

Are we in a Human and Planetary Existential Emergency?
If so, what can we do about it?



Are we in a Human and Planetary Existential Emergency? If so, what can we do about it?

Our perception depends on the distance we have to the object ...



The alien planetary
ecologist ...



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Planetary Life-Support System
Physiology: Homeostasis



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Essential: Earth's Energy Imbalance:
Incoming Energy - Outgoing Energy



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"Healthy Life-Support System":
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Imbalance today: on the order of 10^{-2} (700-800 TeraWatt),
(e.g., Stephens et al., 2012; Trenberth et al., 2014, Cheng et al., 2016)

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A very unhealthy state of the planet!

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Prelude: My Life in Atmospheric CO₂ and Global Population

- 312 ppm/2.637 billion people: Birth
- 320 ppm/3.420 billion people: Started as Carpenter
- 331 ppm/3.942 billion people: Started at university
- 338 ppm/4.304 billion people: Diploma
- 350 ppm/5.201 billion people: PhD
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My “age” in CO₂ increase: 113 ppm.

Increase in CO₂ over the last 20,000 before industrialization: 120 ppm.

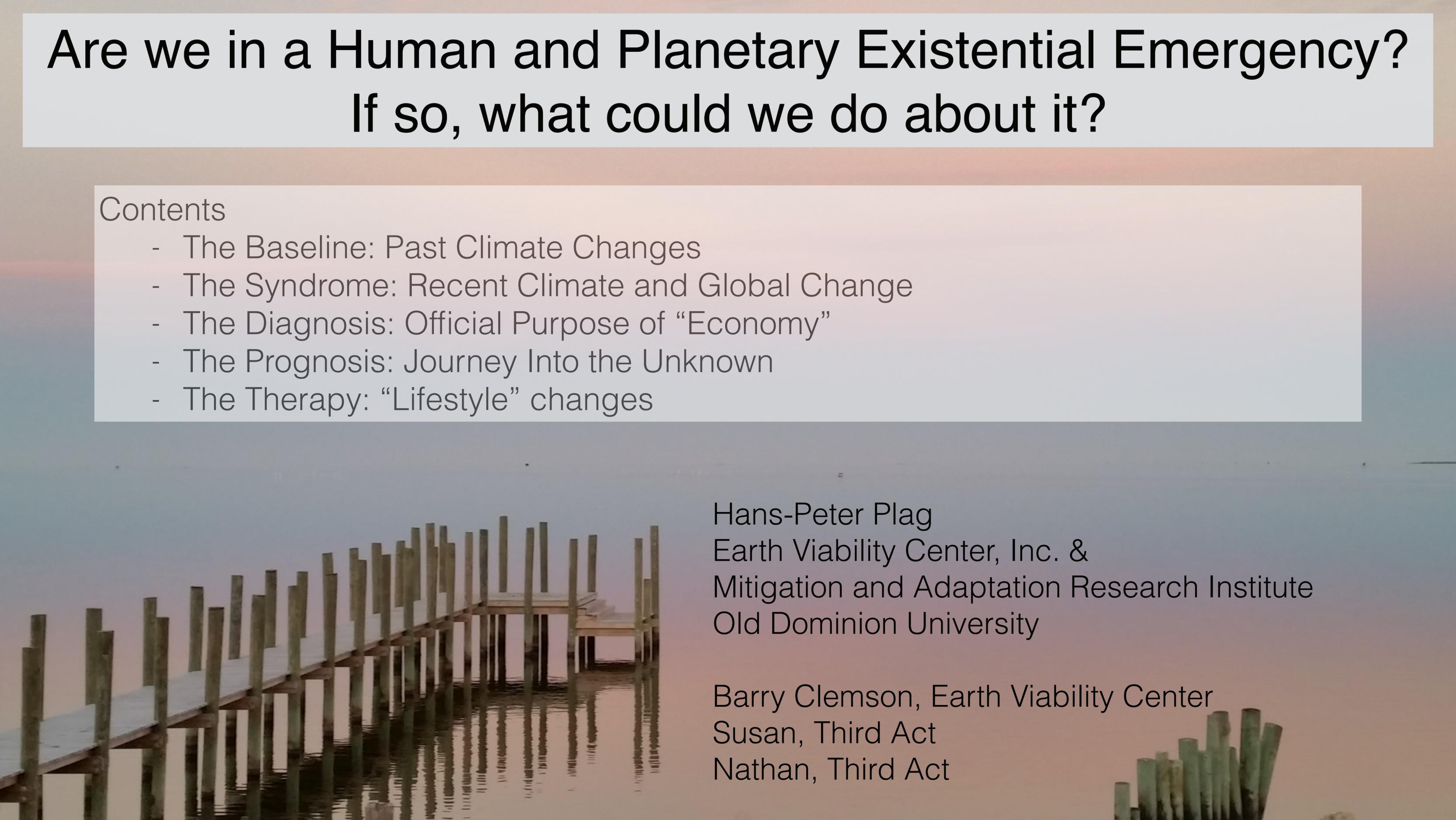
The increase in my life-time was 300 times faster than on average during the pre-industrial 20,000 years

There has never been a time like this in Earth history!

Are we in a Human and Planetary Existential Emergency? If so, what could we do about it?

Contents

- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Official Purpose of “Economy”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes



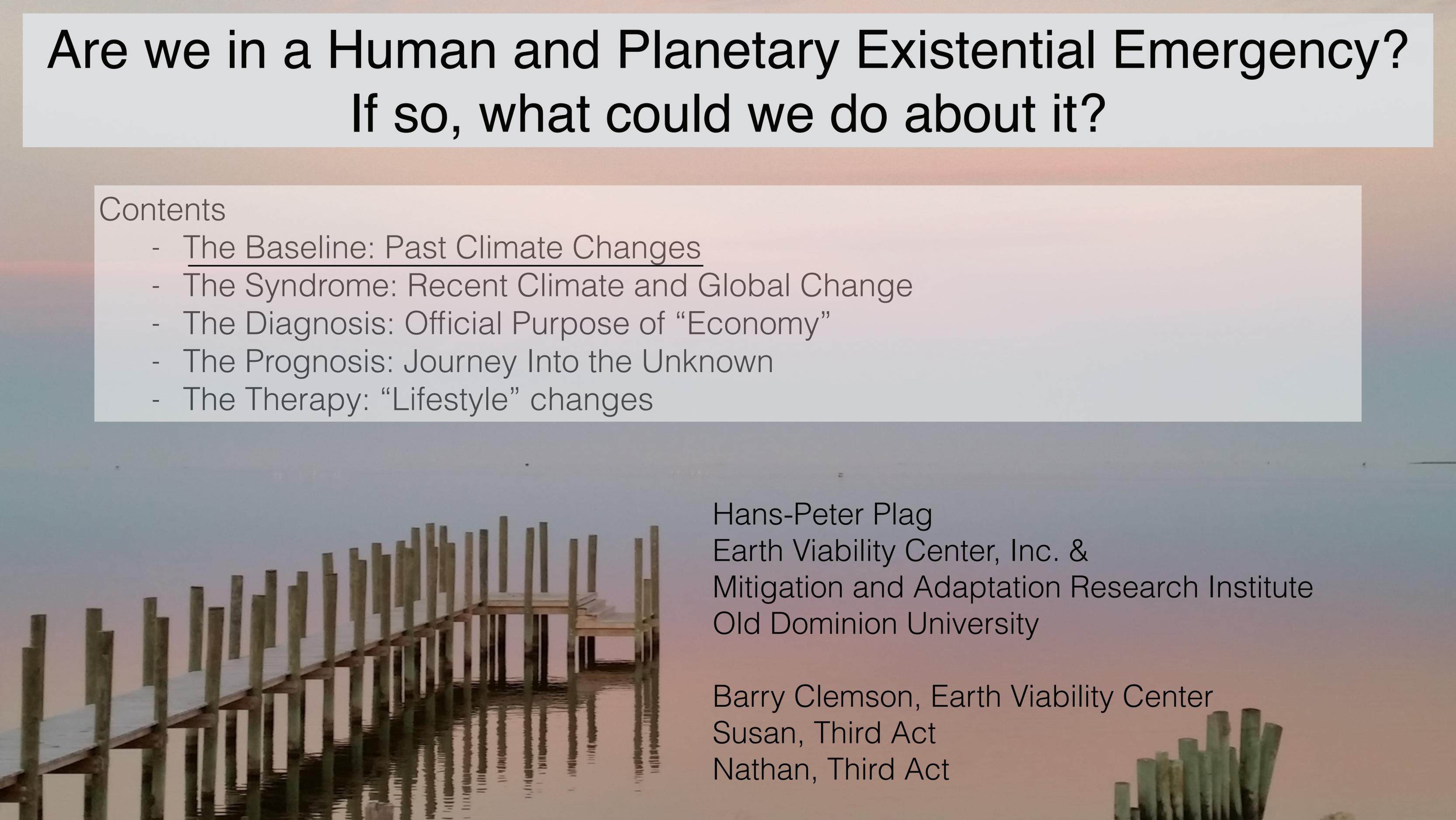
Hans-Peter Plag
Earth Viability Center, Inc. &
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Old Dominion University

Barry Clemson, Earth Viability Center
Susan, Third Act
Nathan, Third Act

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The Baseline: Understanding the System

Planetary Physiology:

A Life-Support System for many species

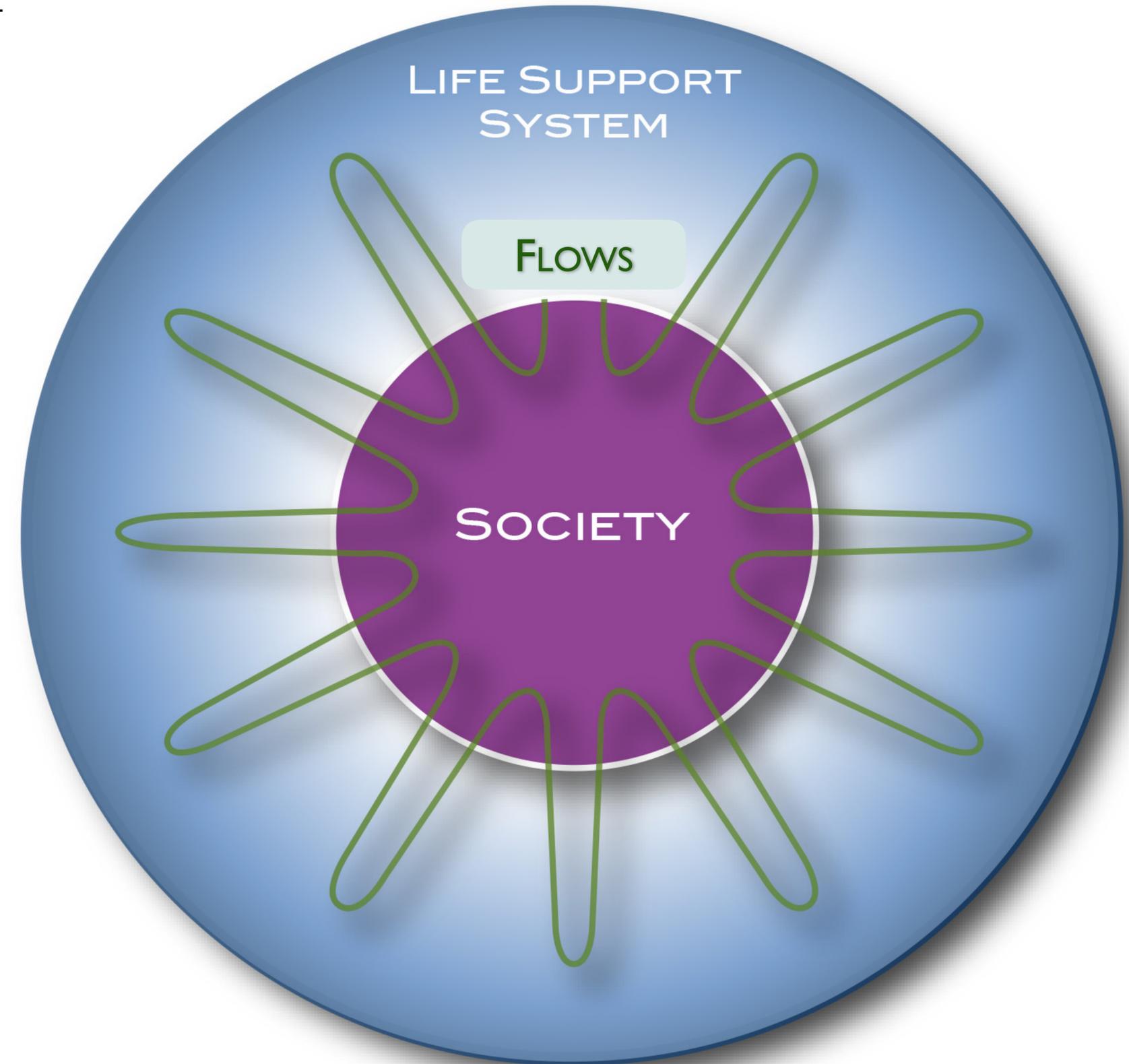


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Flows in the Earth System determine the “Health of the Planet”



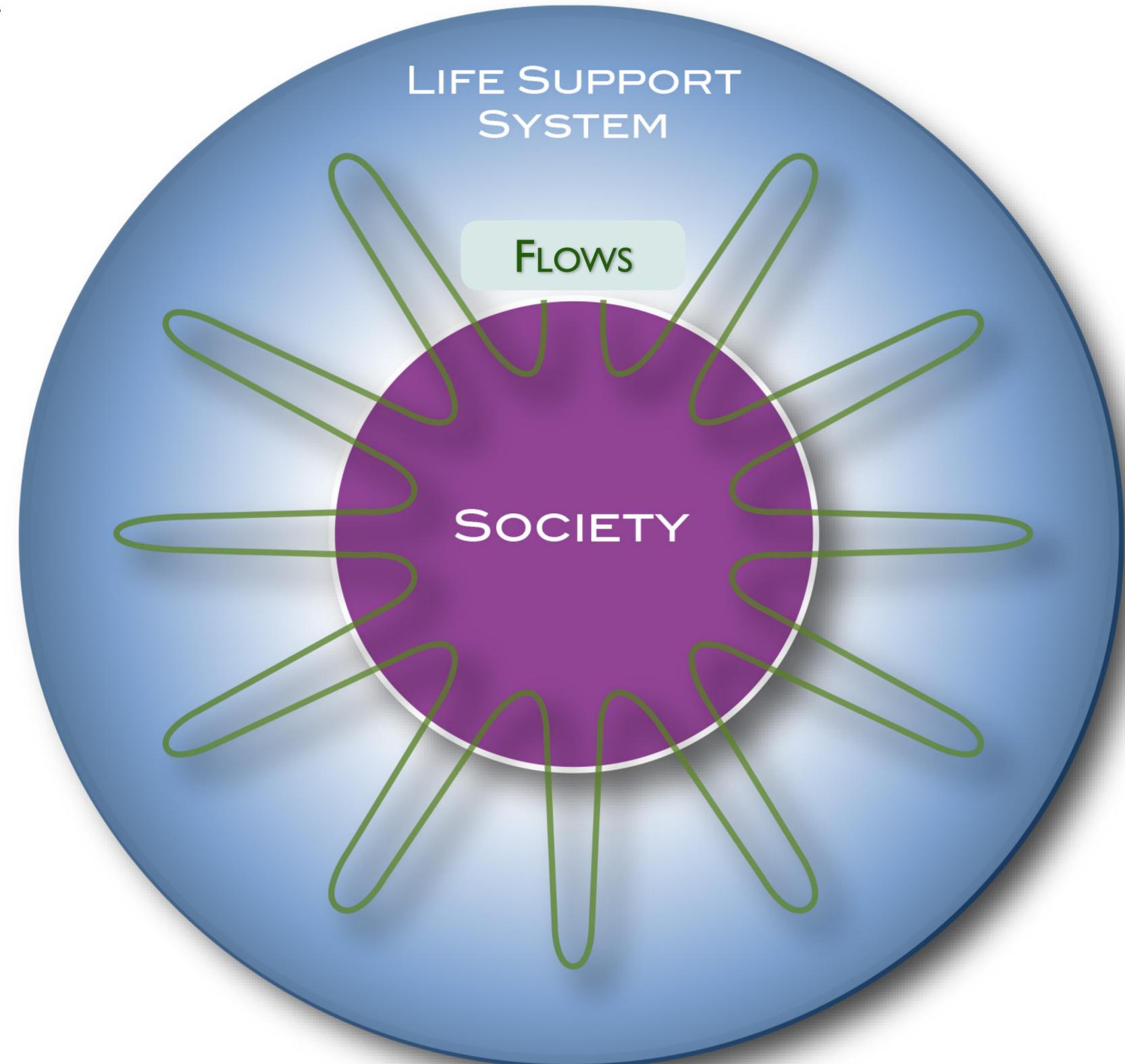
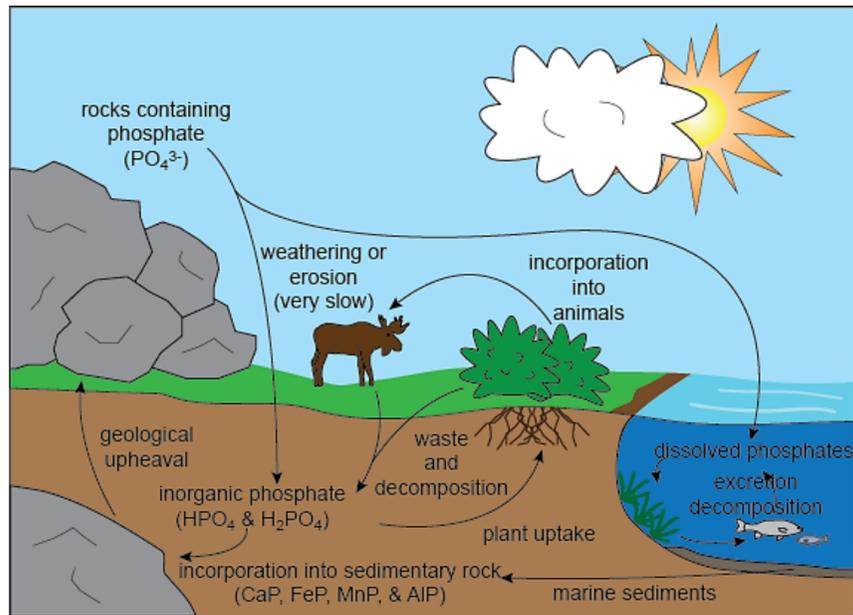
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Everything is about Flows. Some examples:



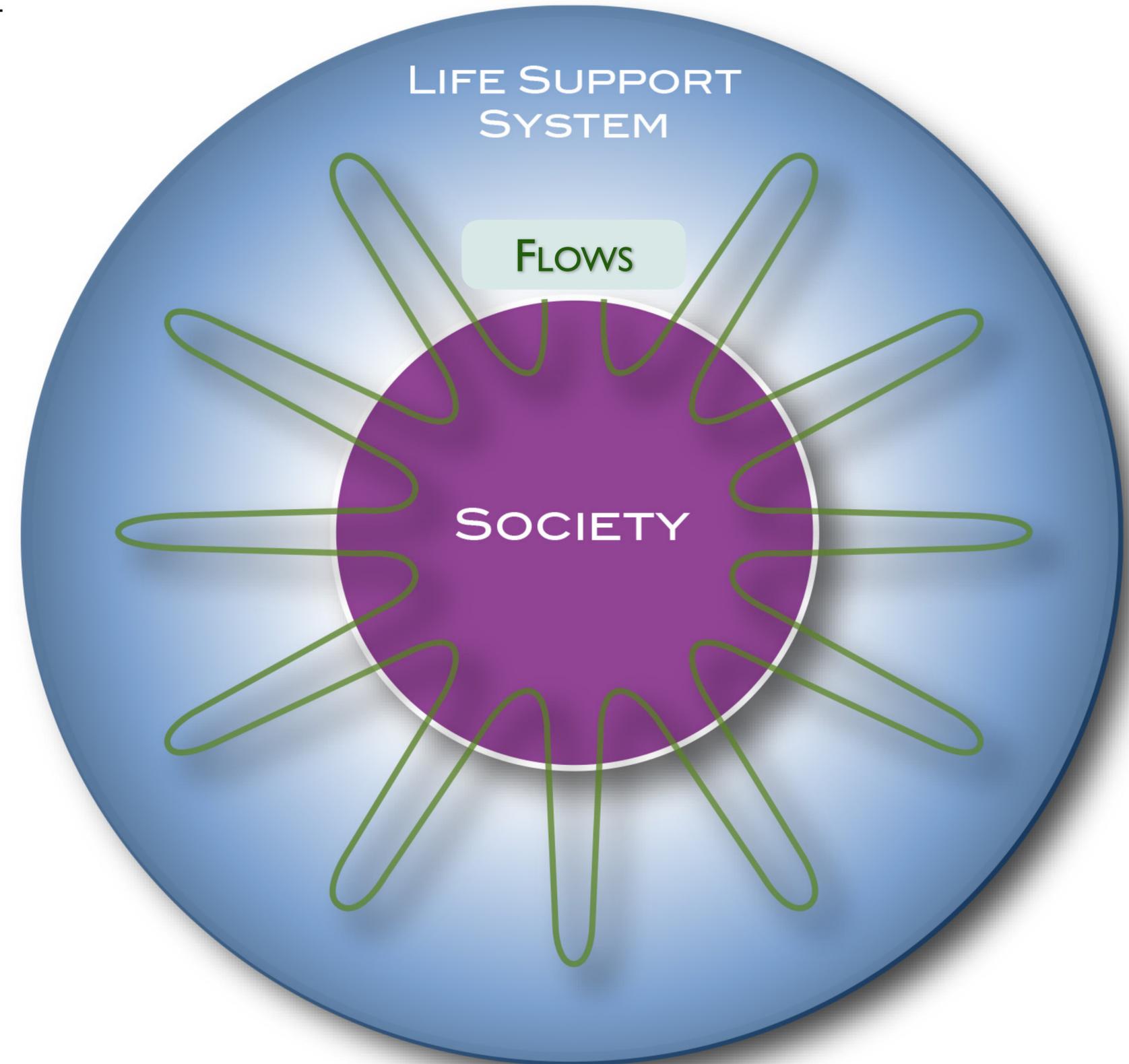
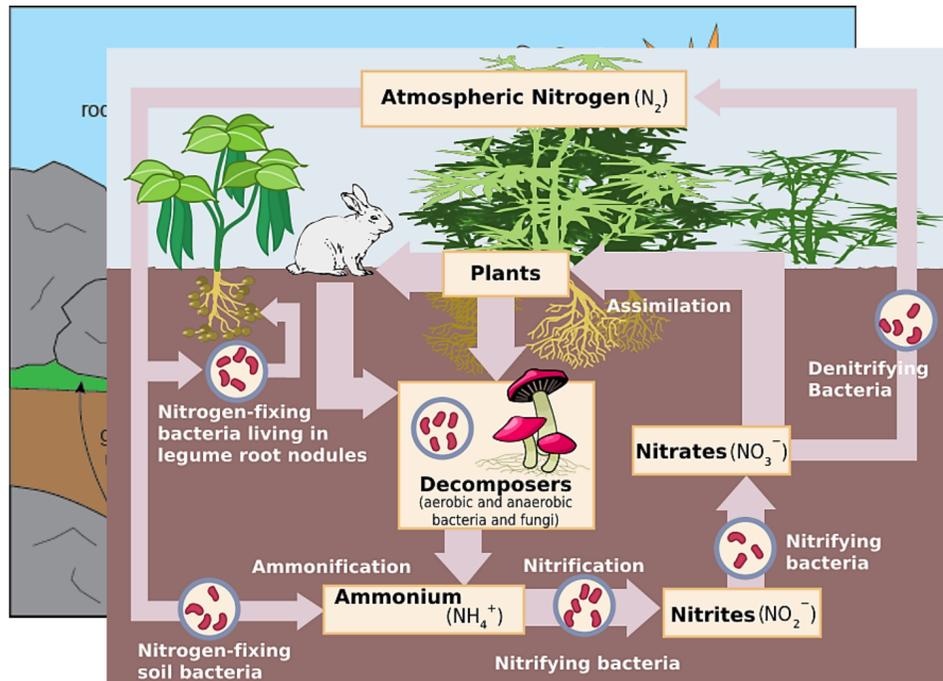
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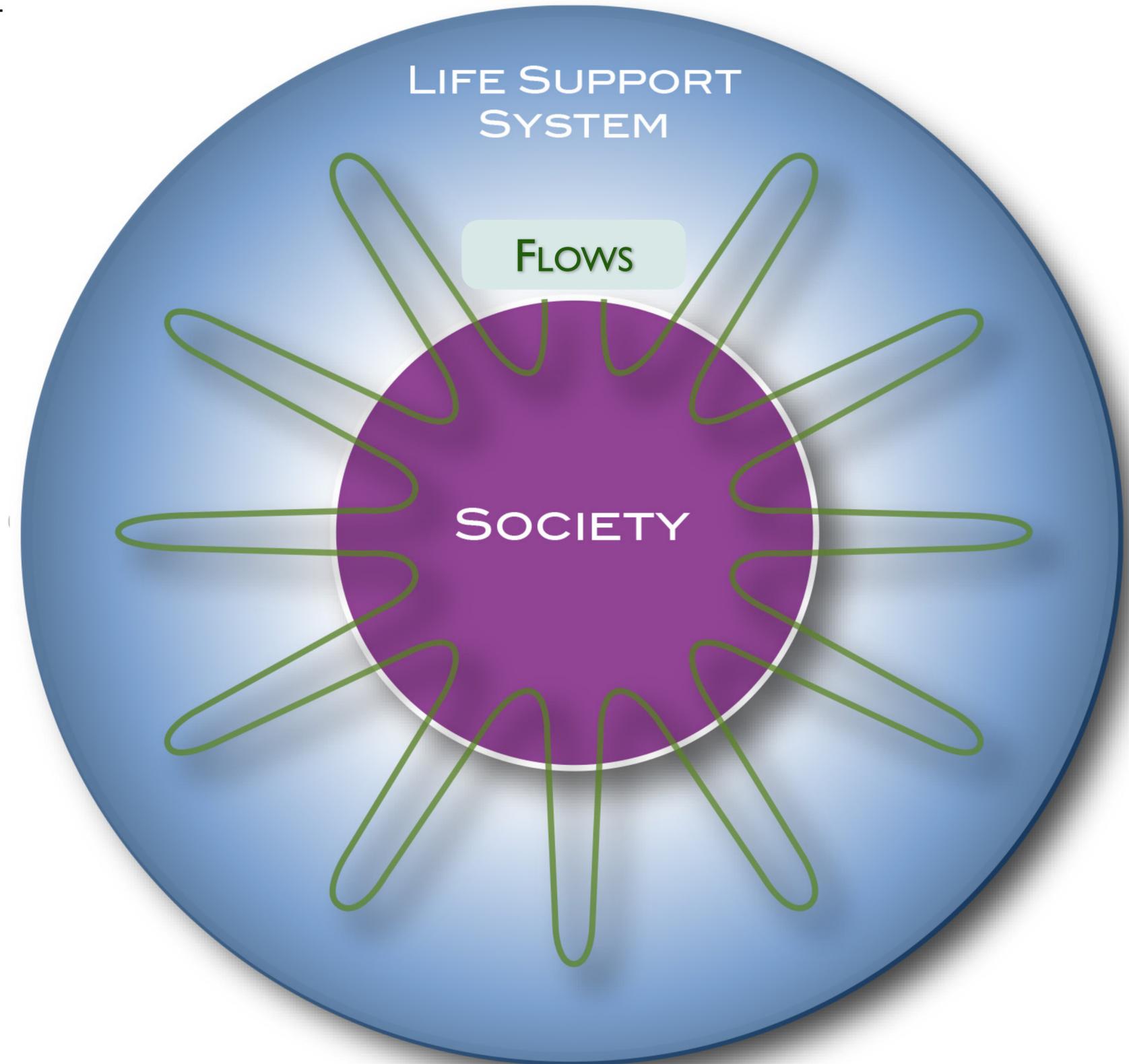
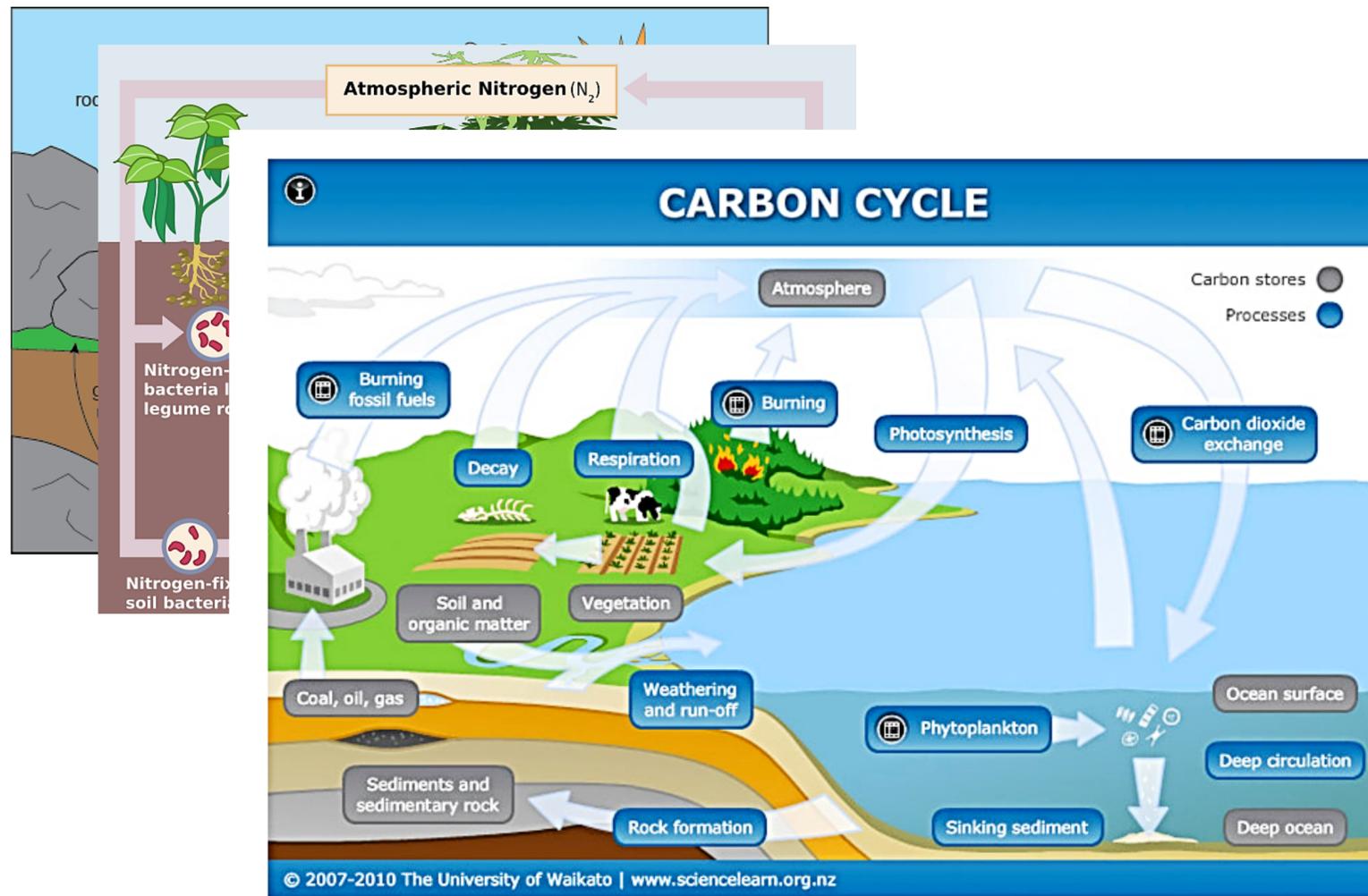
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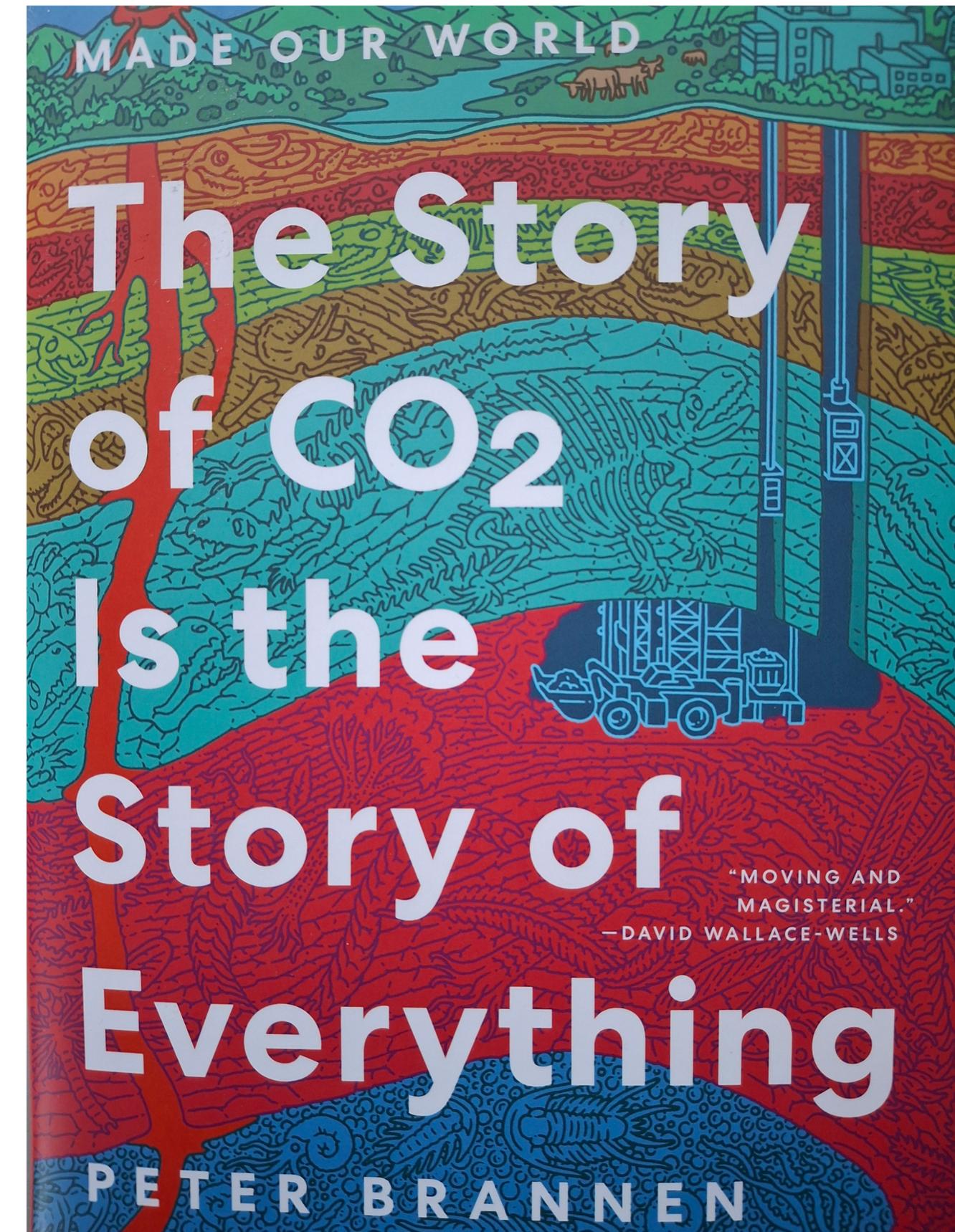
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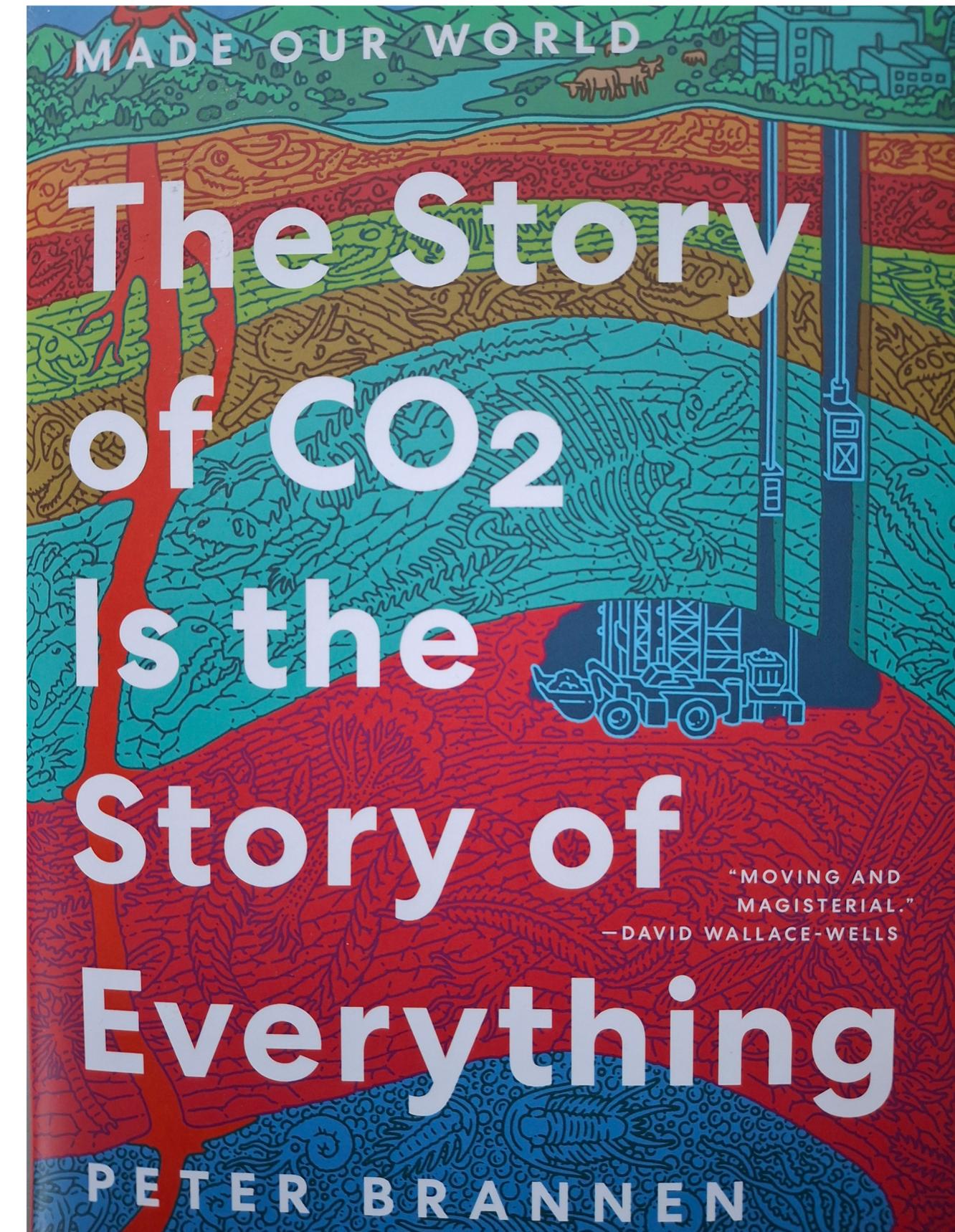
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Everything is about Flows. Some examples:







