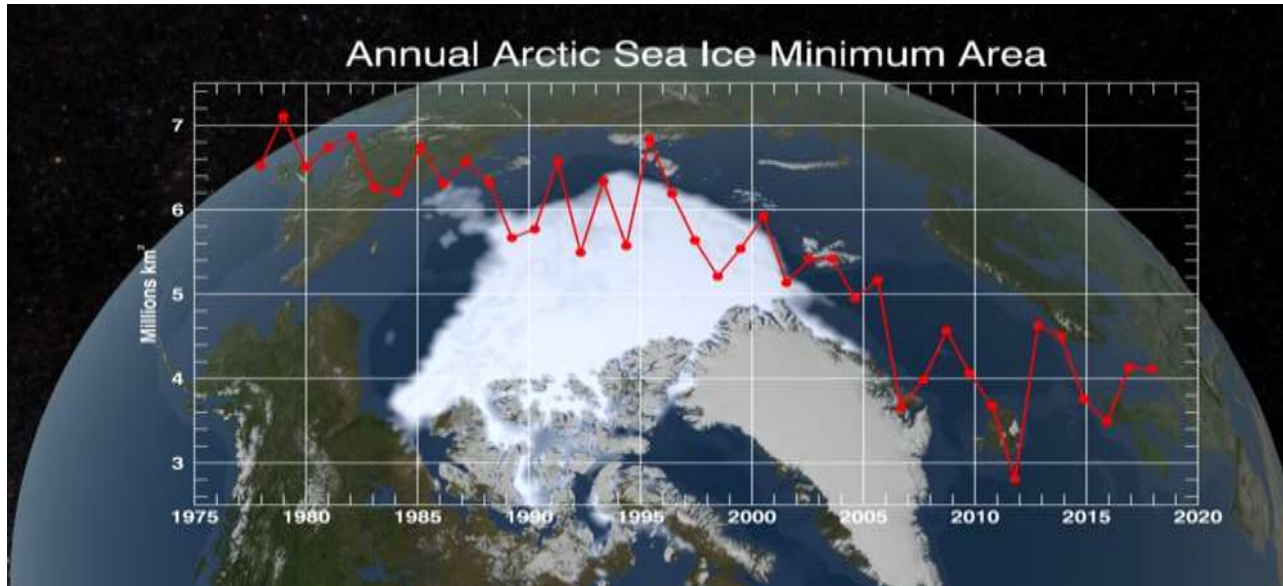
Source: climate.nasa.gov



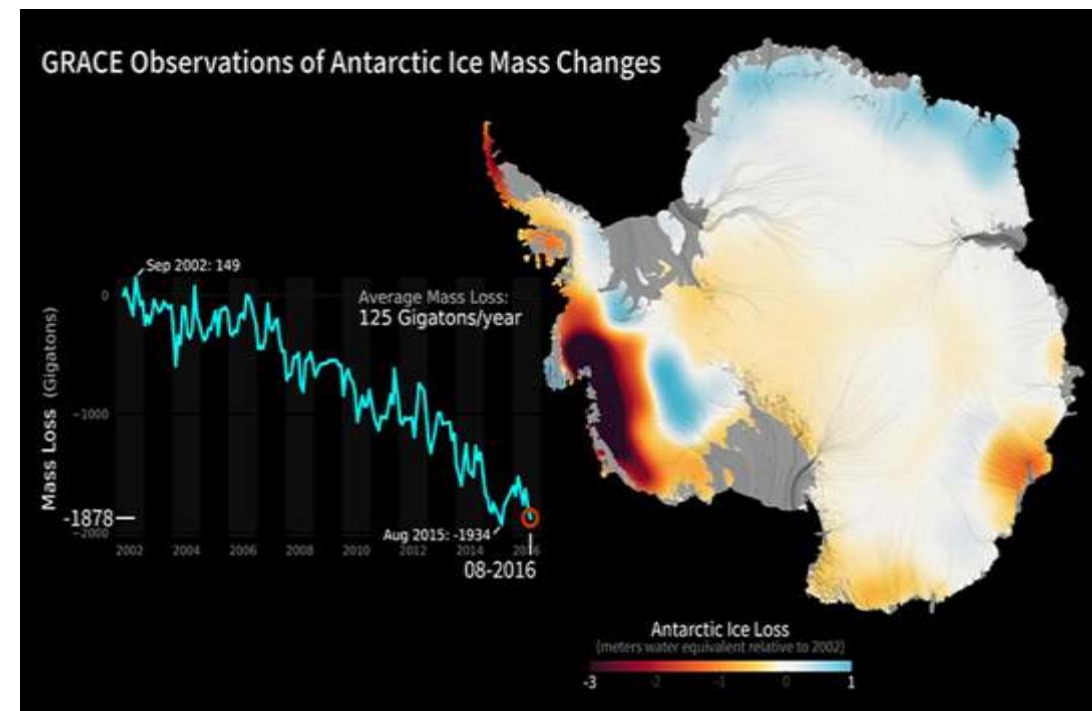
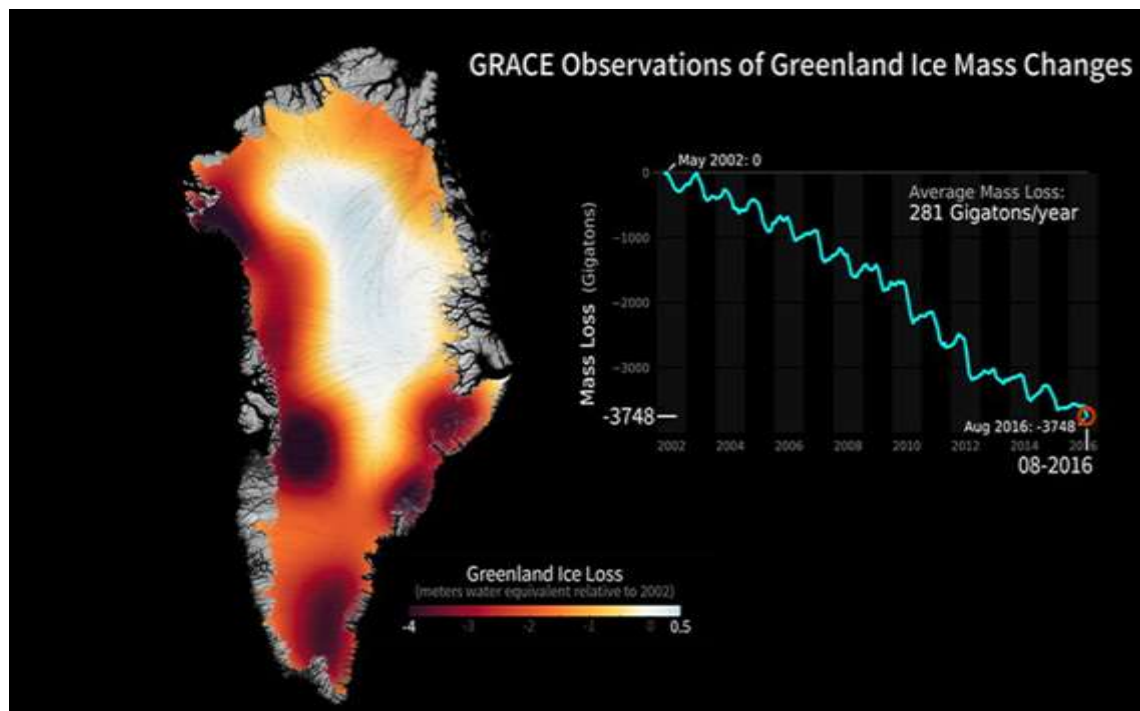
FUSIONE DEI GHIACCIAI MONTANI