... the **steam engine ... transformed western Eurasia overnight...**

... the **resulting radical transformation of the Earth's surface and biosphere ... was only made possible by this half-billion years of photosynthetic energy (stored in fossil fuels) ...**

... the **resulting supereruption of carbon dioxide can be compared only with a few terrifying chapters in geologic history**

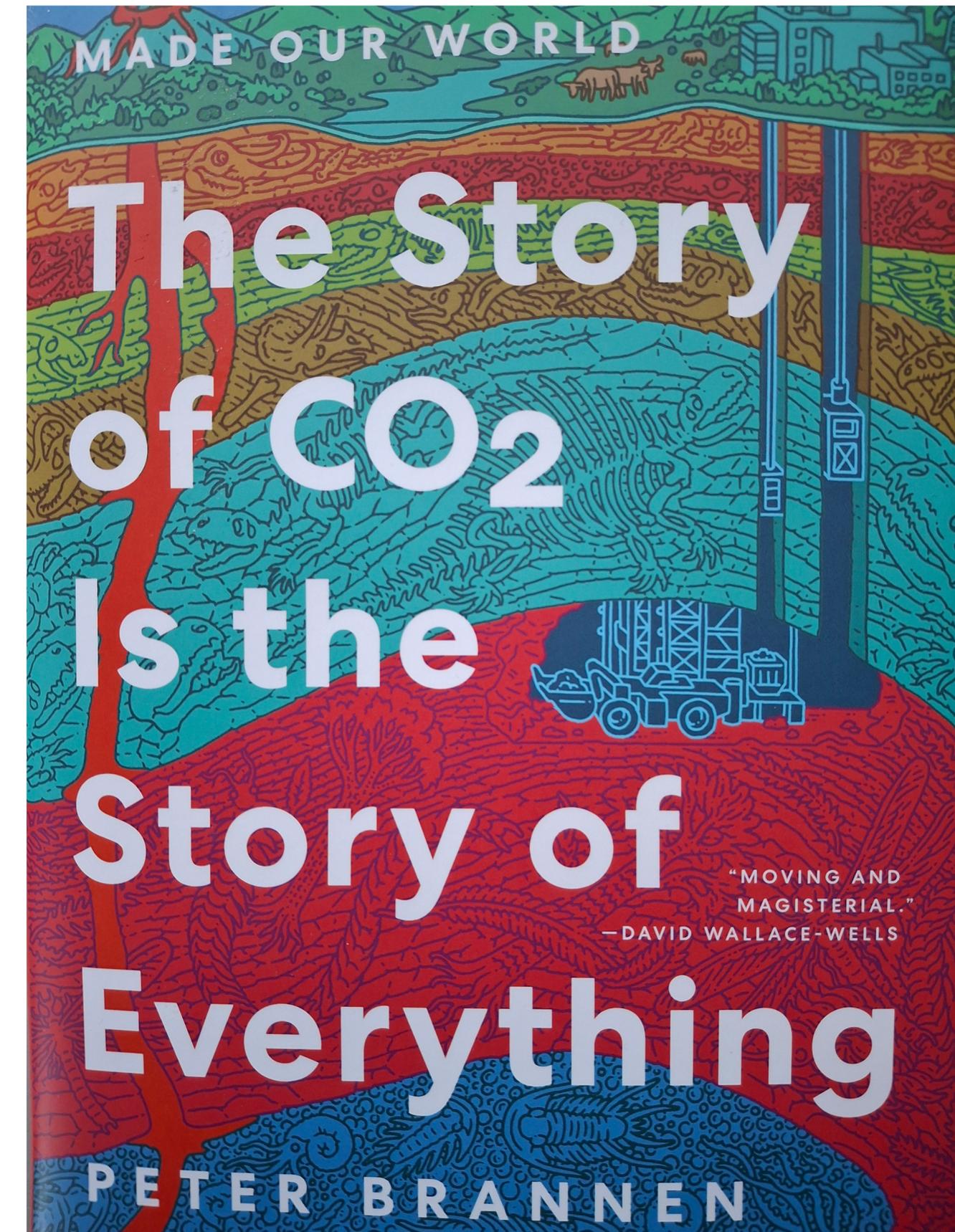
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... **these kinds of transient derangements of the carbon cycle ... have reliably resulted in mass extinction.**

... the **future of the planet's life-supporting global carbon cycle is now governed ... by economic and geopolitical systems.**

... **wisdom of the institutions that govern human affairs ... determine not only our fate on this planet, but most other life on Earth.**

Human society is still hopelessly embedded in, and structured by, these planetary flows of energy and material. They have been merely rerouted through ... the most energetic, voracious organism in Earth history, with the fog of CO2 encircling the world as a testament to this unprecedented new metabolism.



We have put far more CO₂ into the atmosphere than the largest super volcano eruptions in Earth's history.

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biosphere ... was ...
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... the **resulting supereruption of carbon dioxide can be compared only with a few terrifying chapters in geologic history** ...

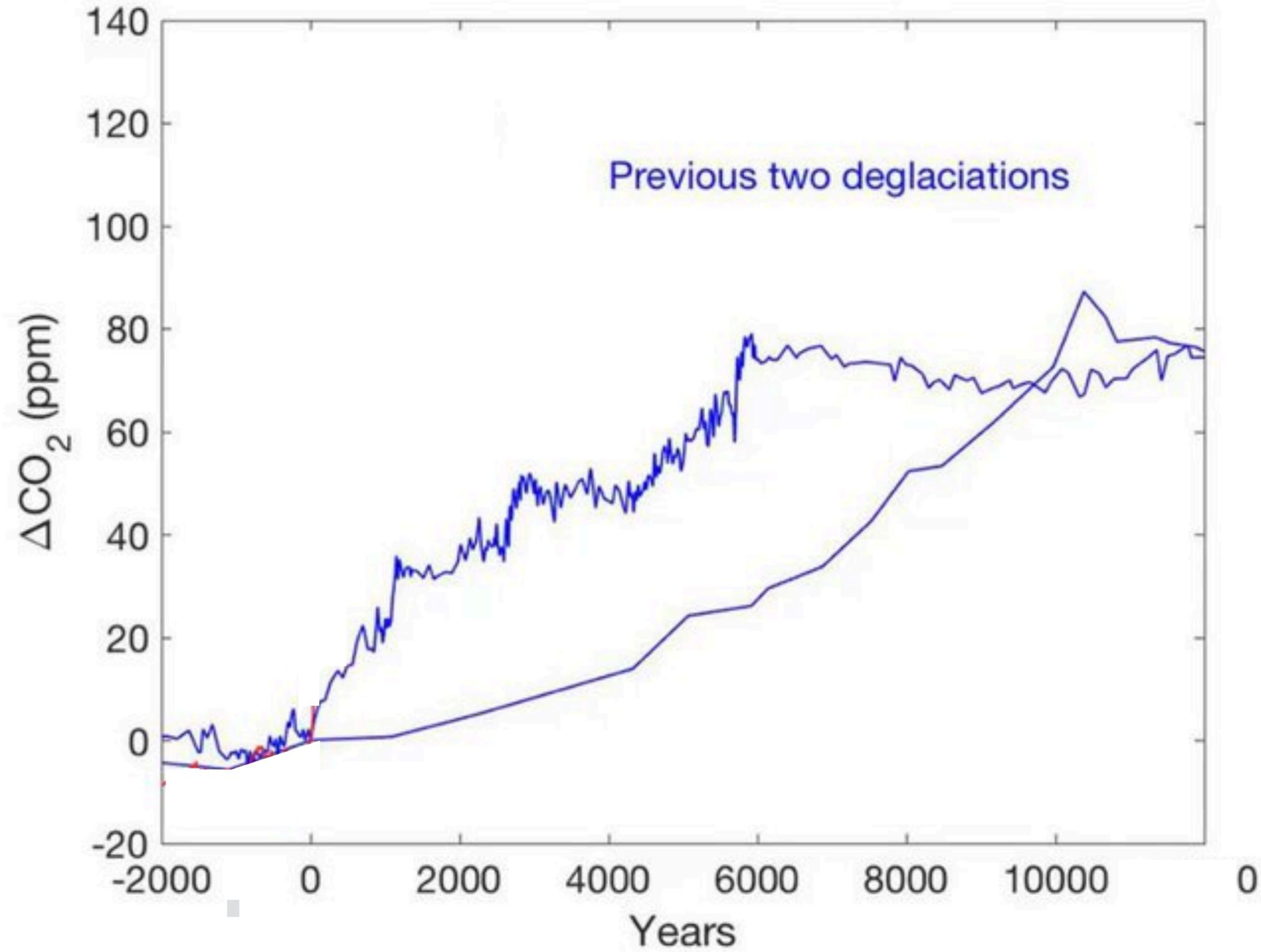
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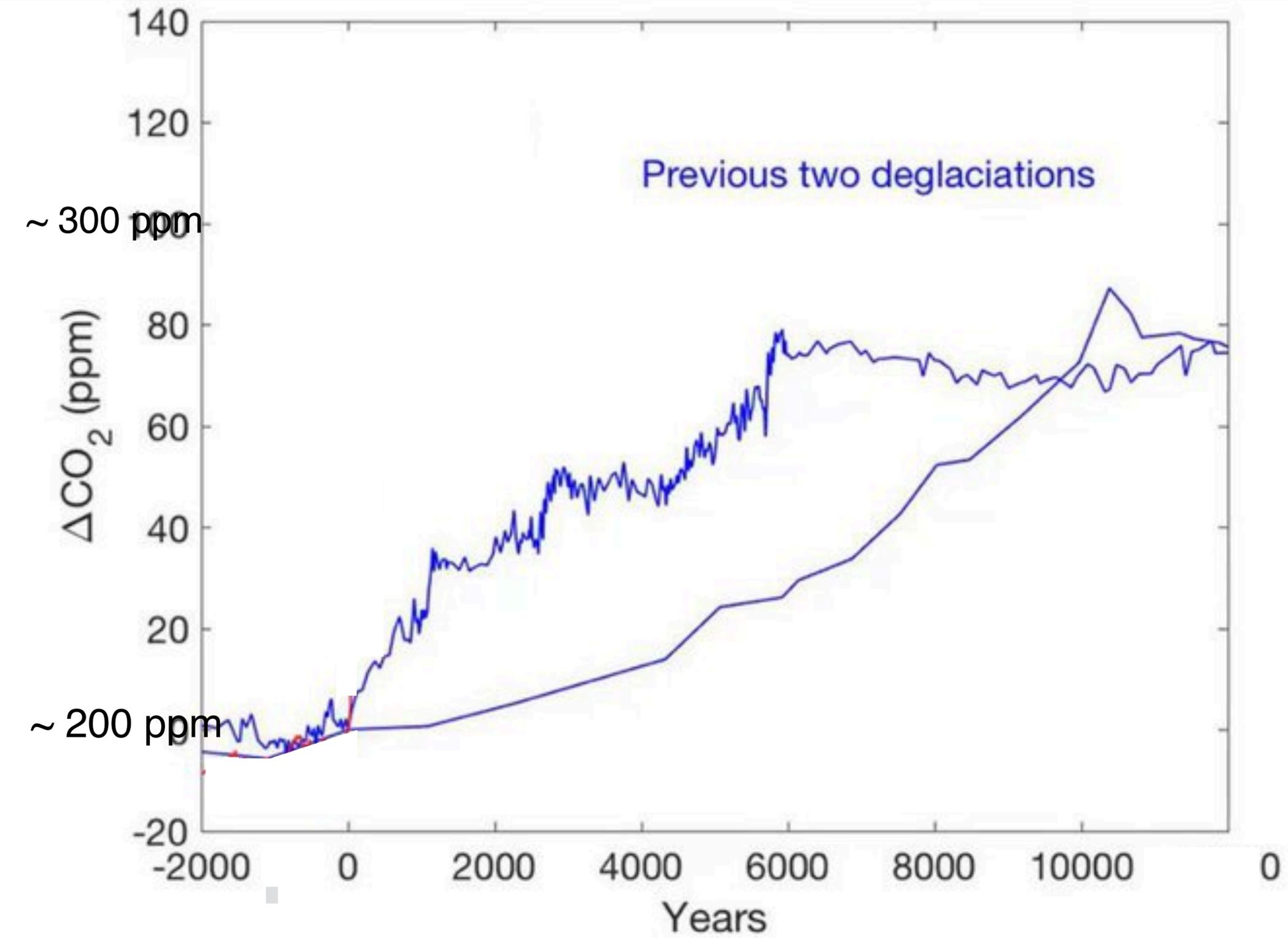
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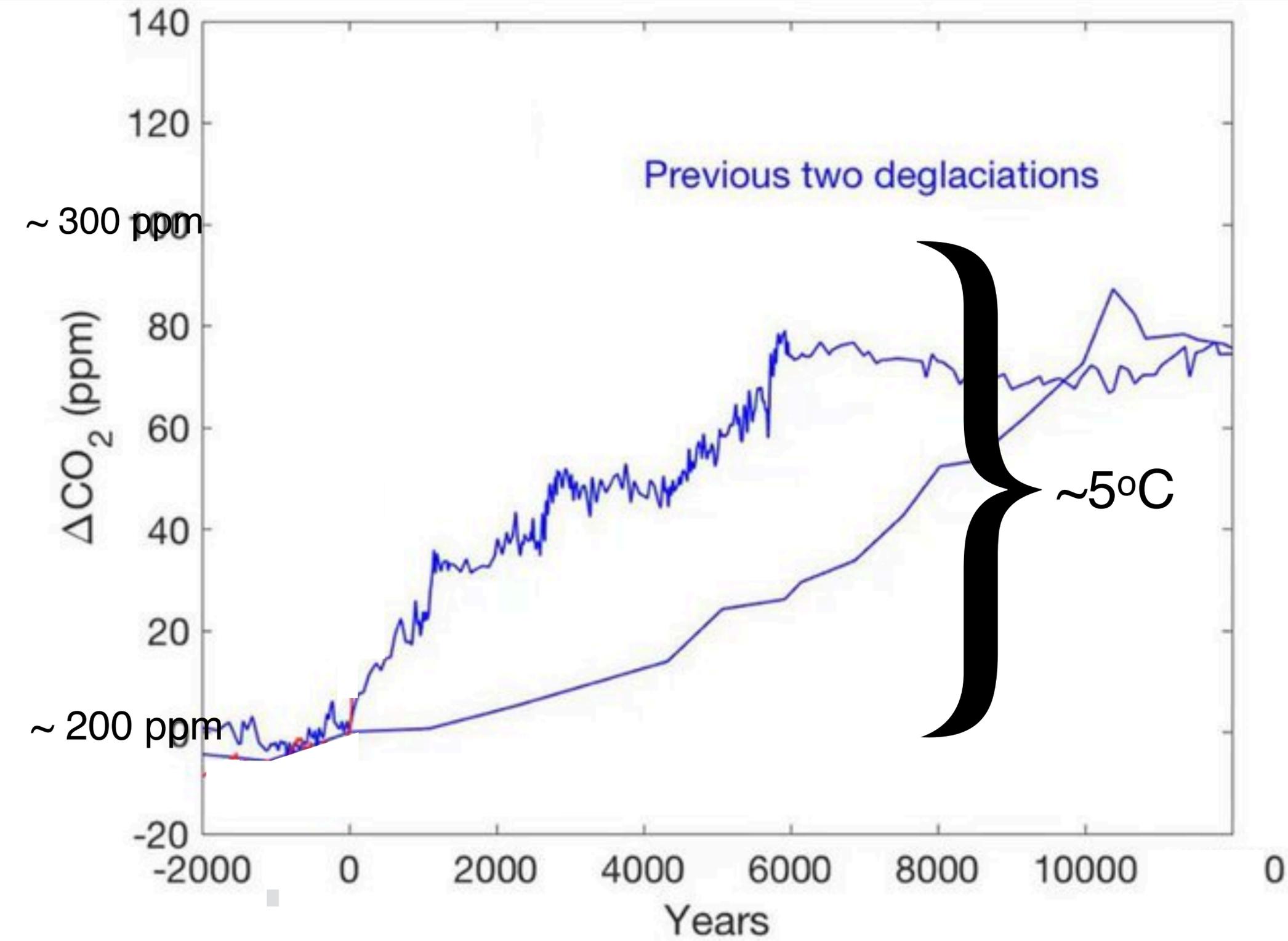
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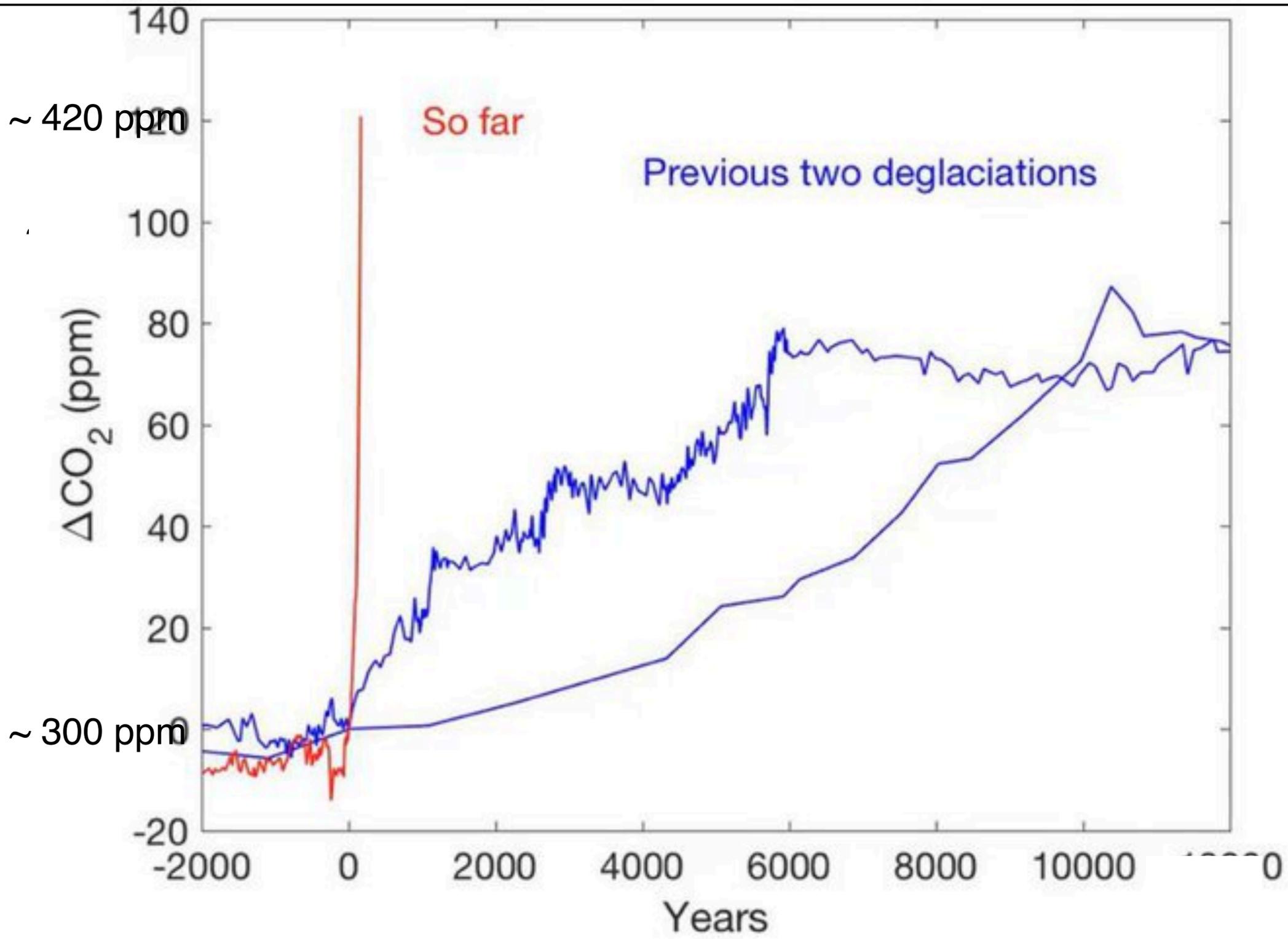
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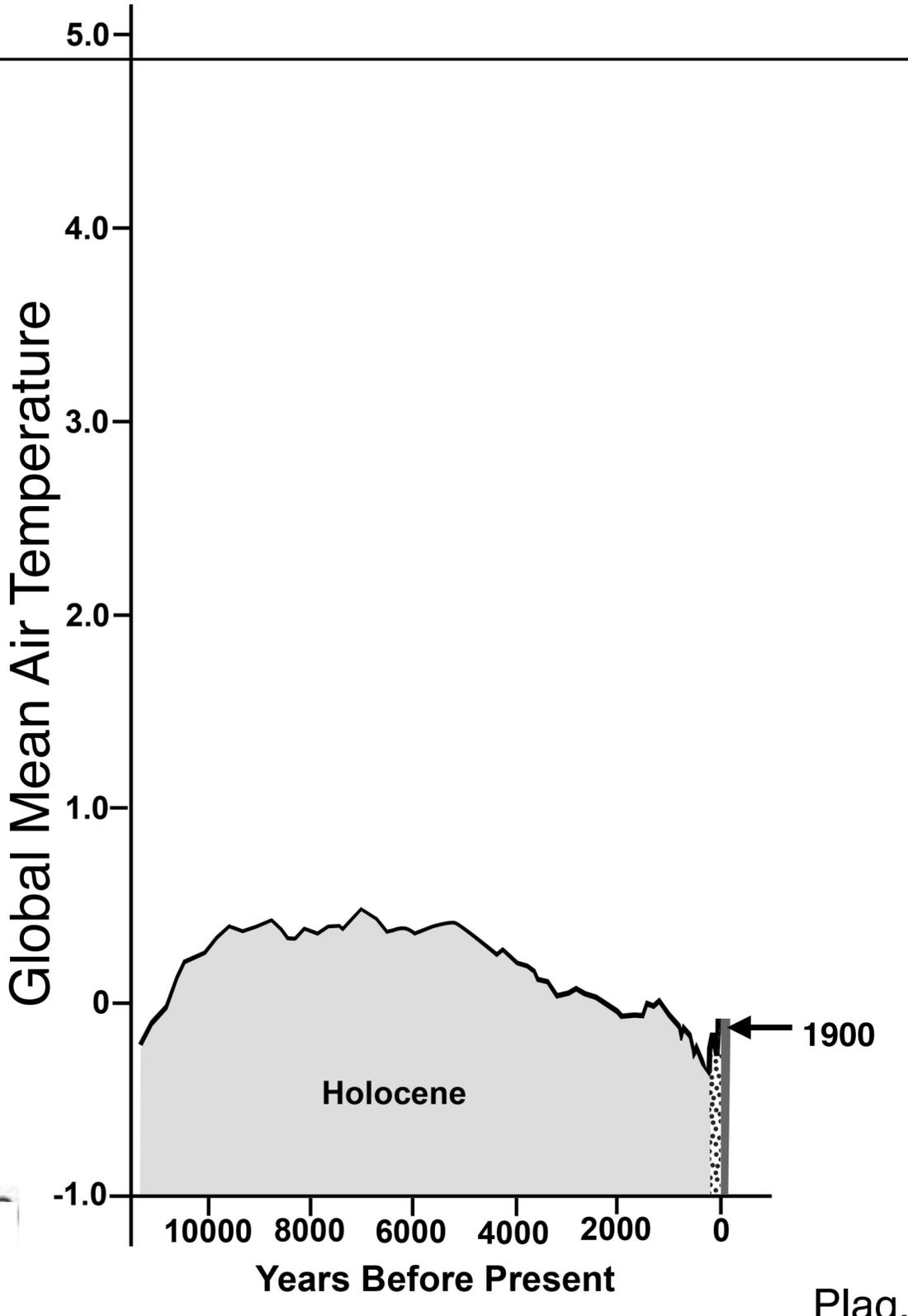
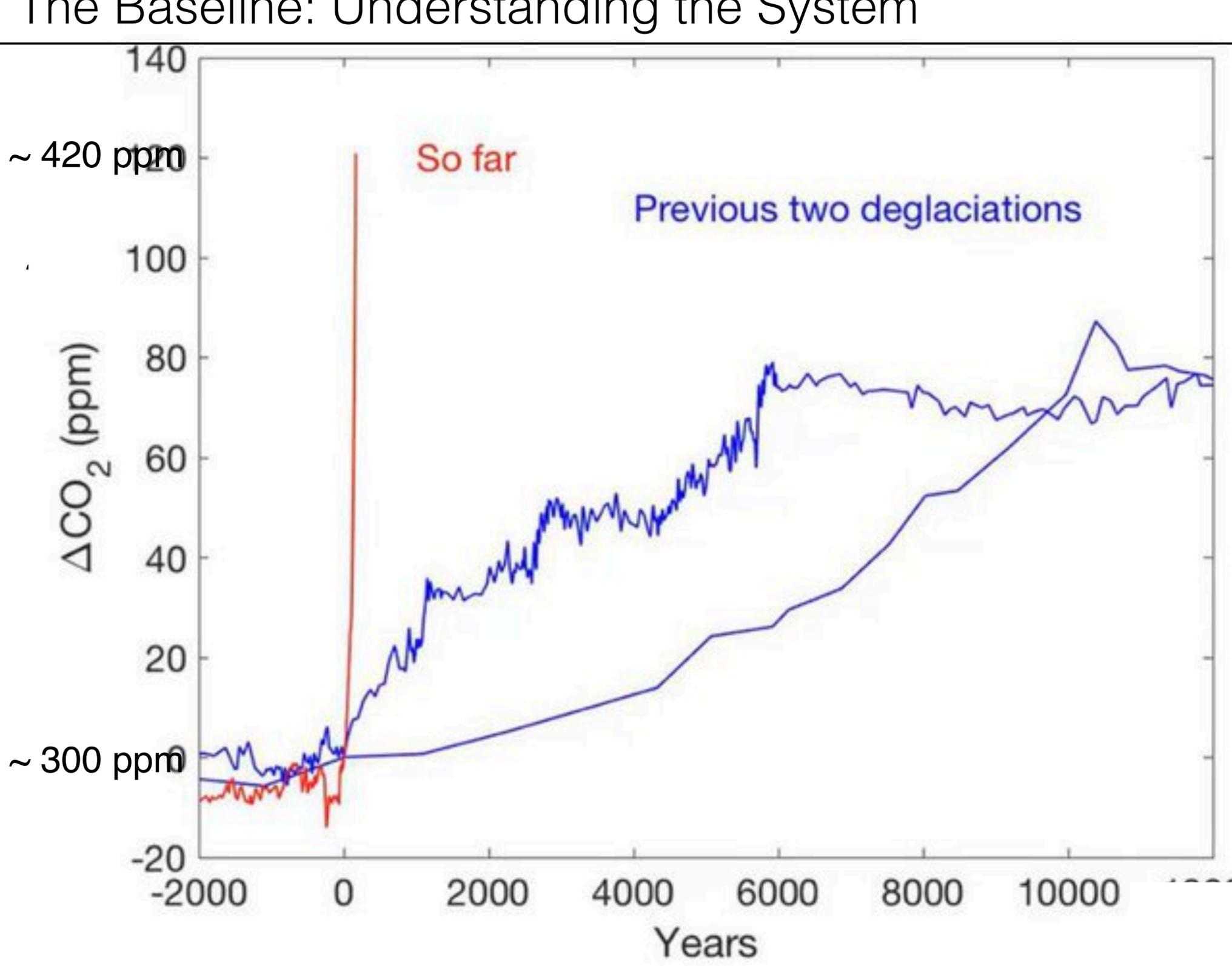
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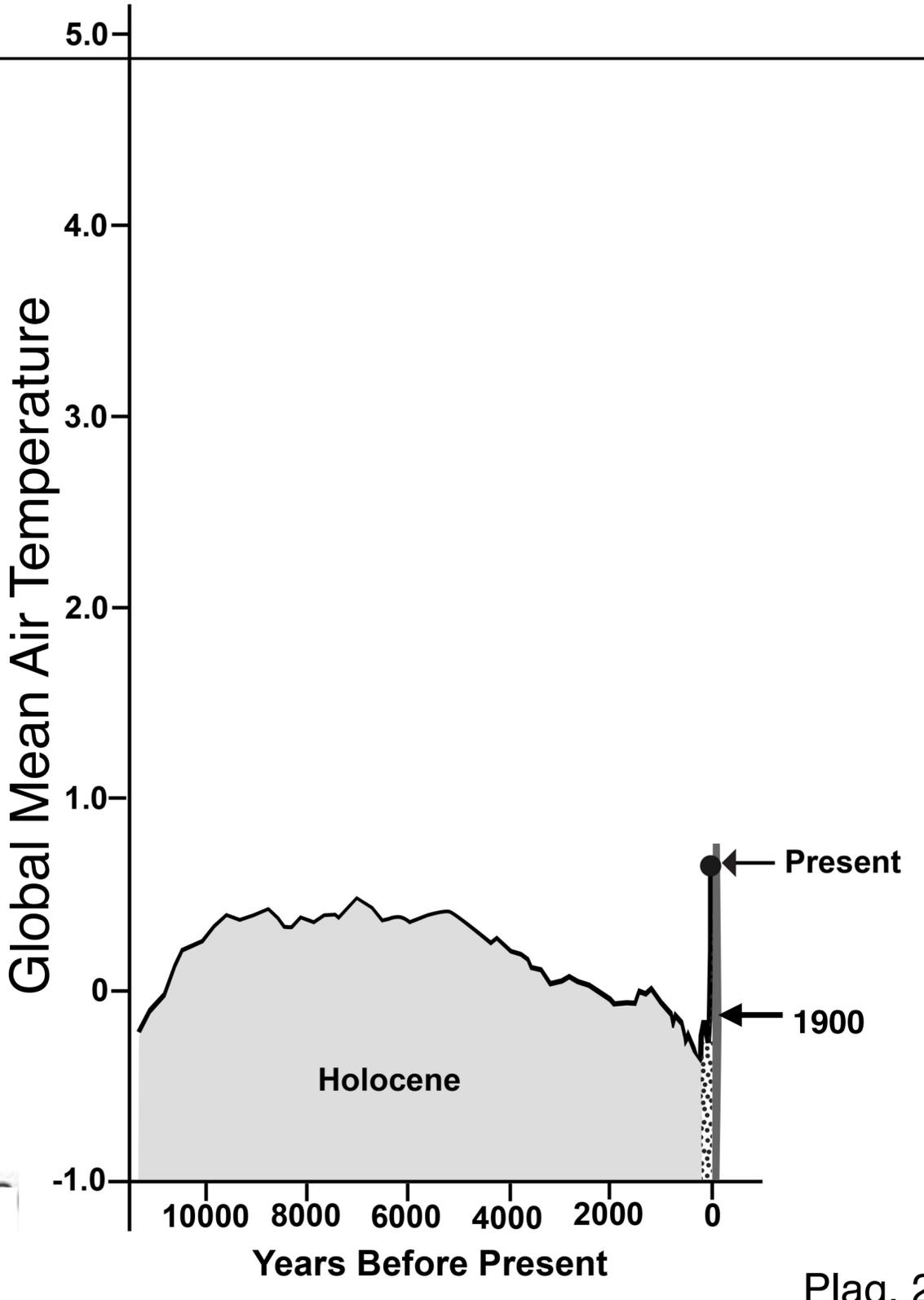
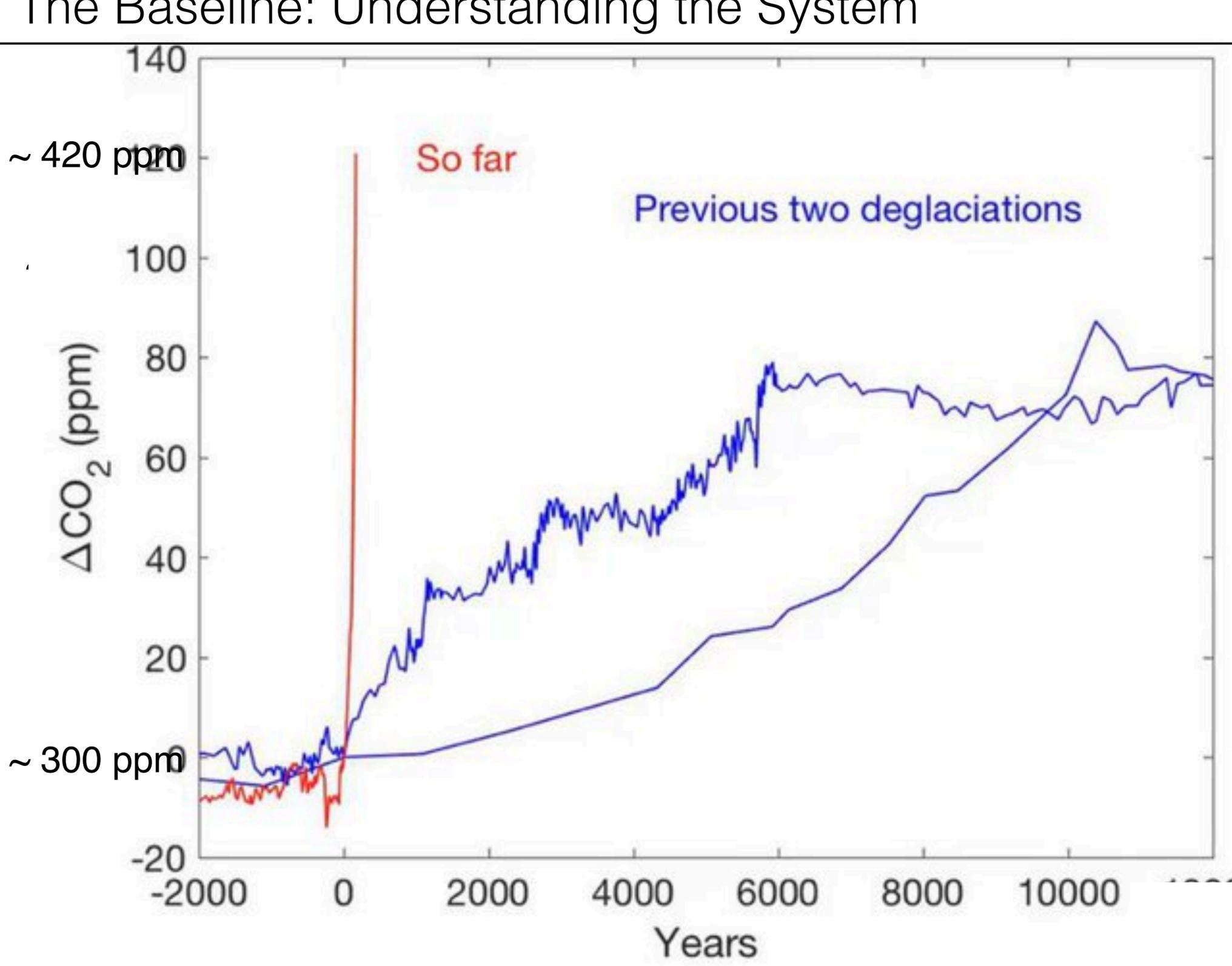
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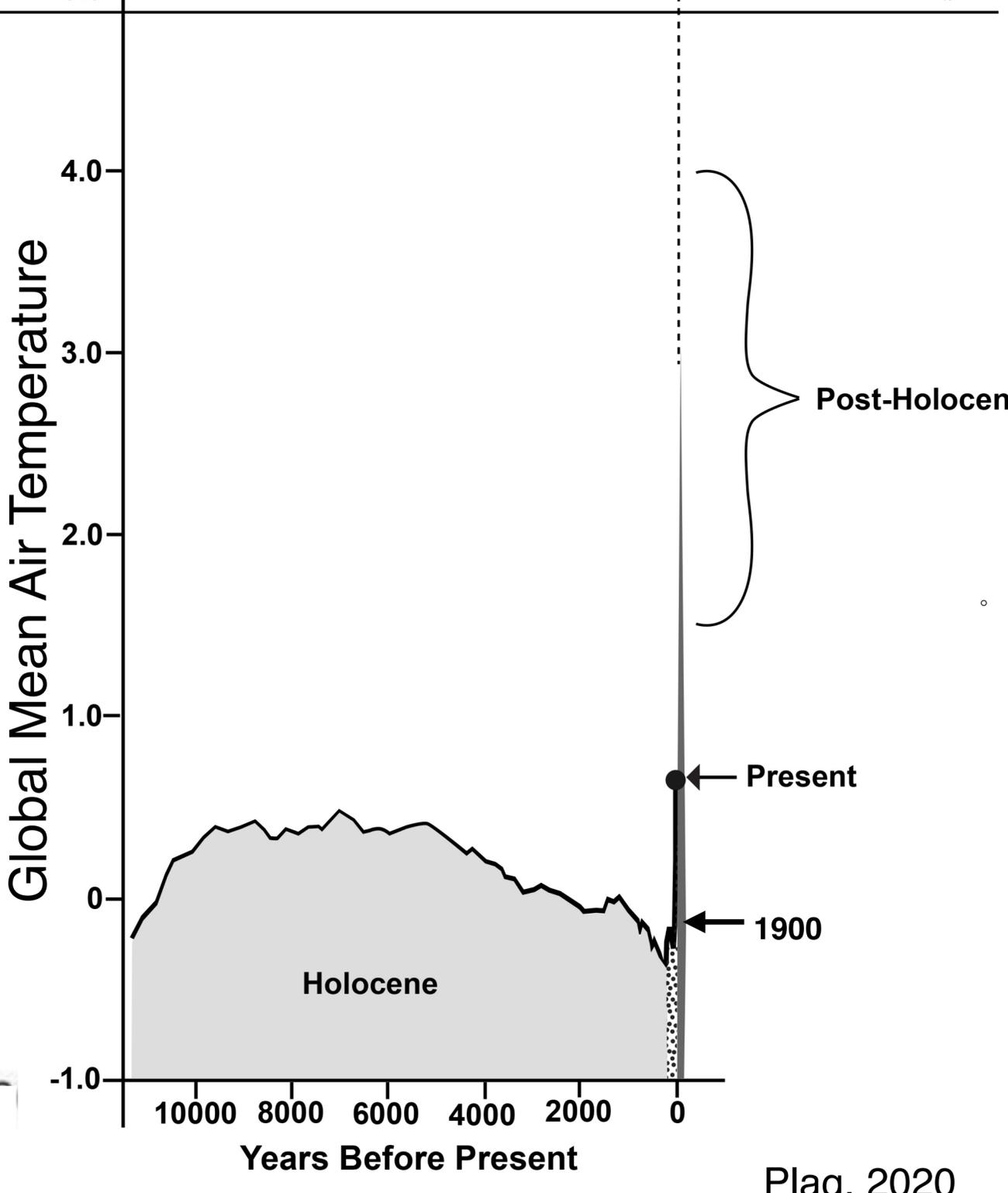
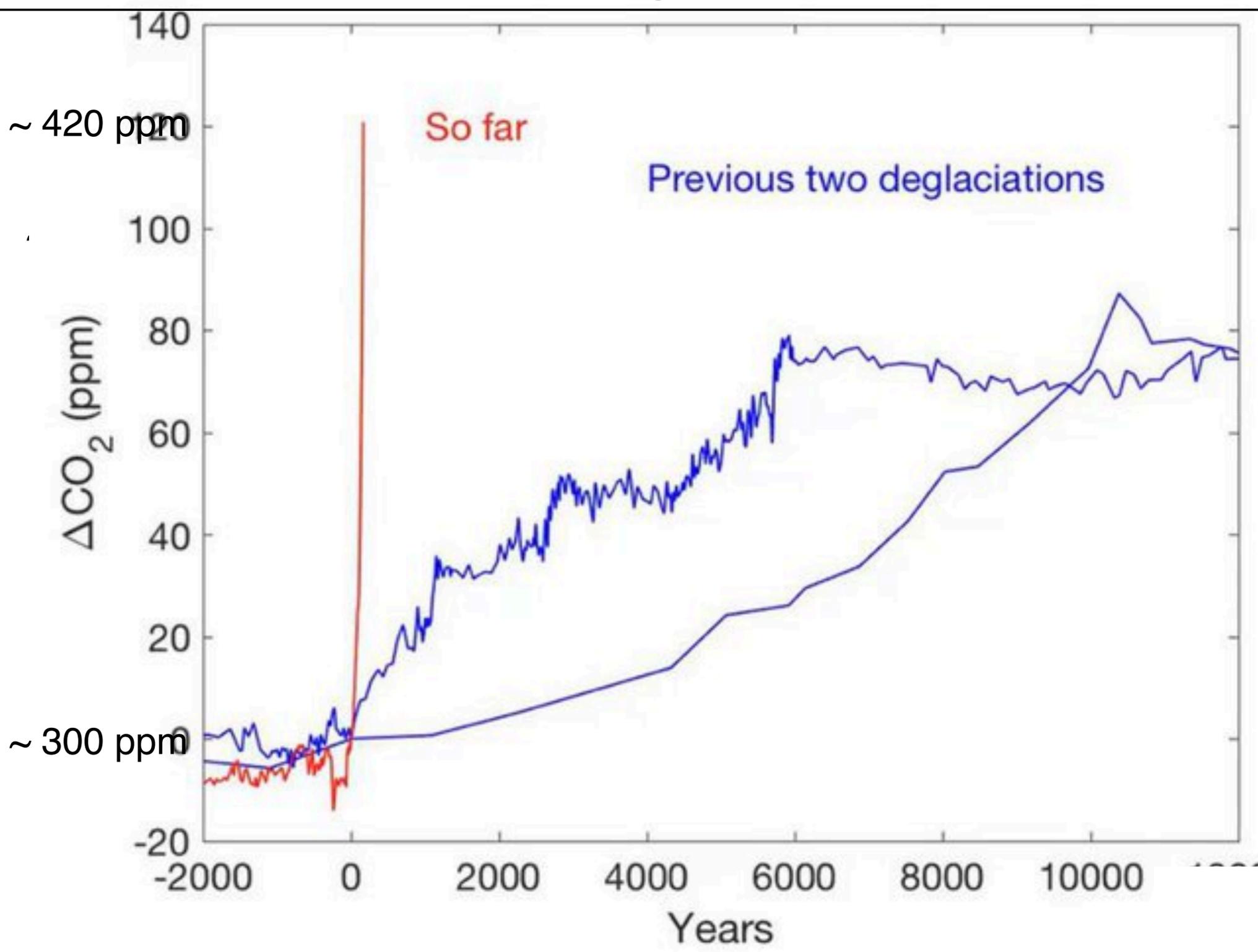
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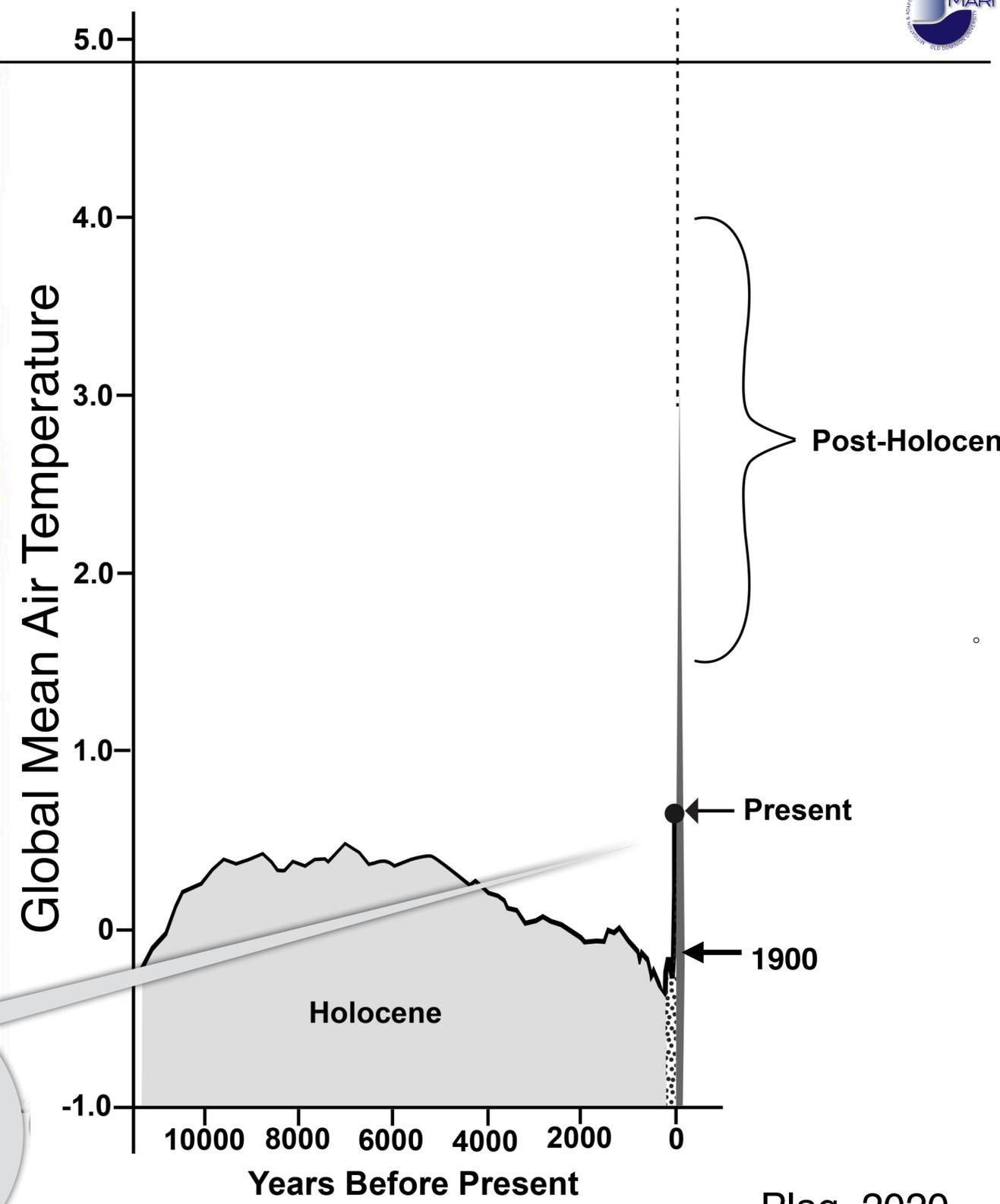
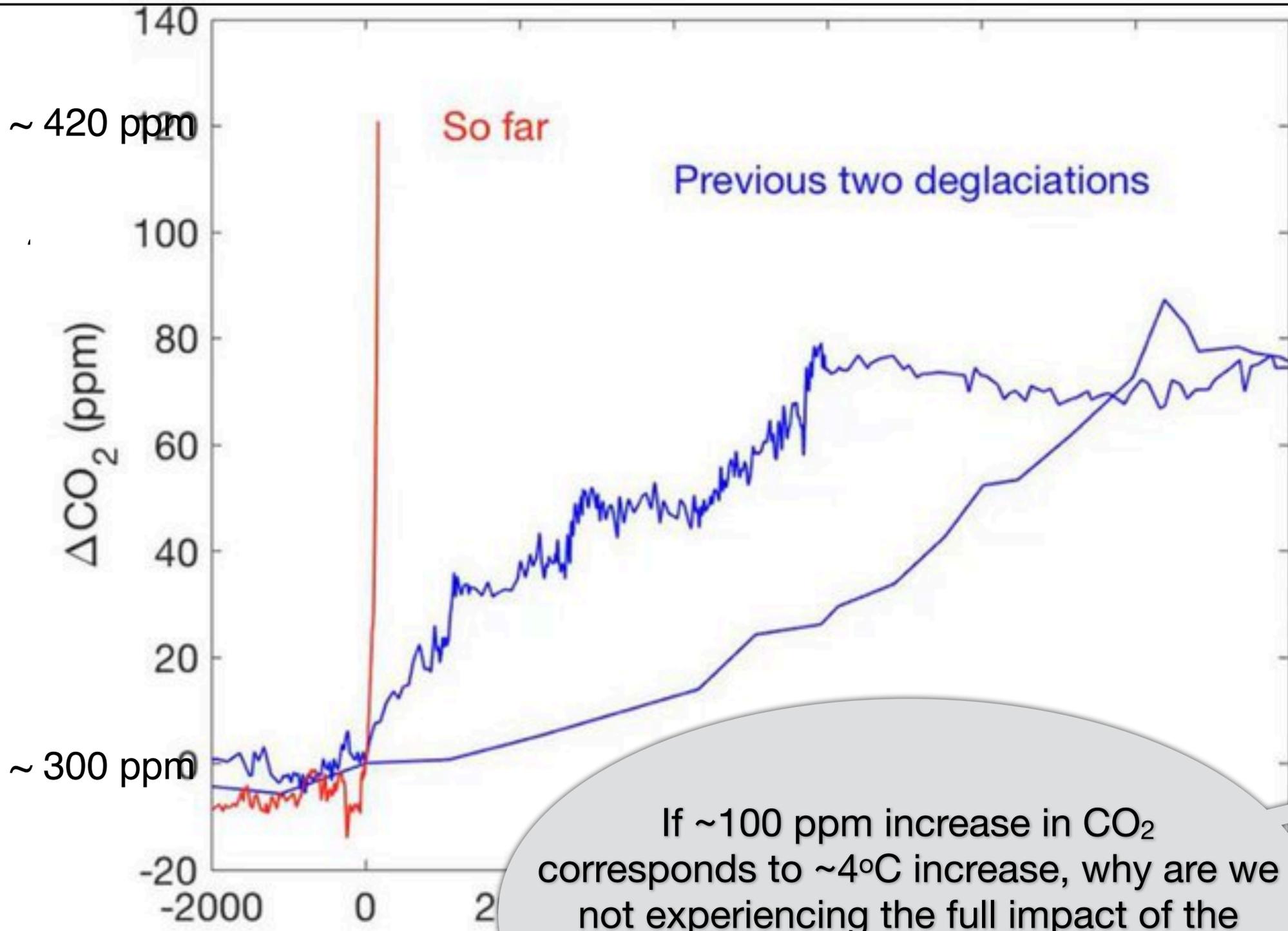
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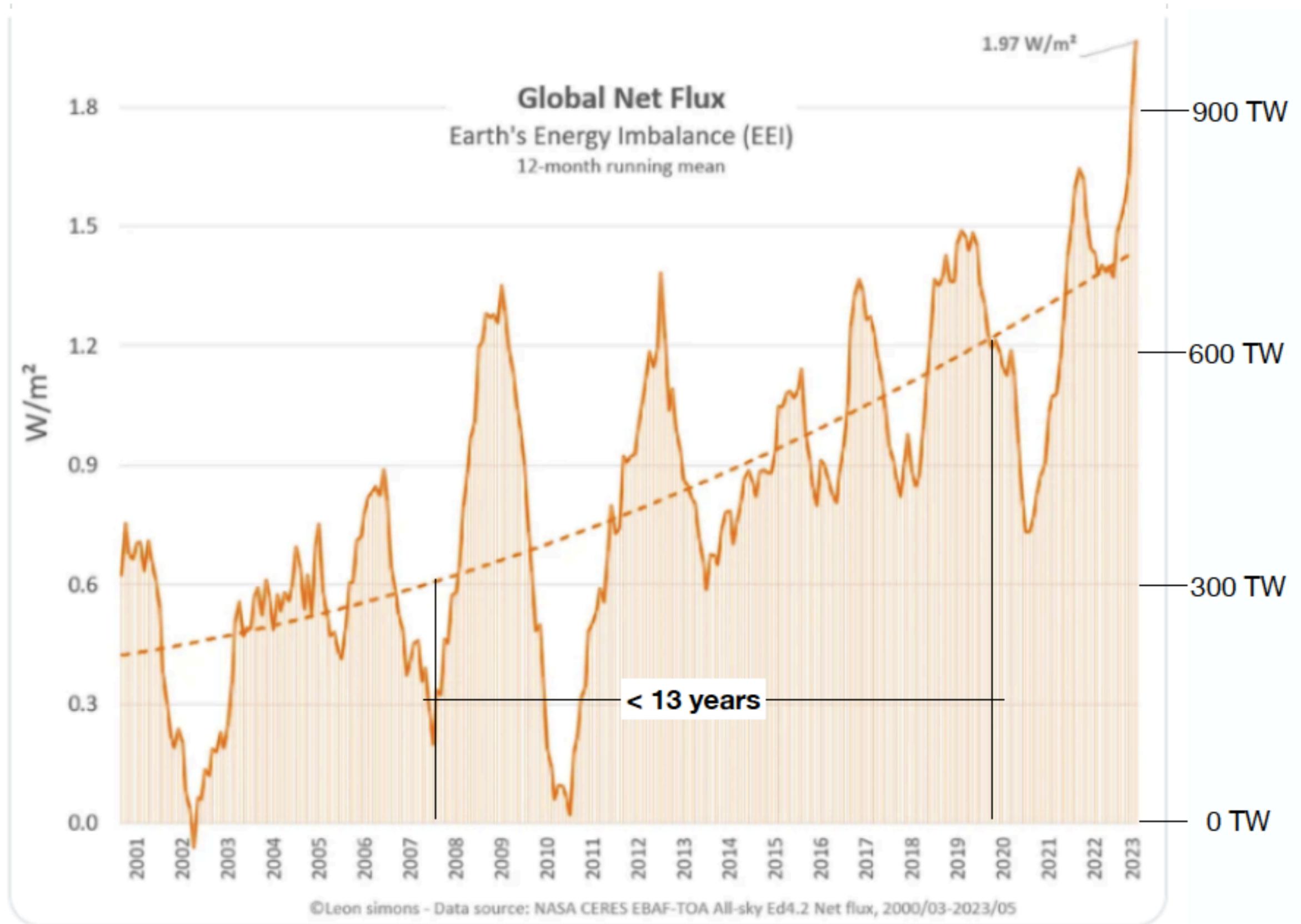


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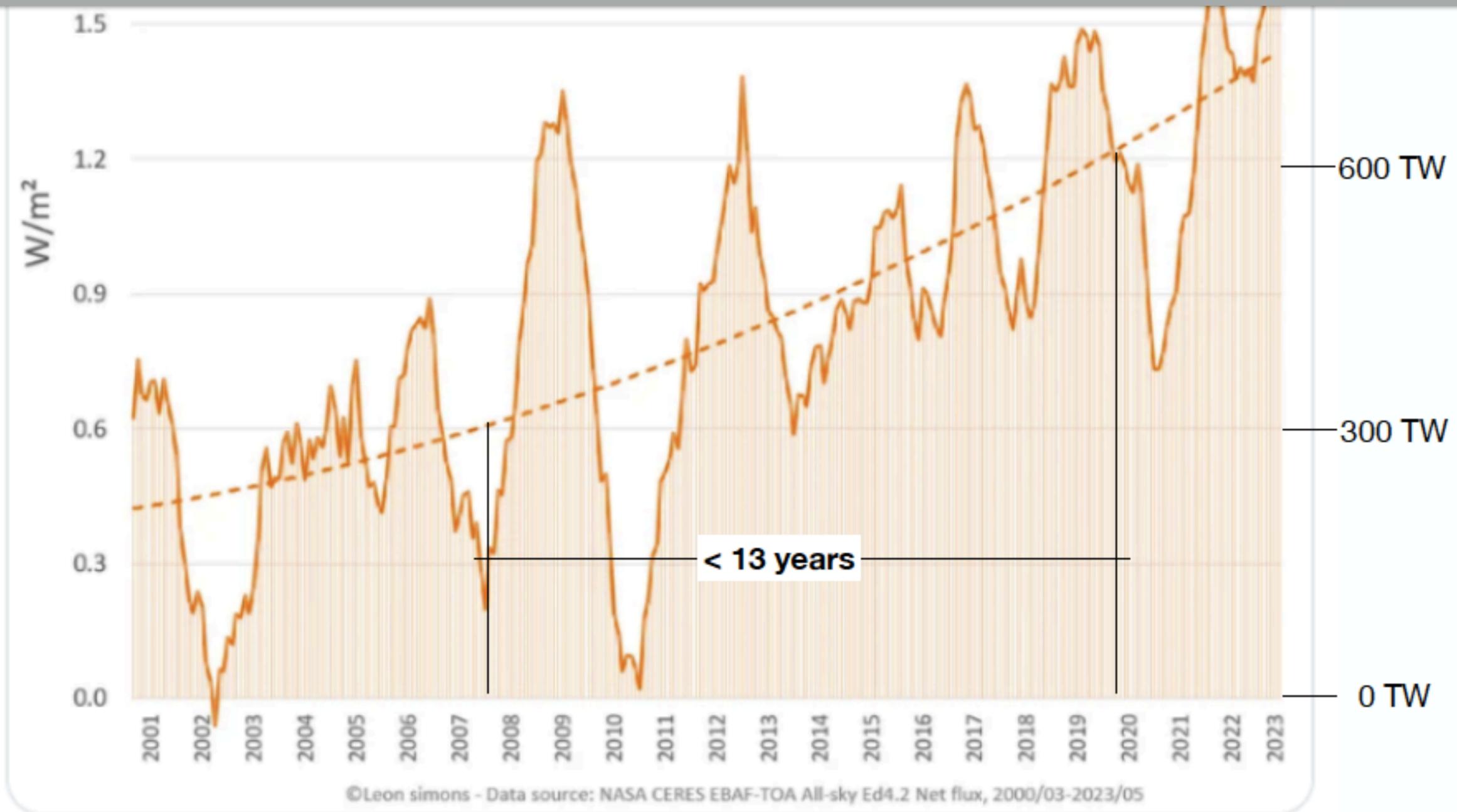


If ~100 ppm increase in CO₂ corresponds to ~4°C increase, why are we not experiencing the full impact of the dramatic increase of 120 ppm in Greenhouse Gasses?

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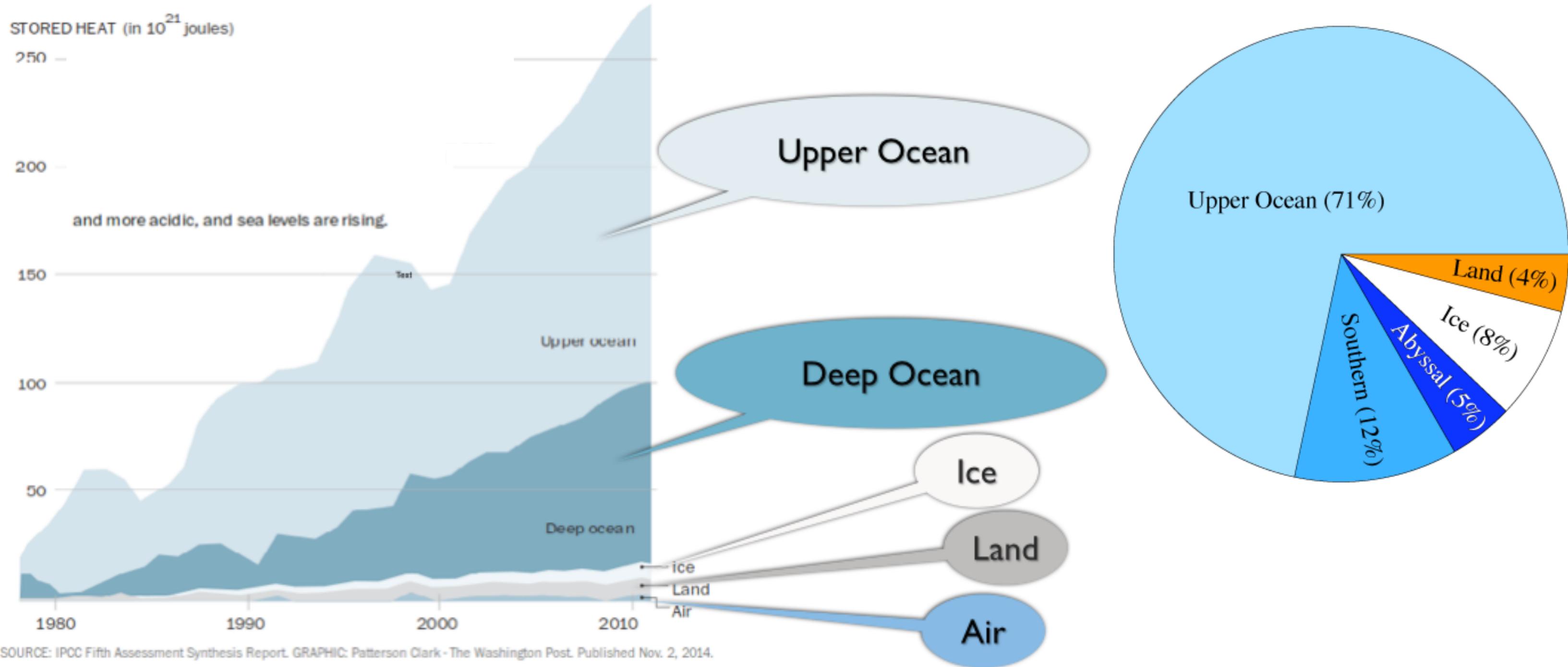


Why is “global warming” (of the atmosphere) so slow?



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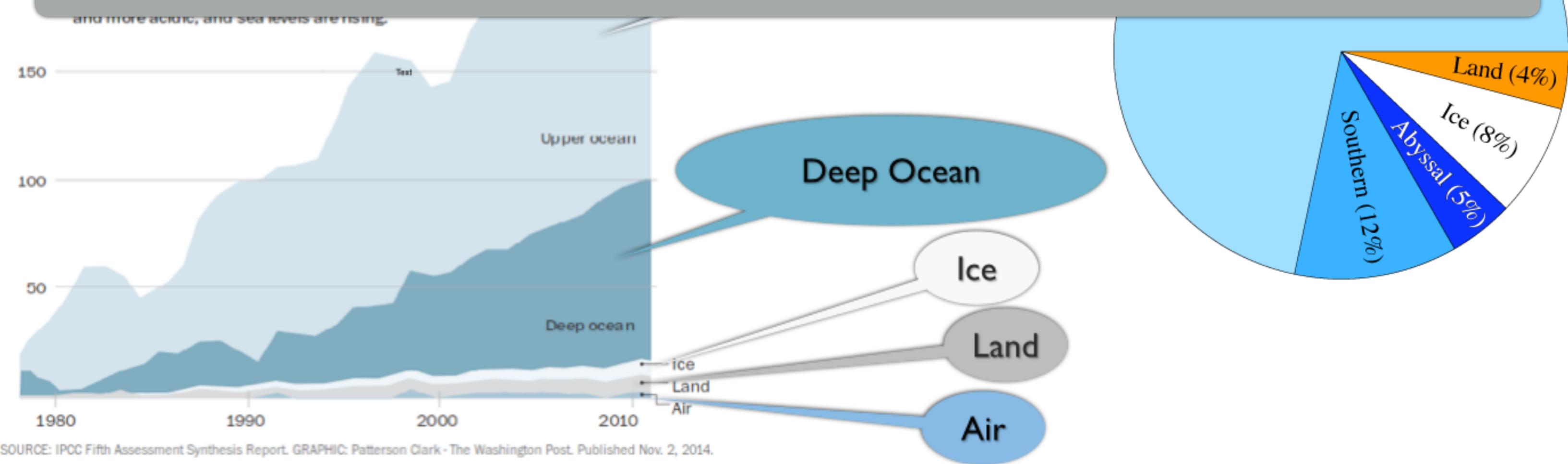
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Why is “global warming” (of the atmosphere) so slow?
More than 95% of the additional energy is absorbed by the ocean
Water has 3300 times the volumetric heat capacity of air
Heating the ocean takes a long time ...