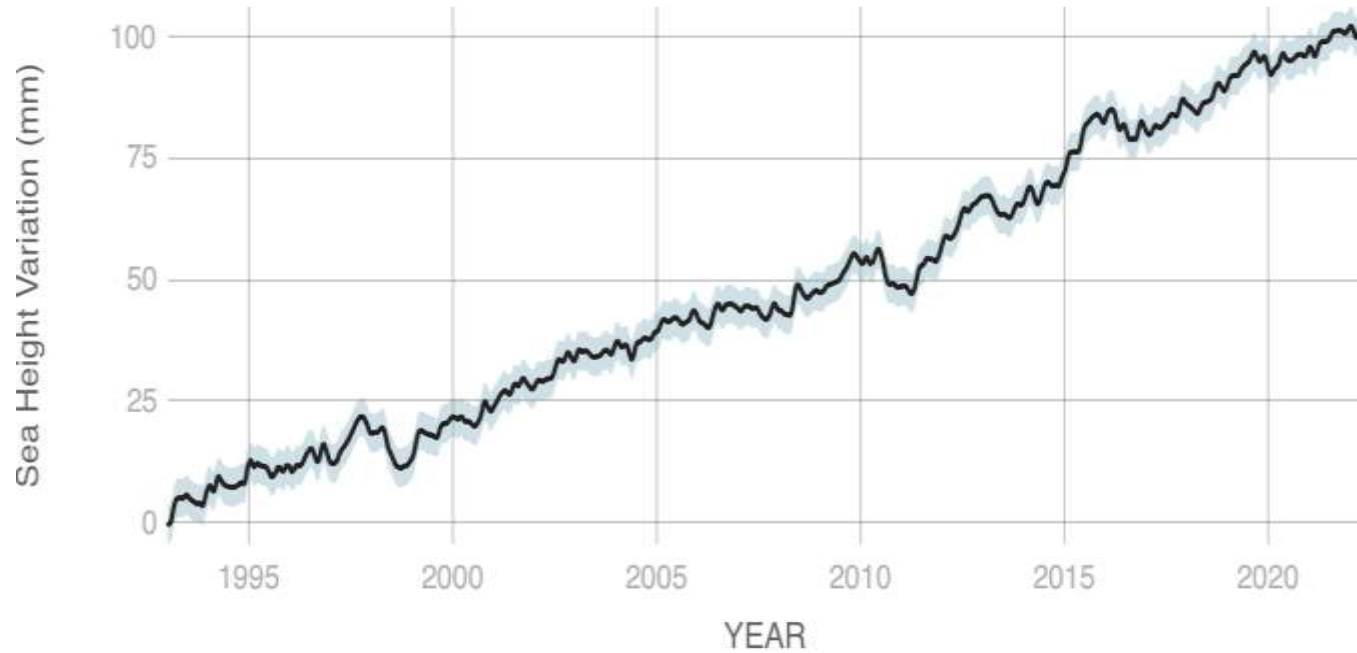
RIDUZIONE ESTENSIONE GHIACCIO MARINO ARTICO



PERDITA MASSA GHIACCIAI CONTINENTALI



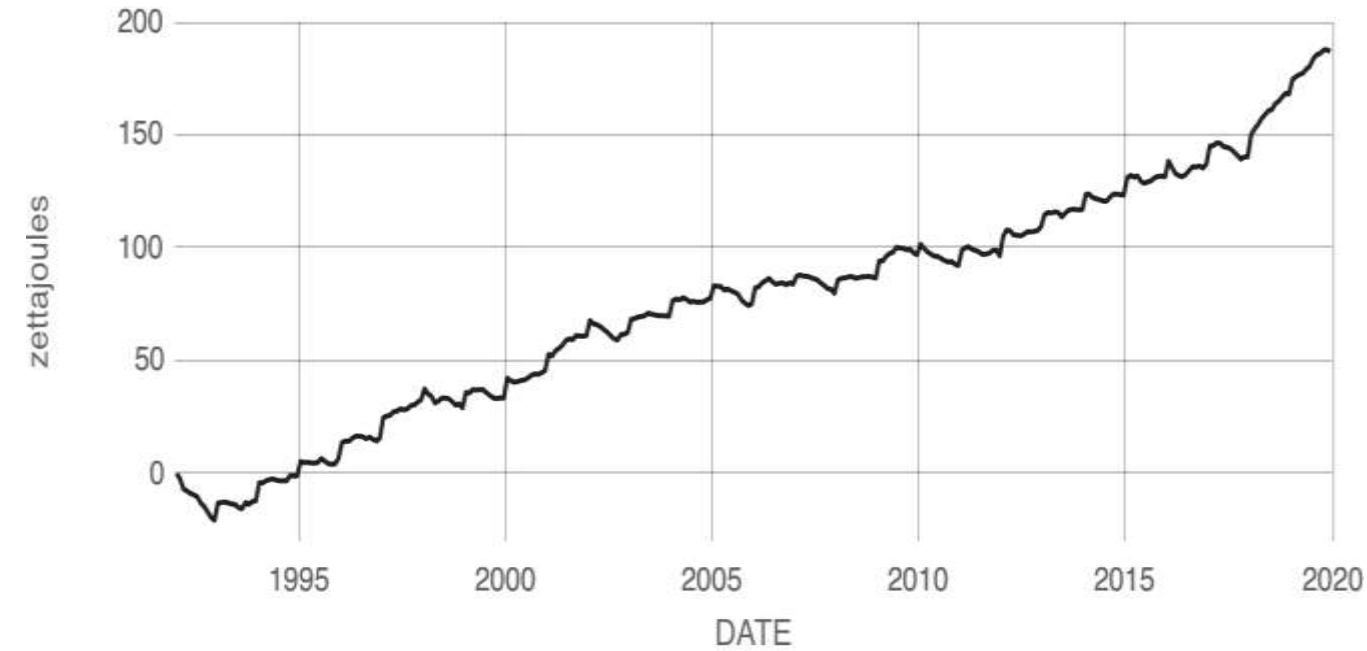
INNALZAMENTO DEL LIVELLO DEL MARE



Source: climate.nasa.gov



AUMENTO TEMPERATURA DEGLI OCEANI E SBIANCAMENTO DEI CORALLI



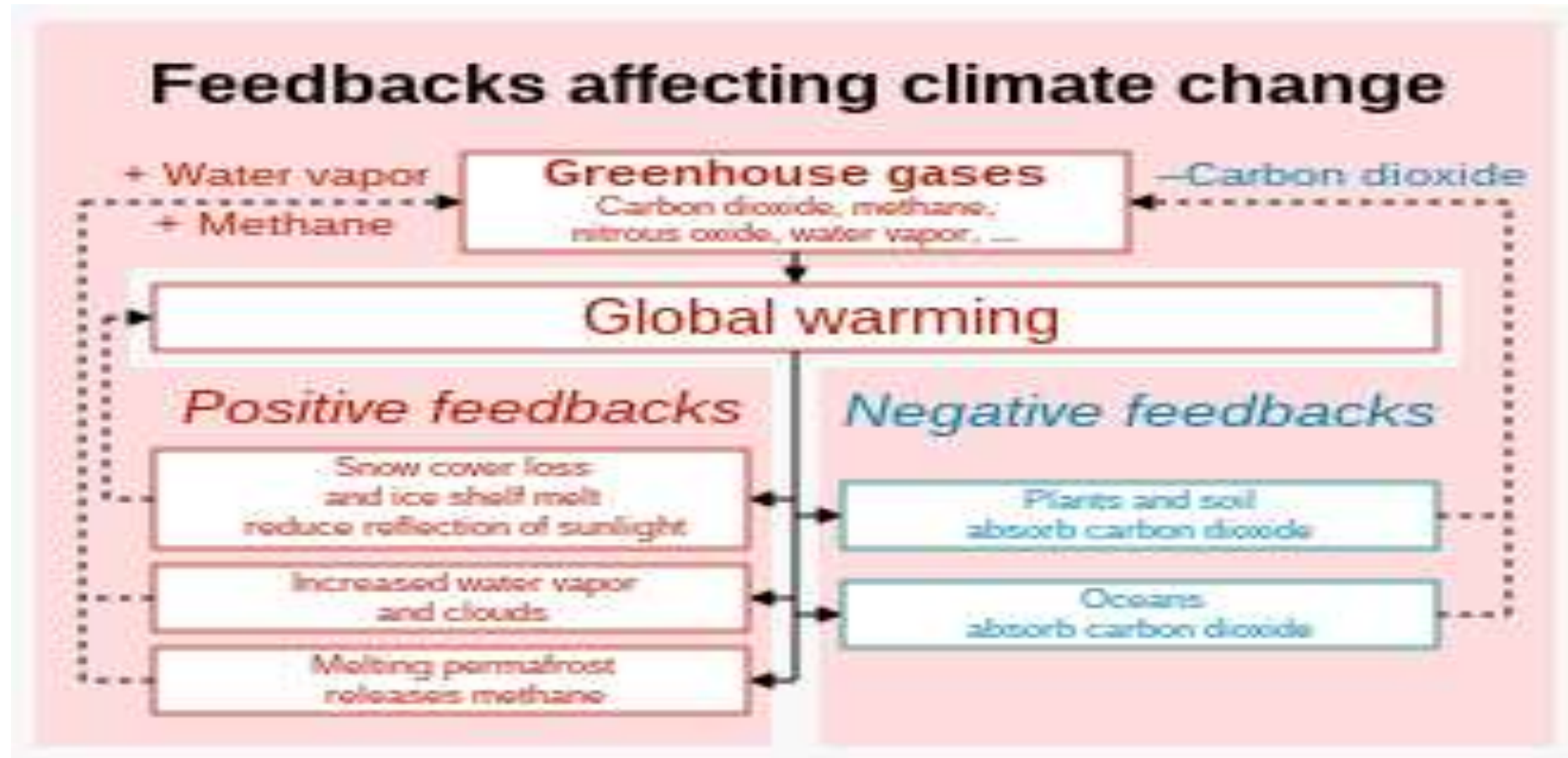
Source: climate.nasa.gov



EVENTI CLIMATICI ESTREMI



SURRISCALDAMENTO GLOBALE E FEEDBACK



RETROAZIONE GHIACCIO-ALBEDO



Interazioni interne - Esempi di Feedback

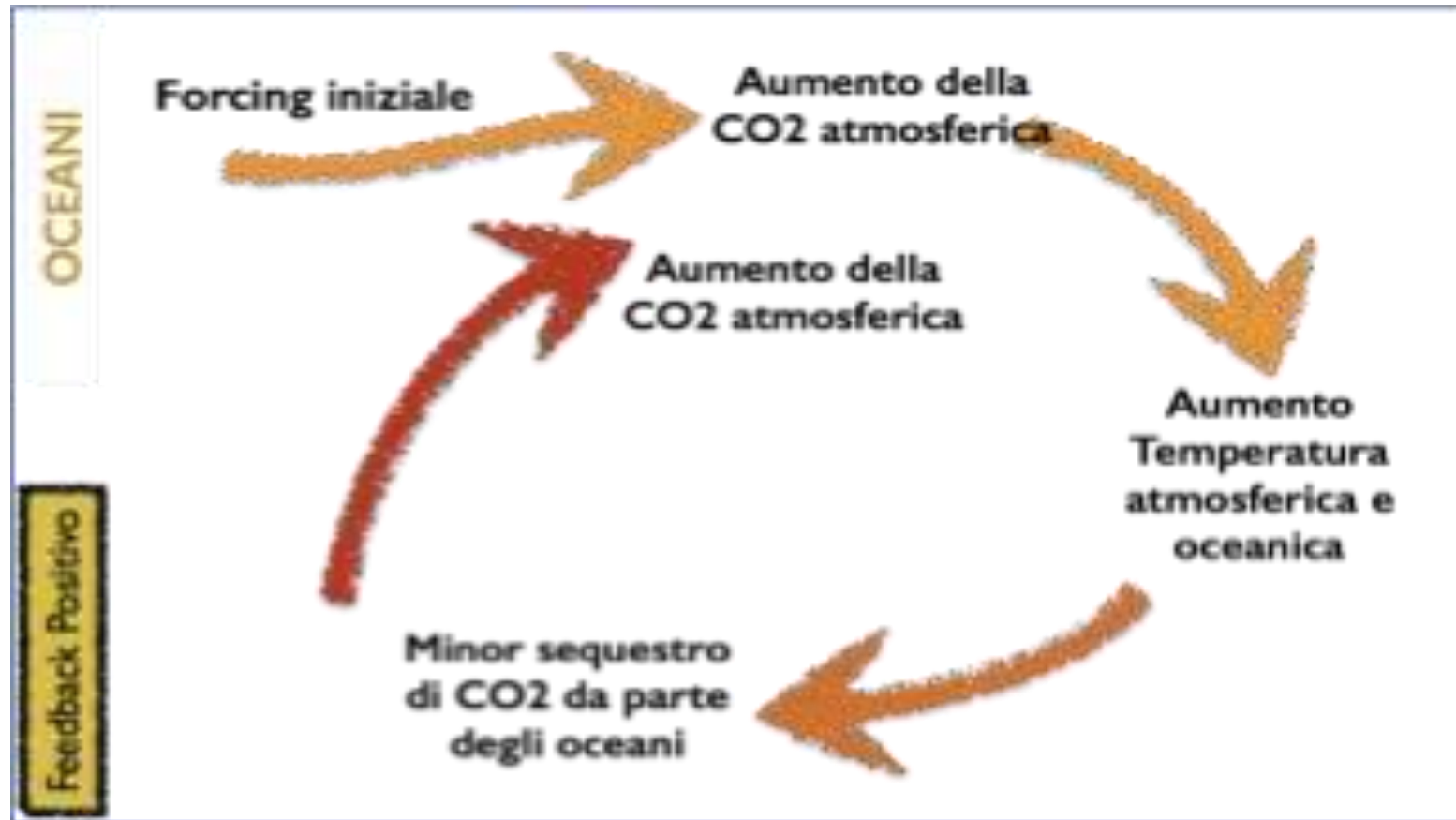


Interazioni interne - Esempi di Feedback

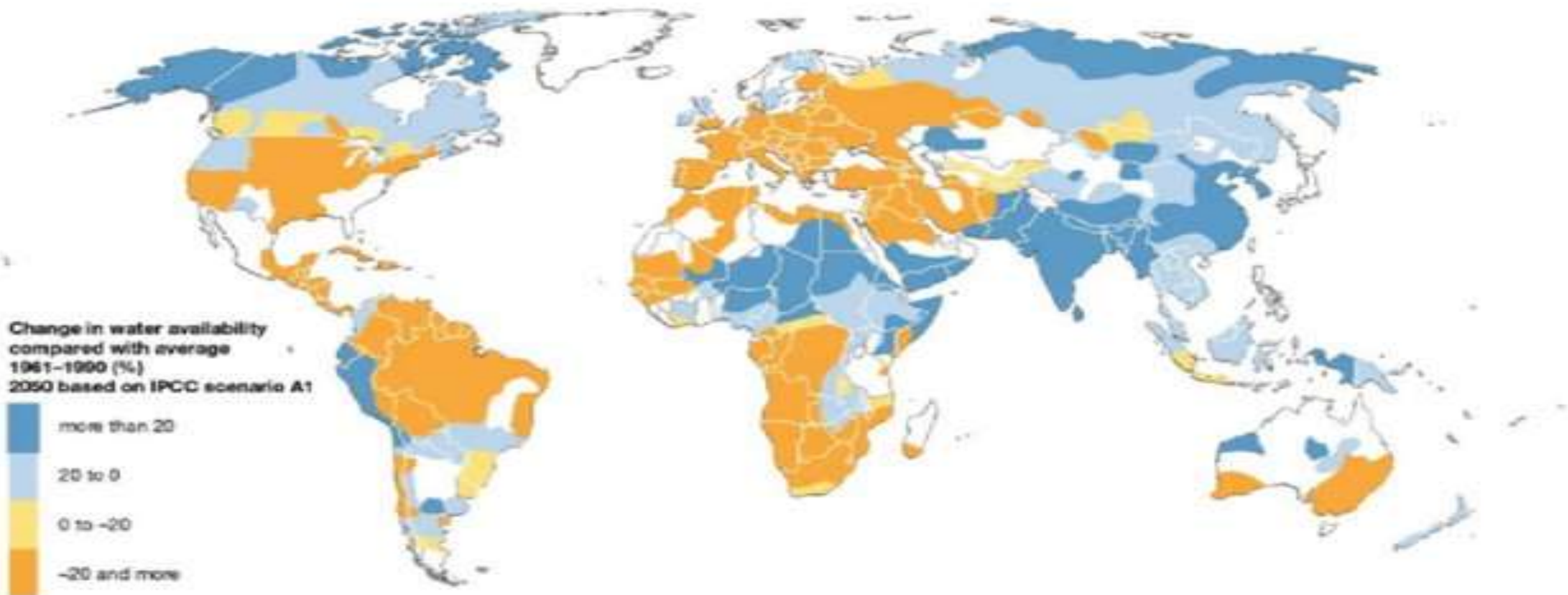
ESEMPI DI VALORI DI ALBEDO

Bianco	1
Neve fresca	0,9
Oceano	0,6
Pozze di ghiaccio sciolto	0,4-0,15 a seconda della profondità
Nero	0

RETROAZIONE LEGATA AGLI OCEANI

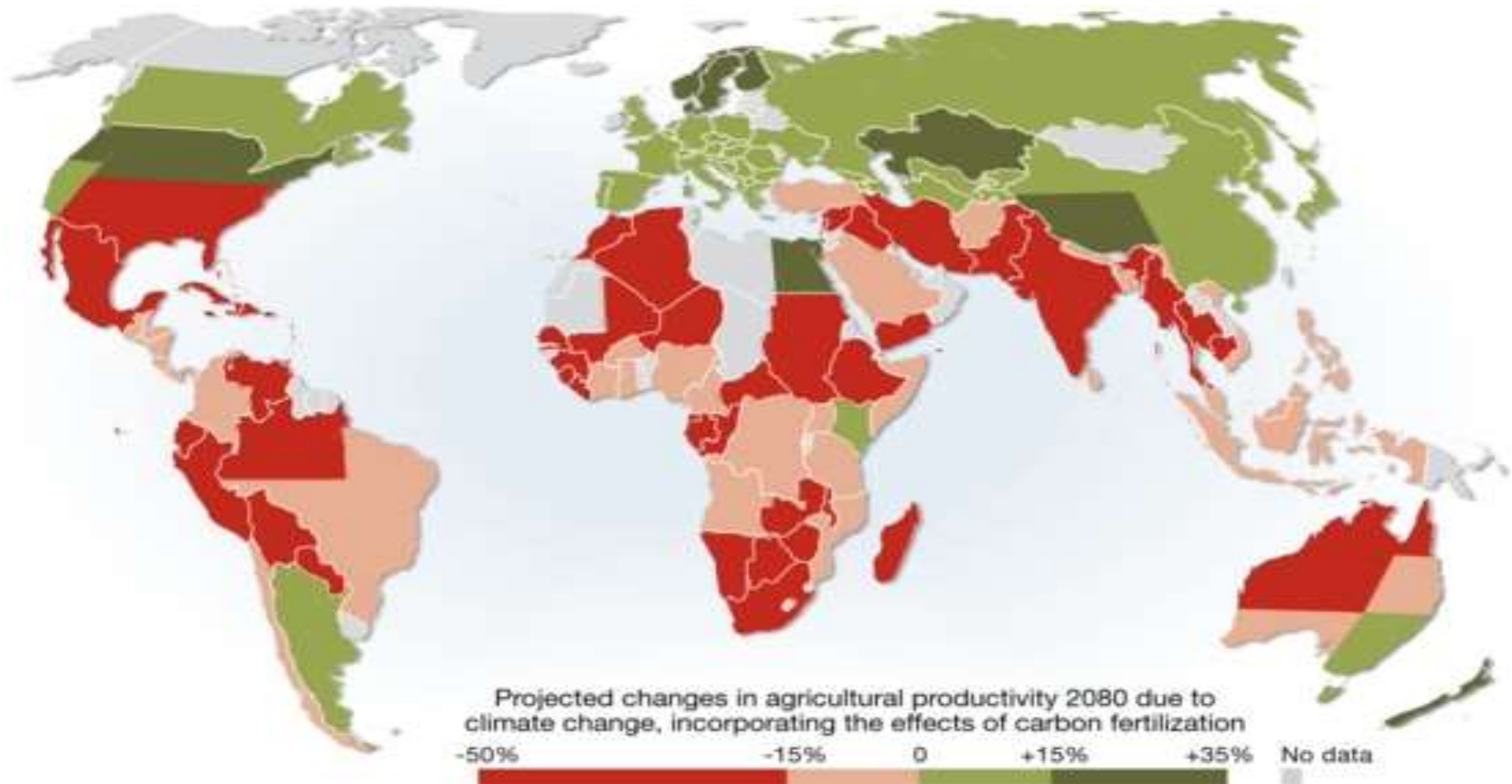


DISPONIBILITÀ IDRICA

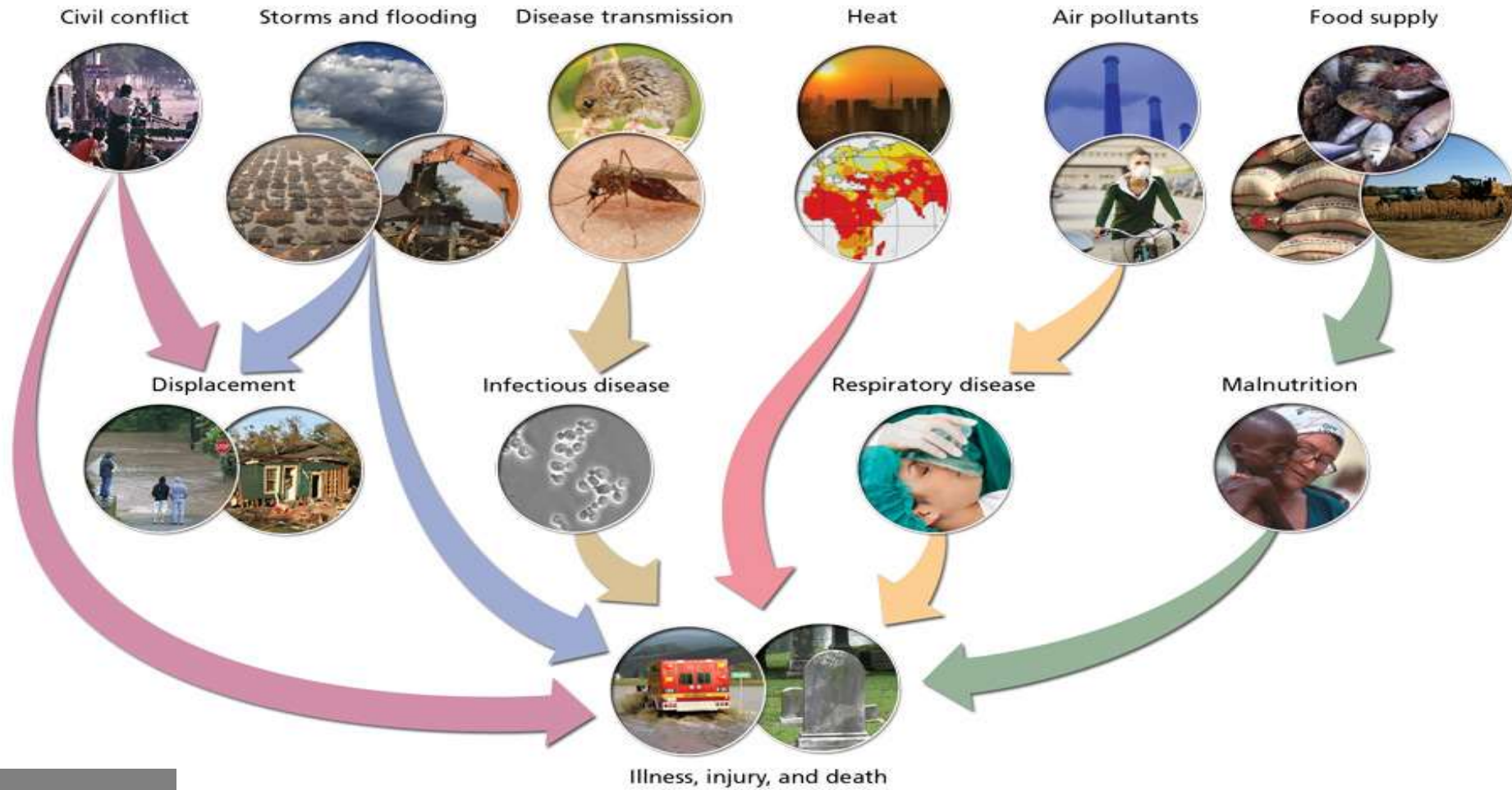


Source: Arnell 2004.

IMPATTO SULLA PRODUTTIVITÀ AGRICOLA

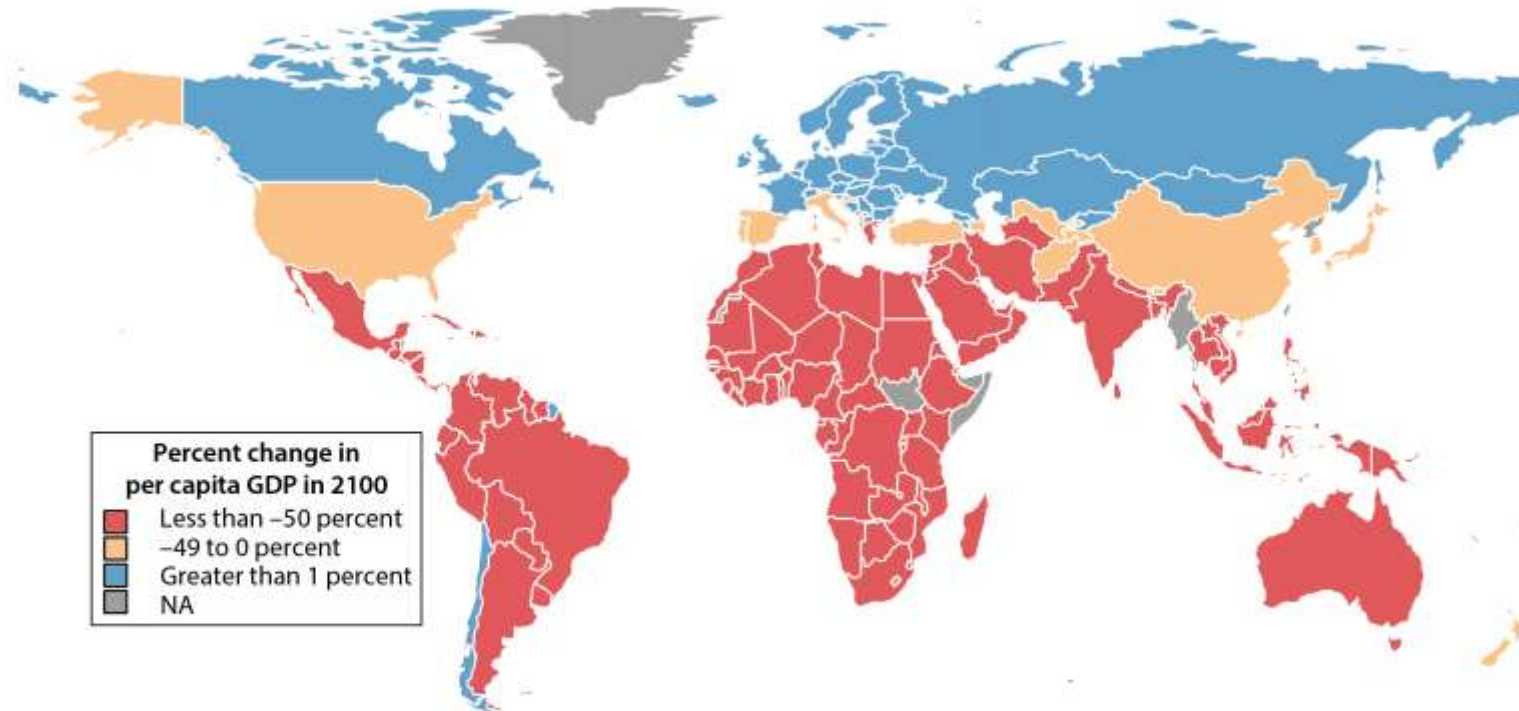


IMPATTI SULLA SALUTE UMANA



PERDITE ECONOMICHE

FIGURE 3.
Climate Change Effect on per Capita GDP in 2100 by Country



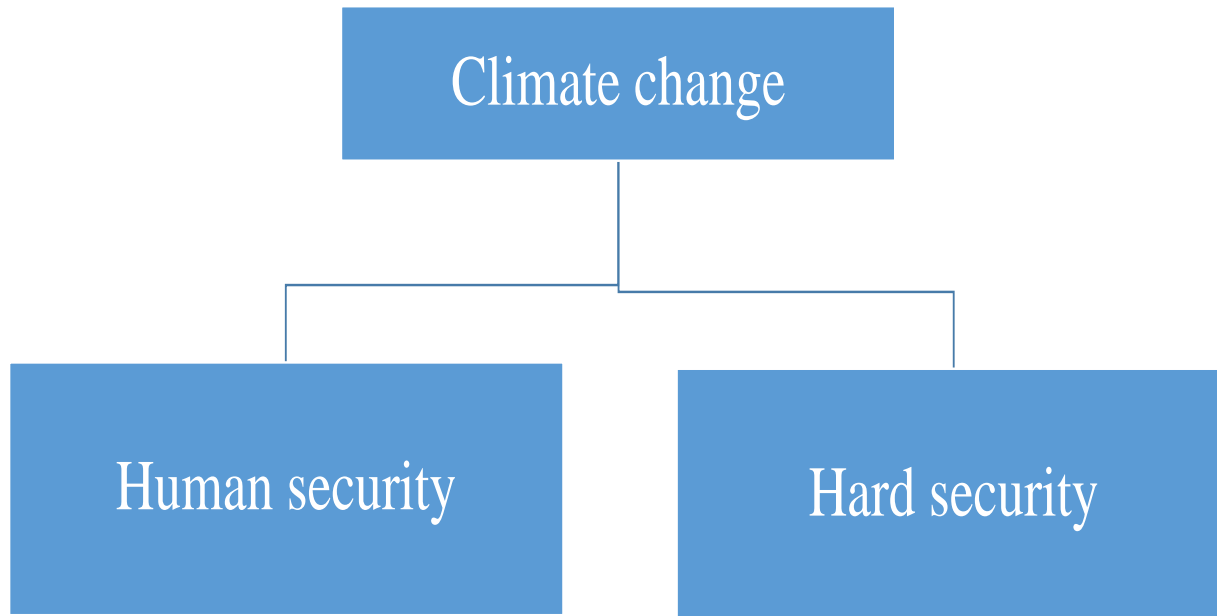
Source: Burke, Hsiang, and Miguel (2015); authors' calculations.

Note: Country-level estimates for GDP per capita in 2100. Figure assumes RCP 8.5, which corresponds to roughly 3.2°C to 5.4°C of warming. GDP loss is associated with the warming from a baseline of 1980–2010 average temperatures. As explained in Burke, Hsiang, and Miguel (2015), estimates include growth-rate effects over the period through 2100.

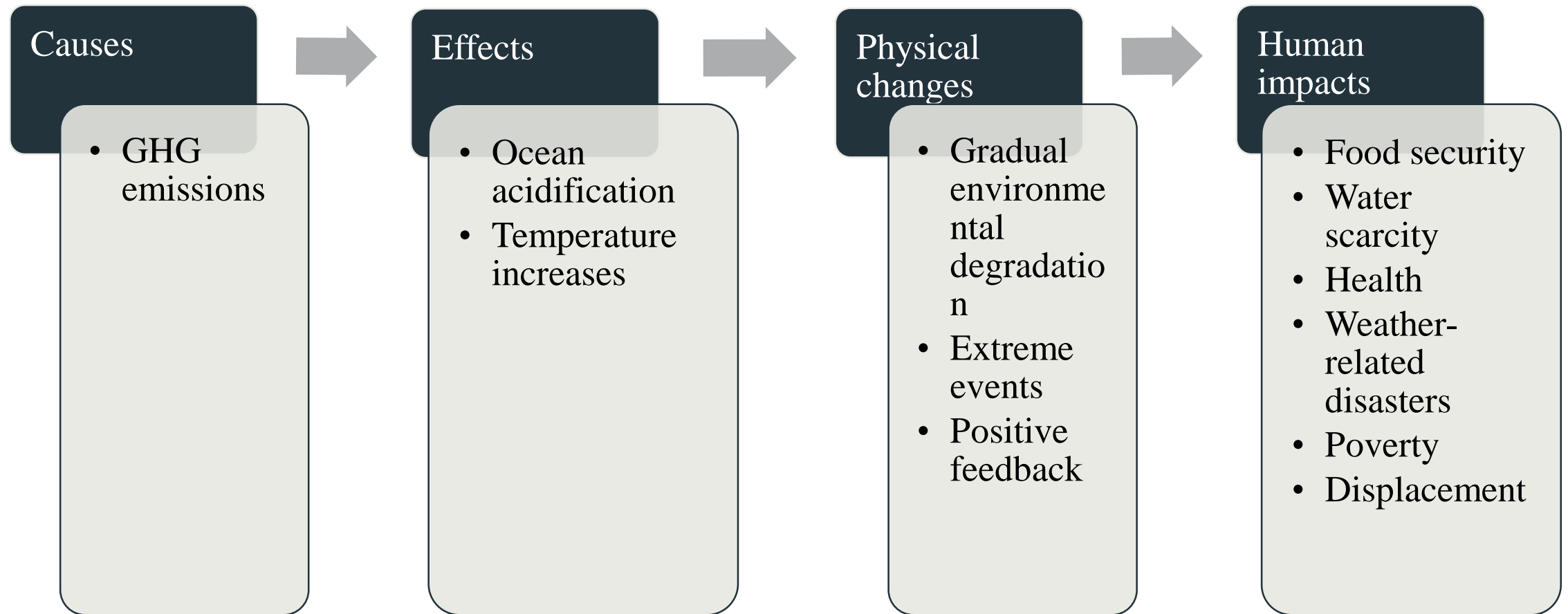
THE HAMILTON PROJECT
BROOKINGS

Stanford Institute for Economic Policy Research (SIEPR)

NESSO TRA CAMBIAMENTO CLIMATICO E SICUREZZA UMANA



EMISSIONI DI CO₂ E IMPATTO SISTEMI SOCIO- ECONOMICI



EMISSIONI DI CO₂ E IMPATTO SISTEMI SOCIO- ECONOMICI



Possono gli impatti del cambiamento climatico estendersi anche al concetto convenzionale di hard security?

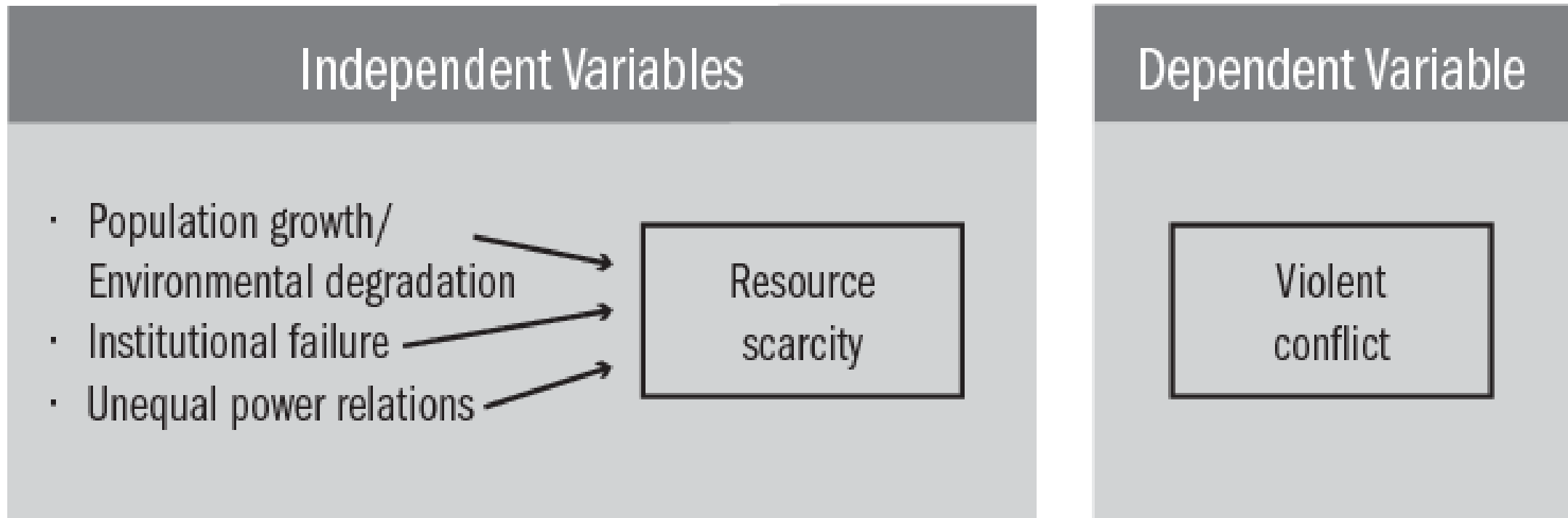
IN NESSO TRA AMBIENTE NEGLI ANNI '90



United Nations Framework
Convention on Climate Change



IN NESSO TRA AMBIENTE NEGLI ANNI '90



IL DIBATTITO: SECONDA FASE (2000)

An Abrupt Climate Change Scenario and Its Implications for United States National Security October 2001

By Peter Schwartz and Doug Randall

Imagining the Unthinkable

The purpose of this report is to imagine the unthinkable – to push the boundaries of current research on climate change so we may better understand its potential implications on United States national security.

We have interviewed leading climate change scientists, conducted additional research, and reviewed several iterations of the scenario with their reports. The scientists support this project, but caution that the scenario depicted is extreme in its fundamental assumptions. First, they suggest the occurrence of an event could most likely happen in a few regions, rather than as globally. Second, they say the magnitude of the event may be substantially smaller.

We have created a climate change scenario that although not the most likely, is plausible, and could challenge United States national security to a degree that should be considered immediately.

Executive Summary

There is substantial evidence to indicate that significant global warming will occur during the 21st century. Because changes have been gradual so far, and are projected to be similarly gradual in the future, the effects of global warming have the potential to be manageable for most nations. Recent research, however, suggests that there is a possibility that the gradual global warming could lead to a relatively abrupt lowering of the ocean's thermohaline convection, which could lead to harsher winter weather conditions, drought, reduced soil moisture, and more intense winds in certain regions that currently provide a significant fraction of the world's food production. With inadequate preparation, the result could be a significant dip in the human carrying capacity of the Earth's environment.

The research suggests that once temperatures rise above some threshold, adverse weather conditions could develop relatively abruptly, with potential changes in the atmosphere's circulation causing drops in some regions of 5-10 degrees Fahrenheit in a single decade. Paleoclimatic evidence suggests that altered climatic patterns could last for as much as a century, as they did when the ocean convection collapsed 8,200 years ago, or, at the extreme, could last as long as 1,000 years as they did during the Younger Dryas, which began about 12,500 years ago.



INSTITUTE OF
THE EUROPEAN UNION

Research, 4 December 2002

COMPRO-02-001

PROG-2002

NAME

PROJECT No. Priority Contract High Representative

DE European Council

ADDRESS European Security Strategy

In conformity with the Transparency initiative and following the outcome of the COMPRO meeting on 10th December, the INSTITUTE OF THE EUROPEAN UNION is pleased to have the European Security Strategy the solution for the European Council.

LIBRARY

EN

IL CAMBIAMENTO CLIMATICO COME MINACCIA ALLA SICUREZZA

**The Nobel Peace Prize
2007**

IPCC
INTERGOVERNMENTAL
PANEL ON
CLIMATE CHANGE





Photo: Ken Opprann
**Albert Arnold (Al)
Gore Jr.**
Prize share: 1/2

Intergovernmental
Panel on Climate
Change (IPCC)
Prize share: 1/2

The Nobel Peace Prize 2007 was awarded jointly to Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr. *"for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change"*

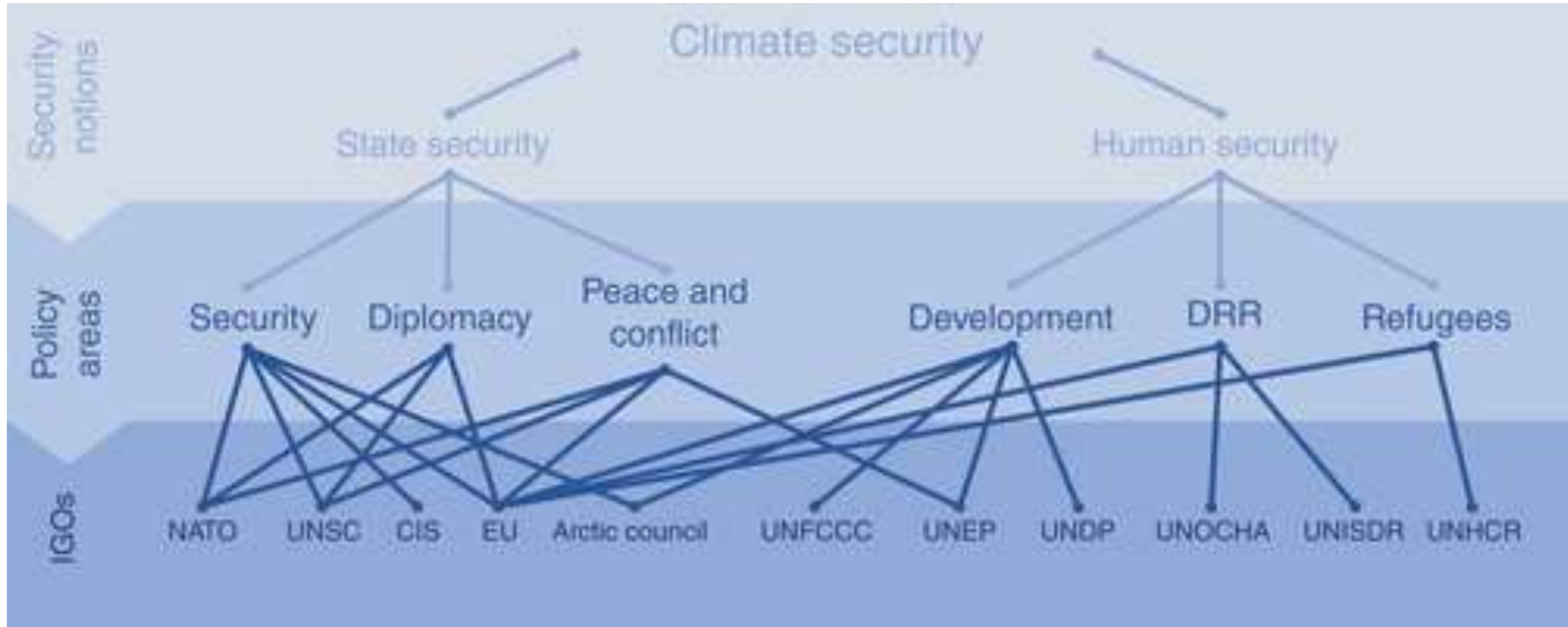


**NATIONAL SECURITY
AND THE THREAT OF
CLIMATE CHANGE**

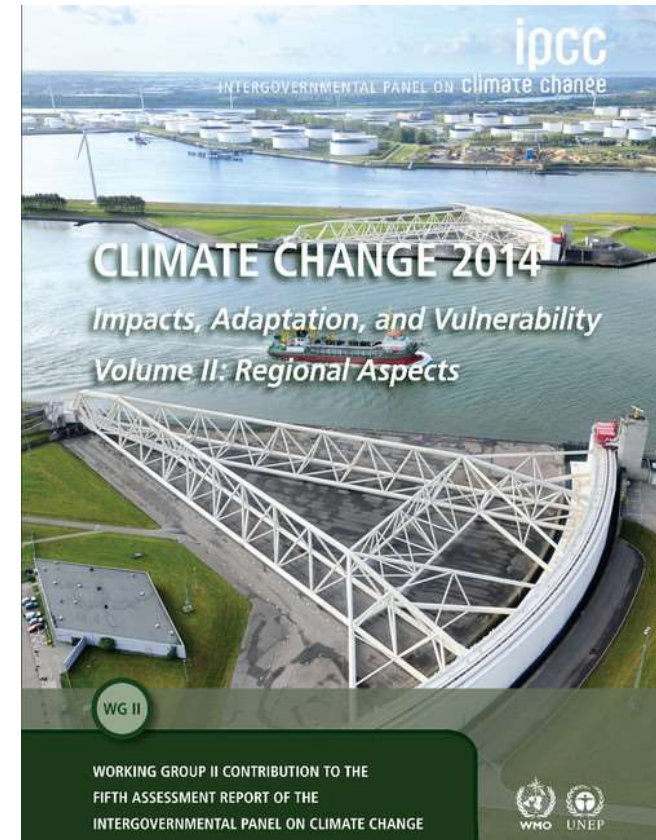
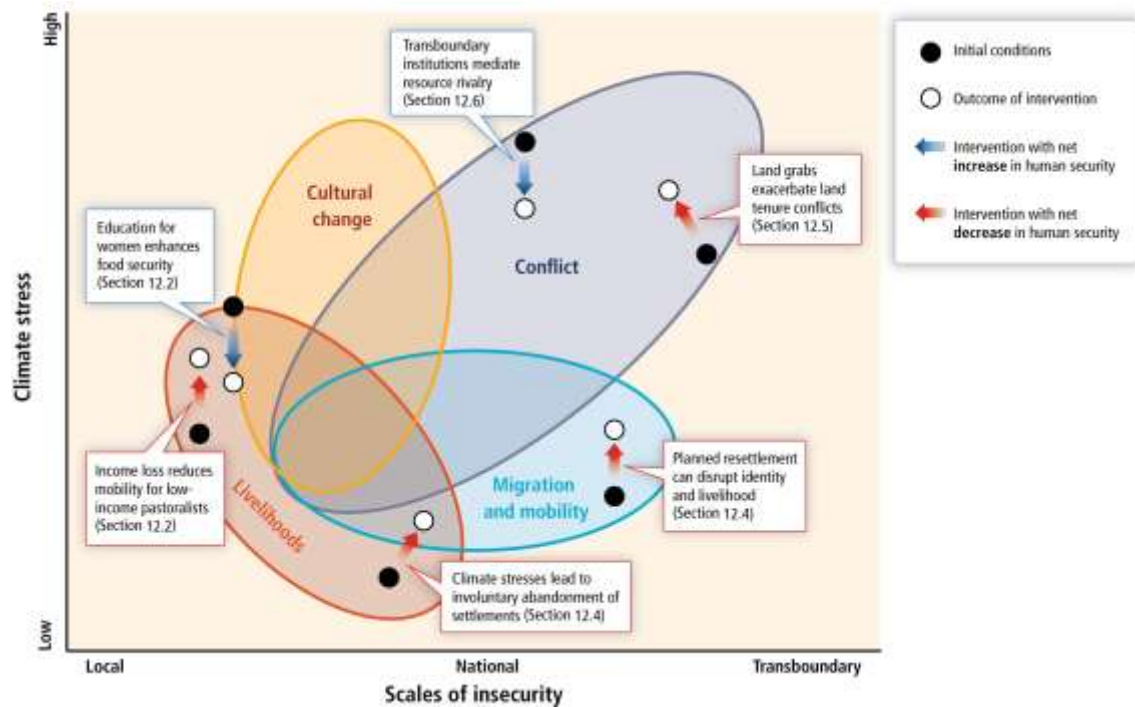
Report by the OMA Commission
March 2006

The OMA Commission
Office of the Secretary of Defense

IL CAMBIAMENTO CLIAMTICO COME UNA QUESTIONE DI SICUREZZA NELL'AGENDA POLITICA



IPCC E SICUREZZA UMANA





G7 GERMANY

2015 | Schloss Elmau

G7 FOREIGN MINISTERS STATEMENT ON CLIMATE CHANGE

- *Climate change is among the most serious challenges facing our world.*
- *It poses a threat to the environment, to global security and economic prosperity.*
- *It has the potential to reverse the progress that has been made in the past decades in tackling global poverty.*
- *Without adequate mitigation and adaptation efforts, the impacts of rising temperatures and changing precipitation patterns heighten the risk of instability and conflict.*
- *We must effectively address this challenge.*