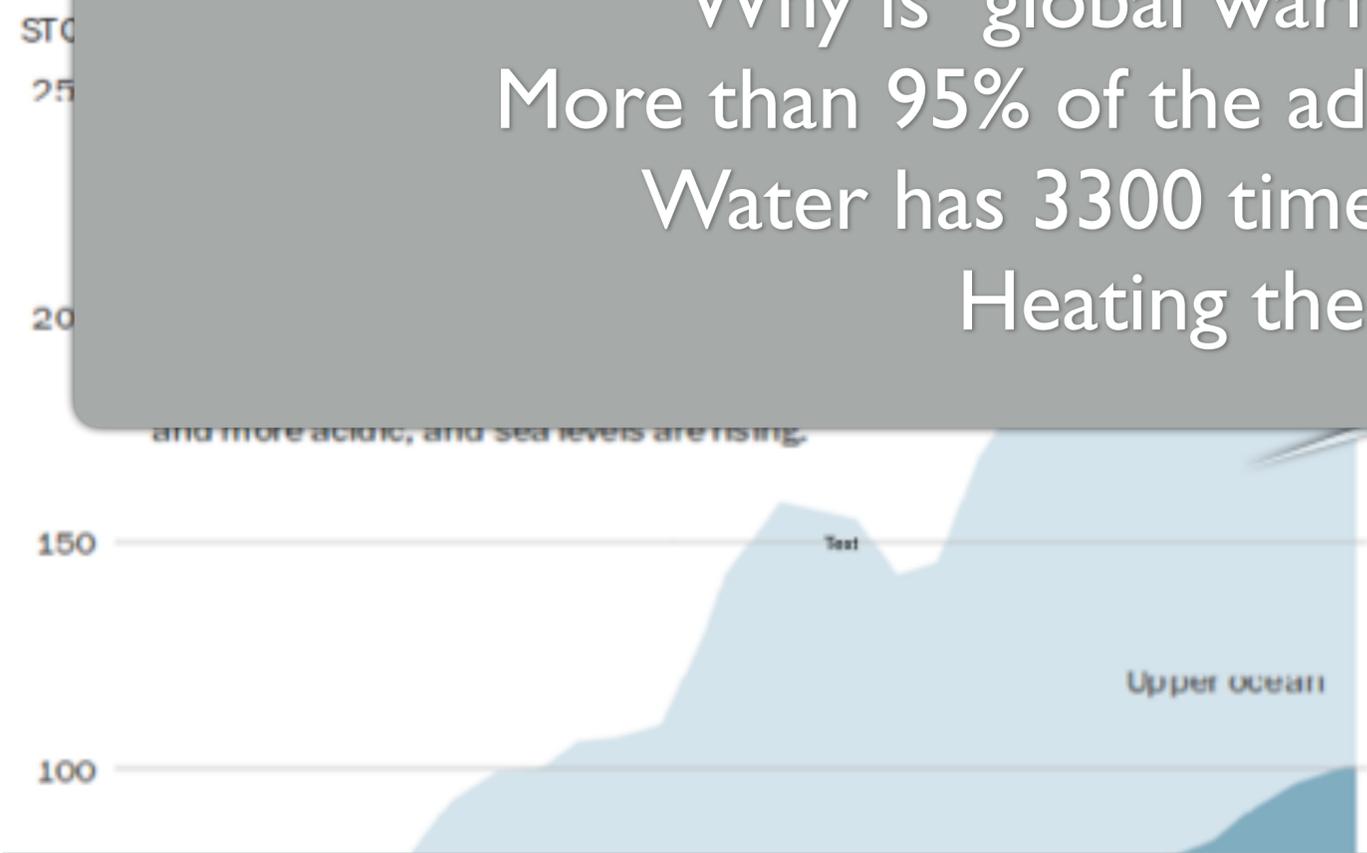


SOURCE: IPCC Fifth Assessment Synthesis Report. GRAPHIC: Patterson Clark - The Washington Post. Published Nov. 2, 2014.

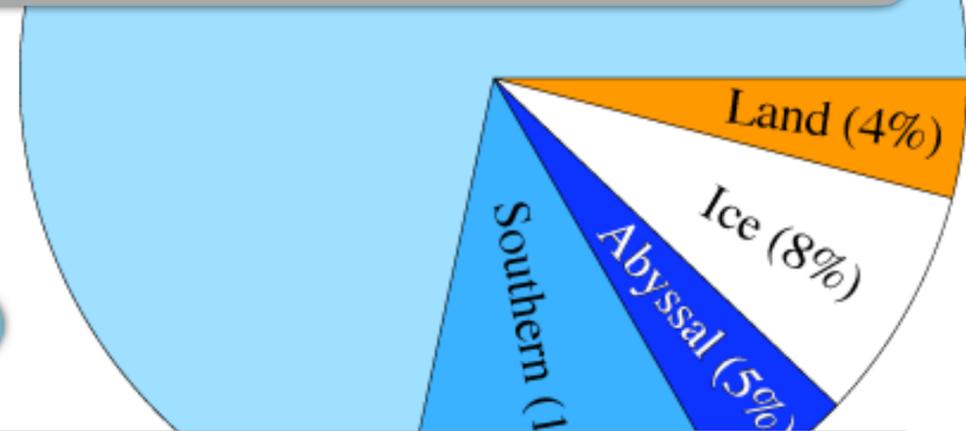
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Deep Ocean



If the same amount of heat that has gone into the top 2000 m of the ocean between 1955-2010 had gone into the lower 10 km of the atmosphere, then the Earth would have seen a warming of 36°C. (IUCN, 2016)



Air

SOURCE: IPCC Fifth Assessment Synthesis Report. GRAPHIC: Patterson Clark - The Washington Post. Published Nov. 2, 2014.

Climate Change is a long-term shift in the statistics of weather - averages, frequency and magnitude of extremes.

The Baseline: Past Climate and Global Change

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Climate is determined by:

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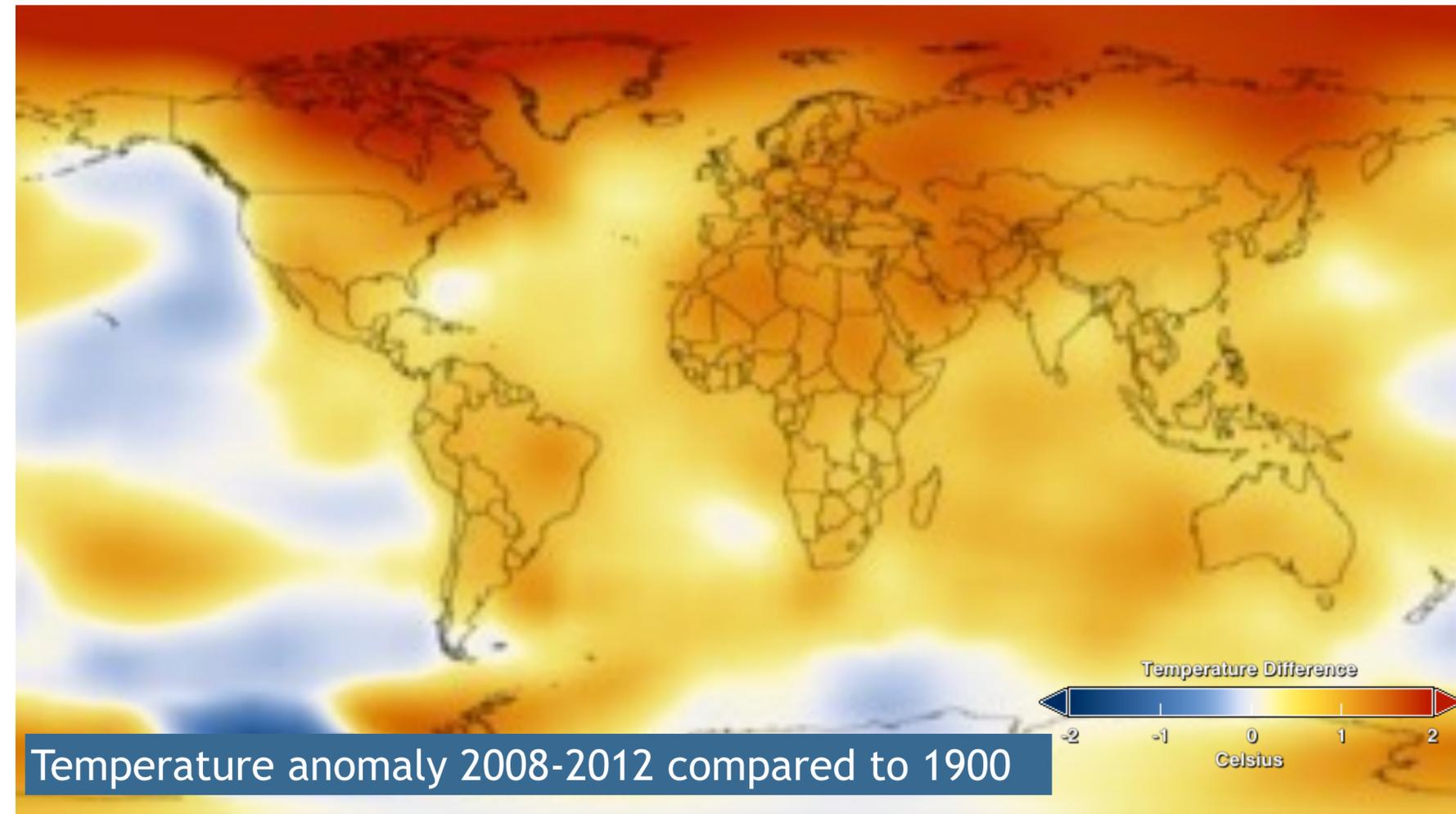
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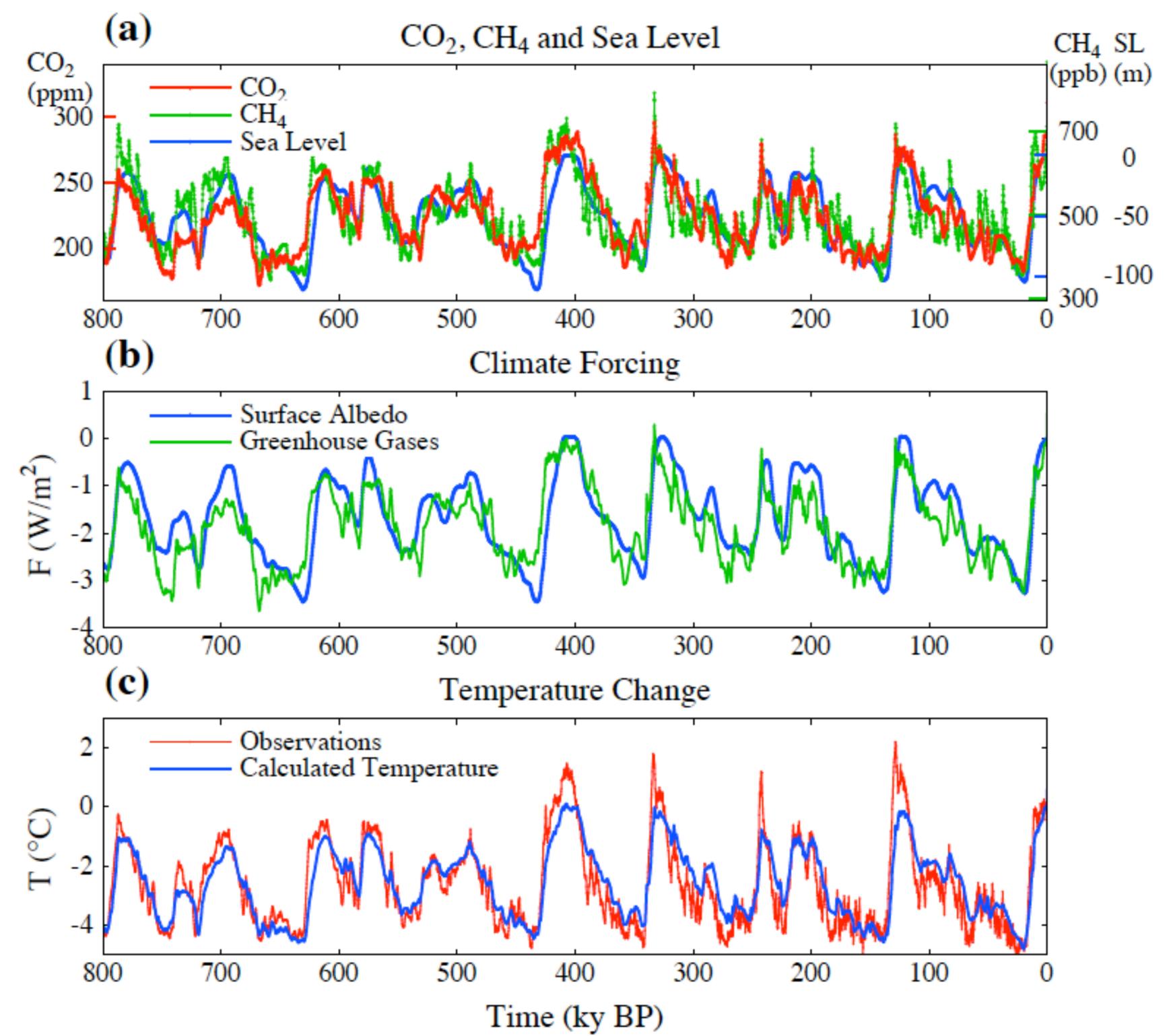
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Climate can change a lot over time.



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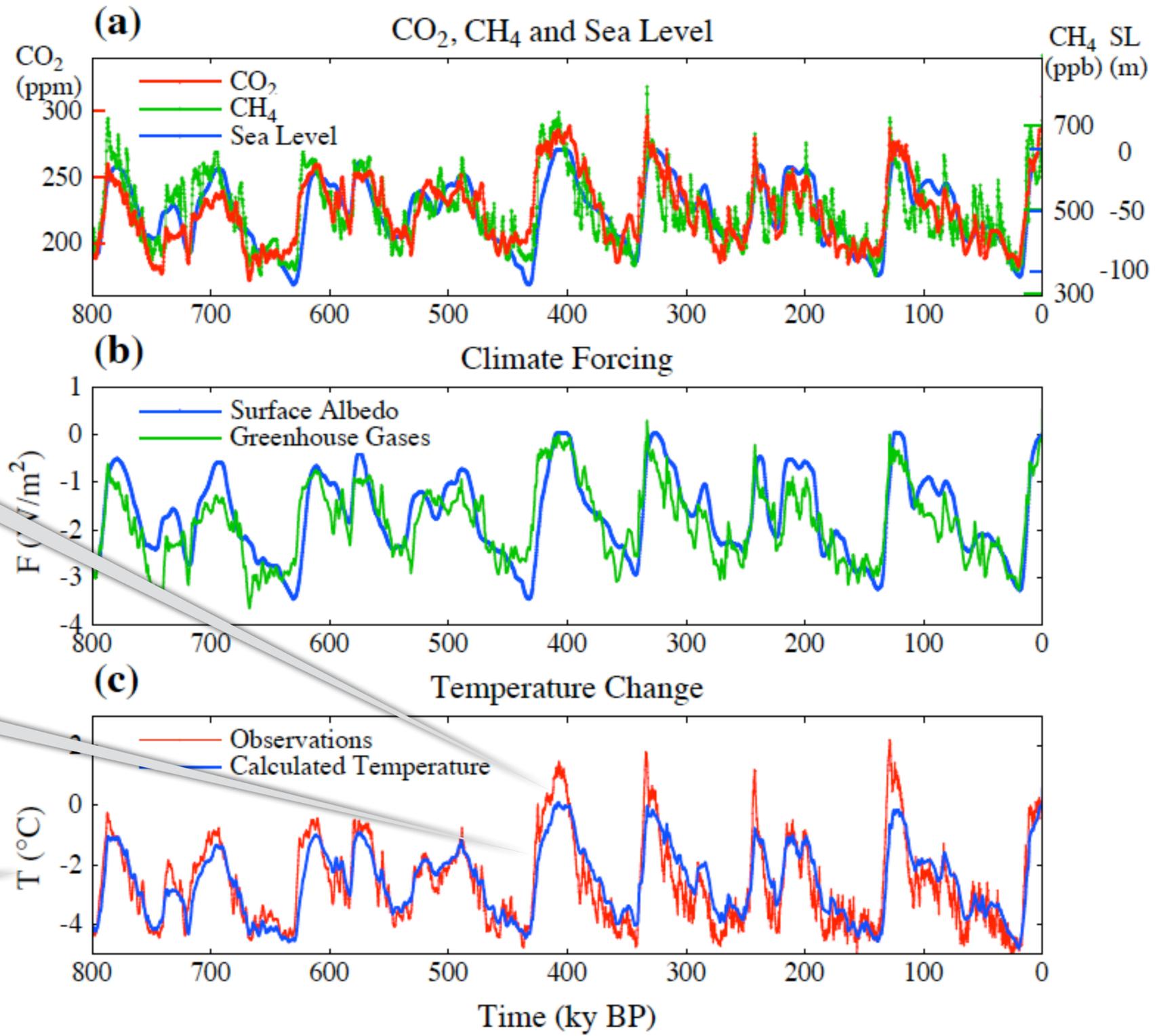
Cold period
Ice age
"glacial"

Warm period
"Inter-glacial"

scales.

Climate can change a lot over time

Temperature difference:
4°C - 5°C



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High Correlation of CO₂ and Temperature

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Warm period "inter-glacial"

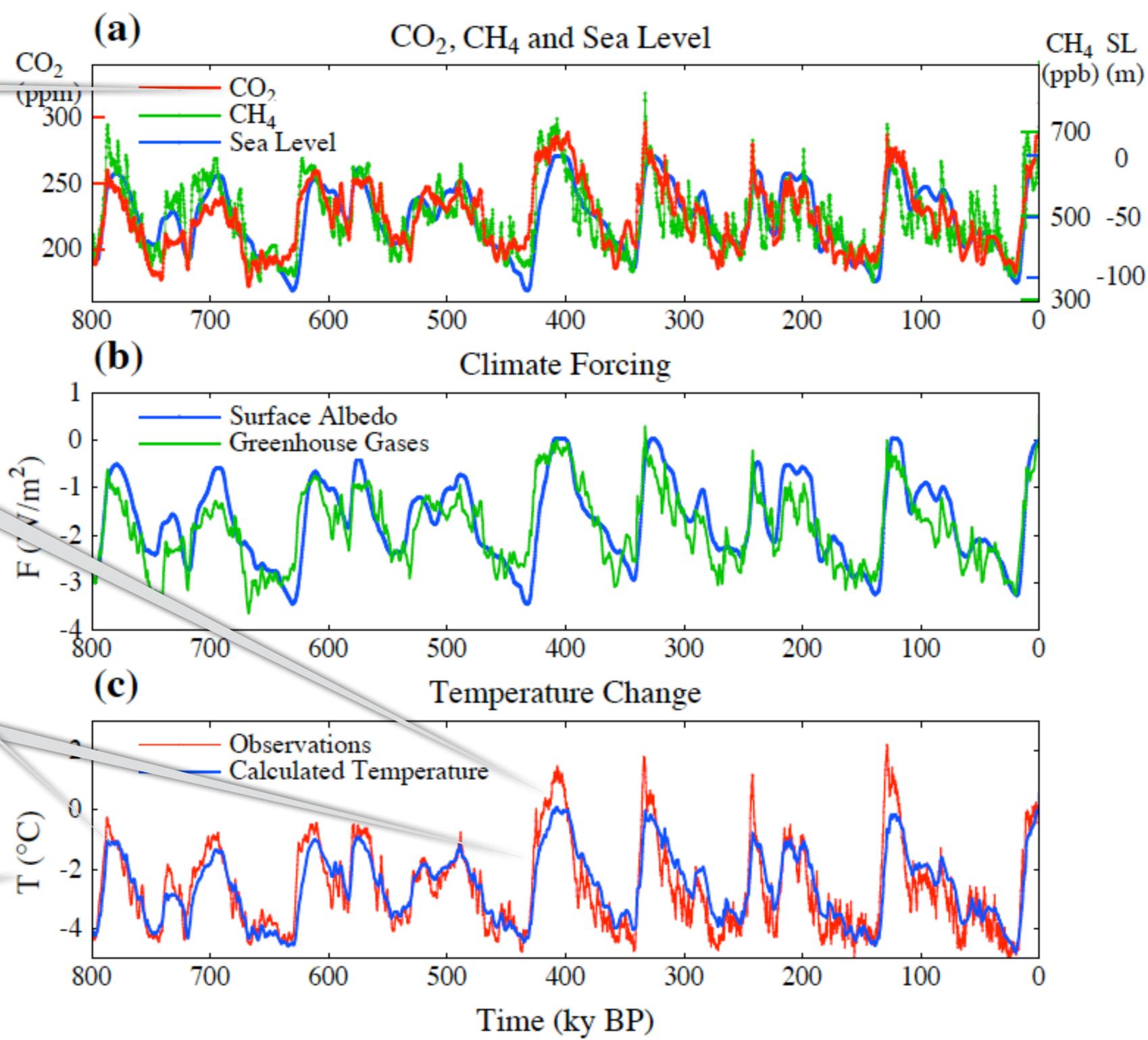
Cold period "glacial" Ice age

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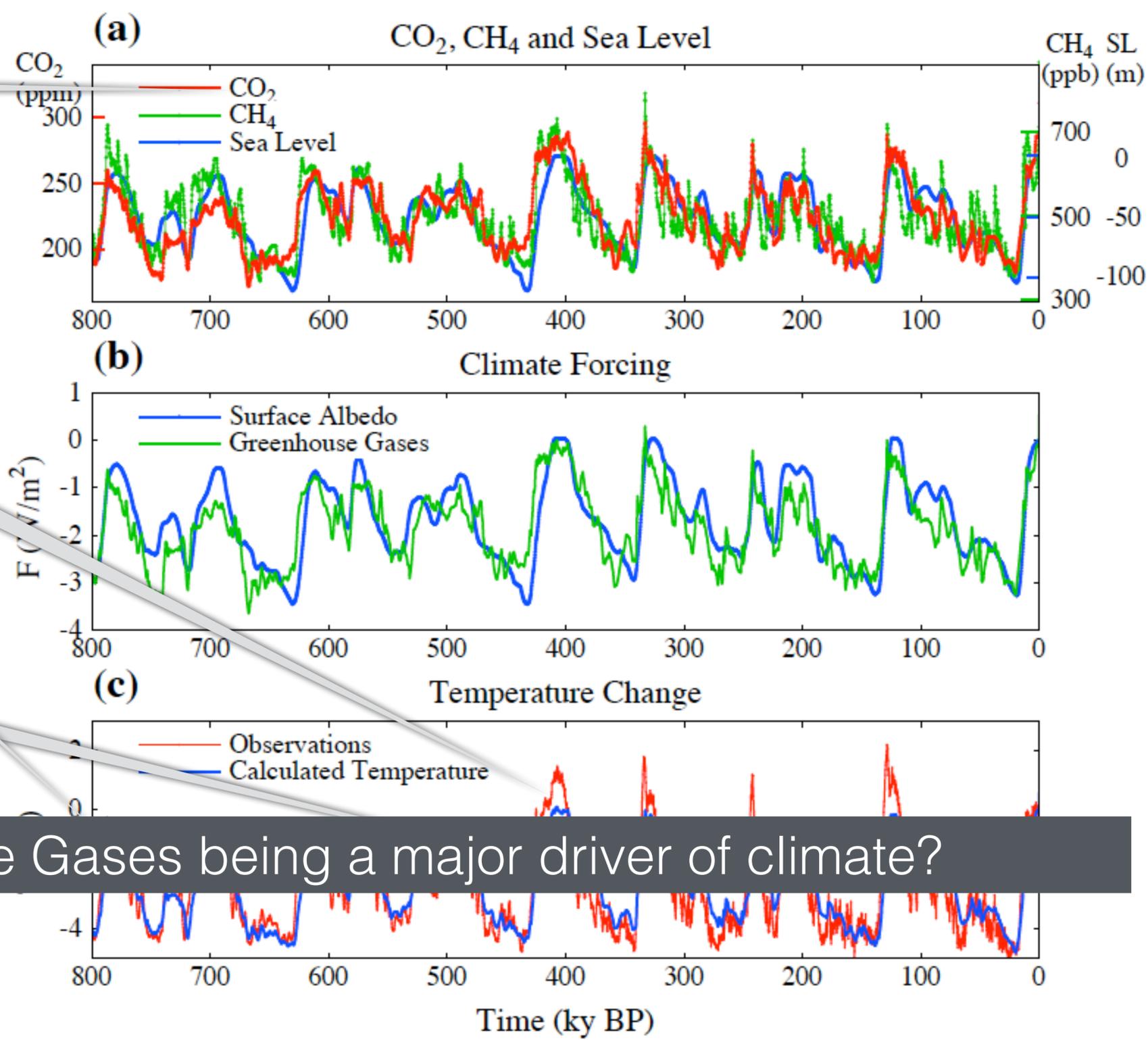
Warm period "inter-glacial"

Cold period "glacial" Ice age

Climate can change on different scales.

Climate can change a lot over time.

difference: 4°C - 5°C



We did we know about Greenhouse Gases being a major driver of climate?



EARTH OBSERVATORY
Where every day is Earth Day

Home

Image

SVANTE ARRHENIUS (1859-1927)

Arrhenius did very little research in the fields of climatology and geophysics, and considered any work in these fields a hobby. His basic approach was to apply knowledge of basic scientific principles to make sense of existing observations, while hypothesizing a theory on the cause of the “Ice Age.” Later on, his geophysical work would serve as a catalyst for the work of others.





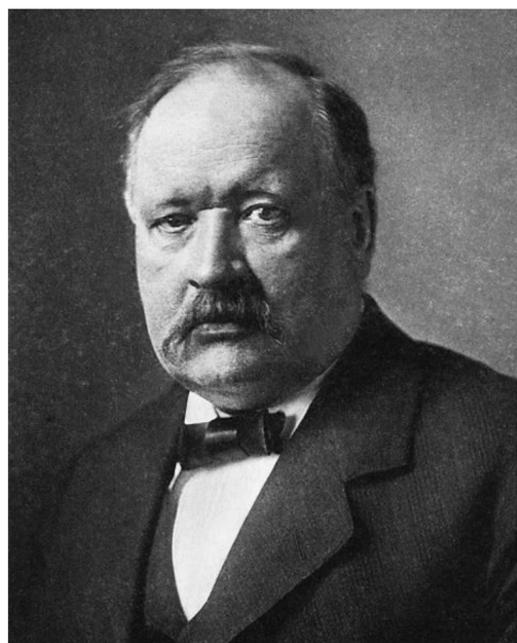
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In 1895, Arrhenius presented a paper to the Stockholm Physical Society titled, “On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.”

This article described an energy budget model that considered the radiative effects of carbon dioxide (carbonic acid) and water vapor on the surface temperature of the Earth, and variations in atmospheric carbon dioxide concentrations. In order to proceed with his experiments, Arrhenius relied heavily on the experiments and observations of other scientists, including Josef Stefan, Arvid Gustaf Högbom, Samuel Langley, Leon Teisserenc de Bort, Knut Angstrom, Alexander Buchan, Luigi De Marchi, Joseph Fourier, C.S.M. Pouillet, and [John Tyndall](#).

Arrhenius argued that variations in trace constituents—namely carbon dioxide—of the atmosphere could greatly influence the heat budget of the Earth. Using the best data available to him (and making many assumptions and estimates that were necessary), he performed a series of calculations on the temperature effects of increasing and decreasing amounts of carbon dioxide in the Earth's atmosphere. His calculations showed that the “temperature of the Arctic regions would rise about 8 degrees or 9 degrees Celsius, if the carbonic acid increased 2.5 to 3 times its present value. In order to get the temperature of the ice age between the 40th and 50th parallels, the carbonic acid in the air should sink to 0.62 to 0.55 of present value (lowering the temperature 4 degrees to 5 degrees Celsius).”



REMARKABLE WEATHER OF 1911

The Effect of the Combustion
of Coal on the Climate — What
Scientists Predict for the Future

By FRANCIS MOLENA

THE year 1911 will long be remembered for the violence of its weather. The spring opened mild and

The mean temperature of every month except November was above the average of that of the 40 years covered by

Popular Mechanics,
March 1912, 393-342

“It is largely the courageous, enterprising, and ingenious American whose brains are changing the world. Yet even the dull foreigner, who burrows in the earth by the faint gleam of his miner's lamp, not only supports his family and helps to feed the consuming furnaces of modern industry, but by his toil in the dirt and darkness adds to the carbon dioxide in the earth's atmosphere so that men in generations to come shall enjoy milder breezes and live under sunnier skies.”



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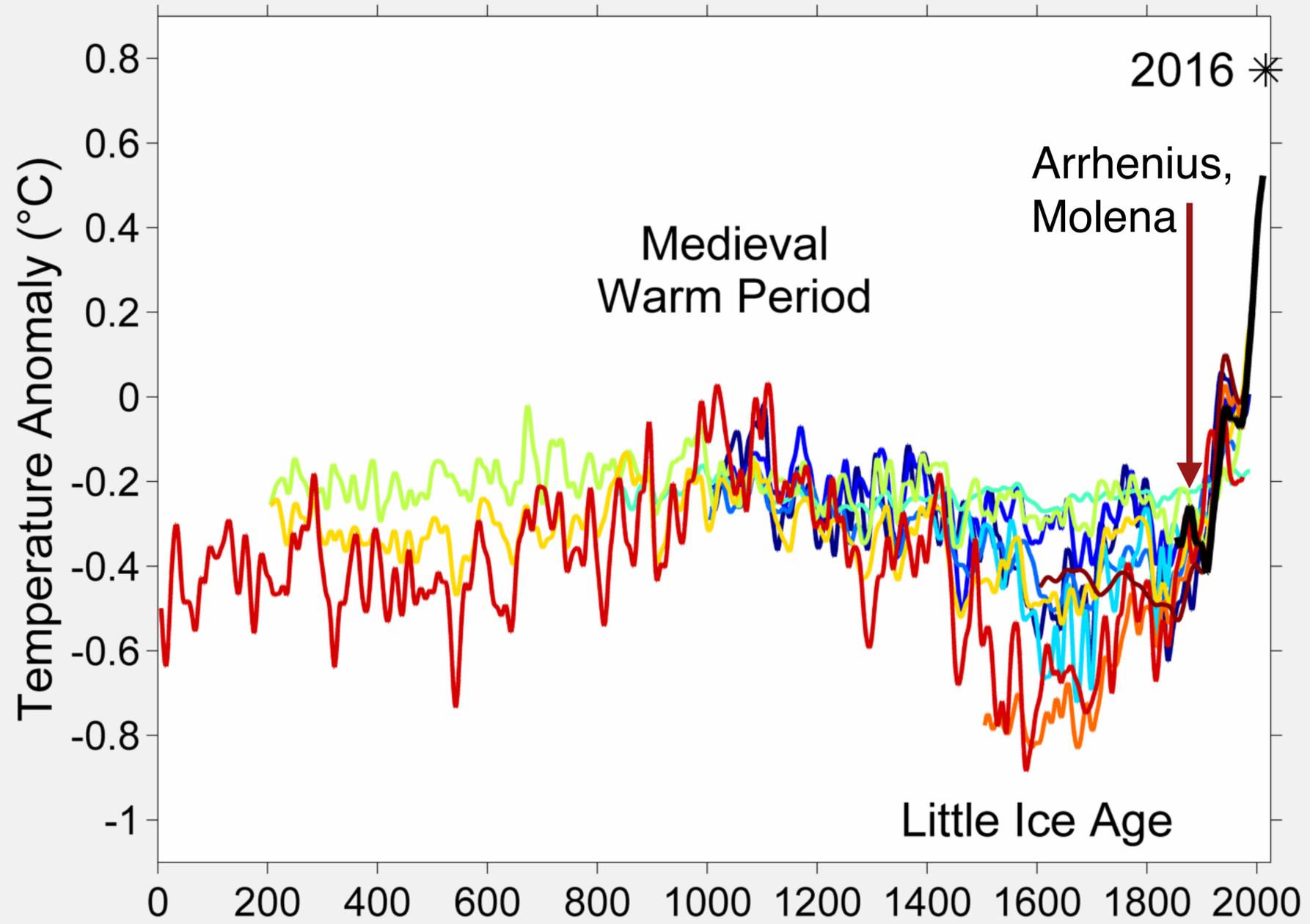
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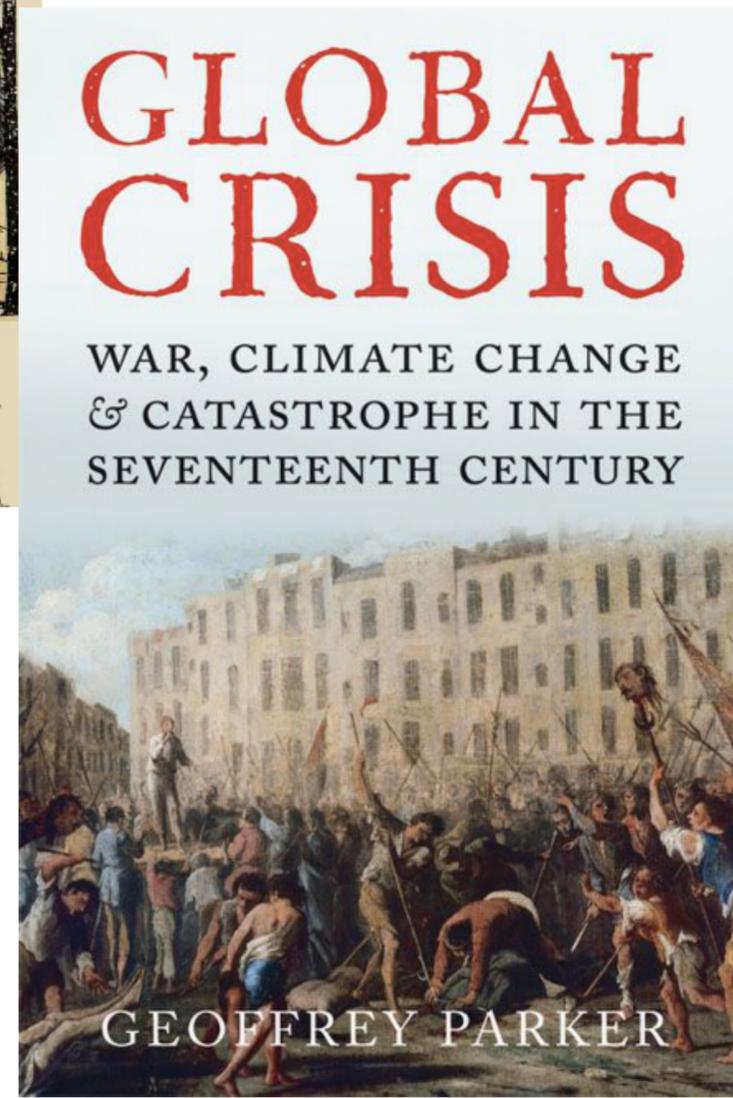
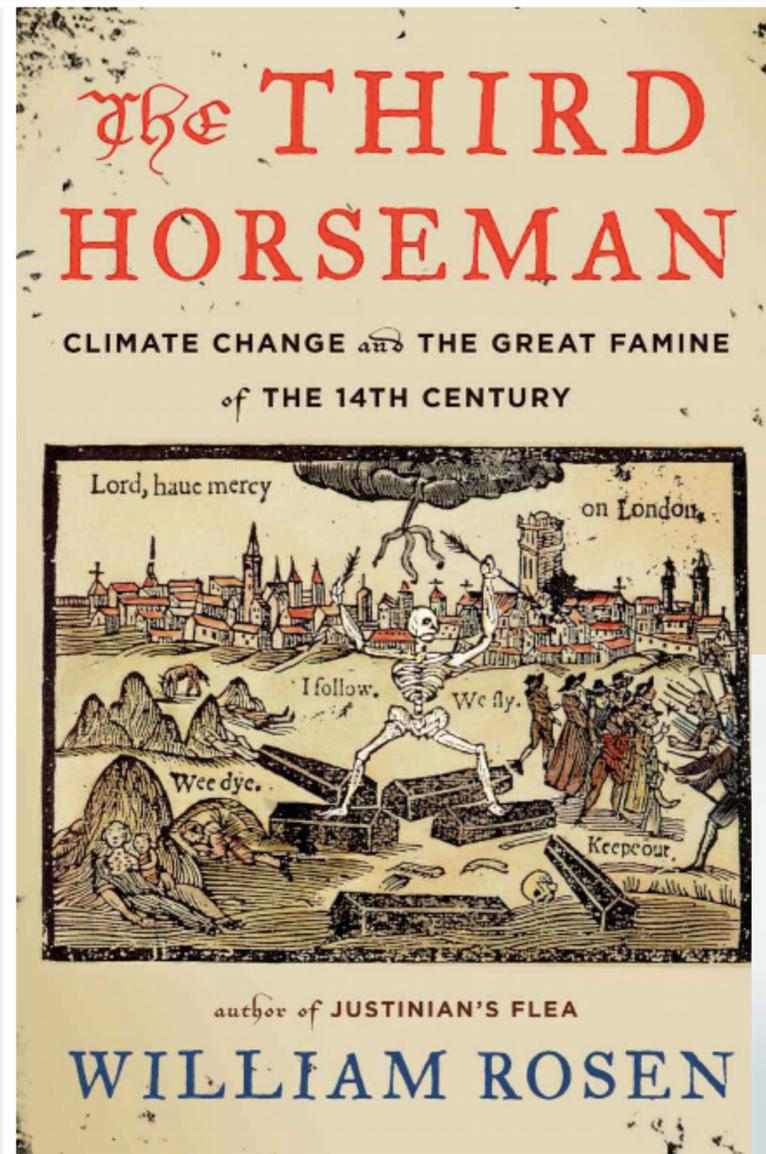
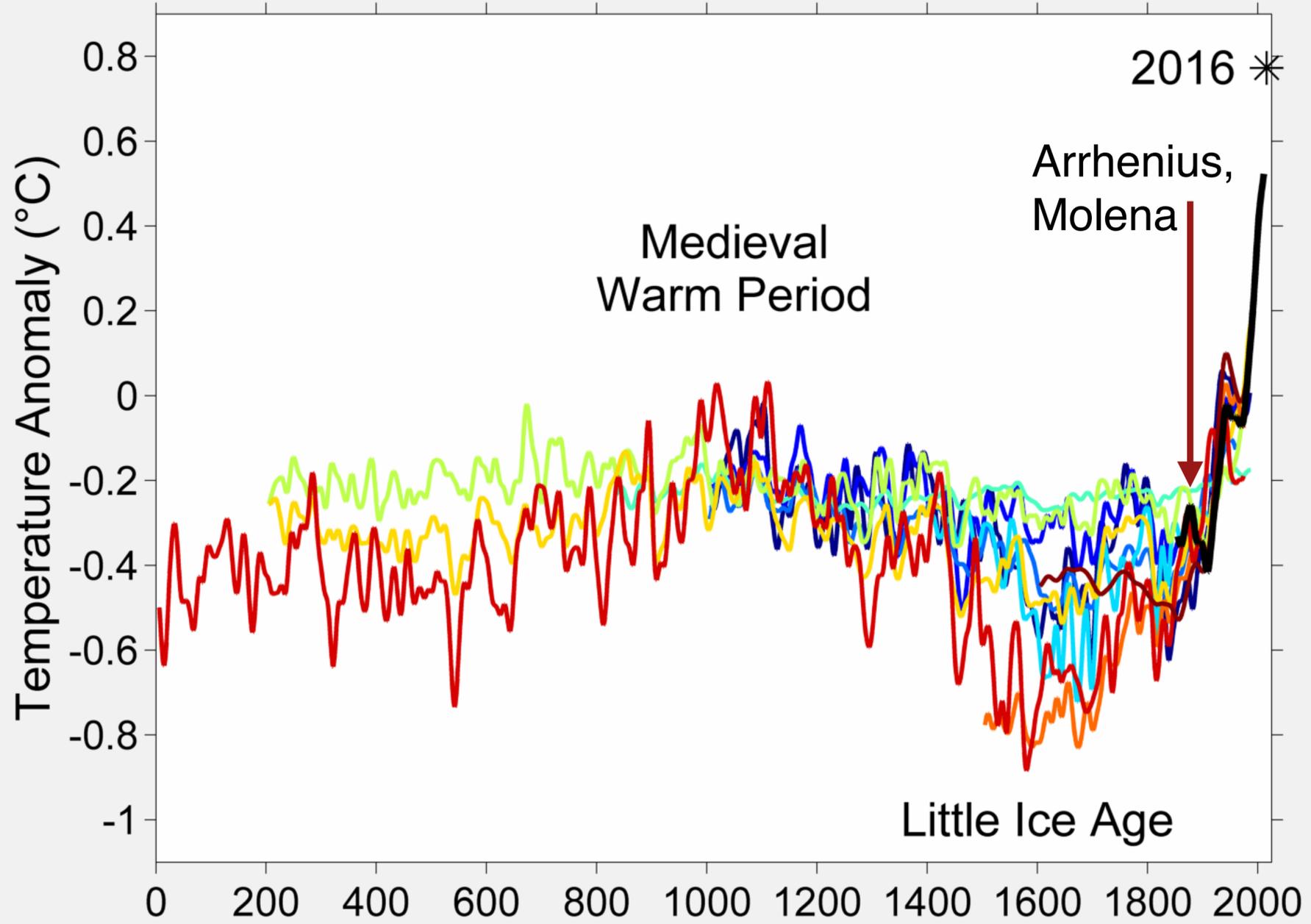
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Reconstructed Temperature