IL NEXUS: QUANDO SI VERIFICA

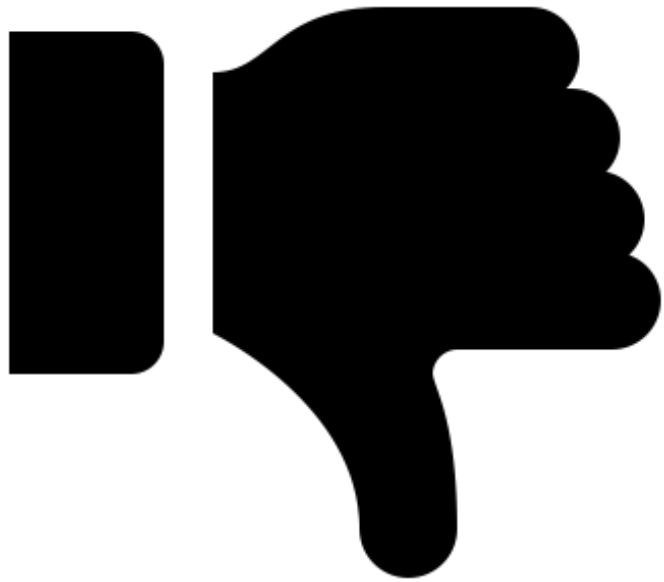
Cambiamento
climatico



conflitti



IL NEXUS: COSA SAPPIAMO

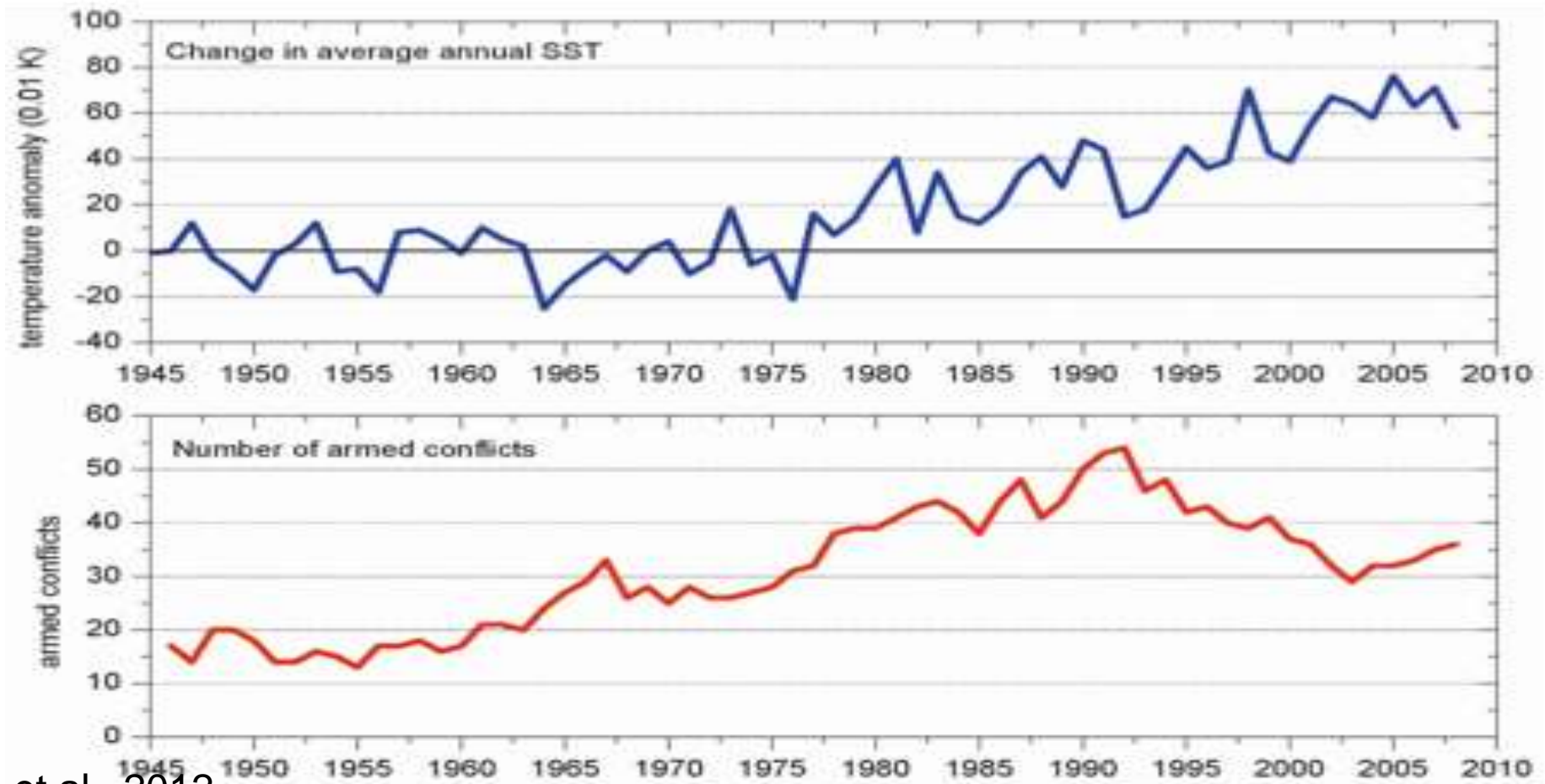


Cambiamento
climatico



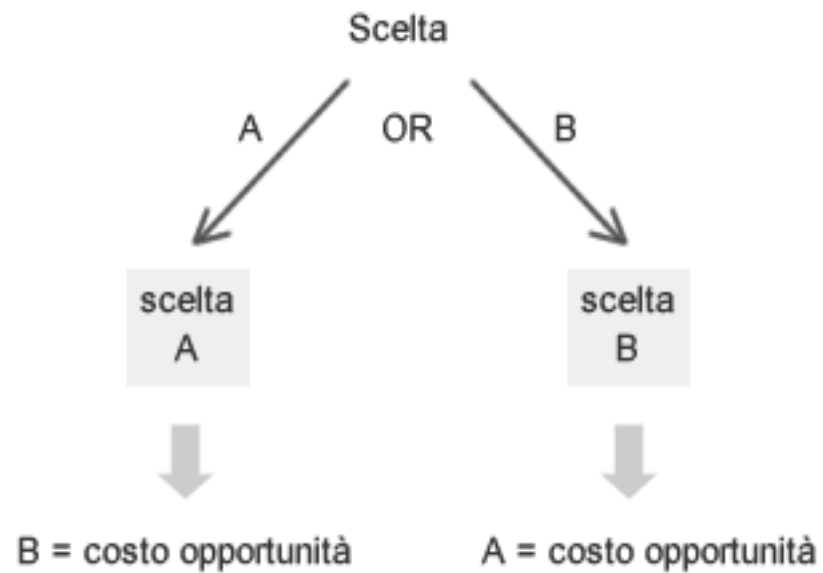
Conflitti
inter-statali

TEMPERATURA GLOBALE E CONFLITTI ARMATI(1945-2008)



Scheffran et al., 2012

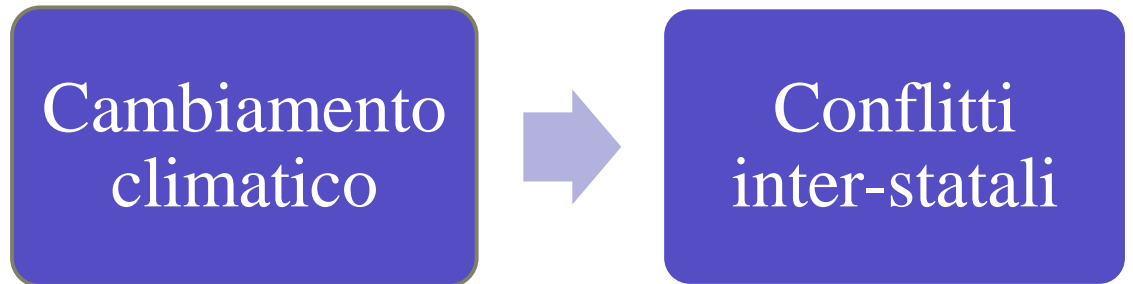
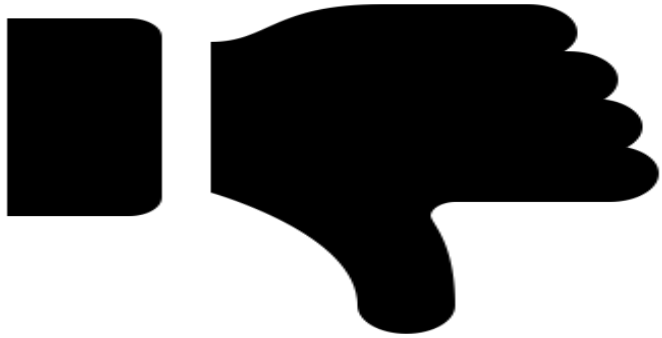
CONCETTO DI COSTO OPPORTUNITÀ



Azioni di adattamento



CORRELAZIONE TRA CAMBIAMENTO CLIMATICO E CONFLITTI TRA DUE O PIÙ STATI



NEXUS: COSA SAPPIAMO?

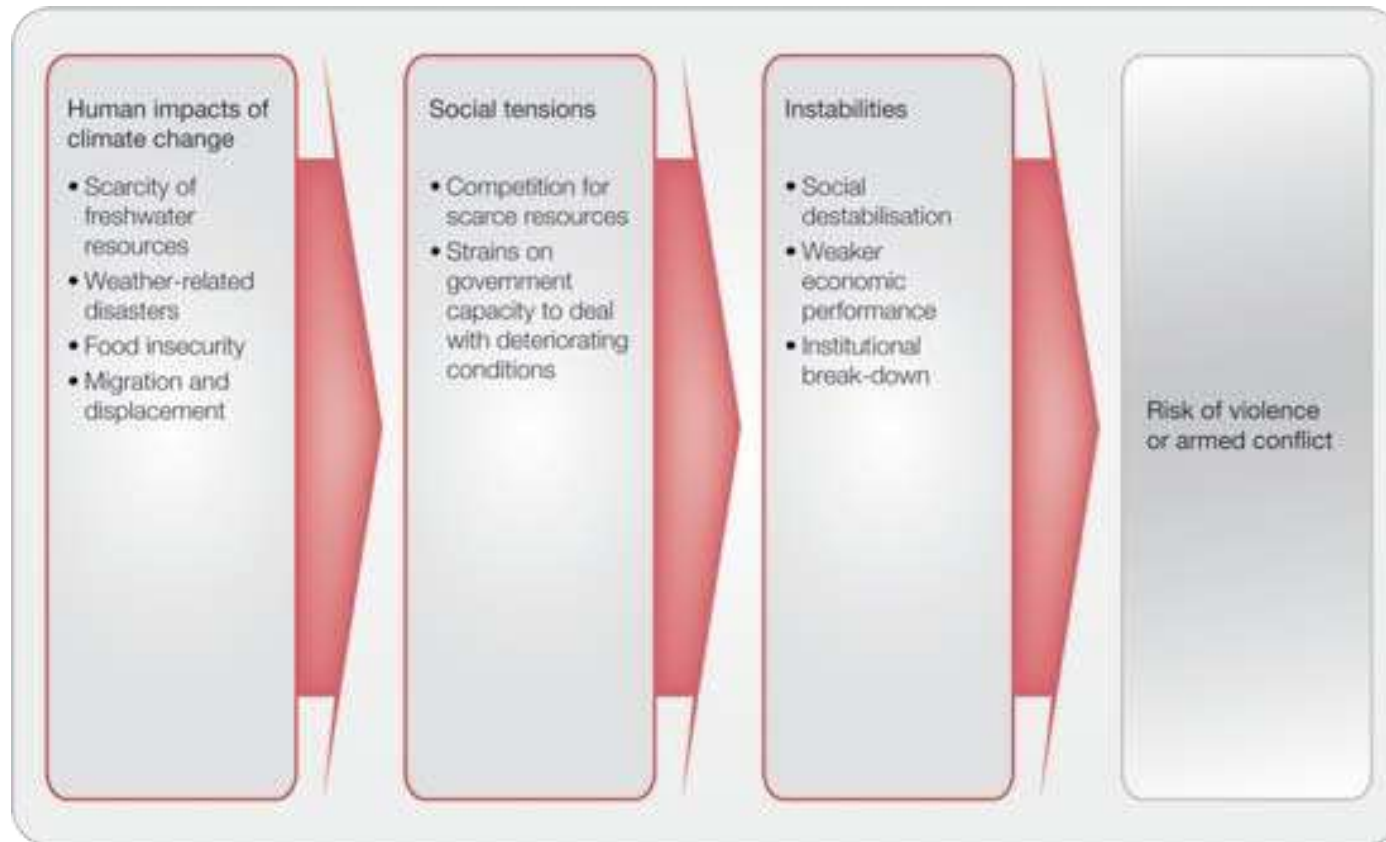


Cambiamento
climatico



Conflitti
intra-statali

CLIMATE-CONFLICTS PERSPECTIVE



SOCIAL-CONFLICTS PERSPECTIVE

Climate change impacts

Temperature increases

Changing rainfall patterns

Sea-level rise

Extreme weather events

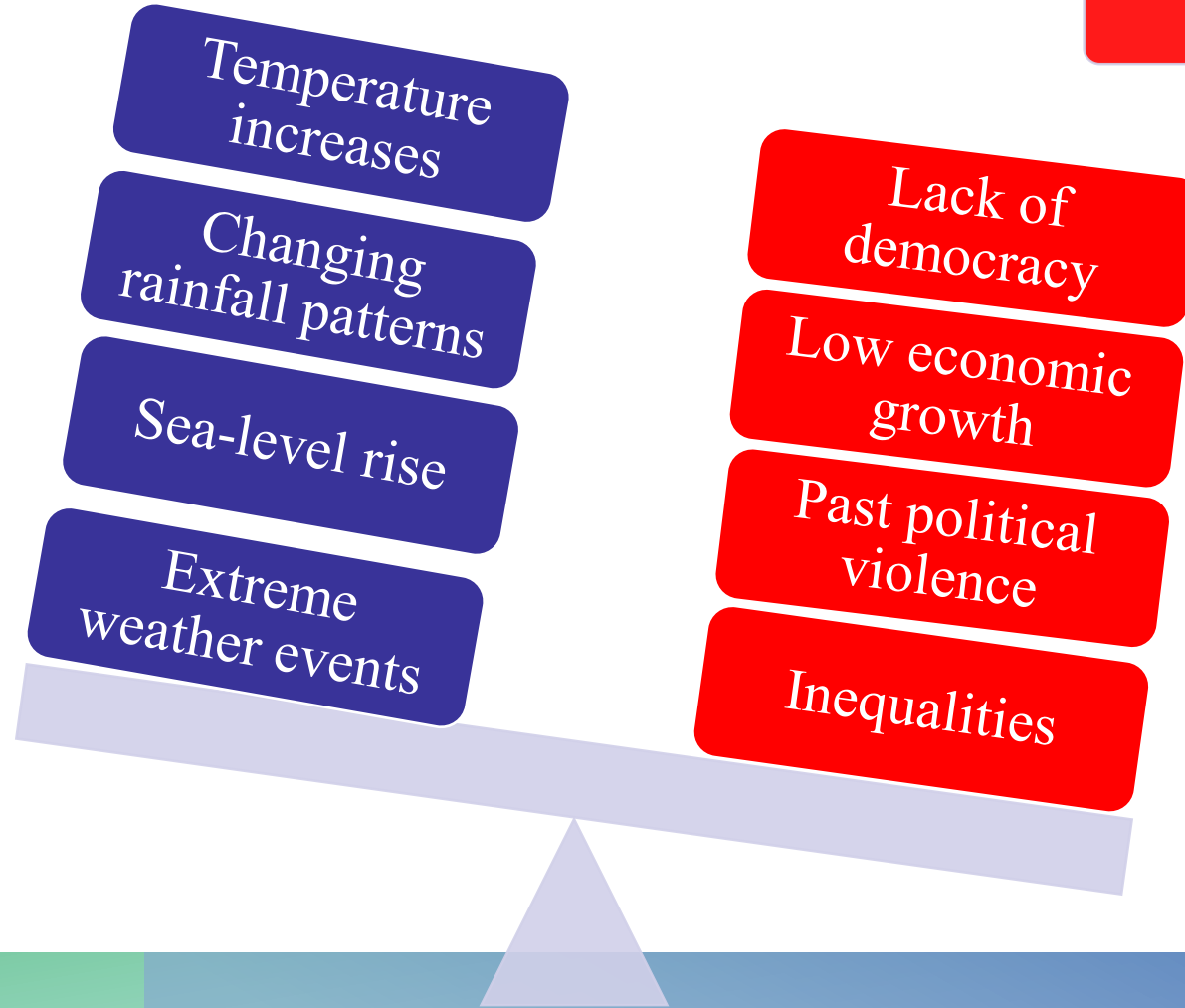
Political and socio-economic factors

Lack of democracy

Low economic growth

Past political violence

Inequalities



COSA CI DICONO GLI STUDI QUALITATIVI?

LETTER

doi:10.1017/S001430011200111

Civil conflicts are associated with the global climate

Siddhant M. Hwang¹*, Kyle C. Metz² & Mark A. Jans¹

It has been proposed that changes in global climate have been responsible for episodes of widespread violence and even the collapse of civilizations¹. But previous studies have not shown that violence can be attributed to the global climate, only that random weather events might be correlated with conflict in some cases^{2,3}. Here we directly associate planetary-scale climate changes with global patterns of civil conflict by examining the dominant inter-annual mode of the modern climate^{4,5}, the El Niño/Southern Oscillation (ENSO). Scientists have argued that ENSO may have driven global patterns of civil conflict in the distant past^{6,7}, a hypothesis that we extend to the modern era and test quantitatively. Using data from 1950 to 2006, we show that the probability of new civil conflicts arising throughout the tropics doubles during El Niño years relative to La Niña years. This result, which indicates that ENSO may have had a role in 23% of all civil conflicts since 1950, is the first demonstration that the stability of modern societies relates strongly to the global climate.

The idea that the global climate might influence the persistence of societies^{8,9} has motivated a growing body of research. However, much of the support for this idea is anecdotal and the two methods being discussed specifically seek to see whether there is a link between fluctuations in the climate and the incidence of violence. The first of these approaches correlates multi-century trends in regional climate with trends in war^{10,11}, but such correlations are weak¹² and global-scale changes are multiple centuries out-of-phase with trends in violence. The second approach avoids confounding trends by correlating modern changes in local annual temperature or rainfall with local civil conflict¹³, but different regional temperatures have yielded different results and the notion that modern local temperature or rainfall trends are analogous for global climate changes has been criticized on three grounds: (1) the global climate may affect many interacting environmental variables that influence conflict but are not directly measured by averages of local temperature and rainfall; (2) systematic environmental changes occur at planetary scales (e.g. volcanic eruptions, greenhouse forcing) that affect global trends but that bias local weather trends that are uncorrelated with trends in other locations; (3) predictable changes in climate and unpredictable weather events may generate very different outcomes, even if they are otherwise identical. To circumvent these concerns, we avoid local proxies for the global climate and instead globally relate global changes in conflict risk to components in the global climate specifically to the tropical annual mode, between El Niño and La Niña phases of ENSO^{4,5}.

ENSO may plausibly influence multiple variables of conflict, such as food production, however, we restrict the analysis to general political violence. We examine the onset and duration of Interstate Conflict Data¹⁴, which codes a country as experiencing conflict onset if there has been 15 battle-related deaths across to a new civil dispute between a government and another regional party over a stated political border (see Supplementary Methods and Supplementary Table 1 for data details). Following common practice¹⁵, a dispute is new if it has been at least 1 year since that dispute was last active. However, each civil country may experience conflict onset in sequential years if the government has disputes with different opposition groups. We

define annual conflict risk (ACR) as a collection of countries to be the probability that a randomly selected country in the test experience conflict onset in a given year. In particular, this ACR measure assumes trends due to the growing number of countries¹⁶ (Supplementary Fig. 1). In an impossible but ideal experiment, we would observe two identical Earths, change the global climate of one and observe whether the two Earths diverged. In practice, we circumvent this experiment if the two Earths that we do observe randomly differ back and forth between two different climate states. Such a case experiment is ongoing and is characterized by rapid shifts in the global climate between La Niña and El Niño.

To identify a relation between the global climate and ACR, we compare countries with themselves when they are exposed to different states of the global climate¹⁷. Heuristically, a society observed during a La Niña is the 'control' for that same society observed during an El Niño treatment. We disrupt this comparison by separating the world into two groups of countries: those whose climate is strongly coupled to ENSO and those weakly affected by ENSO. If climate influences ACR, we expect to observe the larger ENSO signal in the ACR of the former group.

Disrupting the tropical Pacific, ENSO influences virtually the entire tropics by radiating waves through the atmosphere, forcing climate around the globe through so-called teleconnections¹⁸. During an El Niño year, the equatorial region tends to become warmer and drier, whereas shifts in mid and higher latitudes are generally smaller and less consistent¹⁹. To capture this, we partition the globe into two groups based on how coupled they climate are to ENSO, separating countries into teleconnected and weakly affected groups (Fig. 1a; see also Methods, Supplementary Fig. 2–4 and Methods). We identify teleconnected locations using local temperature, instead of other variables^{20,21}, both for theoretical reasons²² and because it is less variable with broader spatial scales. We verify that this partition preserves the well-documented structure of ENSO's impact on countries' average surface temperature, precipitation, and agricultural yields and revenues²³ (Supplementary Table 2 and Supplementary Fig. 3). In the analysis that follows, we base our inferences mainly on correlations over time between ENSO and ACR in the teleconnected group. We define ACR in the weakly affected group only to check that there are no confounding global variables that are correlated with ENSO.

The intensity of the ENSO cycle can be distinguished by anomalies of sea level pressure or ocean surface temperature (SST) over the eastern equatorial Pacific²⁴. We index ENSO by NINO3.4 (Supplementary Fig. 2) the SST anomaly for the open region (Fig. 1a). Our results are insensitive to using alternative indices (Supplementary Fig. 7); but adopting ENSO signals requires that we account for the 'spring barrier'²⁵ by averaging NINO3.4 from March to December rather than over the entire calendar year (see Fig. 1b; see also Supplementary Table 3, 4 and Methods).

We report the conflict parameter ACR on ENSO for both groups and detect a large and significant increase in ACR associated with warmer ENSO values only in the teleconnected group (Fig. 2a, b; and Supplementary Methods). We build a linear multiple regression

Warming increases the risk of civil war in Africa

Markus H. Burk^{1,2,3}, Edward Miguel¹, Shankar Satyanarayan¹, John A. Sigmund¹, and David B. Lobell¹

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Warfare conflict within nations has had disastrous humanitarian consequences throughout much of the world. Here we undertake the first comprehensive examination of the potential impact of global climate change on armed conflict in sub-Saharan Africa. We find strong historical linkages between civil war and temperature in Africa, with warmer years leading to significant increases in the likelihood of war. When combined with climate model projections of future temperature trends, this historical response to temperature suggests a roughly 54% increase in annual conflict incidence by 2050, or an additional 200,000 battle deaths if future wars are as deadly as recent wars. Our results suggest an urgent need to reform African government and foreign aid donors' policies to deal with rising temperatures.

and conflict | climate change

More than two-thirds of the countries in sub-Saharan Africa (Africa) (see Methods) have experienced civil conflict since 1960 (1), resulting in millions of deaths and monumental human suffering. Understanding the causes and consequences of this conflict has been a major focus of social science research, with recent empirical work highlighting the role of economic fluctuations in shaping conflict risk (2). Combined with increasingly available evidence on the potential disruptive effects of climate change on human enterprises, such as through possible declines in global food production (3) and significant sea level rise (4), such findings have encouraged claims that climate change will worsen instability in already volatile regions (5–7).

Despite a growing consensus effort, however, linkages between climate change and conflict remain uncertain, however. Most existing studies linking the 2 variables have focused on the role of precipitation in explaining conflict incidence, finding past conflict in Africa more likely in drier years (2, 7). Given that African countries remain highly dependent on rain-fed agriculture for both subsistence and economic production, with agriculture accounting for more than 50% of gross domestic product and 45–90% of employment across much of the continent (8), the focus on precipitation is understandable. But such a focus leaves important implications for changes in conflict risk under global climate change, as climate models disagree on both the sign and magnitude of future precipitation change over most of the African continent (9). This uncertainty confounds efforts aimed at building a more comprehensive understanding of the human costs of climate change, and planning appropriate policy responses.

Here, global climate model projections of future precipitation were widely, predictions of future temperatures are more certain, particularly over the next few decades. With recent studies emphasizing the potential role of temperature in explaining past spatial and temporal variation in agricultural yields and economic output in Africa (10, 11), it is now apparent that both the temperature fluctuations could affect past and future conflict risk. But few studies have explicitly examined the role of temperature. An analysis of historical temperature trends in 148 U.S. cities that long-term fluctuations of war frequency follow cycles of temperature change (12) however, the relevance of this to modern-day Africa is uncertain.

Author disclosures of potential conflicts of interest and author contributions are found at the end of this article.

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COSA CI DICONO GLI STUDI QUANTITATIVI?

COMMENTARY

Modeling and data choices sway conclusions about climate-conflict links

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In an era of growing concern about the human aspects of climate change, the academic and policy communities are paying increasing attention to the possible link between weather anomalies and violent conflict. Early research papers on the topic by Burke et al. (1) and the analysis and assessment of their work by Hsiang (2) claim contradictory findings, the first drawing a link between increased temperatures and war, and the second—using an expanded dataset and different models—casting those results into question. Hsiang and Hsiang (3) now enter the fray and argue that the original Burke et al. (1) conclusions are robust and present a “roadmap” for future studies of the climate-conflict relationship.

Hsiang and Hsiang (3) compare the coefficient estimates and fit of Hsiang’s model (2) to the Burke et al. (1) findings using

Table 1. Country fixed effects models

	1	2	3
	Estimate	SE	Intercept
Intercept	7.830	1.072	-0.128
Temp.	0.007	0.004	0.009
Open.	0.011	0.005	-0.000
Popul.	0.012	0.004	0.117
Popul. ²	-0.007	0.000	-0.019
Year	-0.003	0.000	0.000
Constant	NA	NA	NA
R-squared	0.110	0.105	0.105
Adjusted R-squared	0.076	0.076	0.076

Model 1 uses the Burke et al. (1) model. Model 2 uses the Hsiang (2) model. Model 3 includes the Hsiang (2) model plus the following variables: Δ population, Δ population density, Δ population density squared, Δ population density cubed, Δ population density to the fourth power, Δ population density to the fifth power, Δ population density to the sixth power, Δ population density to the seventh power, Δ population density to the eighth power, Δ population density to the ninth power, Δ population density to the tenth power, Δ population density to the eleventh power, Δ population density to the twelfth power, Δ population density to the thirteenth power, Δ population density to the fourteenth power, Δ population density to the fifteenth power, Δ population density to the sixteenth power, Δ population density to the seventeenth power, Δ population density to the eighteenth power, Δ population density to the nineteenth power, Δ population density to the twentieth power.

Conclusions about the climate-conflict relationship are also contingent on the assumptions behind the respective statistical analyses. Although the simple fact is generally understood, we stress the disciplinary preferences in modeling decisions. Hsiang and Hsiang (3) use a different statistical procedure for their analysis (10). For identifying causal relationships, using binary variables for the units of analysis to capture all confounding influences upon an outcome of interest (time, war). This perspective allows them to isolate the climate effects and make the case for a conservatively significant higher risk of conflict with increased temperatures (1). Different estimation strategies have led to some inconsistency in the broader area of civil war research (6). Regarding model selection, Hsiang (7) has bluntly suggested, “this is a messy business, which seems to be dominated by practice less by facts than by the department in which one was trained.”

Crucial to the PE approach is understanding cross-national and temporal social dynamics to frequently leveled, even if the data sets exhibit variation in levels (cross-sectional) for the response. Beck and Katz (8) critique the use of PE dummy variables in the study of international economic and political relations and conclude we believe that by including all independent variables, Hsiang and Hsiang (3) are effectively eliminating other known explanations for violence. Conflict researchers generally prefer a modeling approach that uses dummy and social predictors. Our published PE and ongoing work has identified a significant temperature effect in causing conflict risk, but this variable is less effective in predicting conflict than political factors. The conclusion that can be drawn from PE results are of an additional note for broadly explaining conflict at cross-national levels: almost everything is needed in such a reduced form actually fails to help.

A notable effect remained model (10). It shows a different mode of thinking about

Model 1 uses the Burke et al. (1) model. Model 2 uses the Hsiang (2) model. Model 3 includes the Hsiang (2) model plus the following variables: Δ population, Δ population density, Δ population density squared, Δ population density cubed, Δ population density to the fourth power, Δ population density to the fifth power, Δ population density to the sixth power, Δ population density to the seventh power, Δ population density to the eighth power, Δ population density to the ninth power, Δ population density to the tenth power, Δ population density to the eleventh power, Δ population density to the twelfth power, Δ population density to the thirteenth power, Δ population density to the fourteenth power, Δ population density to the fifteenth power, Δ population density to the sixteenth power, Δ population density to the seventeenth power, Δ population density to the eighteenth power, Δ population density to the nineteenth power, Δ population density to the twentieth power.

Climate not to blame for African civil wars

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Local actors within policy and practice contend that environmental variability and shocks, such as drought and prolonged heat waves, drive civil wars in Africa. Recently, a widely publicized scientific article appears to corroborate this claim. The paper investigates the causal foundation for the claimed relationship in detail, using a host of different model specifications and alternative measures of drought, heat, and civil war. The paper concludes that climate variability is a poor predictor of armed conflict. Instead, African civil wars can be explained by genetic, historical, and cultural factors, including prewar political institutions, poor national economic, and the collapse of the Cold War system.

climate • climate change • conflict • security

Although the onset of climate change remains under debate and the accuracy of future projections is questioned, another aspect of global warming has attracted far greater controversy: links to the background. Research on security implications of climate change is still in its infancy, and contemporary discussion is shaped by conjecture and ideographic evidence. Absence of a solid research tradition notwithstanding, key actors do not seem far from proposing that future wars will be fought over diminishing resources (1–6). However, the science of “climate breach conflict” also has received some support within academic research (3, 4). This paper investigates the scientific evidence base for the claimed relationship. Using a host of alternative measures of drought, heat, and civil war under various model specifications, the paper concludes that climate variability is a poor predictor of armed conflict. Instead, African civil wars can be explained by genetic, historical, and cultural conditions, including political institutions, poor national economic, and the collapse of the Cold War system.

Results
There has been a significant warming of the globe over the past half century (7). Although changes in temperature and precipitation patterns vary between regions, the African continent is a whole has become notably drier and hotter, an illustration in Fig. 1. Most of this drying has occurred along the Mediterranean, northern Sahara, and southern Africa, subsonic parts of East Africa and the Horn have become wetter. According to most Intergovernmental Panel on Climate Change scenarios, this trend will continue (7). The cause of the period has most significant changes in civil war occurrences, with a gradual accumulation of conflict extending beyond the Cold War period, followed by a rapid drop since the late 1990s. The time trend is not exactly linear, a slightly different pattern, with the highest peak in annual casualties in the initial postconflict years and another one shortly after the mid-2000s. The first decade of the 21st century has been a comparatively peaceful one. In Africa generally, Fig. 1 demonstrates a steady upward trend for the opposing trends in climate and conflict over the past 25 yr.

Recently, a PNAS article by Burke et al. received wide publicity for its reported strong empirical connections between civil war and temperature in Africa (8, 9). In fact, Burke et al. concluded that adverse impacts of future warming will outweigh any likely positive effects of economic growth and democratization in Africa. Assuming constant growth in per capita income and the

scenario, we should expect a 54% increase in civil war incidence by 2041.

There are good reasons to be skeptical about such conceptual claims. First, the study is limited to major civil wars and fails to distinguish between linear war episodes (<1,000 annual casualties) and great. The stringent inclusion criteria includes a number of crucial methodological problems in the design—the classic region of interest (locally-induced conflicts)—including in Chad, Niger, Mali, and Senegal. It remains unclear whether the results hold up if alternative and more inclusive definitions of conflict are applied. Second, the Burke et al. (8) study applies an unconventional operationalization of the dependent variable, focusing on protracted rather than outbreak of violence, but including only conflict years that contain a minimum of 1,000 direct fatalities. This has some unfortunate consequences. For example, consider the civil war in Sierra Leone. The conflict is widely accepted as lasting from March 1991 until the ceasefire and signing of the Accords in late 2002.¹ However, the Burke et al. (8) article considers Sierra Leone as war in 1994–1999 only, the only 7 yr in which direct annual casualty estimates exceeded the 1,000 deaths threshold. Using climate data for 1997–1999 to explain a war that had caused approximately between 2,000 and 2,500 battle deaths by 1995 (14), however, makes little sense. Third, the empirical analysis by Burke et al. is limited to the period from 1981 to 2002. Since 2002, civil war incidence and severity in Africa have decreased further while the warming and drying of the continent have persisted (Fig. 1). Fourth, the study replicates conventional raw-dating correlation with primary fixed effects and time trends to response to control methodological concerns. However, the methodological rationale and theoretical justification for these fixes can be questioned, and they therefore introduce other problems.

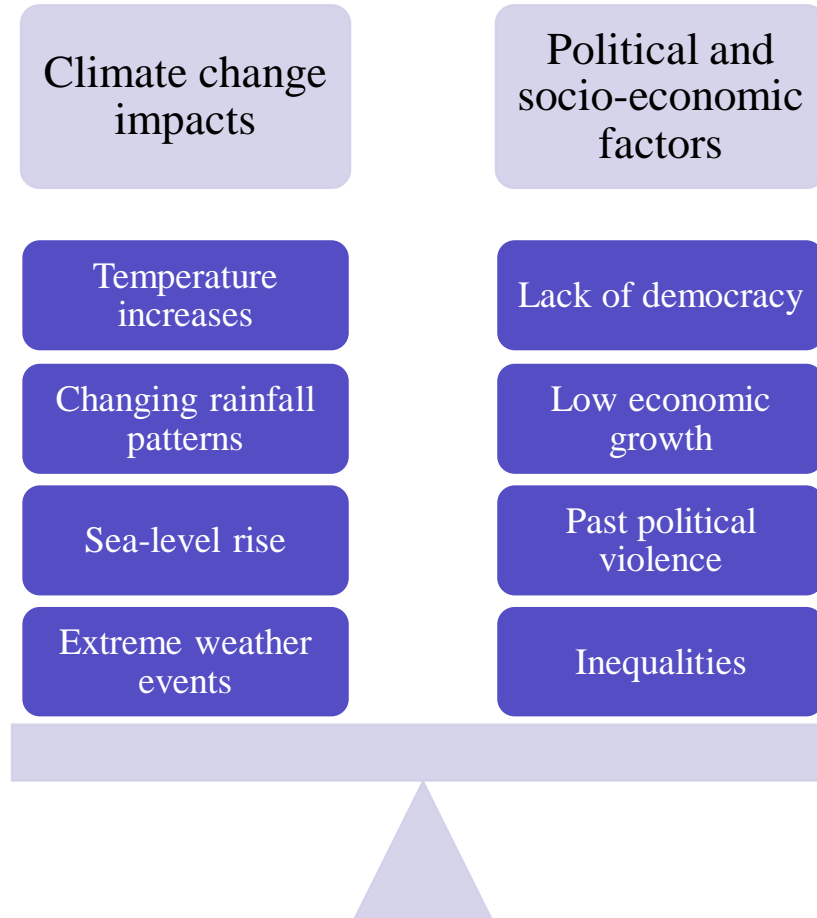
The present paper provides a more comprehensive evaluation of civil war climate variables and civil war risk in Sub-Saharan Africa. It offers a number of key improvements on earlier research. First, it departs from a fixed, narrow definition of civil war by applying multiple comprehensive measures of armed conflict across the continent, as well as fully utilizing the full annual deaths threshold. Second, an inclusive definition criterion threshold of 27 annual battle deaths encompasses better methodological of violent conflict within contexts of conventional statistical analysis (15–18). Second, the analysis models the outbreak and incidence of civil war in distinct processes and develops predictor candidates for climate conditions before the initiation of

Author contributions: H.H. designed research, performed research, analyzed data, and wrote the paper.

The author declares no conflict of interest.
This article is a U.S. Government work and, as such, is in the public domain in the United States of America.

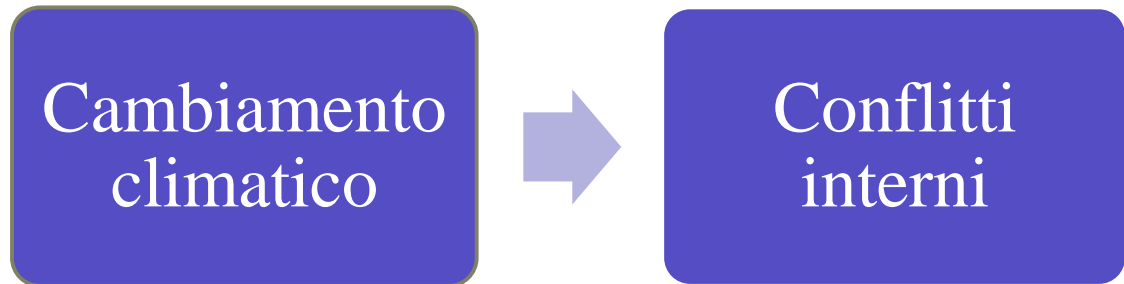
¹As in previous literature (Burke et al. 8), the article concludes that a significant impact of future warming will outweigh any likely positive effects of economic growth and democratization in Africa. Assuming constant growth in per capita income and the

APPROCCIO SETTORIALE E NEXUS



NEXUS: COSA SAPPIAMO

Si...Se

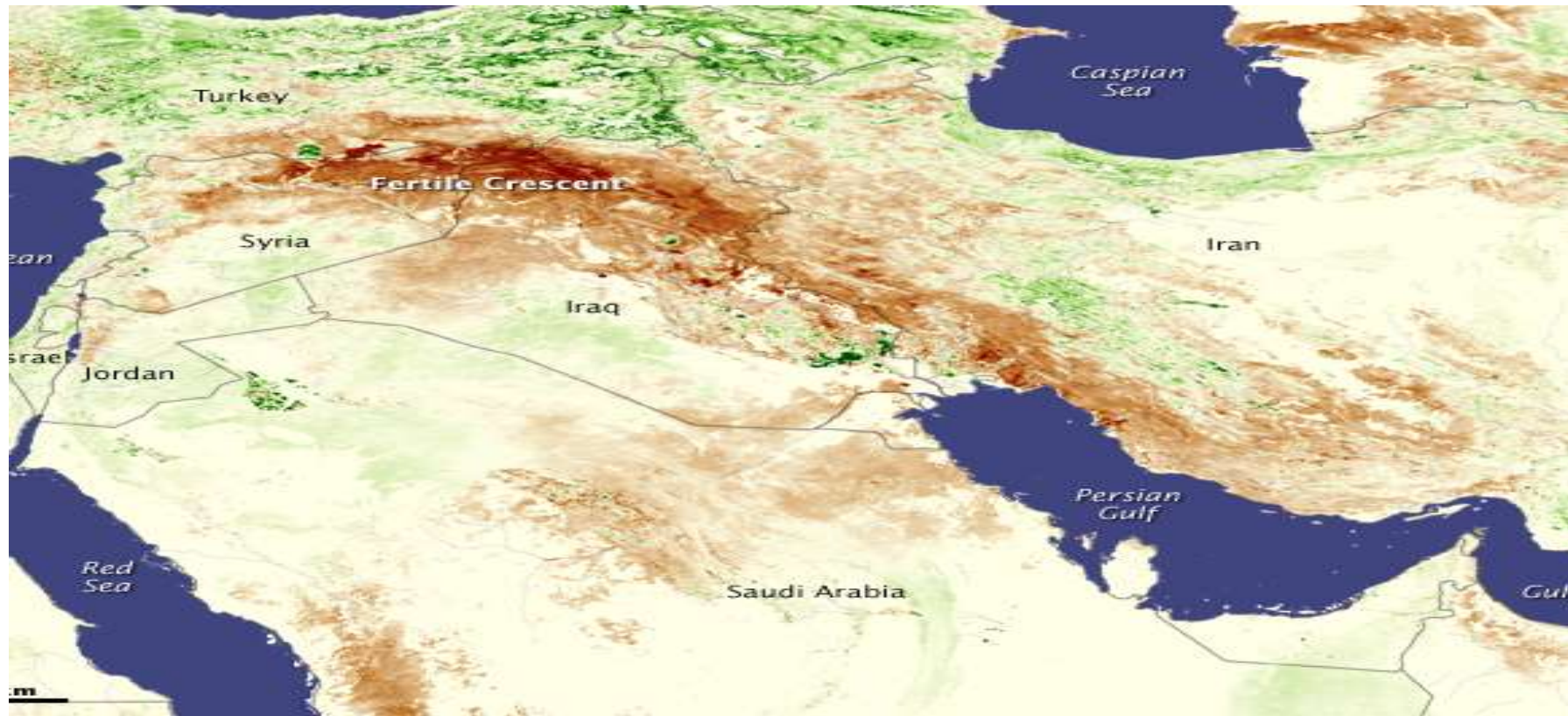


CAUSE DEL CONFLITTO SIRIANO

- Authoritarian, corrupt, unrepresentative, and unfair regime
- Social and economic inequalities within the country
- Sectarian disparity