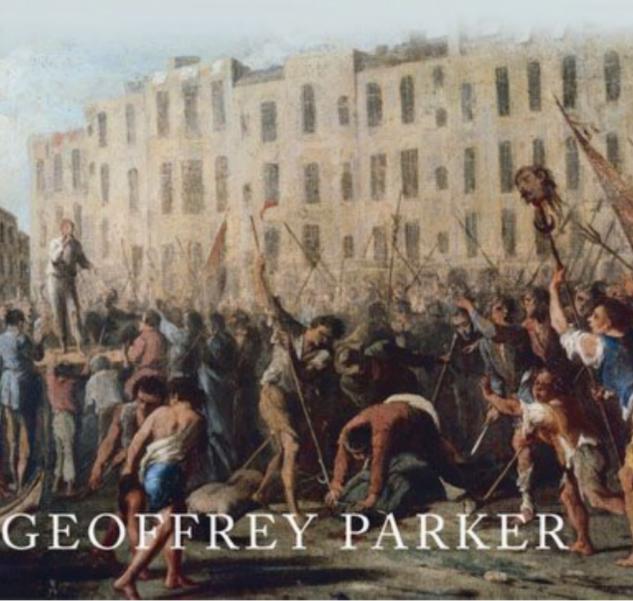
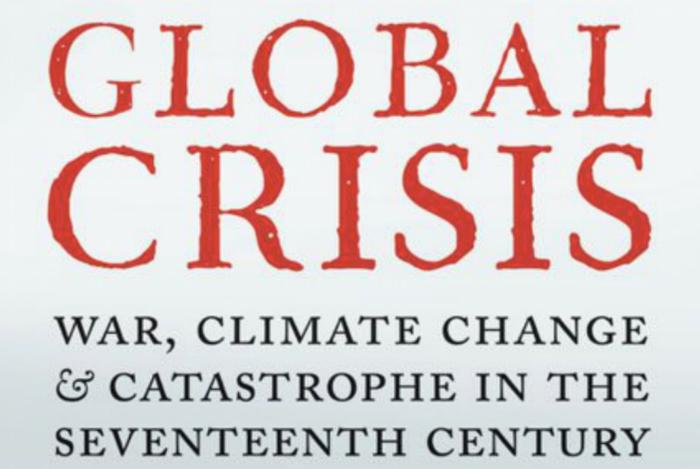
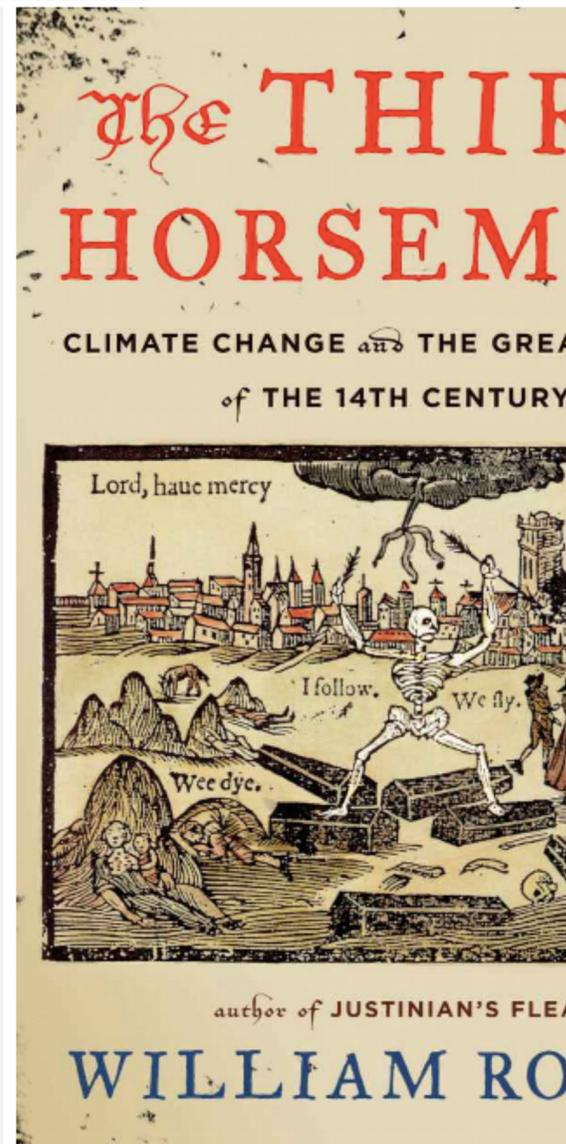
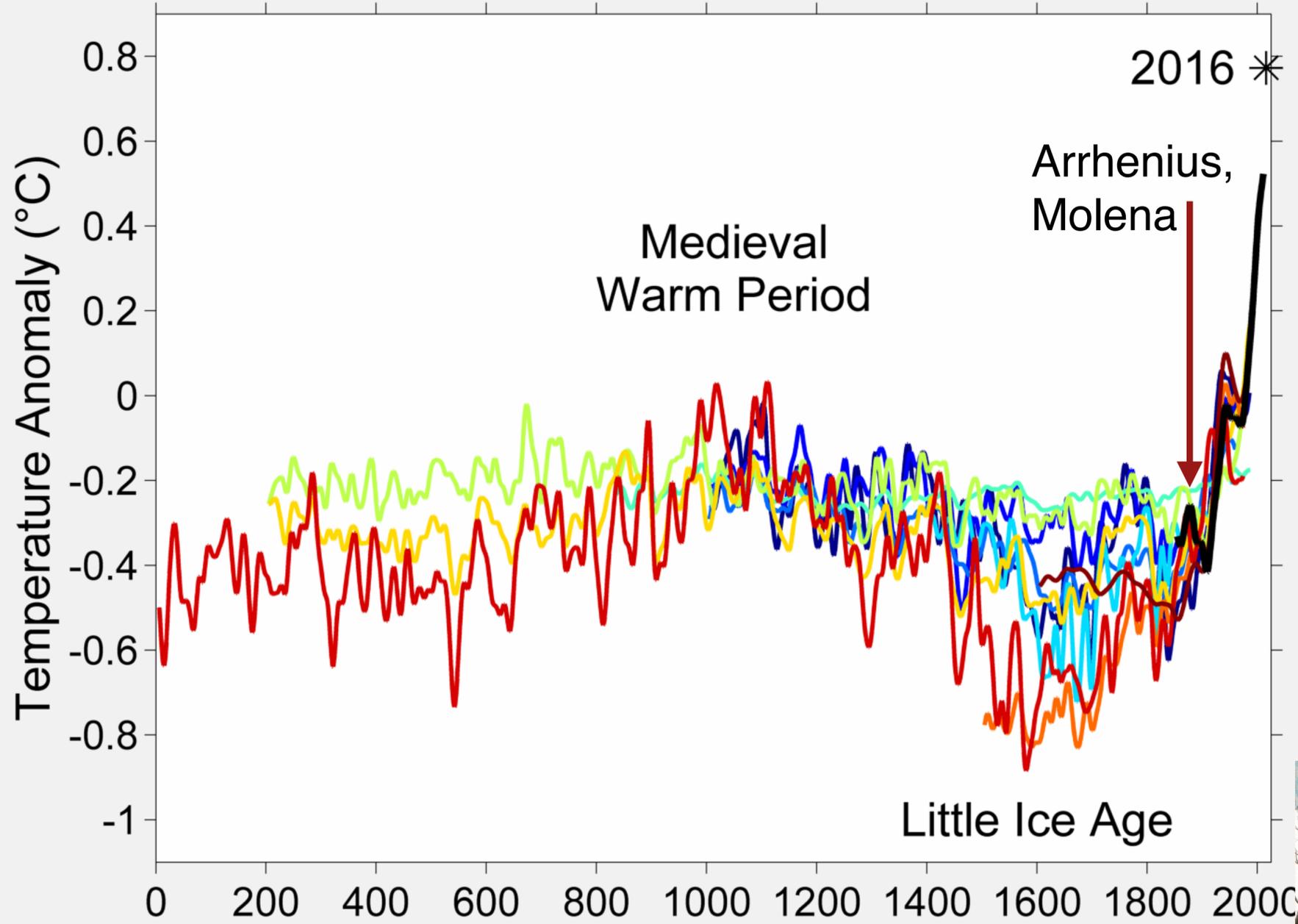


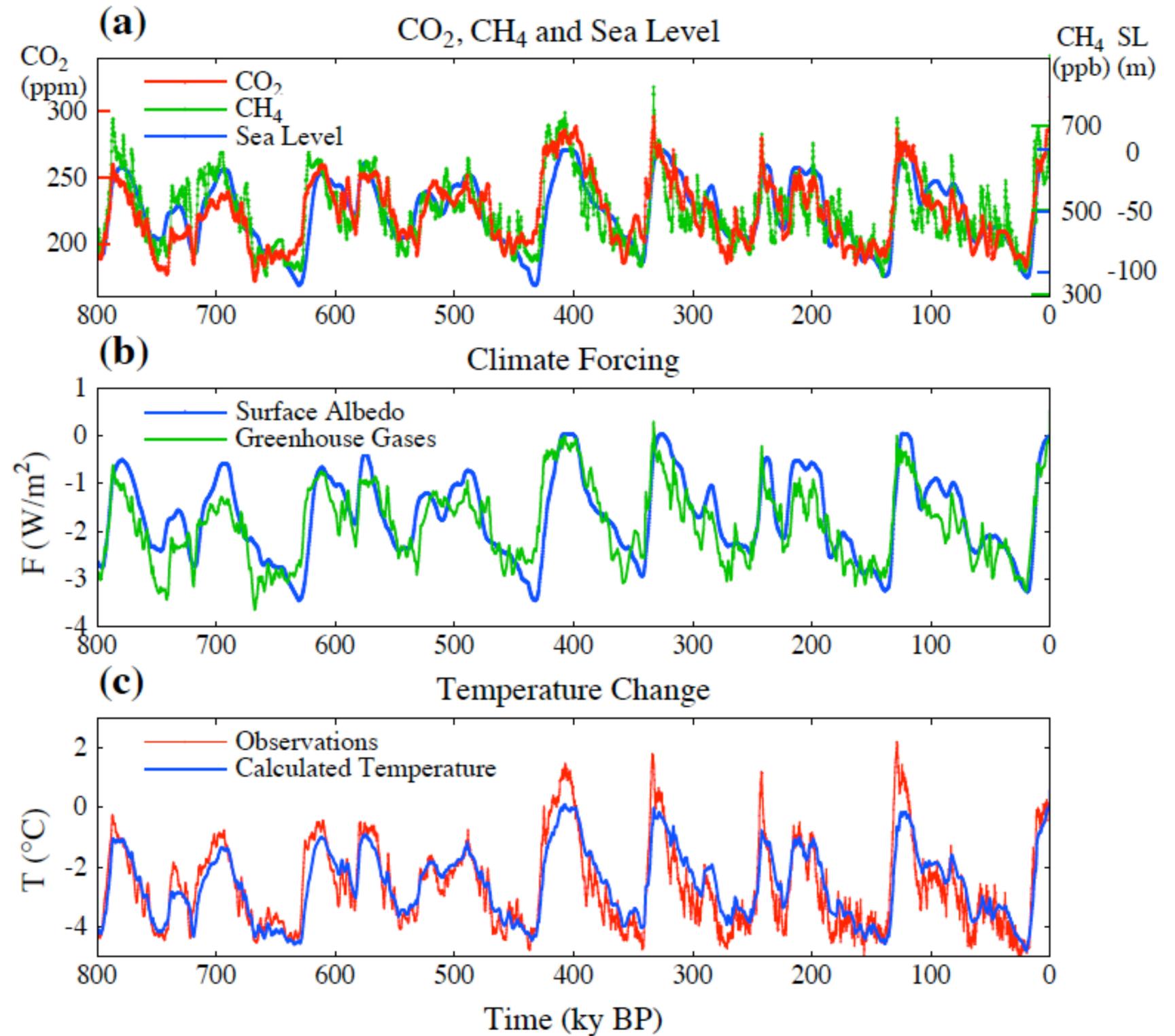
The Baseline: Past Climate and Global Change

Reconstructed Temperature

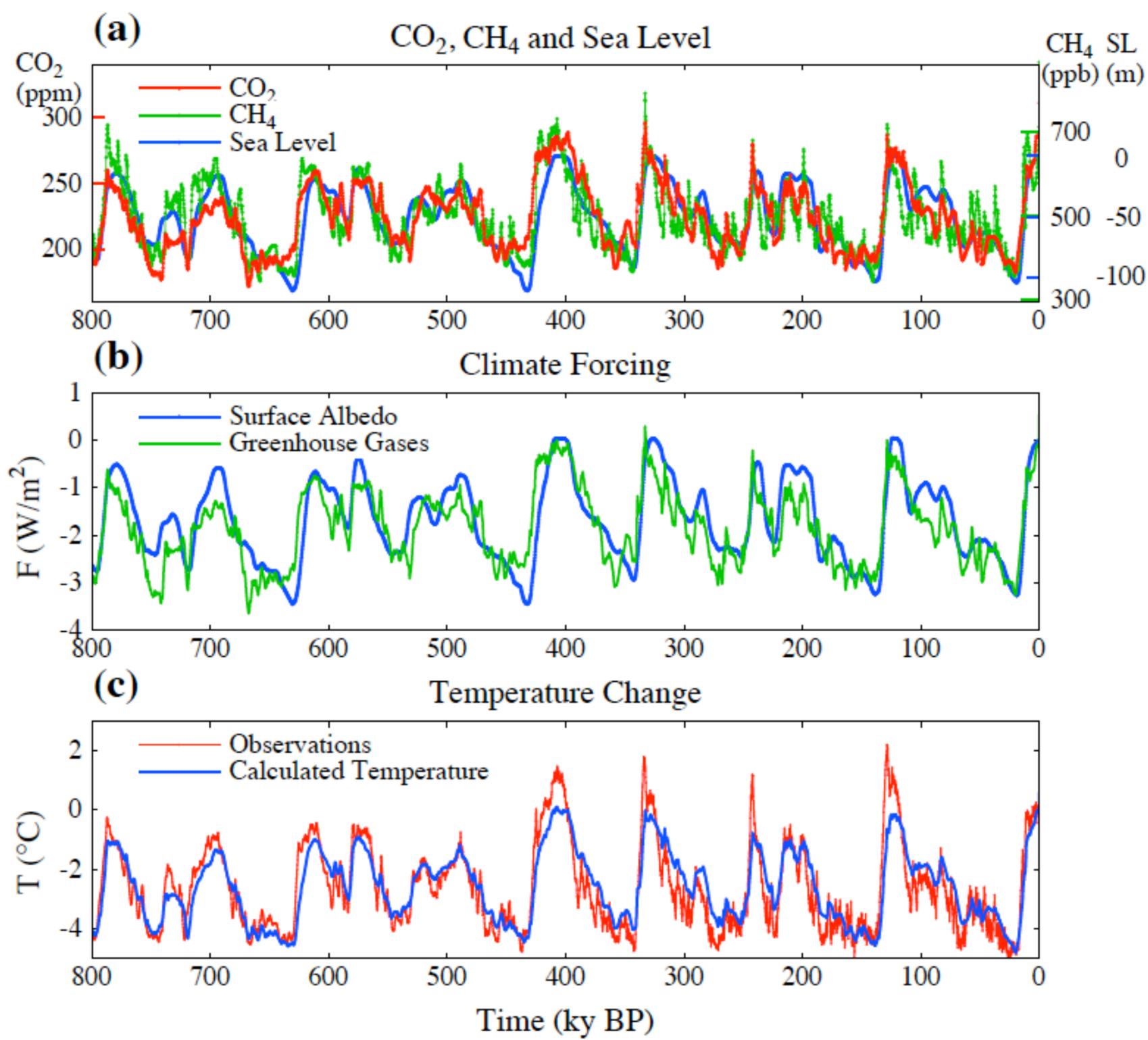
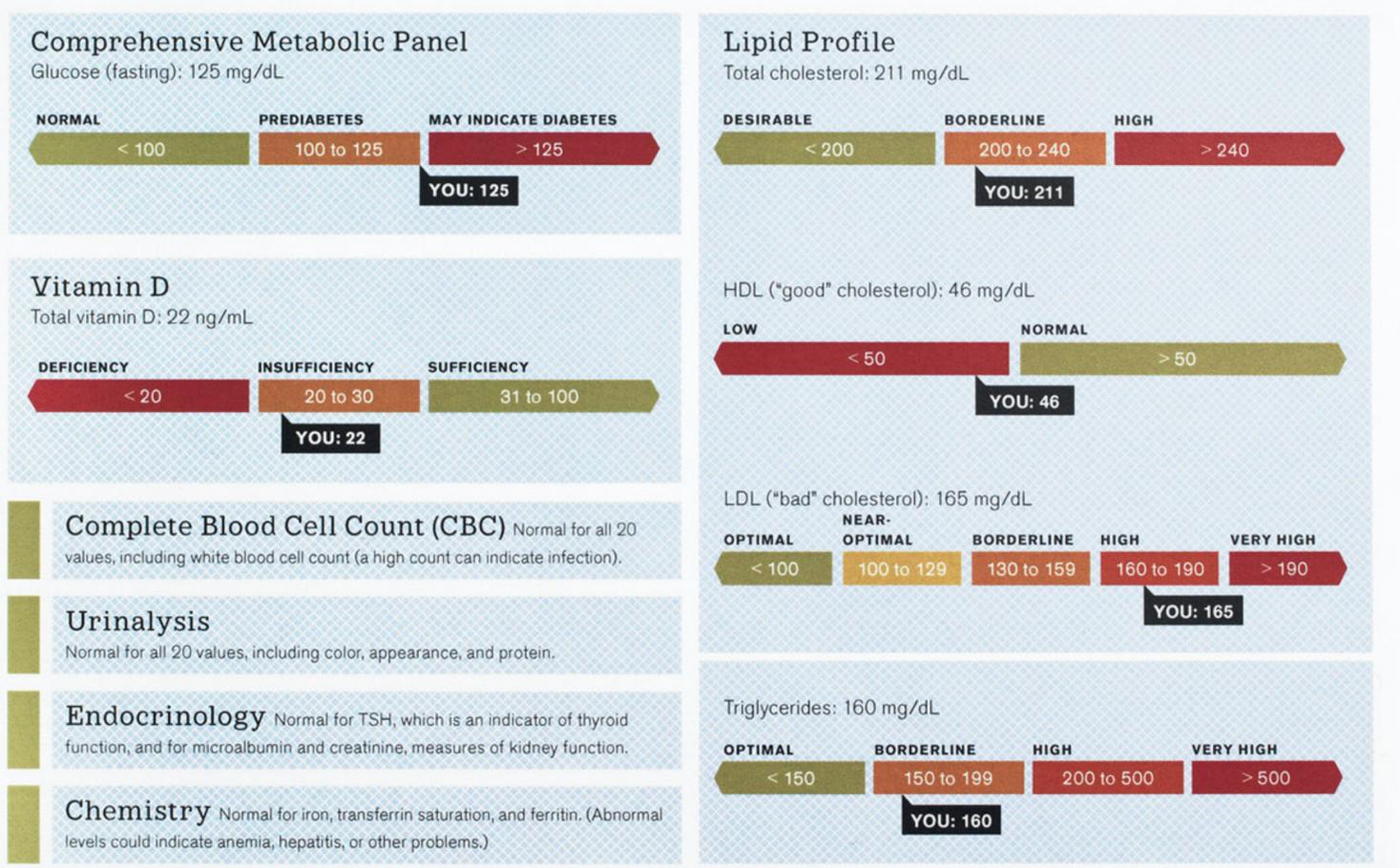


Reconstructed Temperature

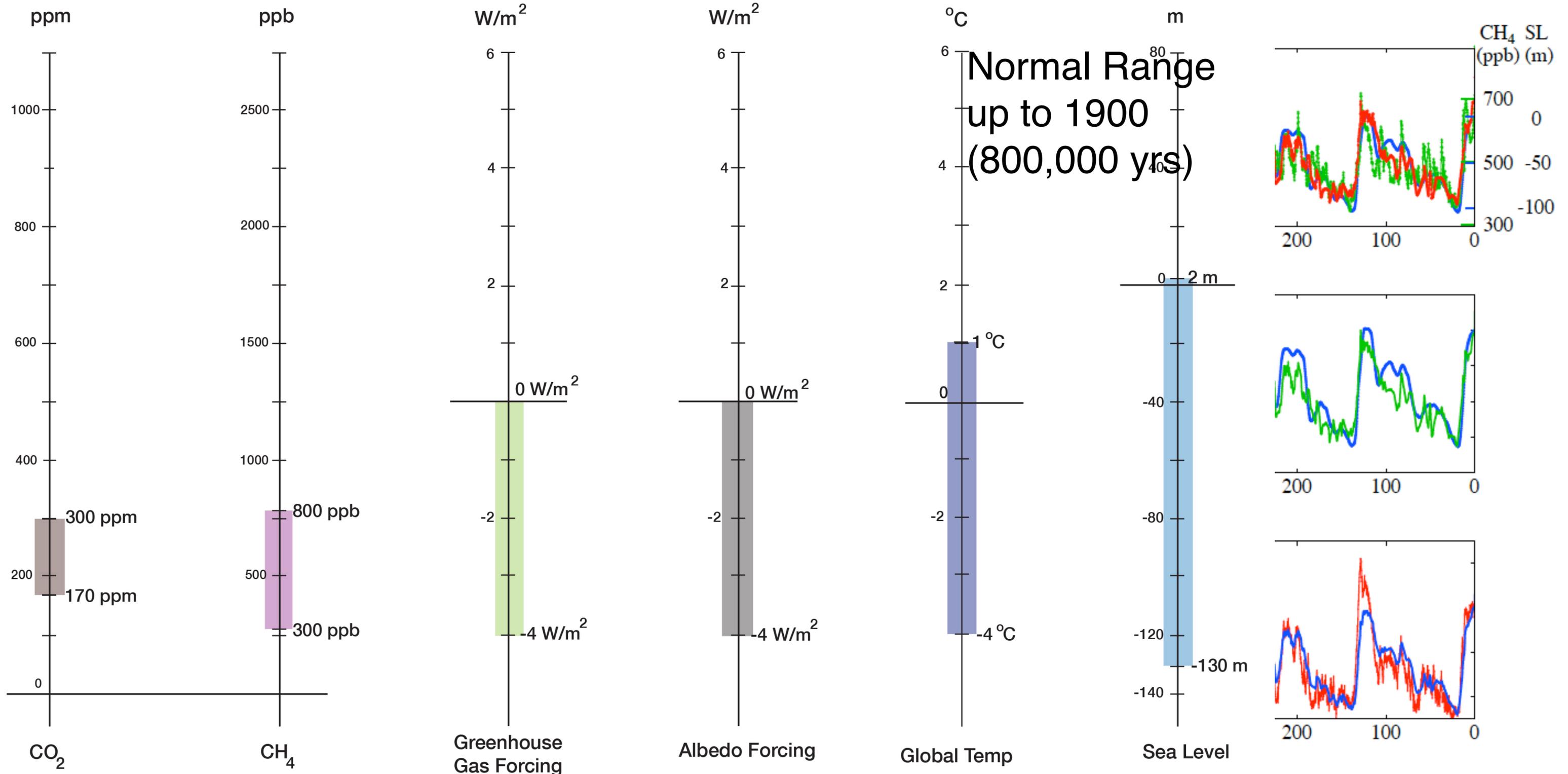




Medical Lab Sheet

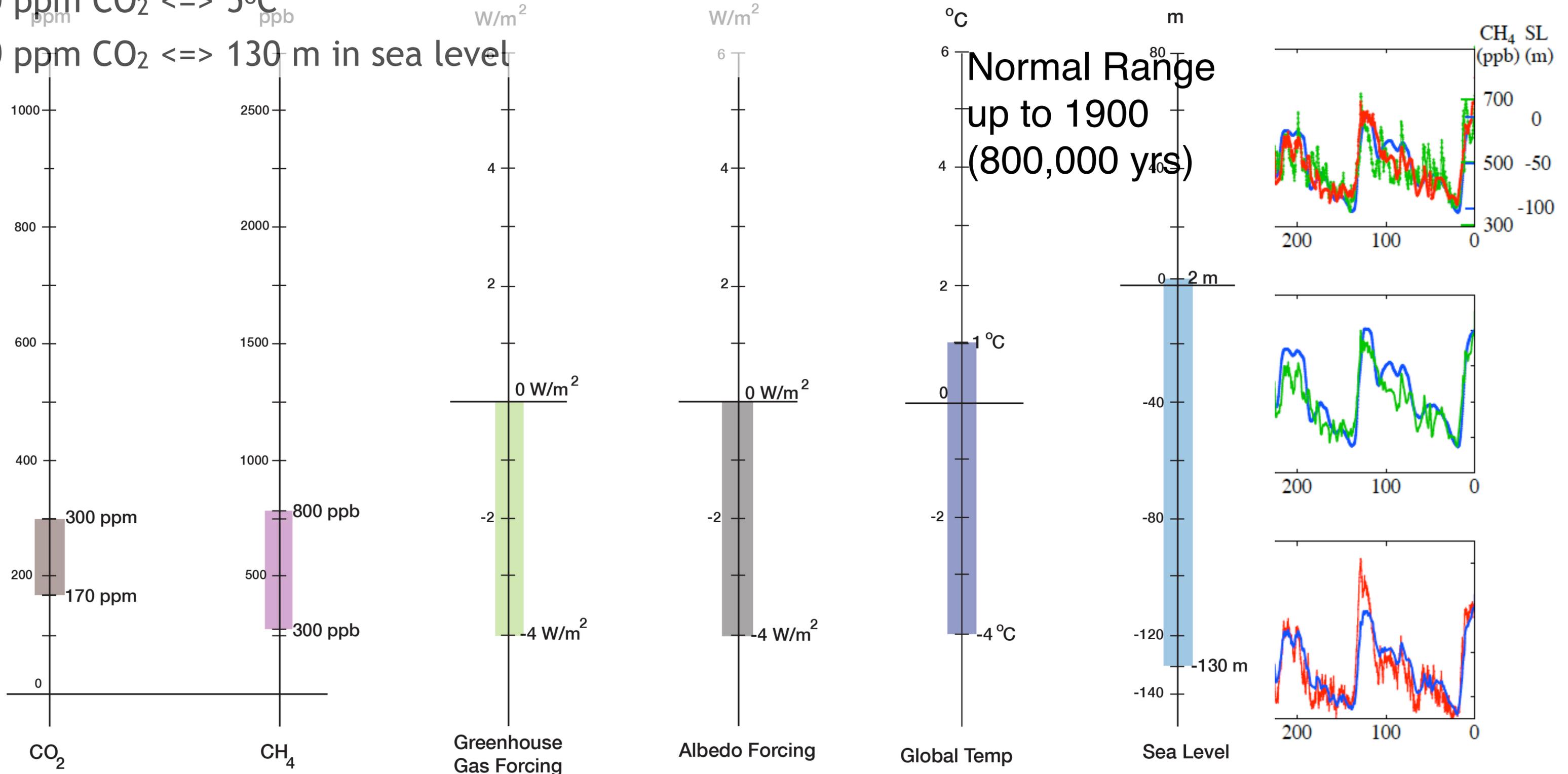


The Baseline: Past Climate and Global Change - Developing the Earth's Lab Sheet



Long-term (centuries to millennia) correlations:

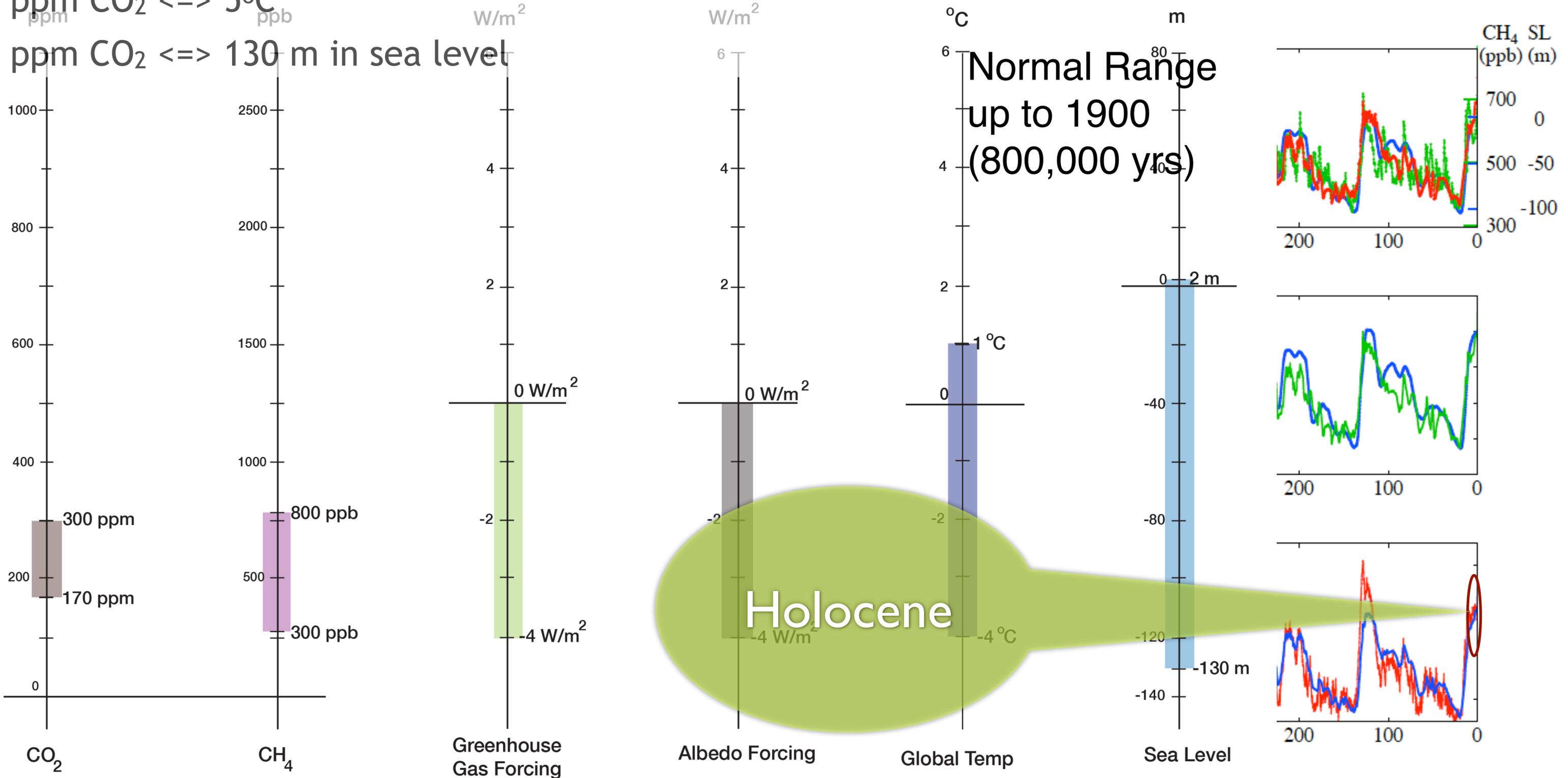
- 130 ppm CO₂ \Leftrightarrow 5°C
- 130 ppm CO₂ \Leftrightarrow 130 m in sea level



The Baseline: Past Climate and Global Change - Developing the Earth's Lab Sheet

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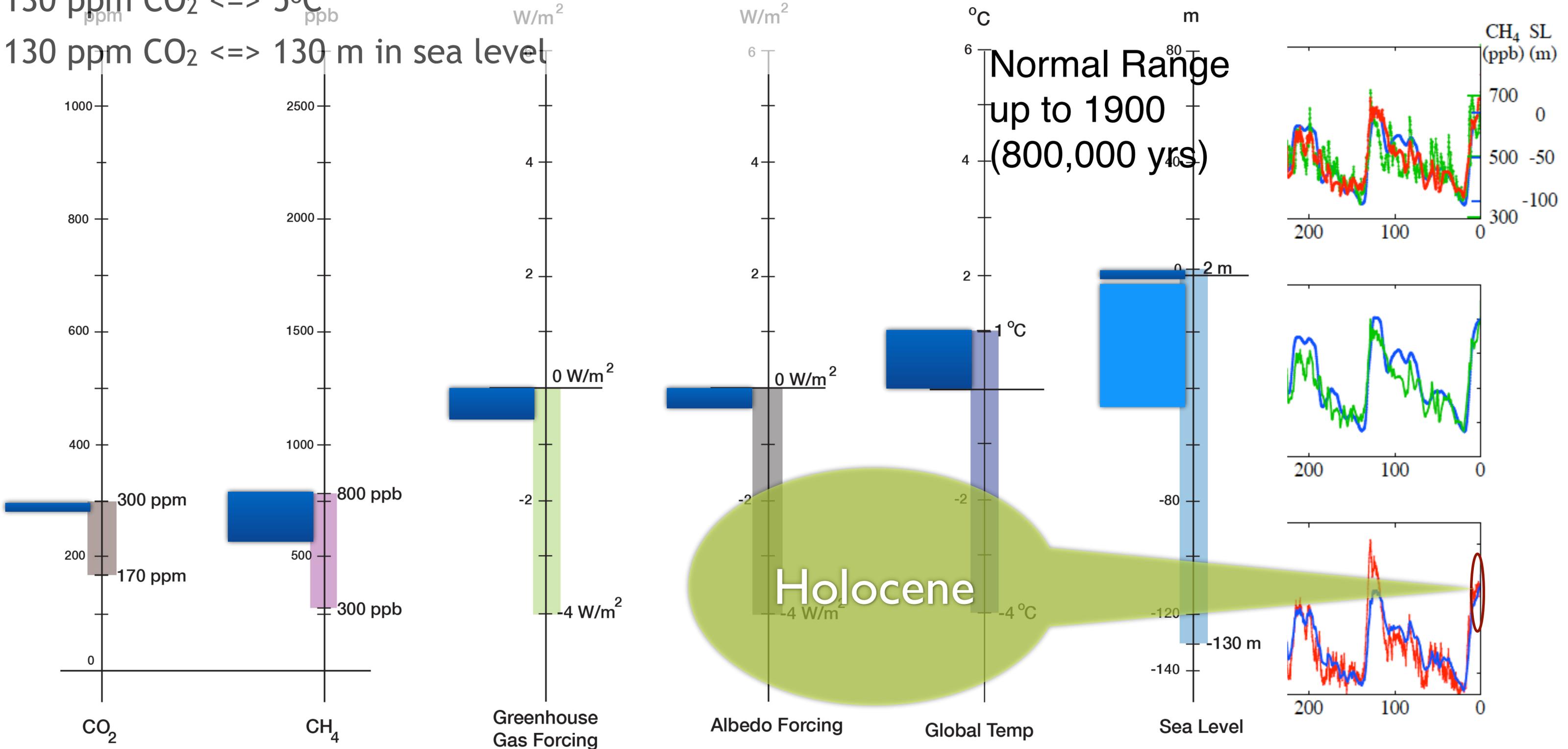
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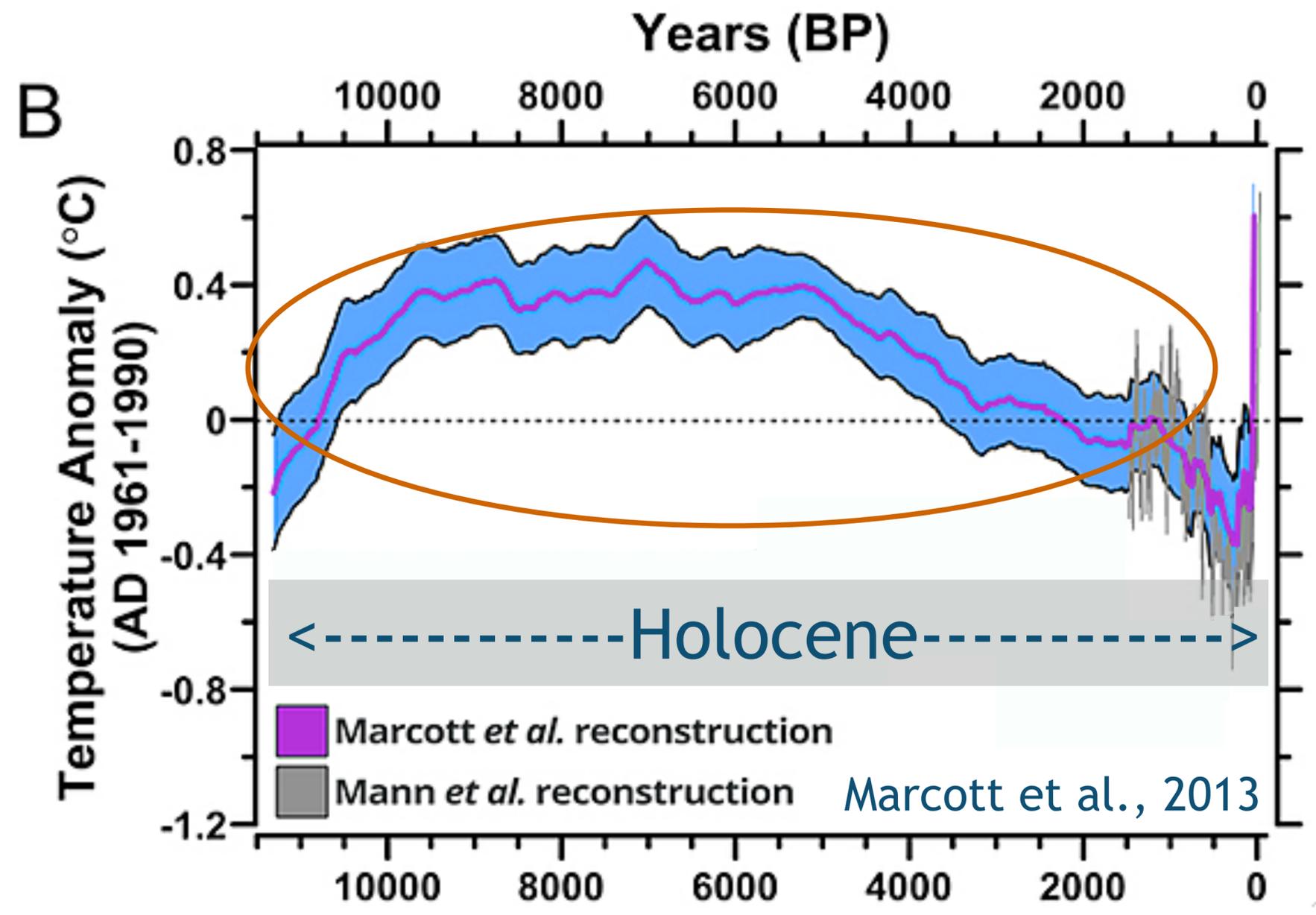
The Baseline: Past Climate and Global Change - The Holocene Normalcy Biases

Normalcy Bias: Climate variations are small and sea level is stable

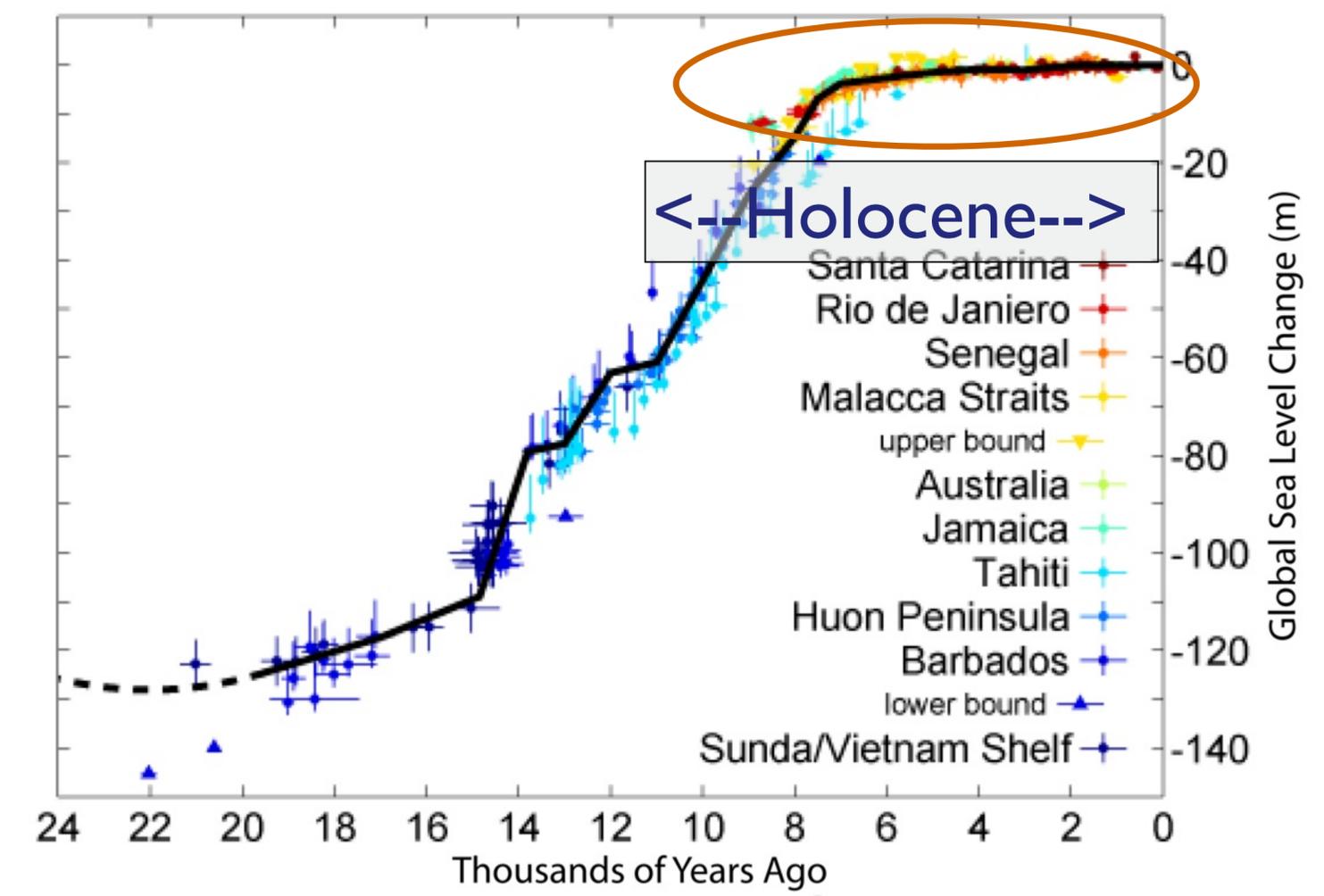
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Global Temperature Changes



Global Sea Level Changes

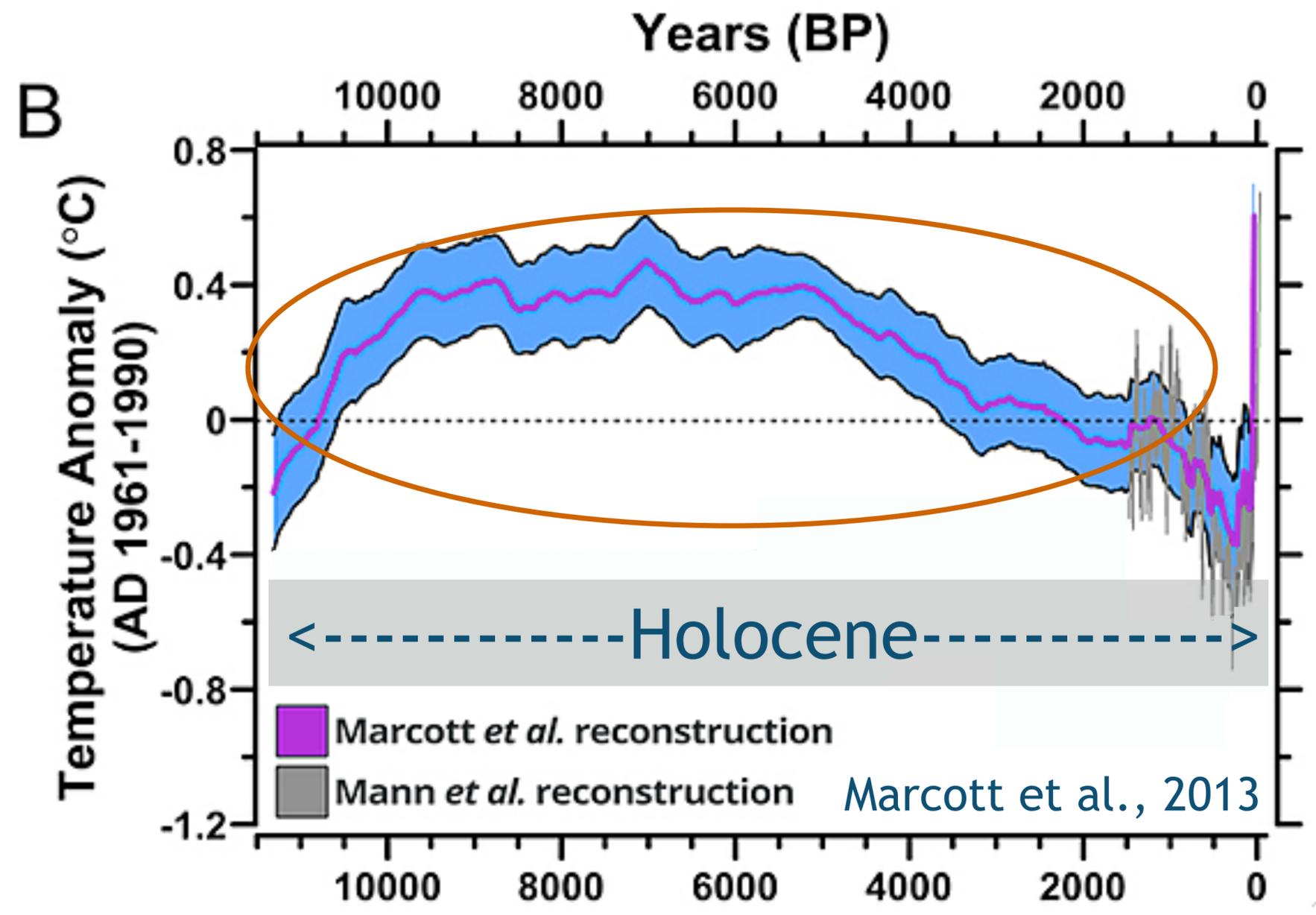


With stable climate and sea level, the Holocene was a safe operating space for humanity.

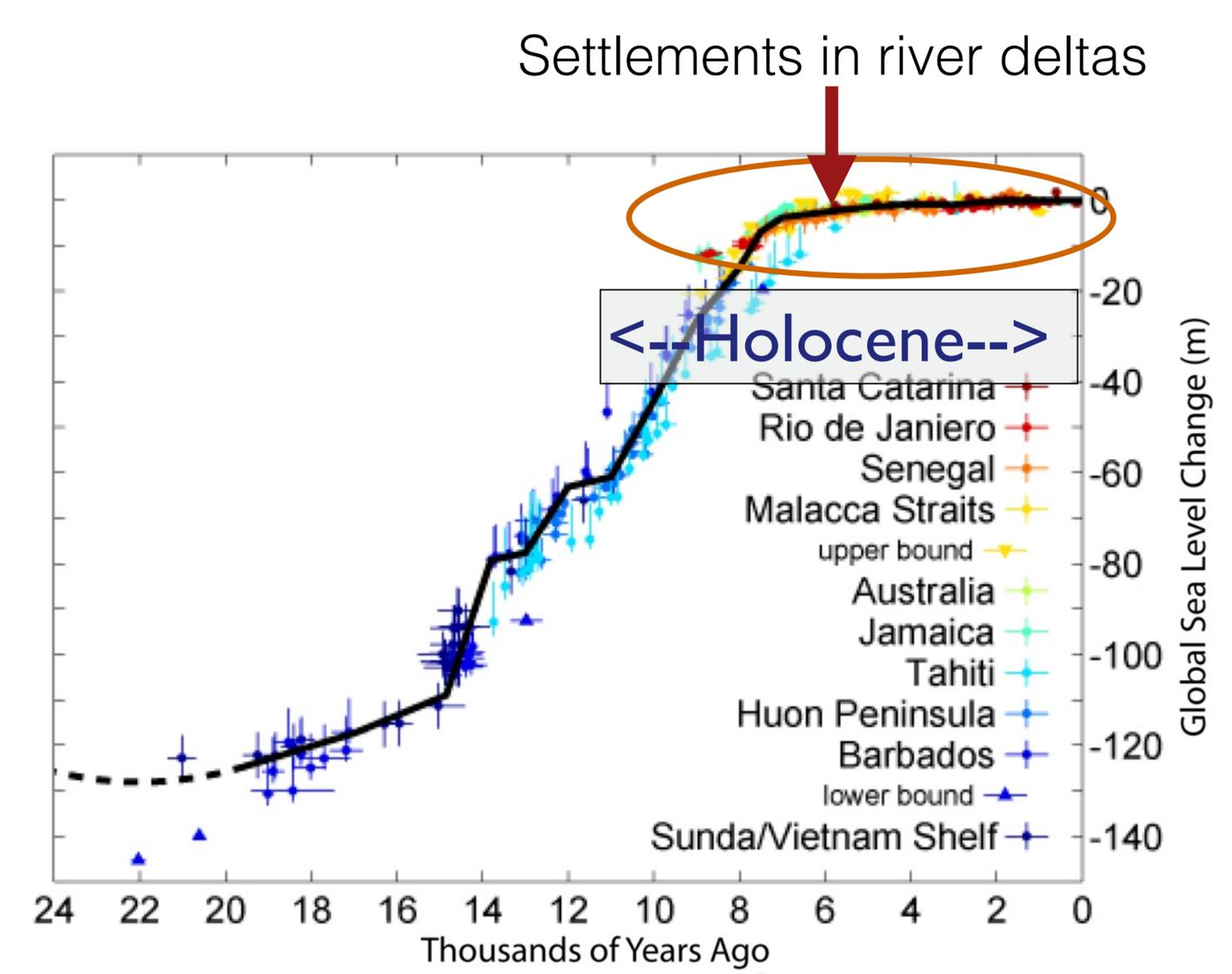
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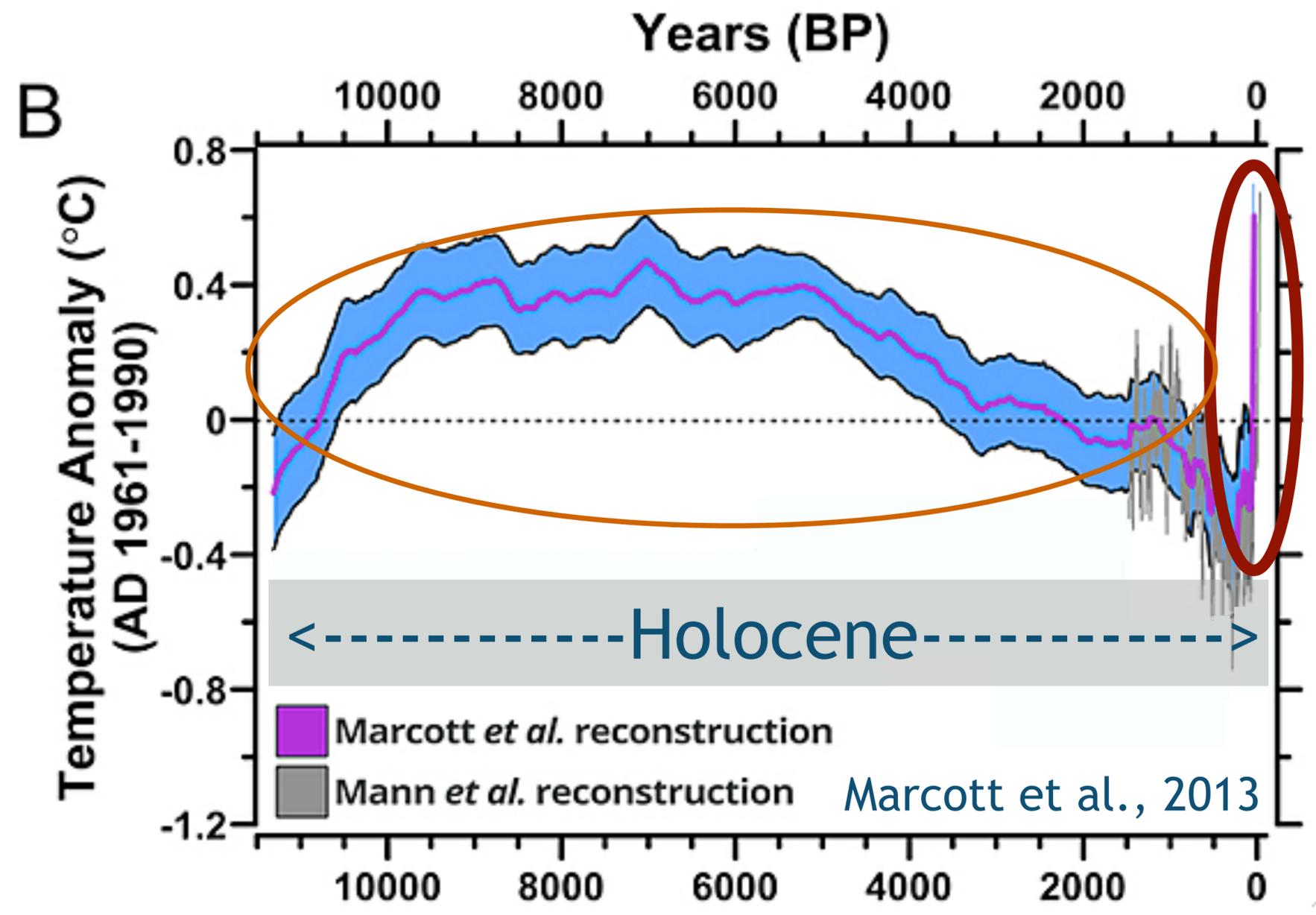


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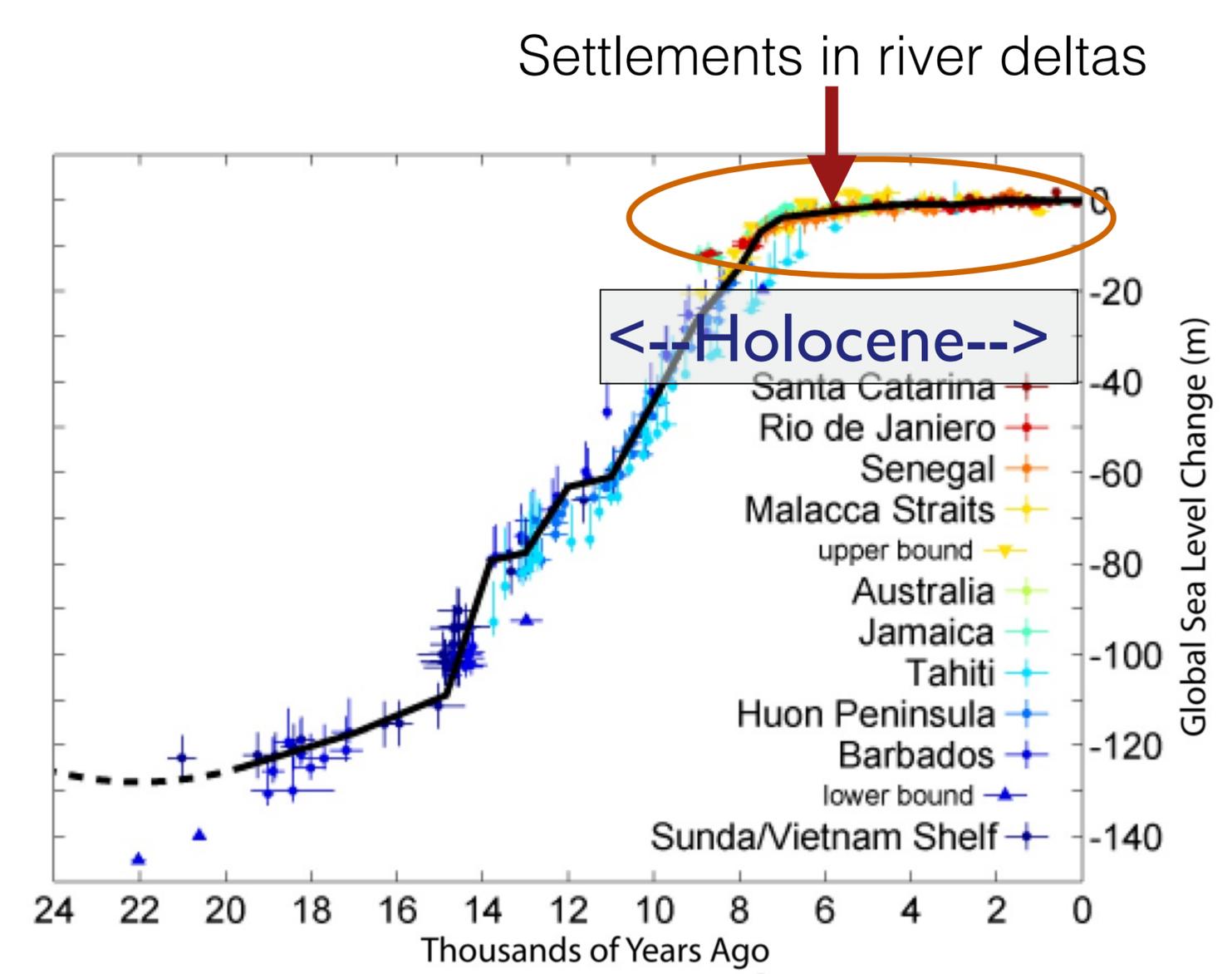
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Global Sea Level Changes



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Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a “safe operating space for humanity”

Are we in a Human and Planetary Existential Emergency? If so, what can we do about it?