LA VARIABILE NASCOSTA: LA SICCITÀ



SICCITÀ COME VARIABILE ESPLICATIVA

Studies claiming that climate change played a role in the onset of the Syrian civil war tend to use a four-stage process (Gleik, 2014; Werrell, Femia Stenberg, 2015; Kelly et al., 2015; Femia, Werrell, 2017):

- Syria experienced a heavy drought in the period between 2006-2009 and this drought was very likely an effect of human-induced climate change;
- The drought hit the north-eastern agricultural areas very hard where the lack of effective adaptation capacity or external support caused the collapse of the regional agricultural economy, contributing to massive loss of livelihood;
- This loss caused a massive migration from rural regions to peri-urban areas of major cities;
- The migration aggravated problems related to social service provision and resource availability in (peri-)urban areas, facilitating the onset of protests and the subsequent civil war

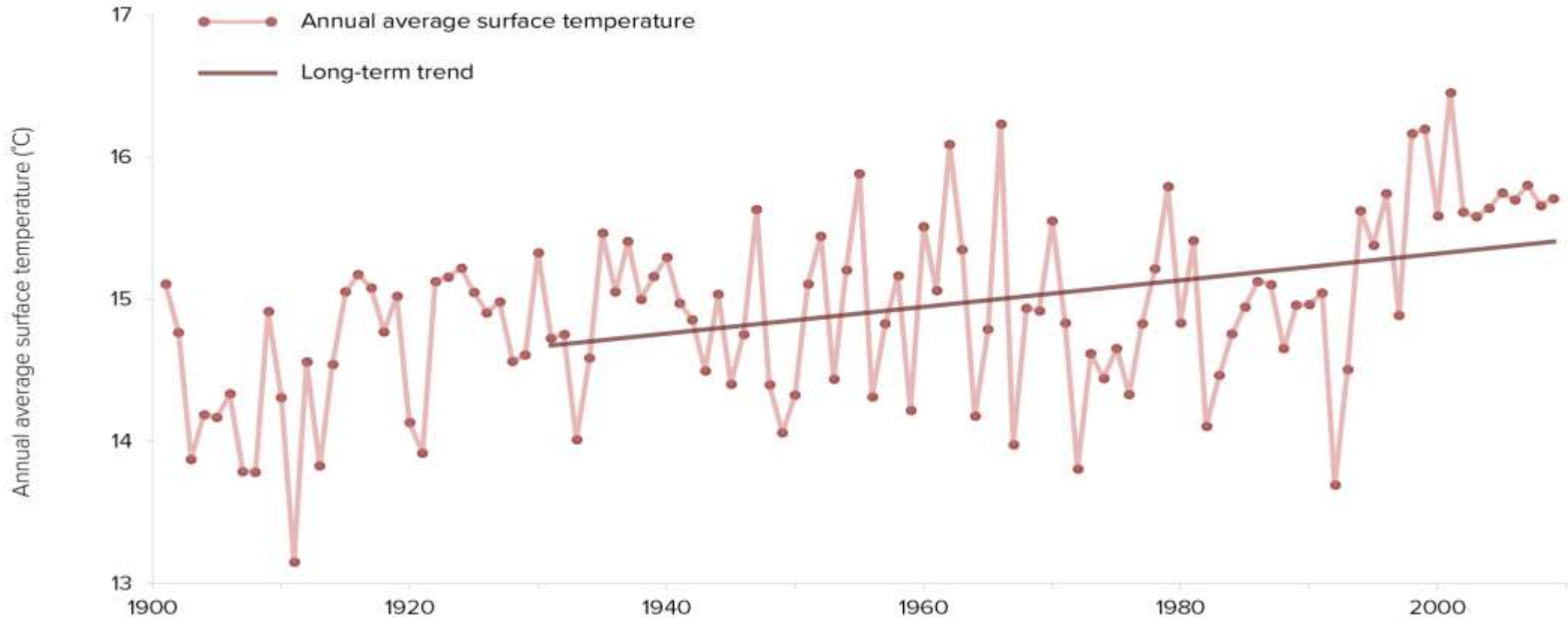
SICCITÀ COME VARIABILE NON ESPLICATIVA

Studies claiming that climate change played no role or a minor in the onset of the Syrian civil war (de Chatel, 2014; Selby, 2014; Selby et al., 2017):

- No scientific evidence to confirm the relationship drought and human-induced climate change;
- Other middle eastern countries such as Turkey, Palestine, Israel and Jordan were affected by drought but in these countries no revolt took place;
- This confirms that other socio-economic and political factors contributed to the Syrian war: discrimination against non-Alawite group, heavy state repression, economic liberalization and rising unemployment, poor public services provision.

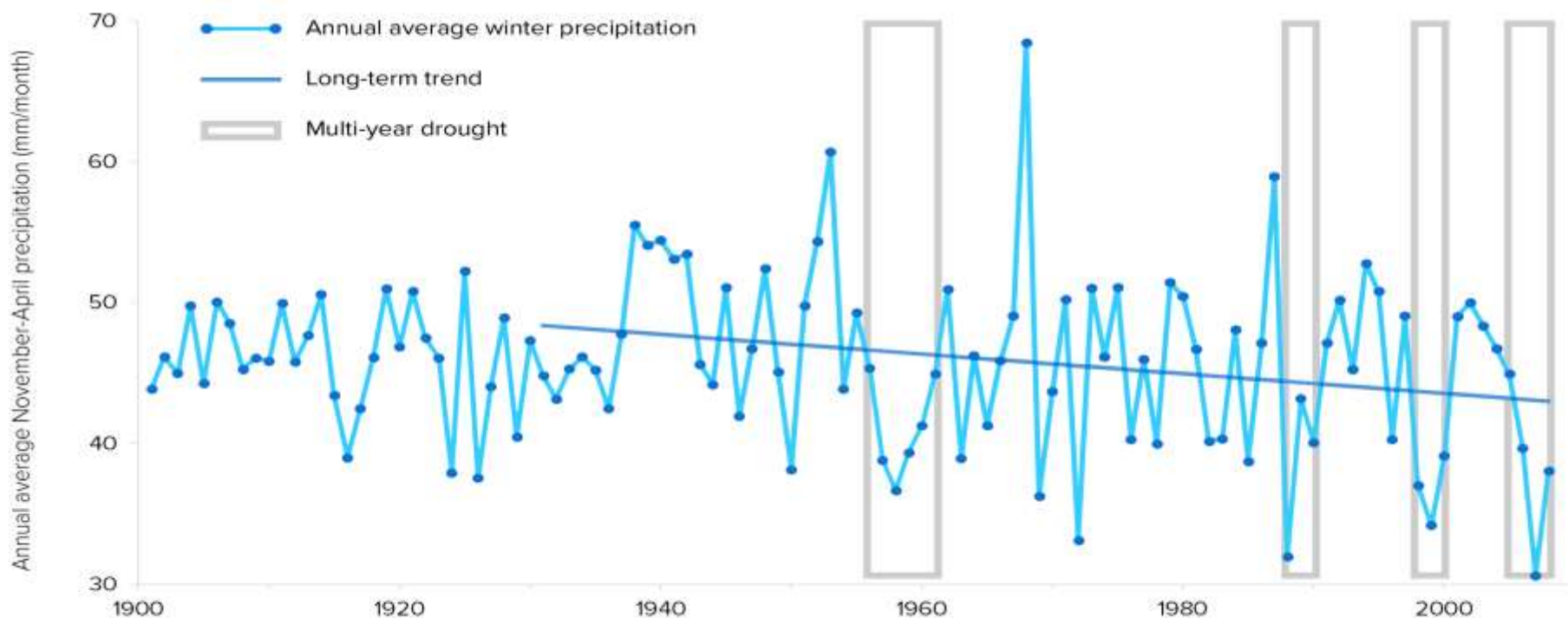
Temperature (1901 - 2009)

Temperature has shown a long-term increasing trend in the Fertile Crescent. Every year from 1994 through 2009 was warmer than the century-long average for the region.



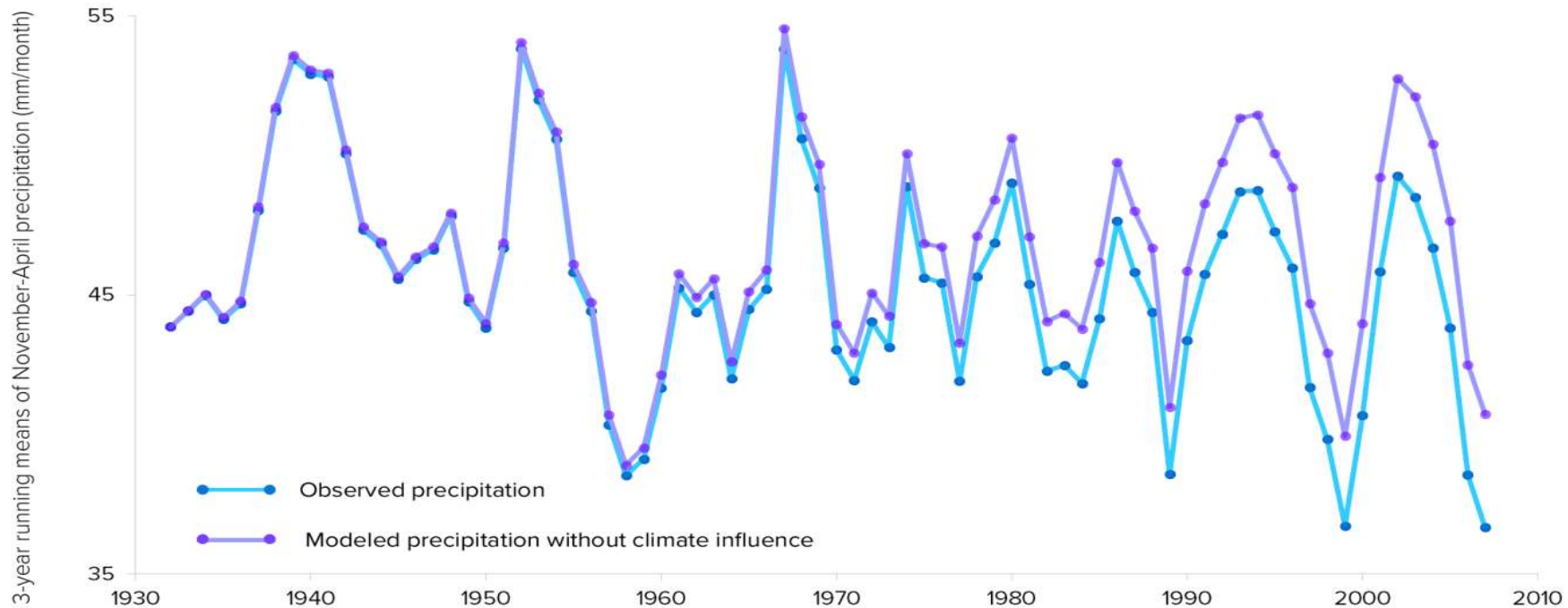
Rainfall (1901 - 2008)

Precipitation patterns are changing in the Fertile Crescent. Rainfall from November through April, when most of it occurs, has decreased 13% since 1931. The gray boxes represent multi-year droughts, which are defined as three or more consecutive years when precipitation is below the century-long average.

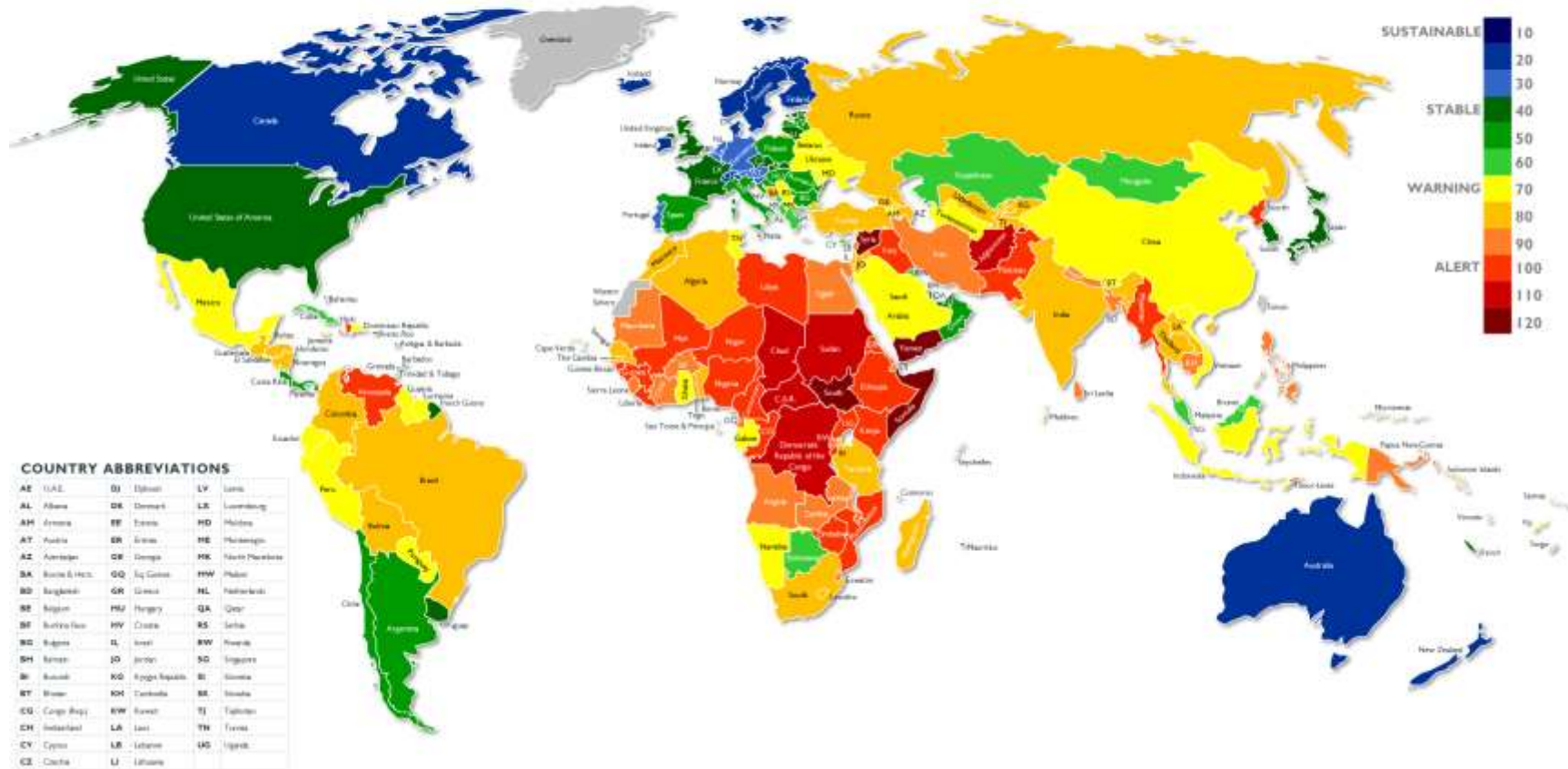


Separating the Influence of Climate Change (1932 - 2007)

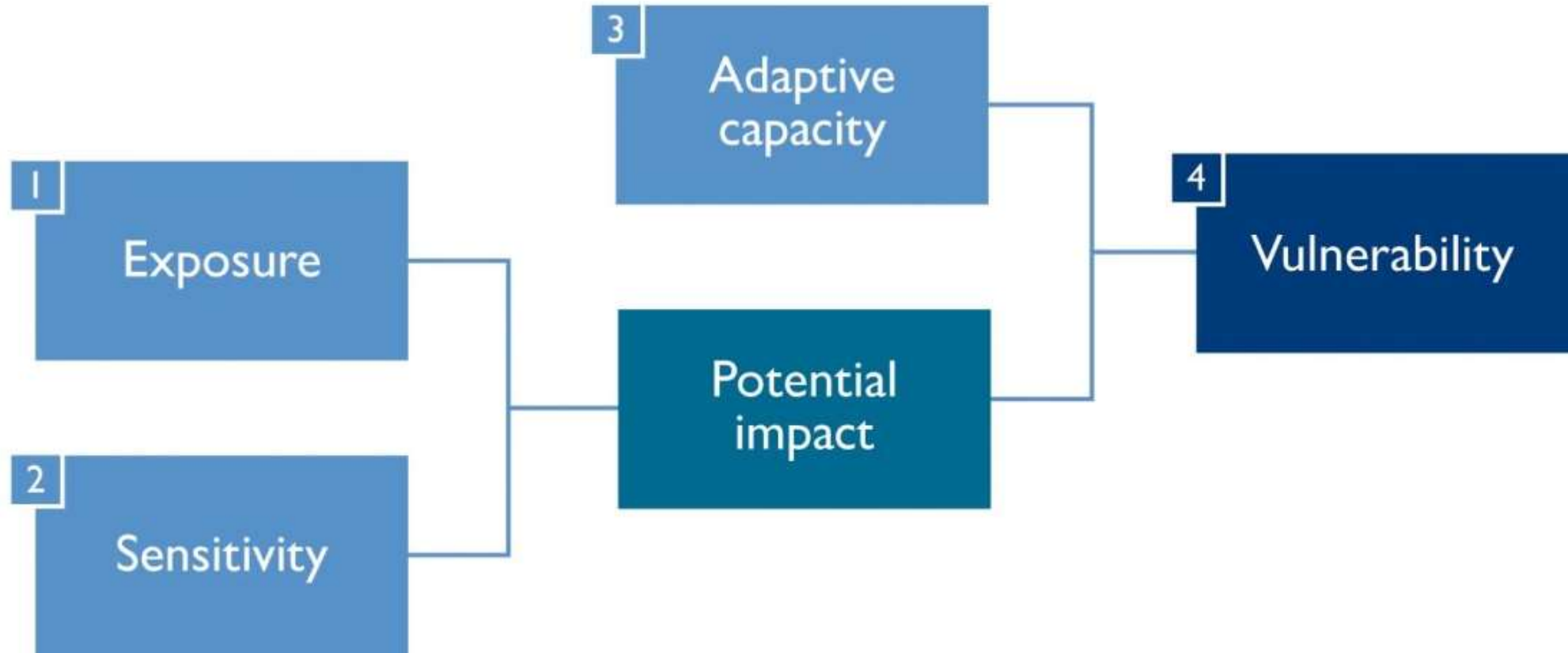
Using measurements of carbon dioxide concentrations in the atmosphere coupled with climate models and statistical analysis, scientists were able to estimate what rainfall in the Fertile Crescent would have looked like without the influence of climate change.