Contents

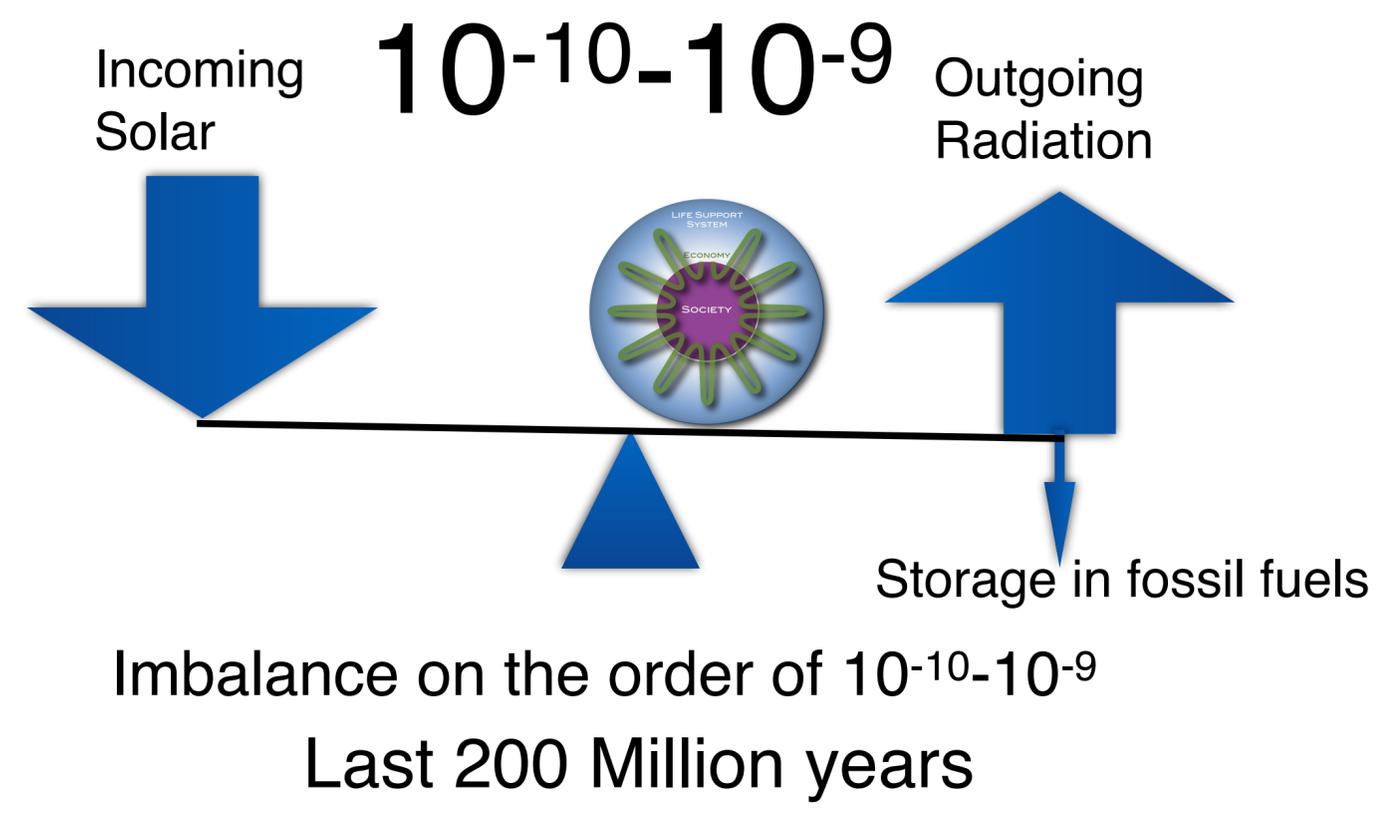
- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Official Purpose of “Economy”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes



Earth's Energy Imbalance

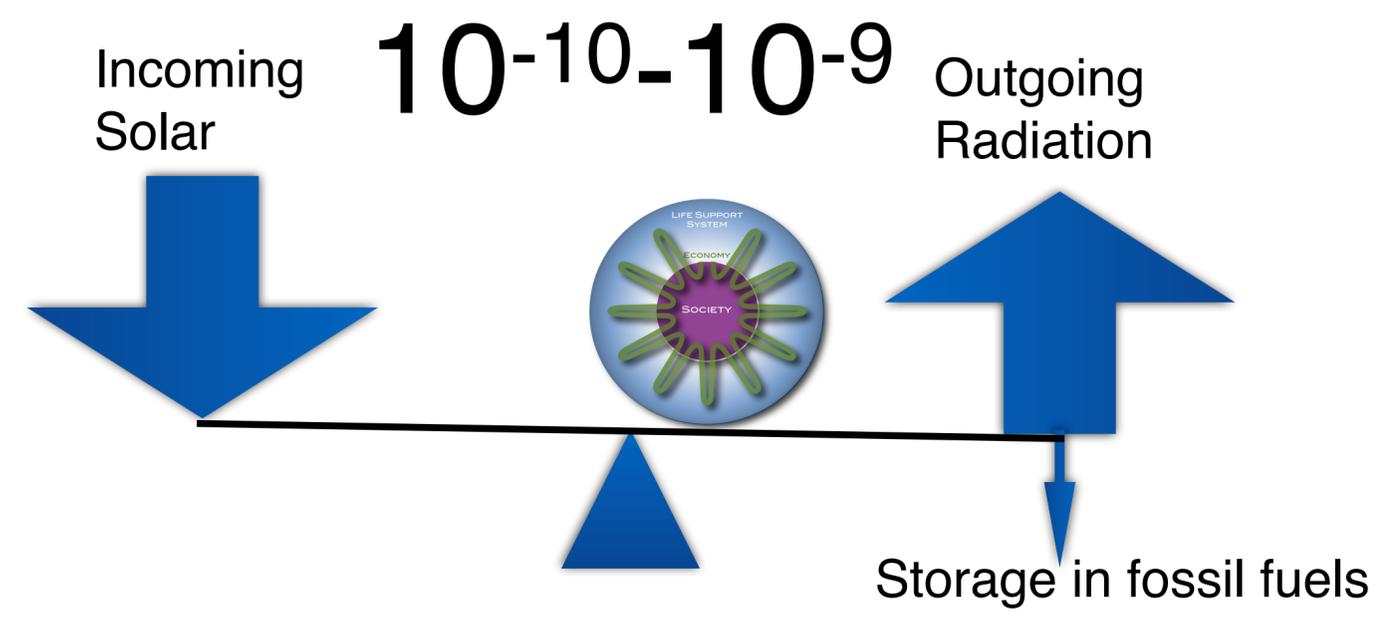
The Syndrome: Humans and Energy Usage

Earth's Energy Imbalance



The Syndrome: Humans and Energy Usage

Earth's Energy Imbalance

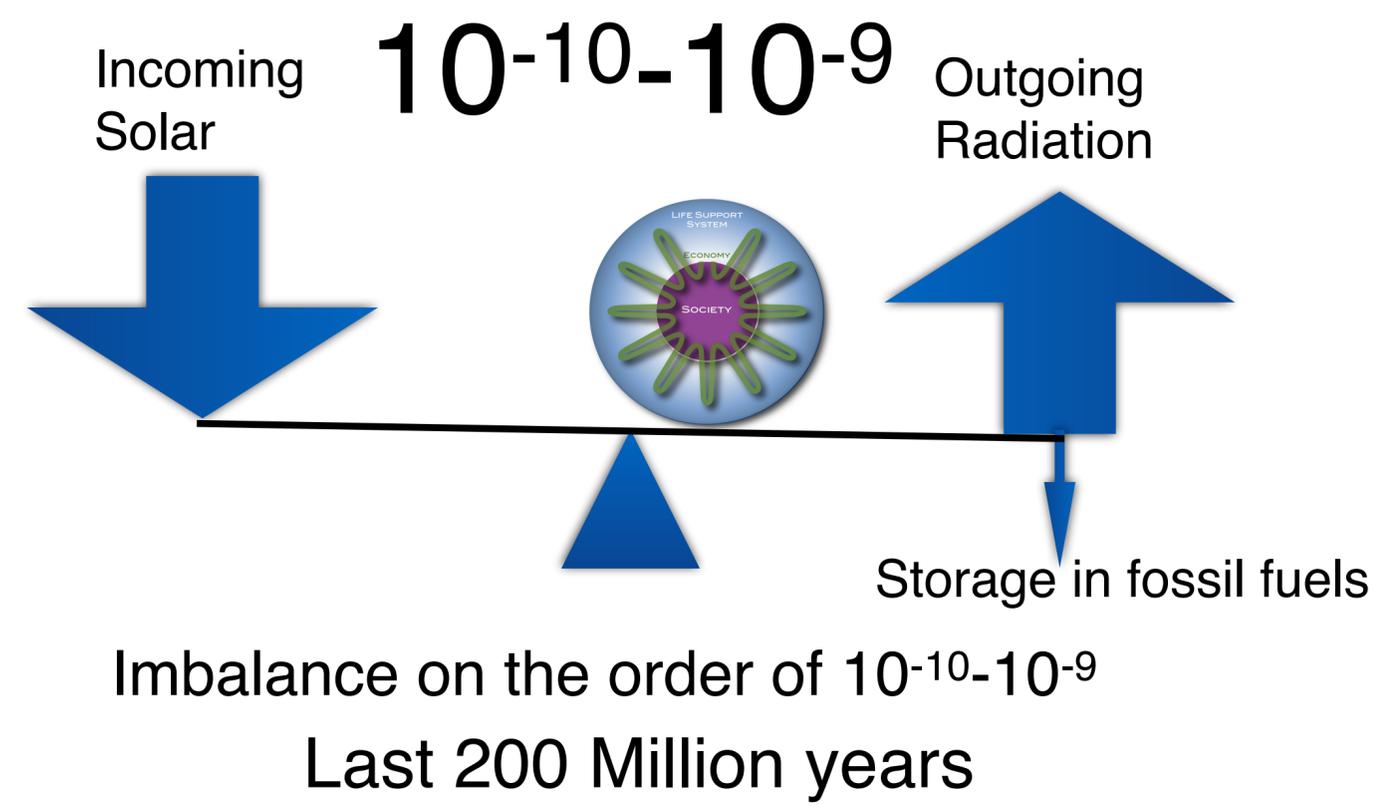


Imbalance on the order of $10^{-10}-10^{-9}$
Last 200 Million years

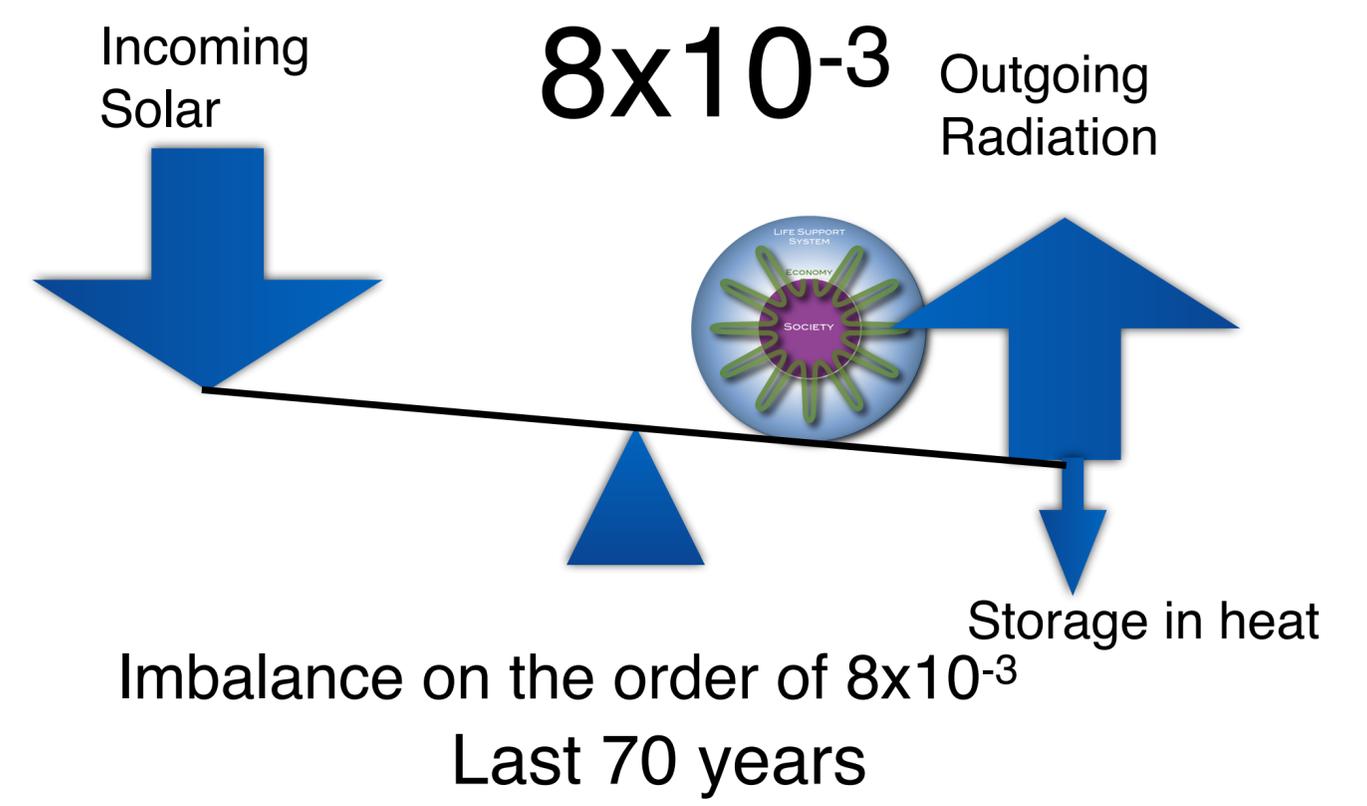
Total energy storage in 200 Myrs:
Order 100-1000 ZetaJoules

The Syndrome: Humans and Energy Usage

Earth's Energy Imbalance



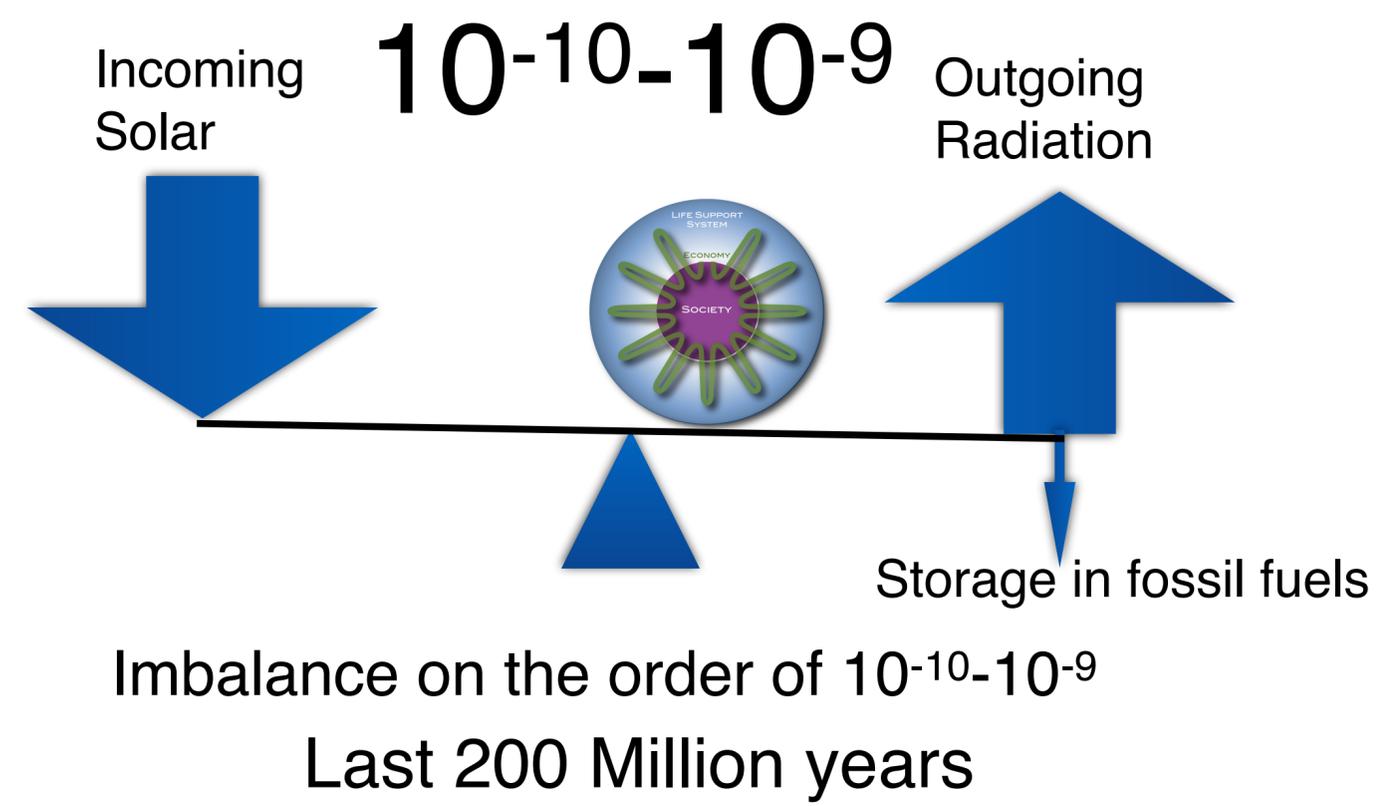
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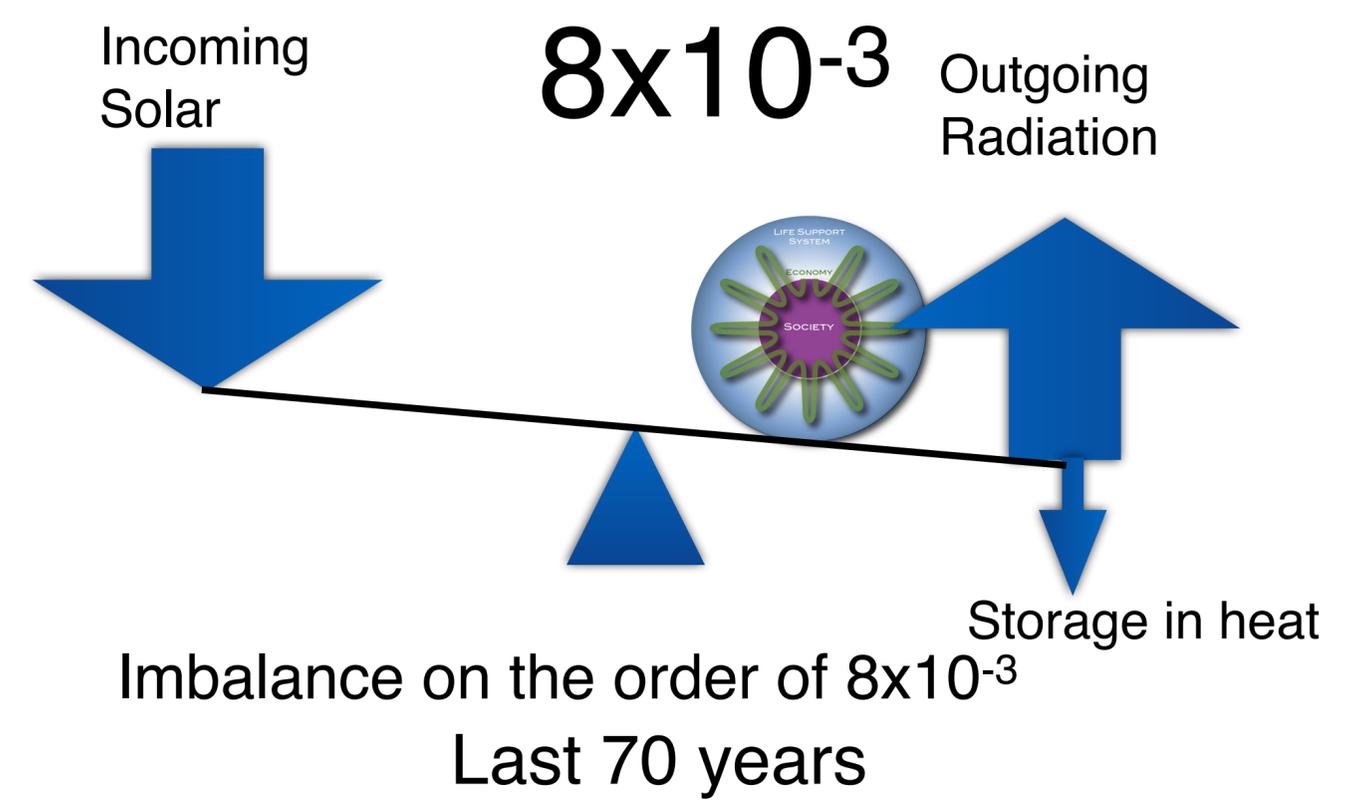
Total energy storage per century:
Now on the order 2000 ZetaJoules

The Syndrome: Humans and Energy Usage

Earth's Energy Imbalance



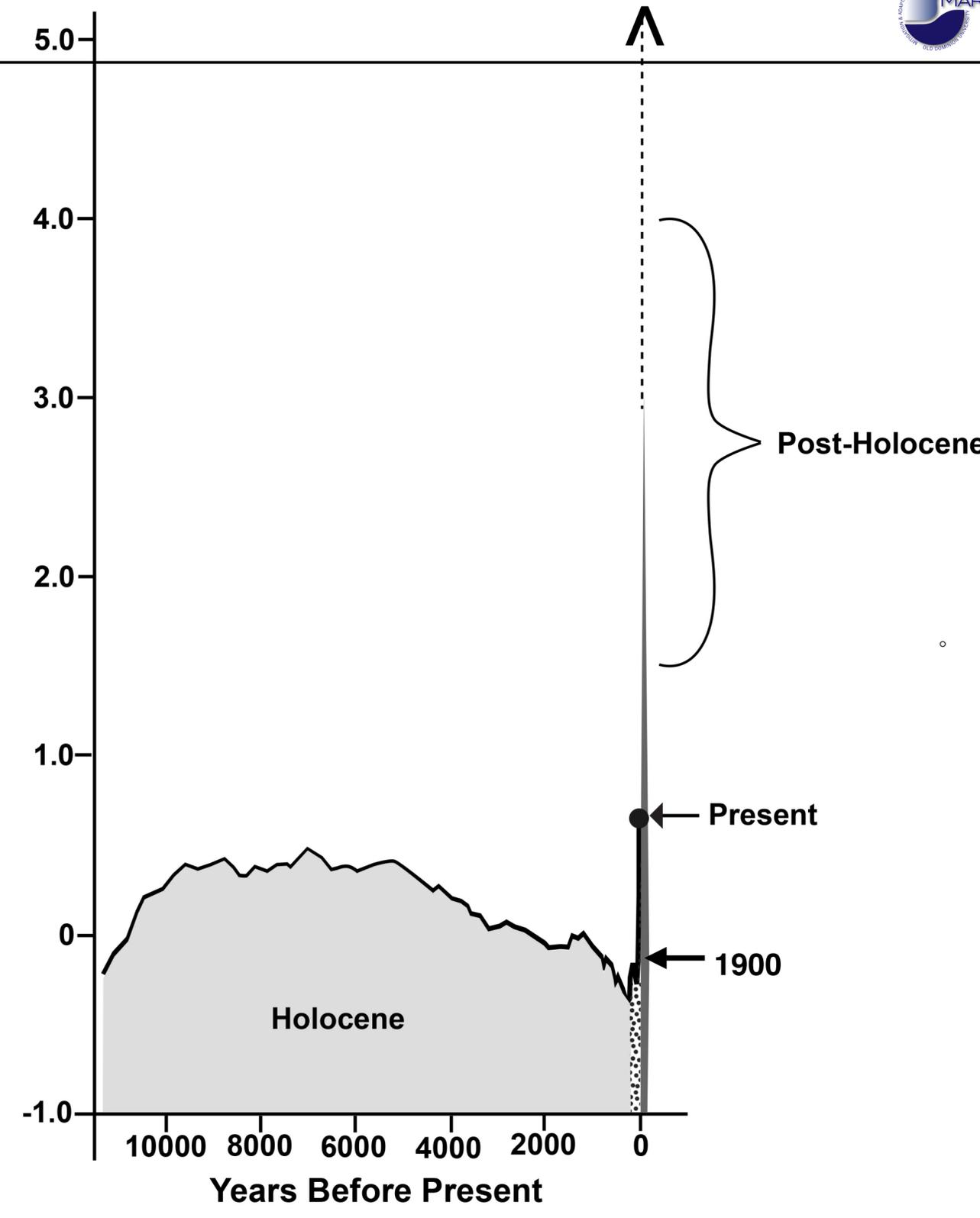
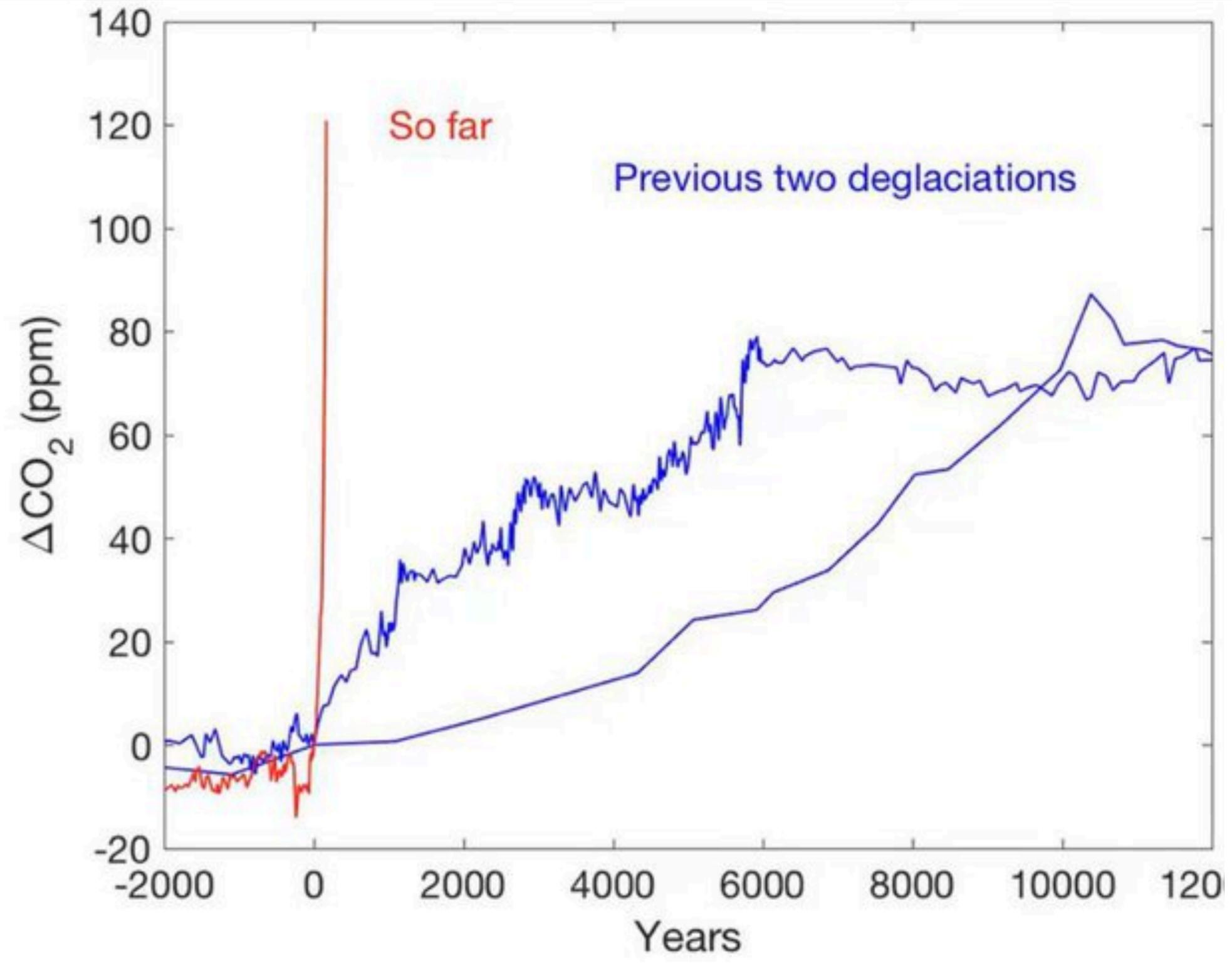
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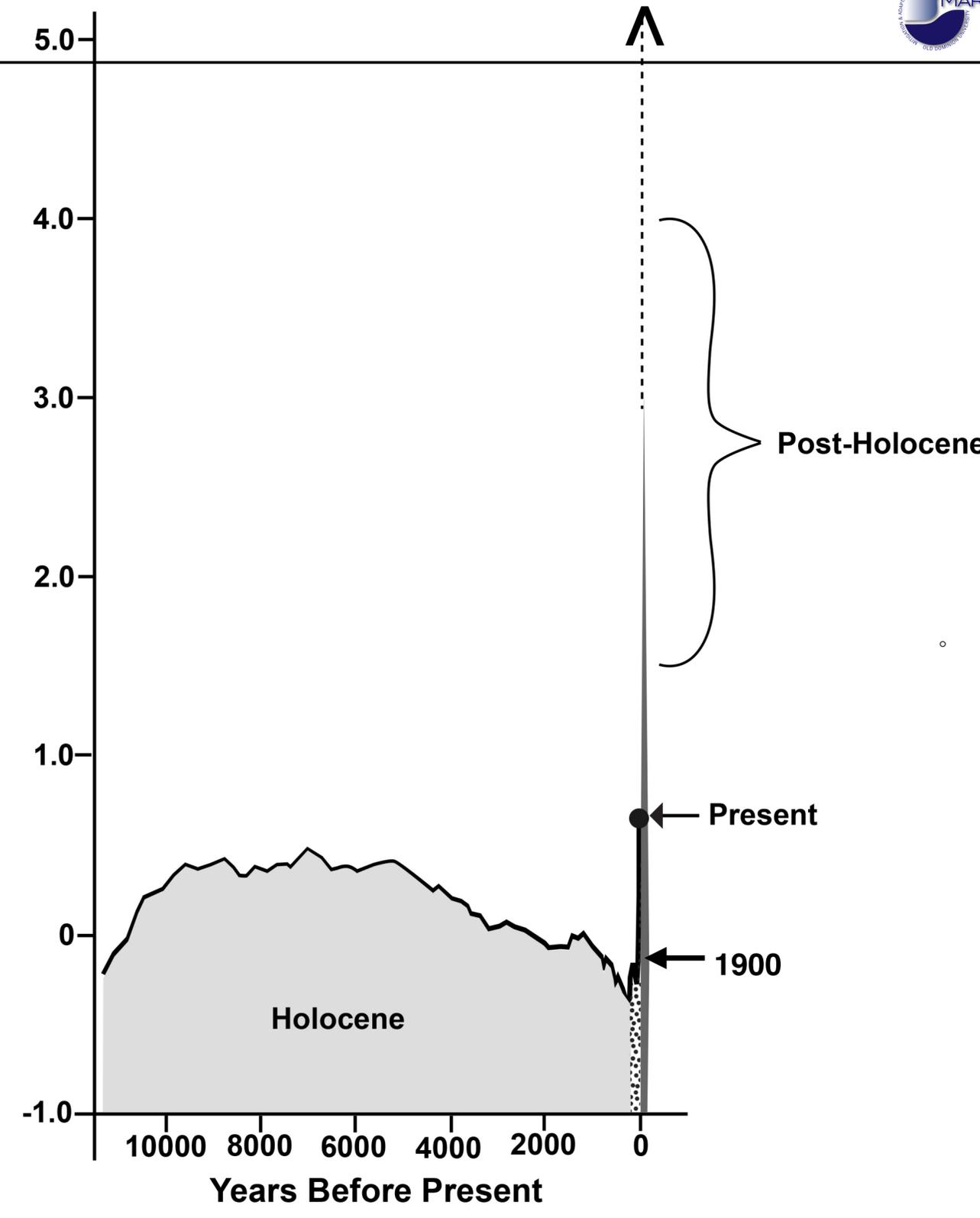
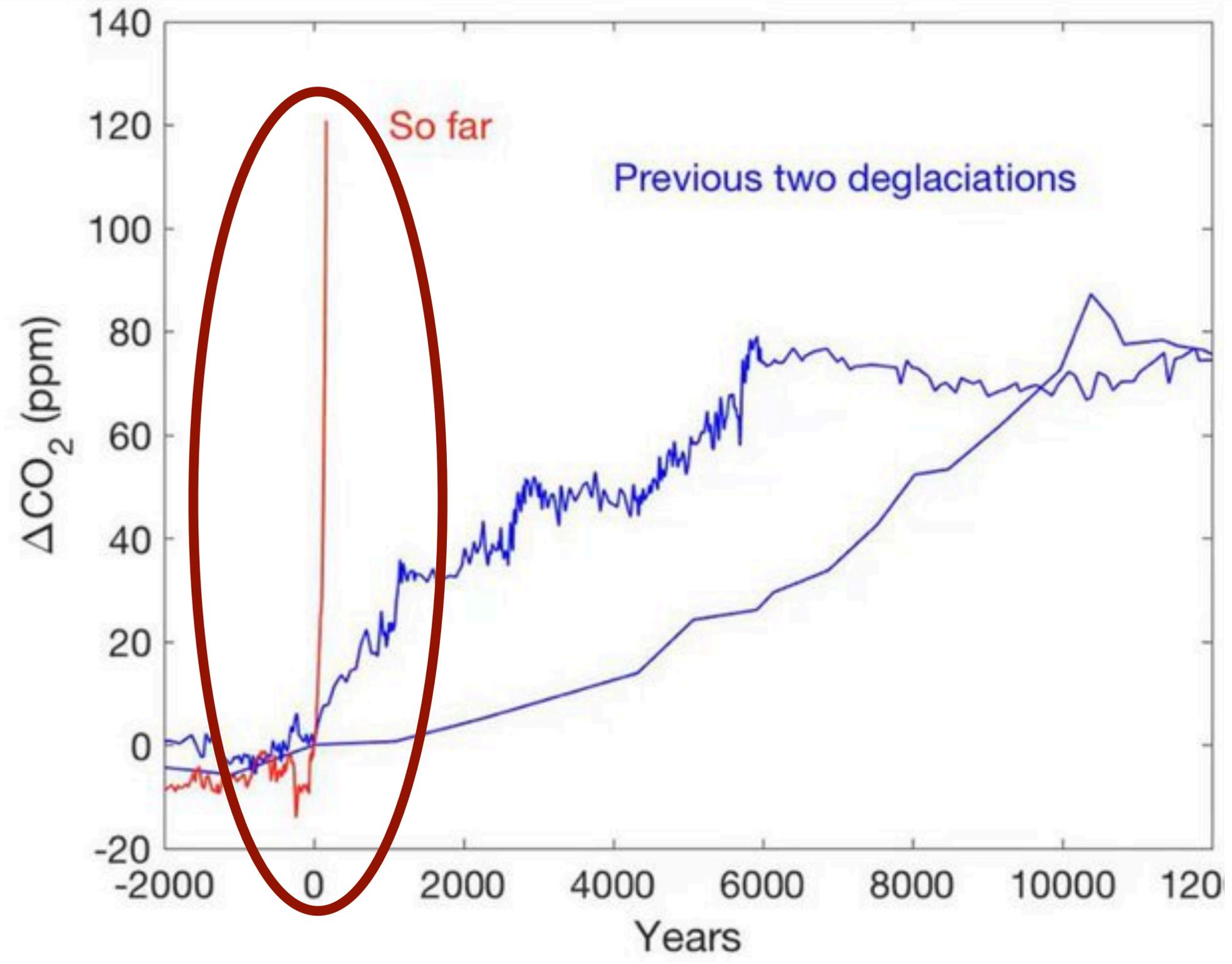
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What increased the Earth's energy imbalance by a factor of 10^6 to 10^7 ?