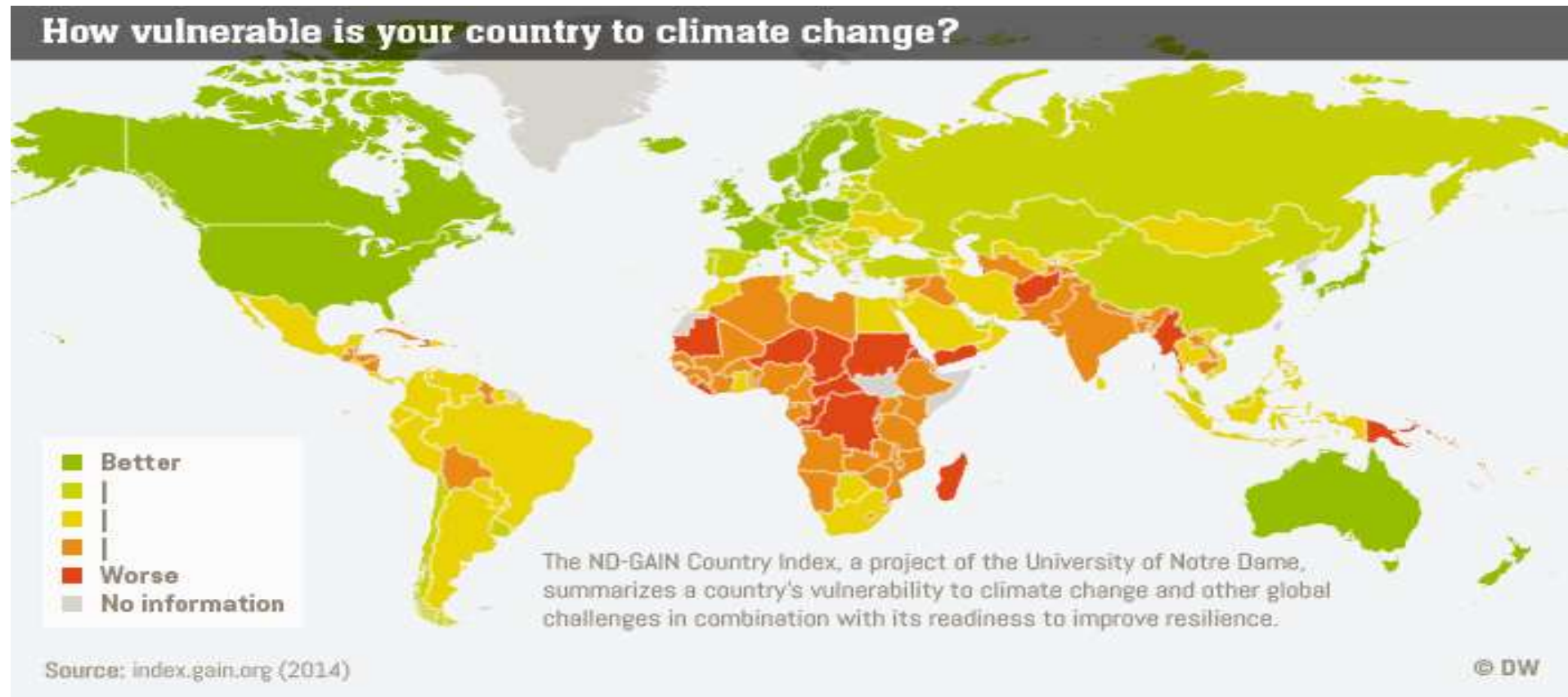
Graphic based on: Kelley, C.S., S. Mohtadi, M.A. Cane, R. Seager and Y. Kushnir, 2015: Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proc. Nat. Acad. Sci.*, 112(11): 3241 - 3246, doi/10.1073/pnas.1421533112.



VULNERABILITÀ CLIMATICA IPCC



Vulnerabilità della Siria al Cambiamento climatico

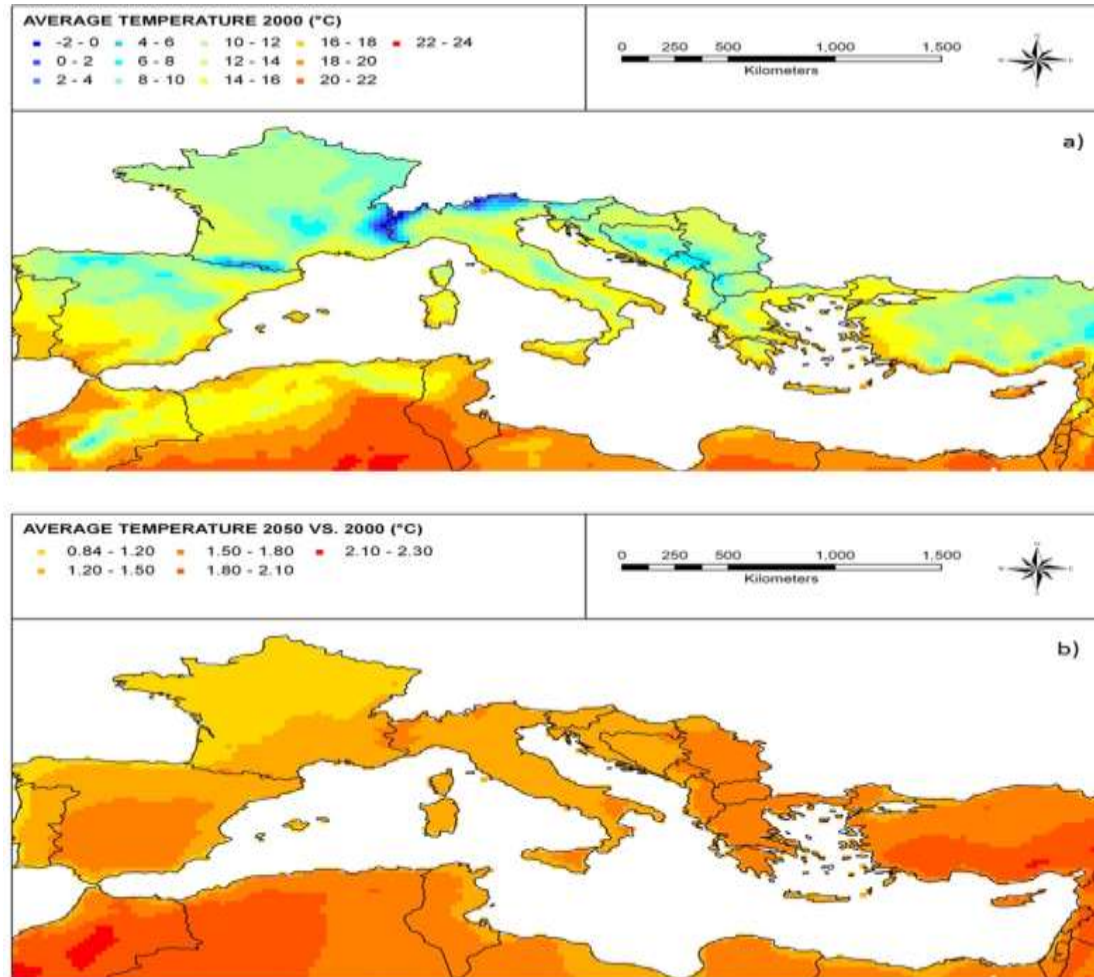


VULNERABILITY AND READINESS TO CLIMATE CHANGE

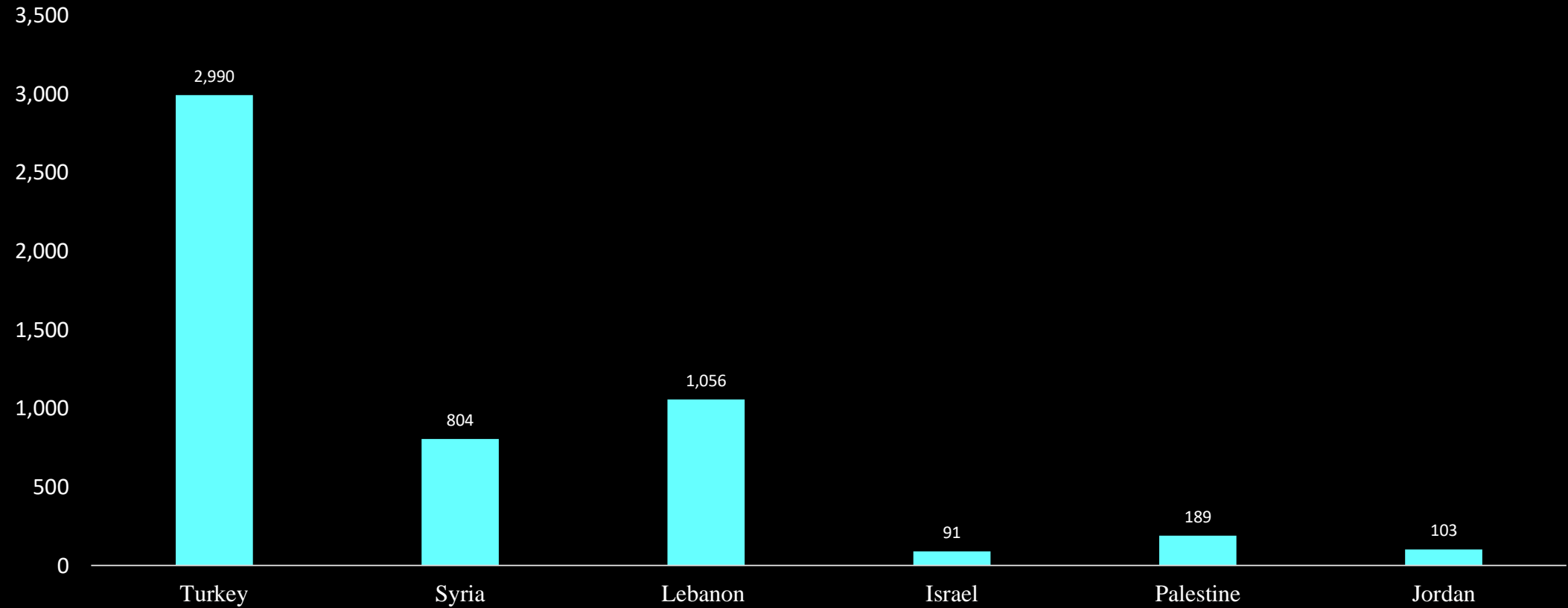
Country	ND-GAIN Index		Vulnerability		Readiness	
	Rank	Score	Rank	Score	Rank	Score
Israel	29	61.4	19	0.338	32	0.567
Turkey	47	56.3	21	0.339	66	0.464
Jordan	81	50	50	0.378	108	0.378
Lebanon	106	45.2	78	0.408	133	0.311
Syria	134	39.2	102	0.439	179	0.222

Source: University of Notre Dame, 2010

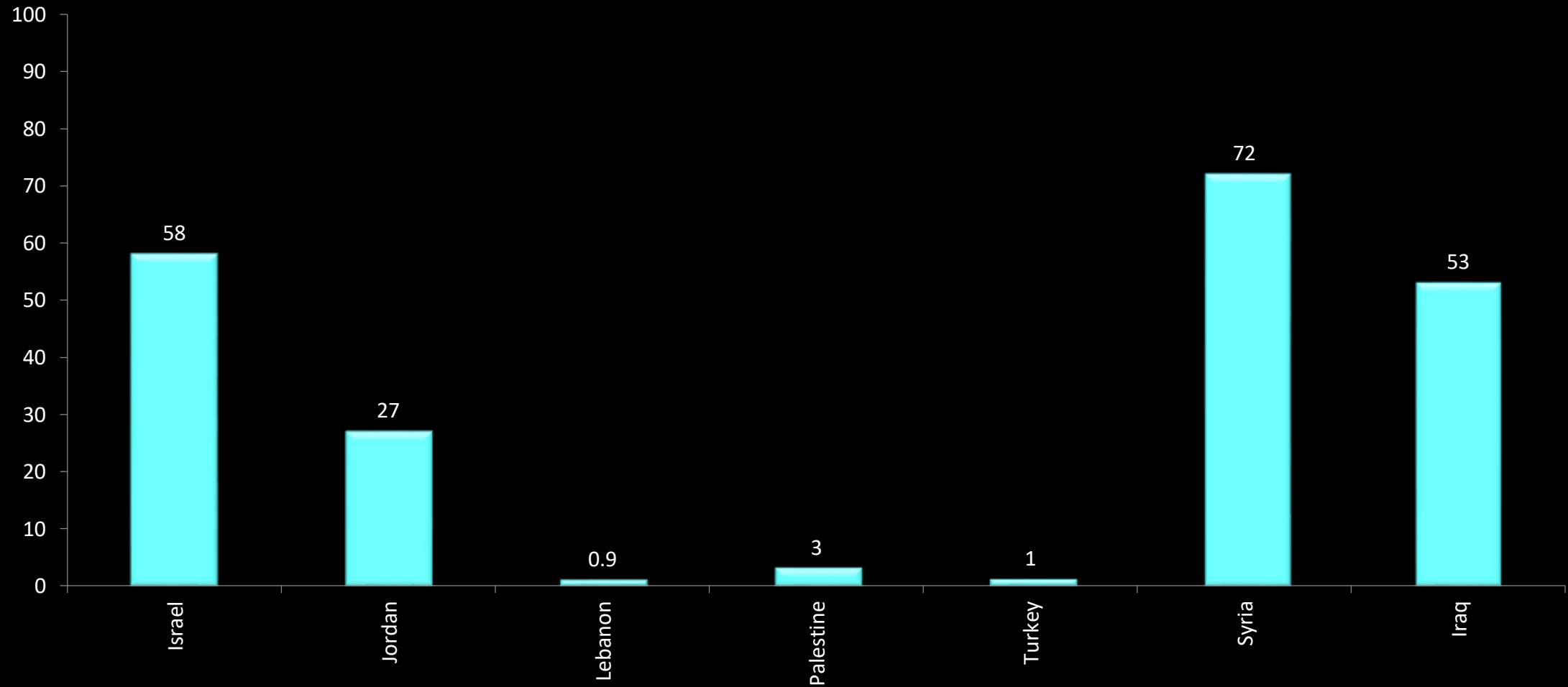
Il Mediterraneo come un hot-spot del cambiamento climatico



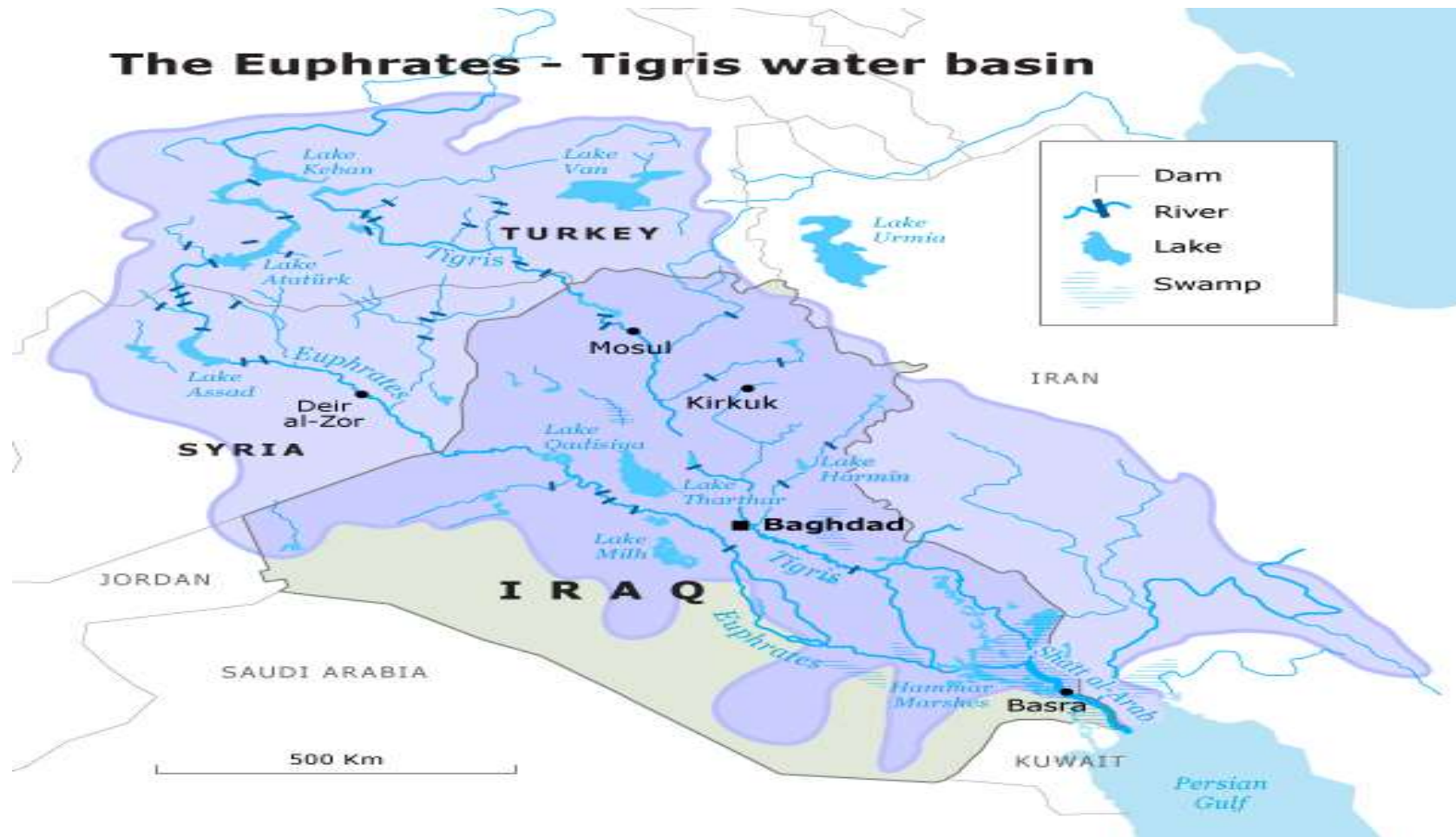
Risorse idriche rinnovabili pro-capite (m³)



Indice di dipendenza delle risorse idriche rinnovabili (%)



BACINO TIGRI-EUFRATE



PROGETTI IDRICI



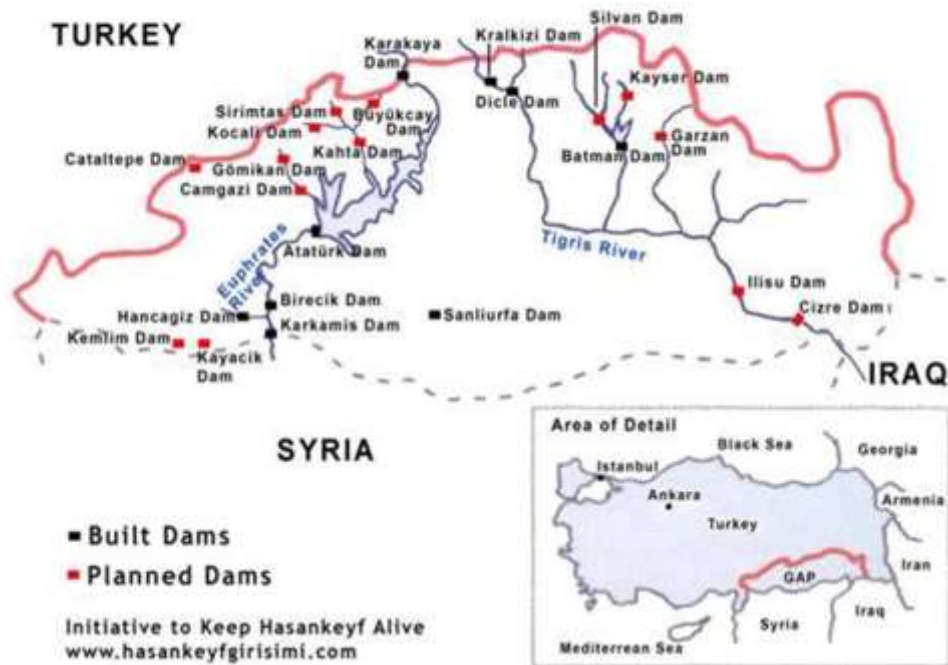
Keban 1 Dam 1966-1974



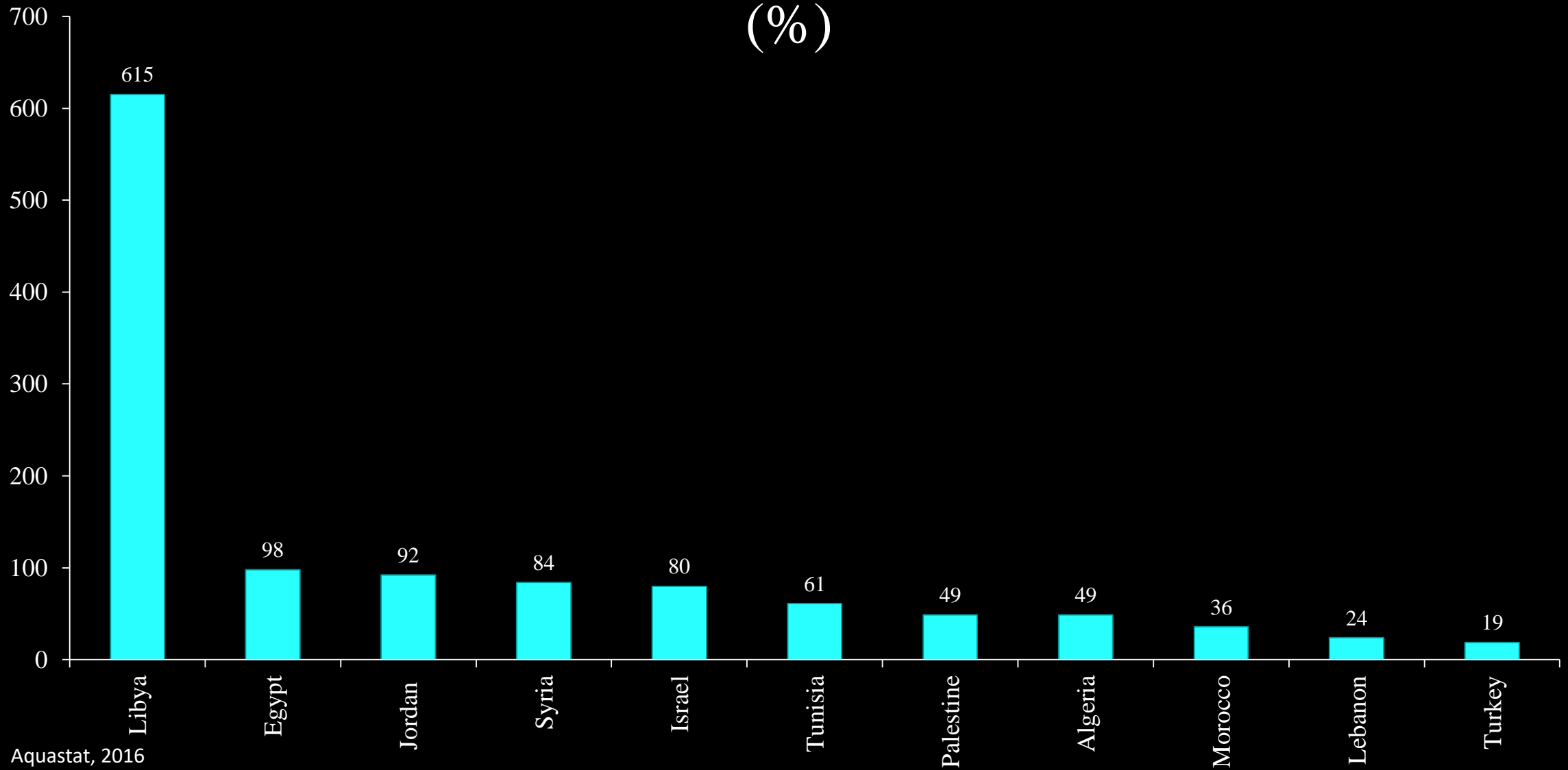
Tabqa Dam 1968-1974

GREAT ANATOLIAN PROJECT (GAP)

Region of Southeastern Anatolia Project (GAP) and locations of built and planned dams



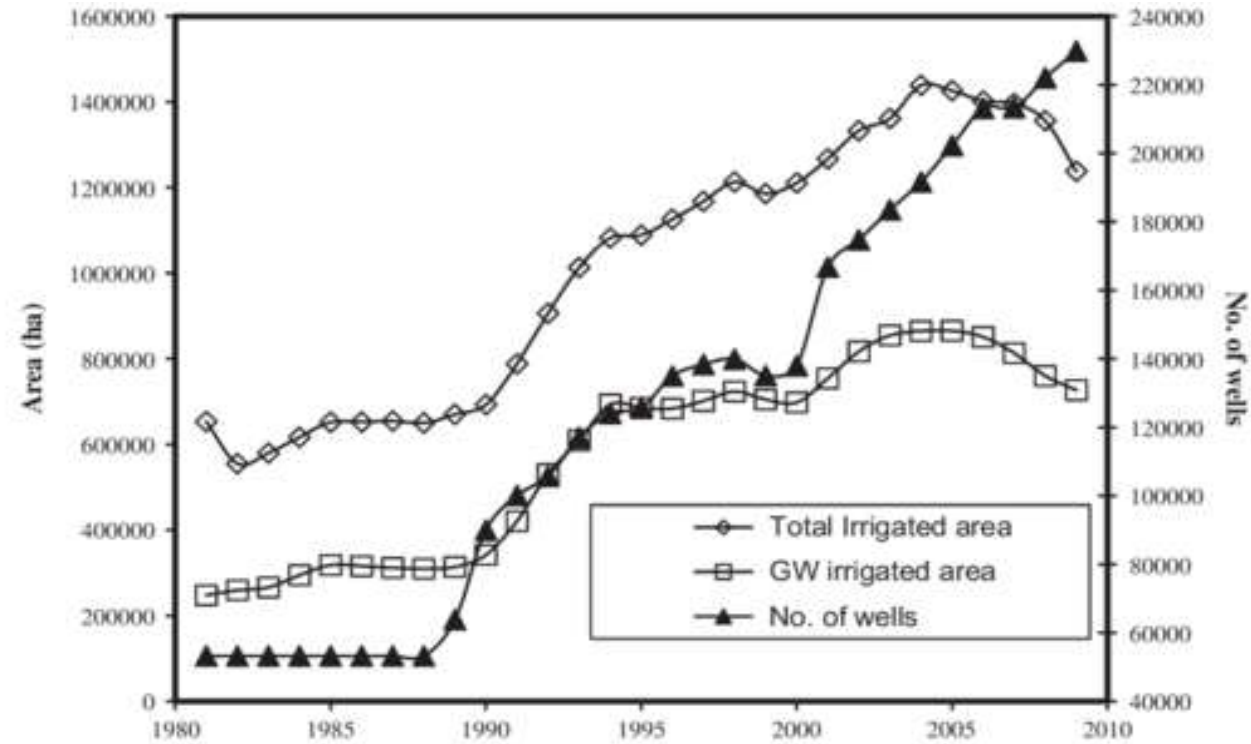
Indice di sfruttamento idrico (%)



QUESTIONE IDRICA E DINAMICHE INTERNE

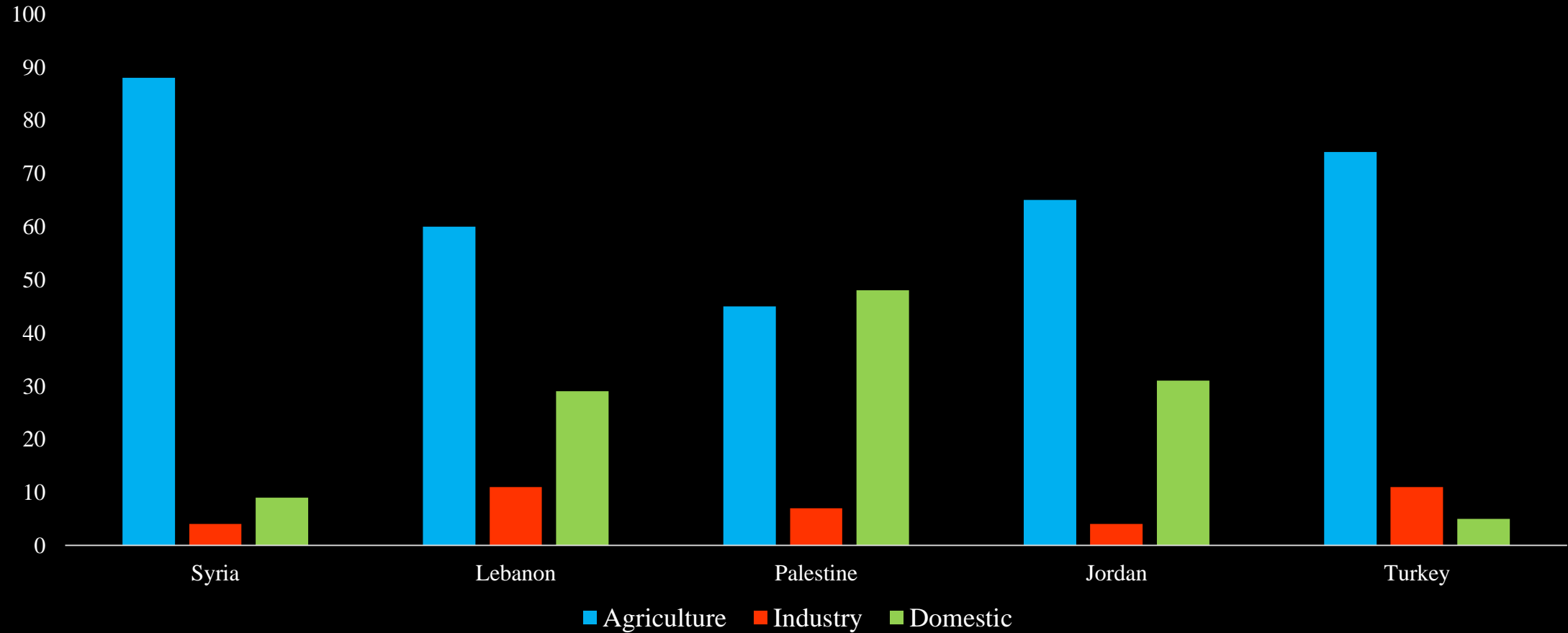


TREND AREA IRRIGUE

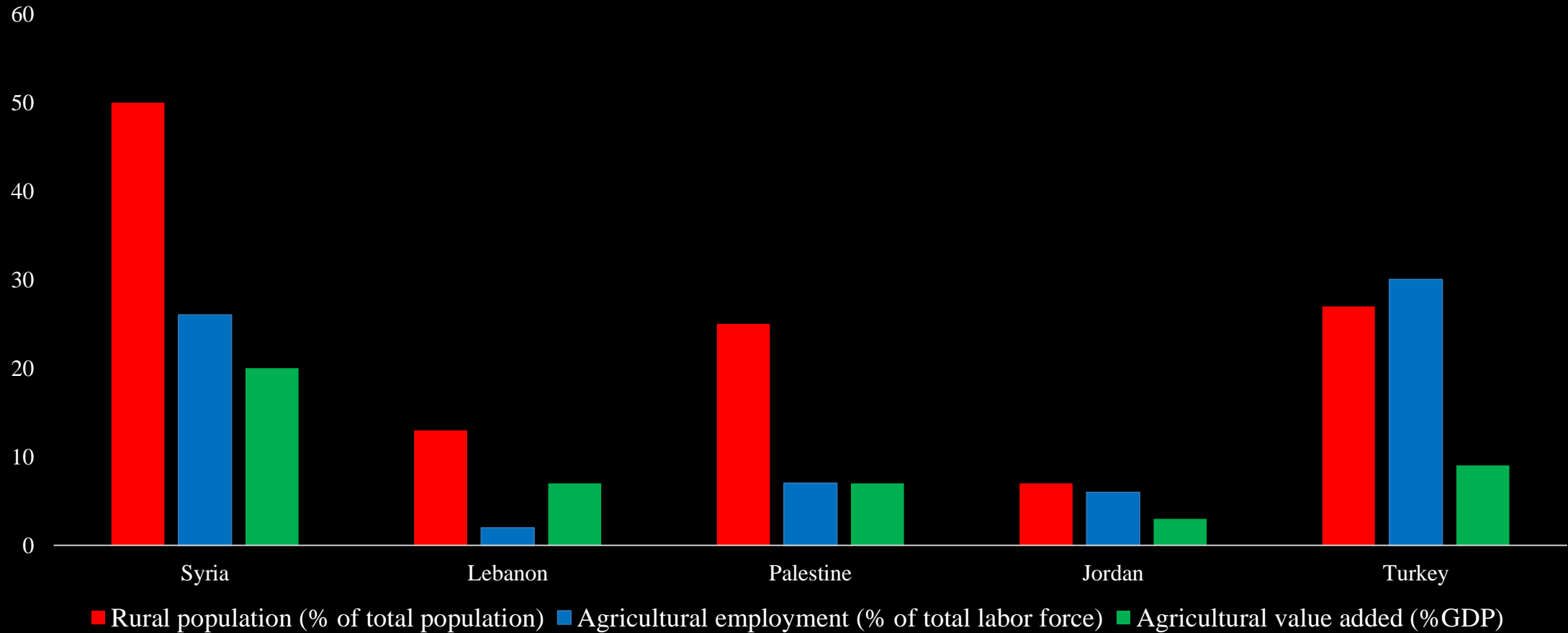


Sources: Authors' elaboration based on FAOSTAT (2013); MAAR (2010), the Annual Agricultural Statistical Abstract for year 2010, Syrian Ministry of Agriculture and Agrarian Reform, Damascus, Syria.

Allocazione idrica per settore (%)



Agricultural GDP, labor force, and rural population



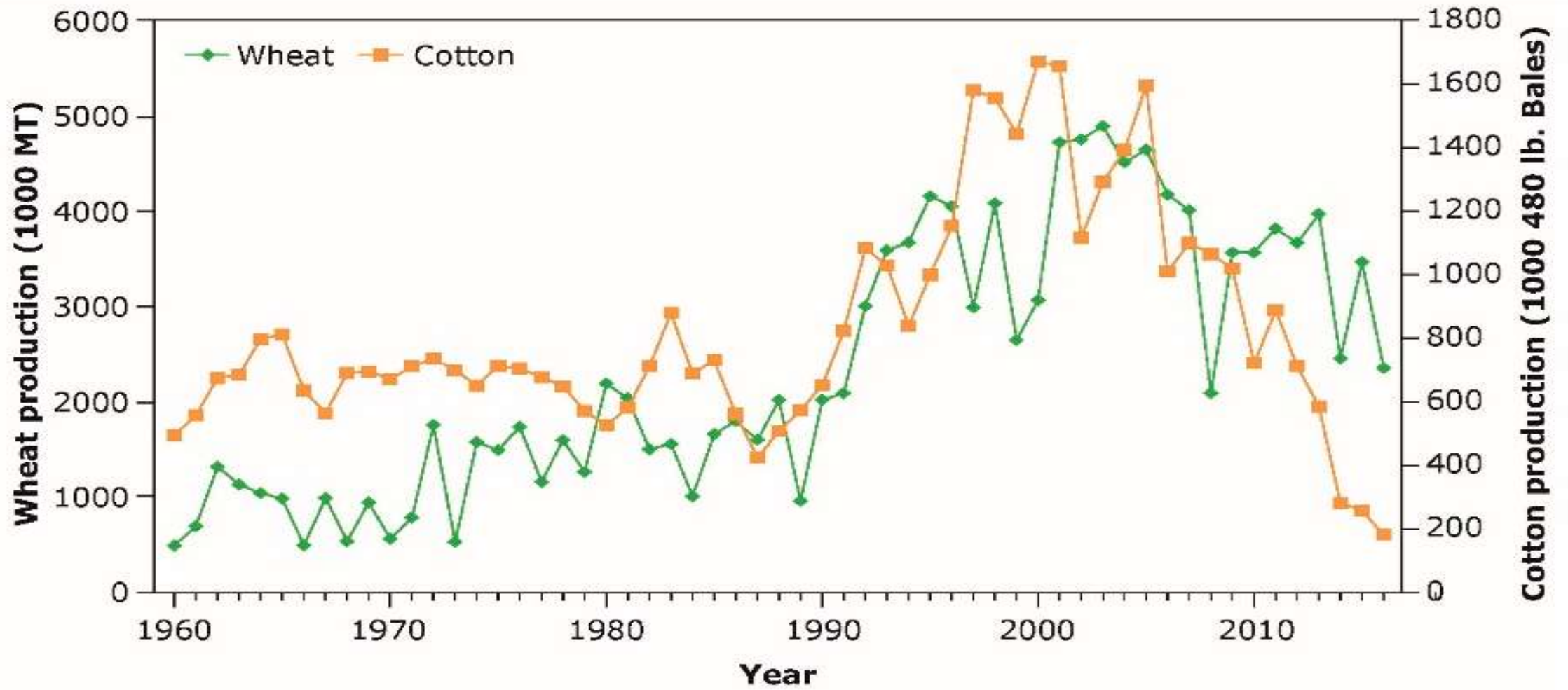
SISTEMA SOCIO-ECONOMICO NEL PERIODO PRE-CONFLITTUALE

Transition from a planned economy model to a social market economy:

- reduce the national debt
- start a process of economic liberalization
- integrate the Syrian economy into the global system and become a member of the WTO

The Tenth Five Year Plan (2006-2010):

- abolish fuel, water and food subsidies and reduce the financial support to the agricultural sector



Karnieli et al., 2019

CRISI ALIMENTARI GLOBALE



SICCITÀ E RIFORME SOCIO-ECONOMICHE NEL PERIODO PRE-CONFLITTO

- Food insecurity
- Loss of livelihood in rural areas
- Out-migration of people from rural areas toward cities

Discontent with the Assad regime + other elements of instability = outbreak of the civil war

Conclusioni:

- Esiste un nesso tra cambiamento climatico e sicurezza umana
- Non vi è alcuna evidenza scientifica su una possibile correlazione tra cambiamento climatico e conflitti tra due o più stati
- Non vi è una relazione diretta di causa-effetto tra cambiamento climatico e conflitti interni perché la relazione è complessa e probabilistica
- Per esplorare il nesso abbiamo bisogno di approcci interdisciplinari, modelli teorici integrati delle interazioni clima-società e studi empirici multi-metodo in grado di combinare metodologie qualitative e quantitative.