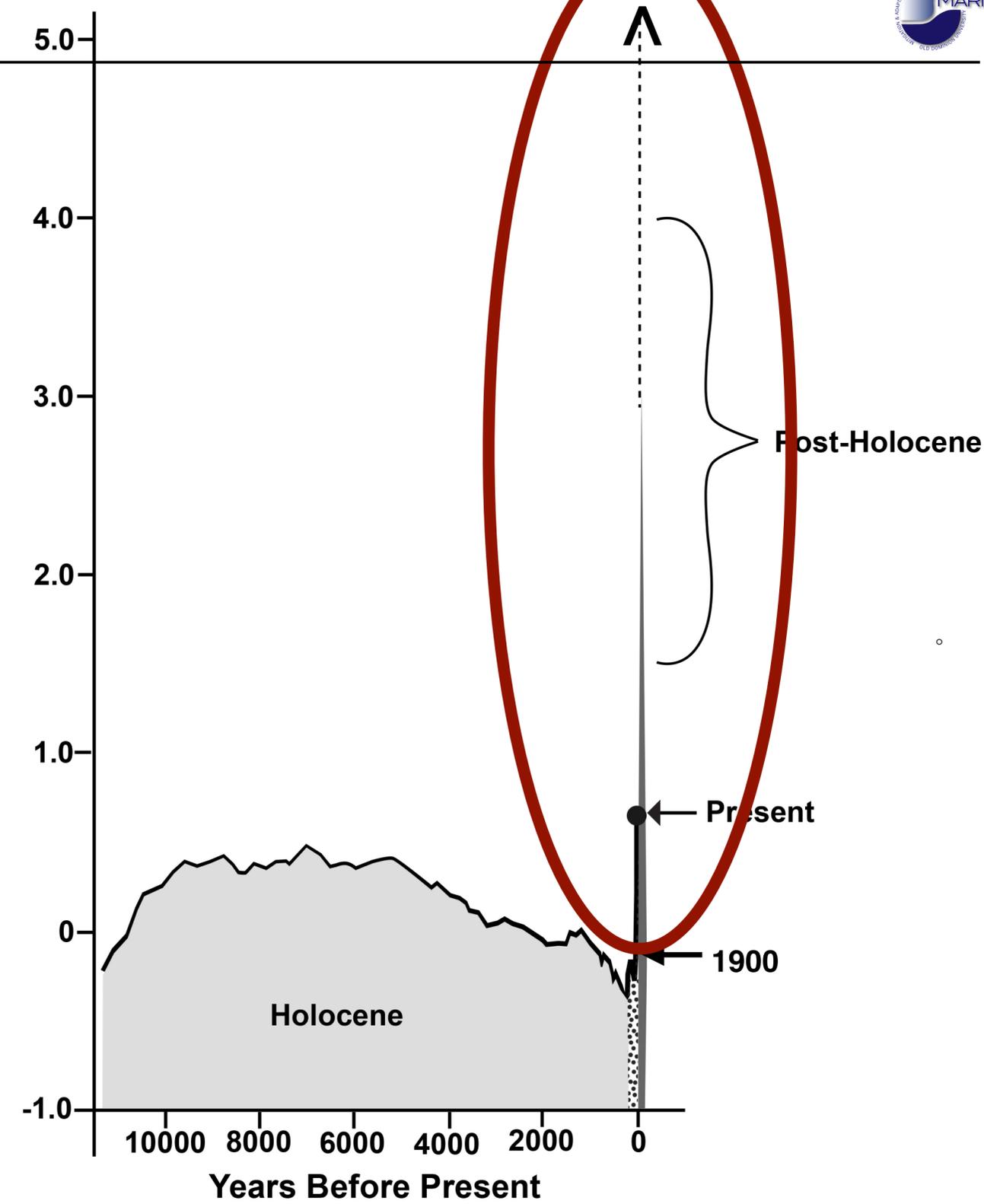
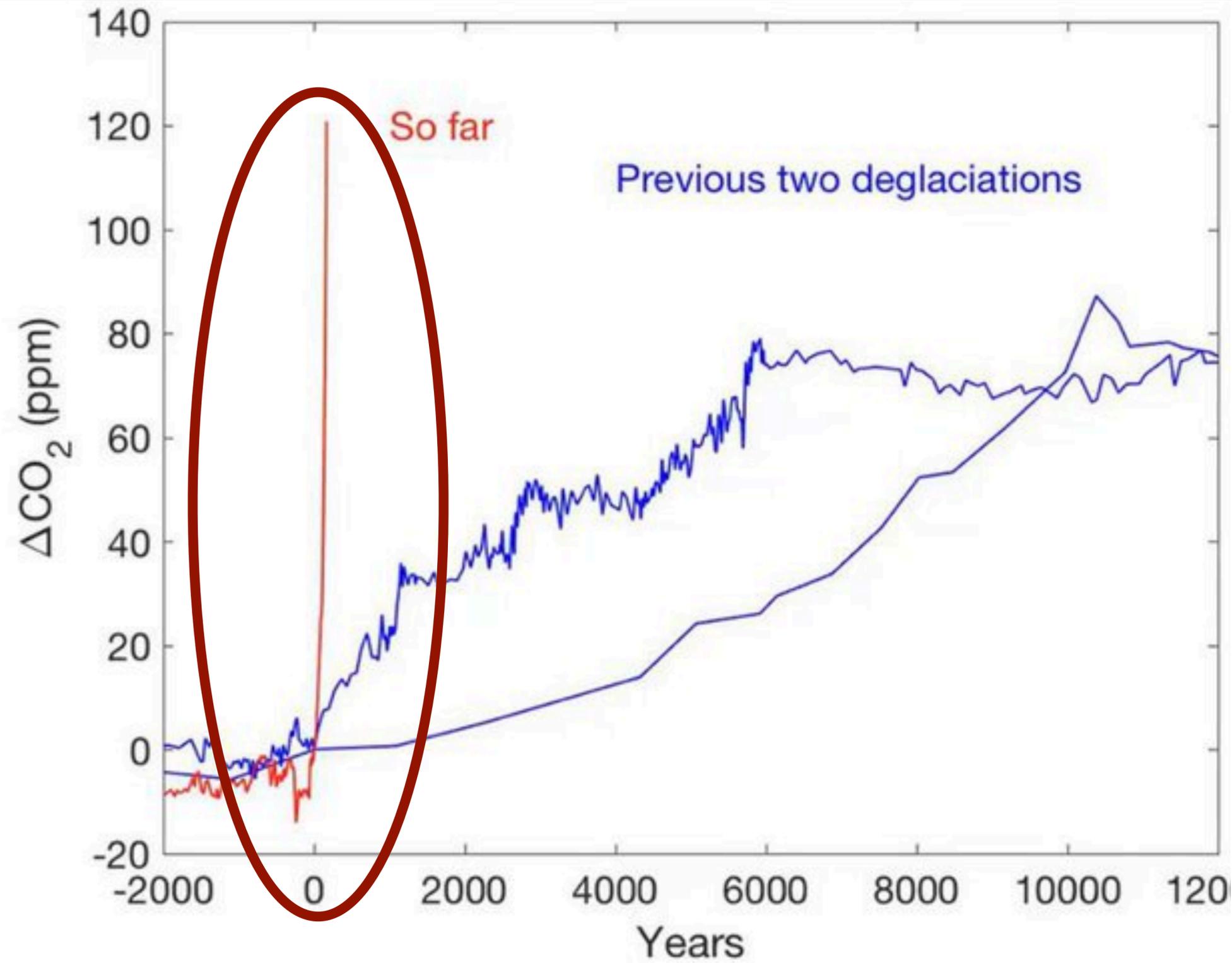
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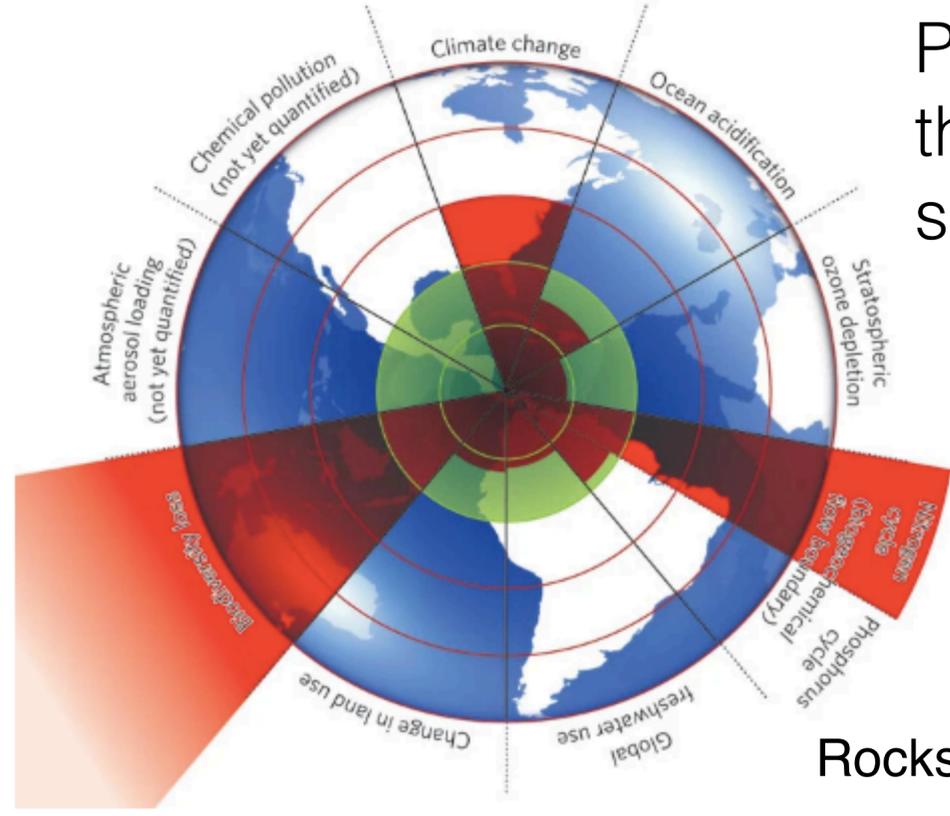


The Syndrome: Humans and Energy Usage



The Syndrome: Boundaries Planetary Systems

Planetary Boundaries for the safe operating space for humanity

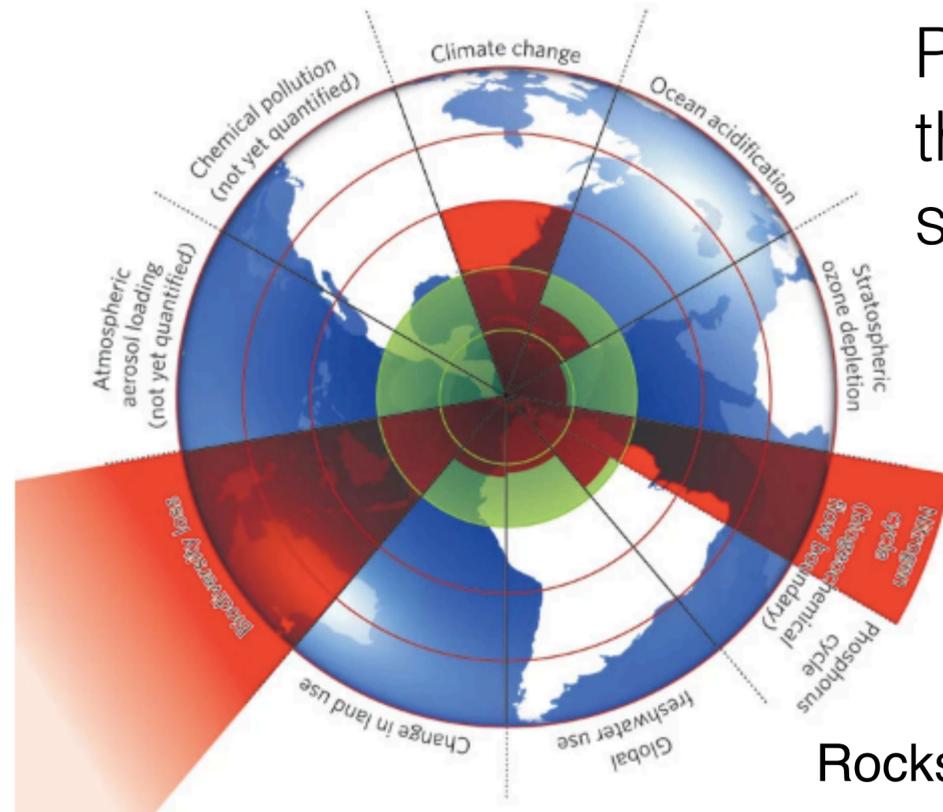


Rockstrom et al., 2009

The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.

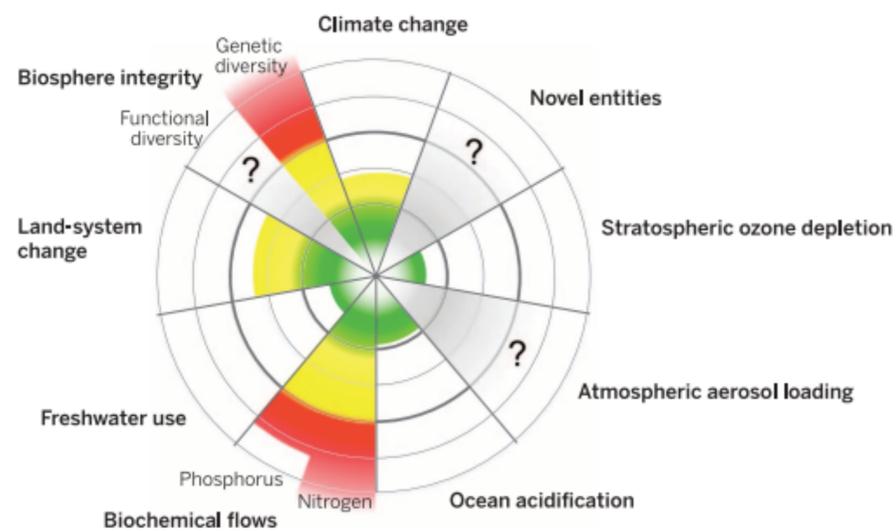
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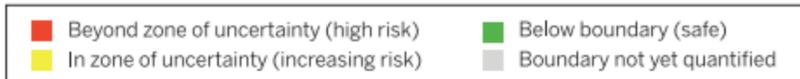


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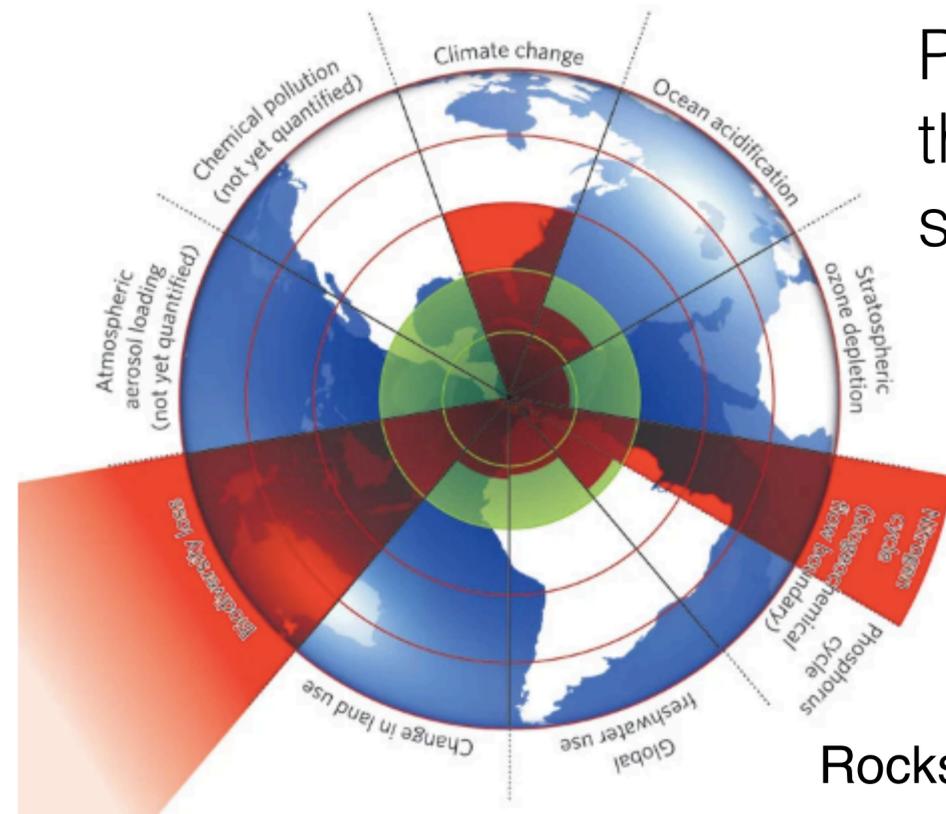


Steffen et al., 2015



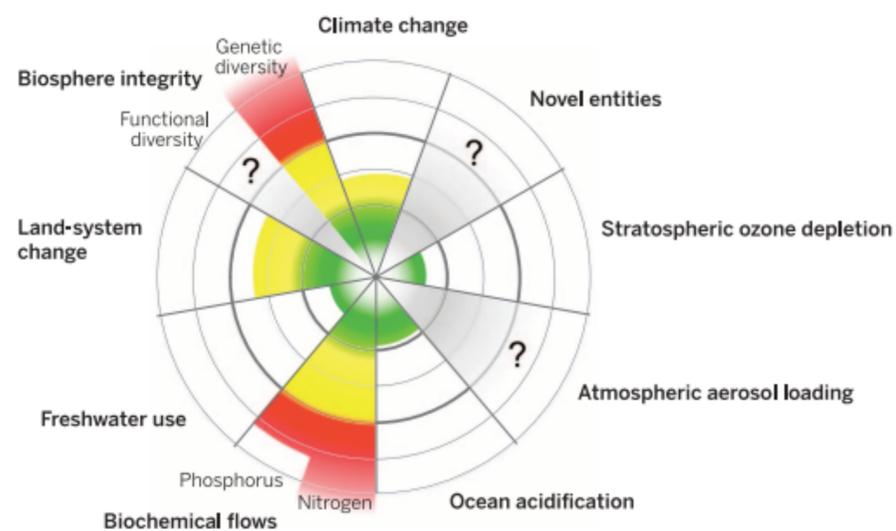
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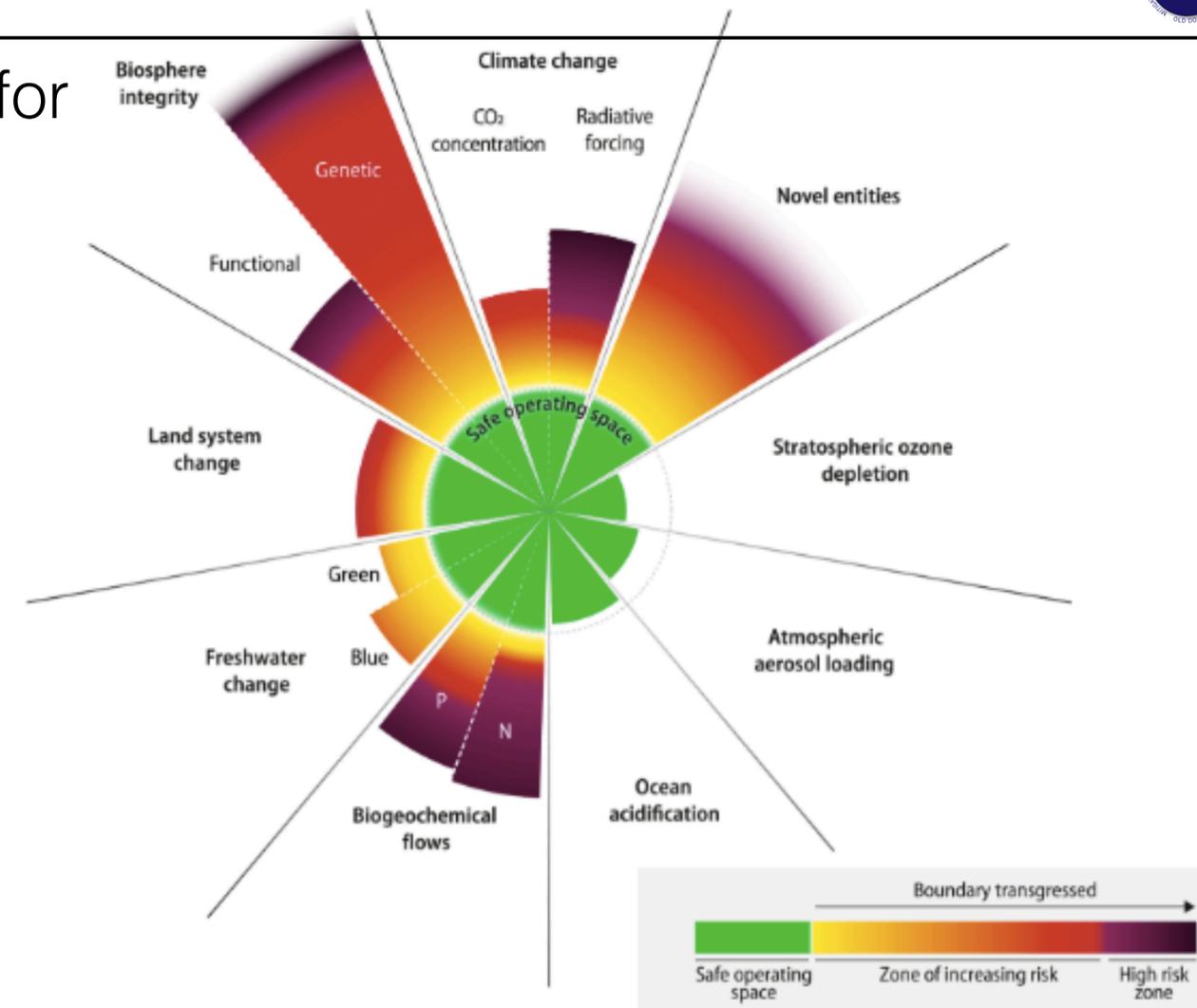
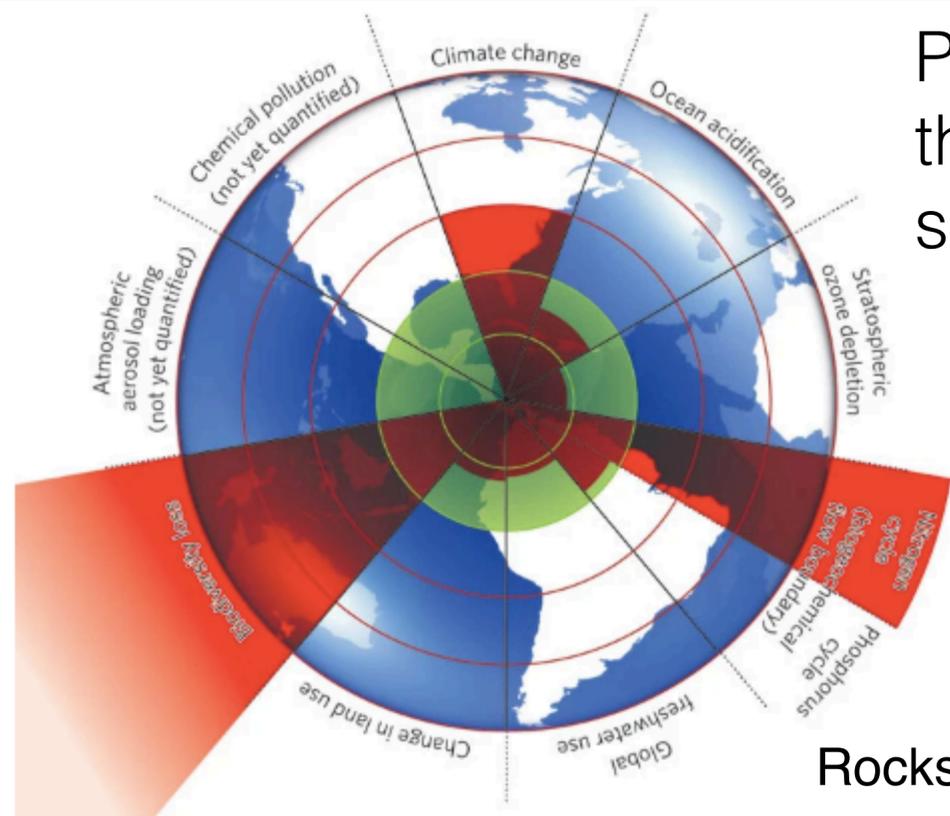


Fig. 1. Current status of control variables for all nine planetary boundaries. Six of the nine boundaries are transgressed. In addition, ocean acidification is approaching its planetary boundary. The green zone is the safe operating space (below the boundary). Yellow to red represents the zone of increasing risk. Purple indicates the high-risk zone where interglacial Earth system conditions are transgressed with high confidence. Values for control variables are normalized so that the origin represents mean Holocene conditions and the planetary boundary (lower end of zone of increasing risk, dotted circle) lies at the same radius for all boundaries (except for the wedges representing green and blue water, see main text). Wedge lengths are scaled logarithmically. The upper edges of the wedges for the novel entities and the genetic diversity component of the biosphere integrity boundaries are blurred either because the upper end of the zone of increasing risk has not yet been quantitatively defined (novel entities) or because the current value is known only with great uncertainty (loss of genetic diversity). Both, however, are well outside of the safe operating space. Transgression of these boundaries reflects unprecedented human disruption of Earth system but is associated with large scientific uncertainties.

Richardson et al., 2023

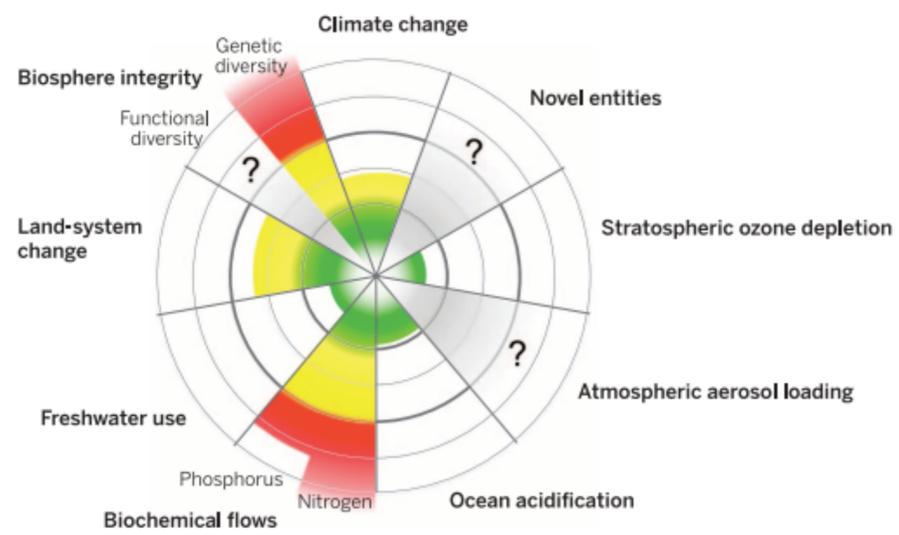
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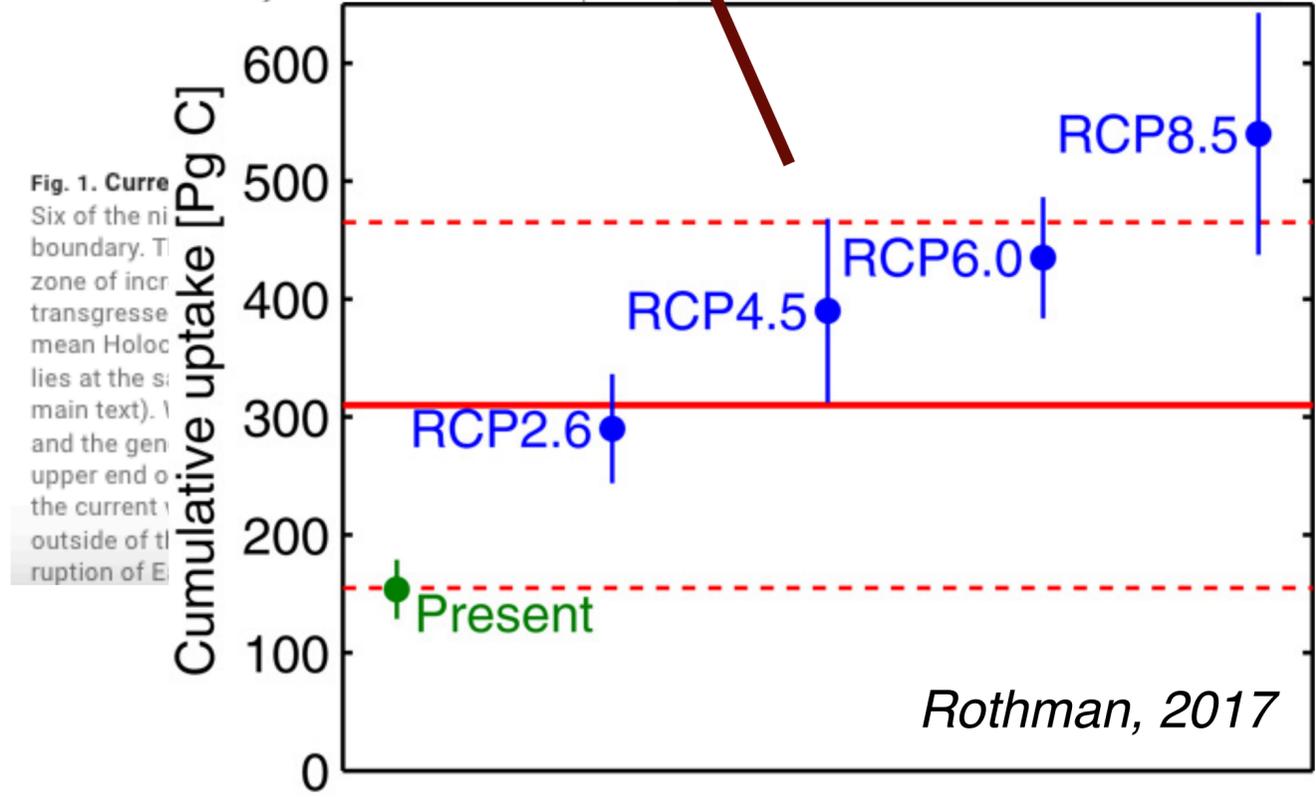
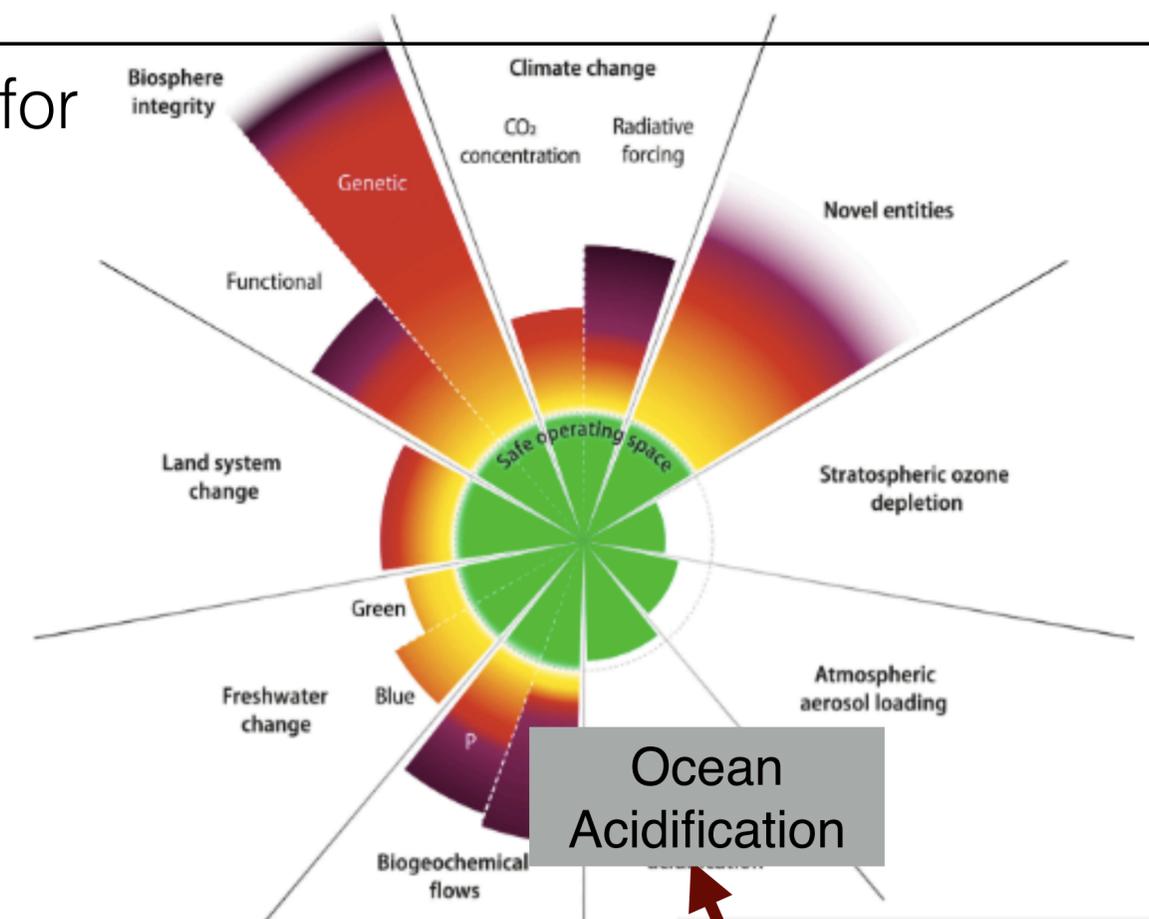
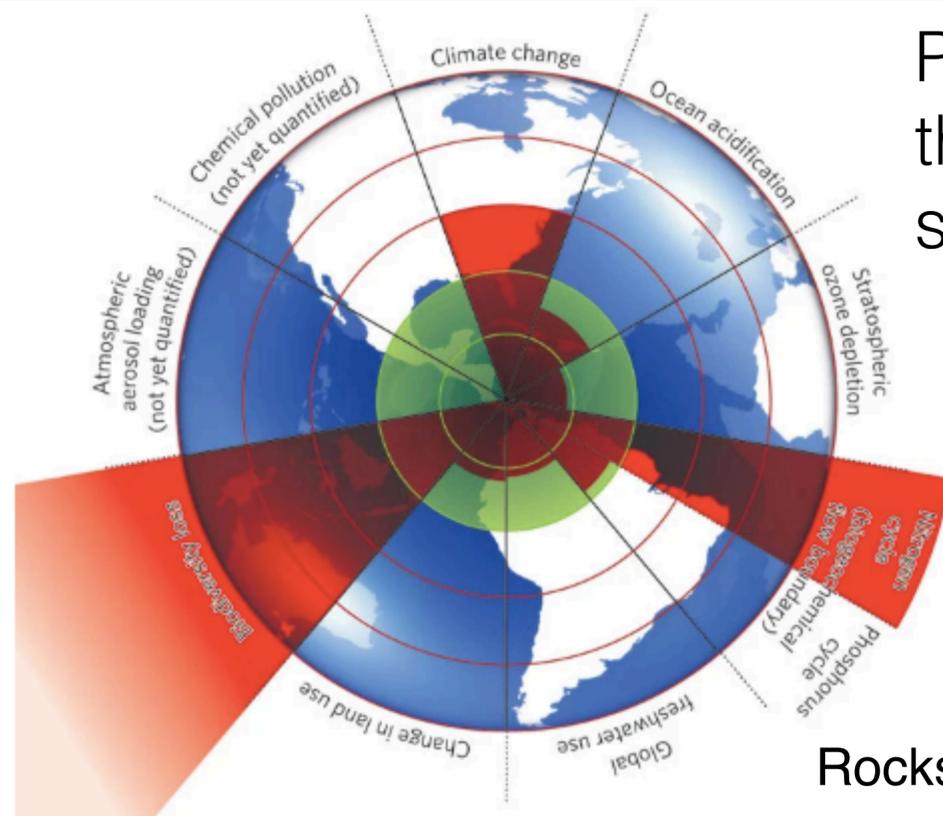


Fig. 1. Current cumulative CO₂ uptake is well below the boundary. The zone of increasing transgression of the boundary lies at the same level as the present (see main text). The RCP8.5 scenario is the most aggressive and the RCP2.6 scenario is the least aggressive. The RCP4.5 and RCP6.0 scenarios are intermediate. The RCP8.5 scenario is outside of the zone of uncertainty of the current system.

Rothman, 2017

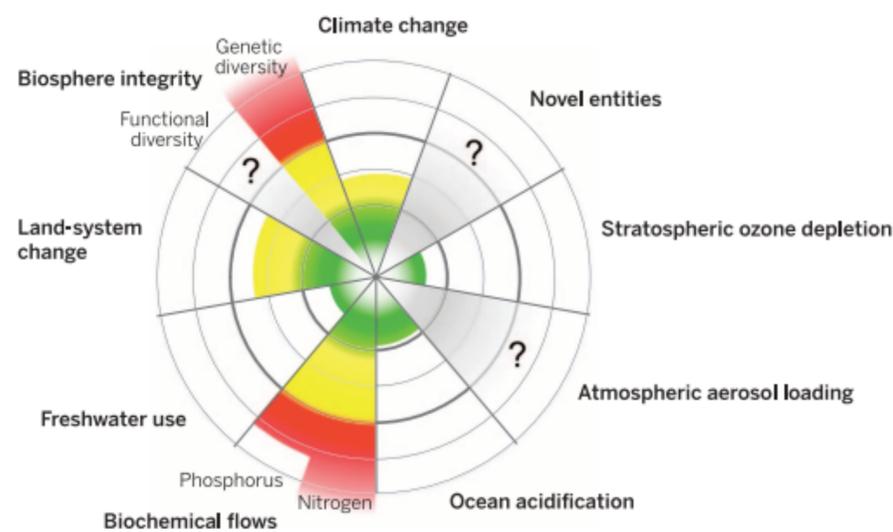
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Steffen et al., 2015

■ Beyond zone of uncertainty (high risk) ■ Below boundary (safe)
■ In zone of uncertainty (increasing risk) ■ Boundary not yet quantified

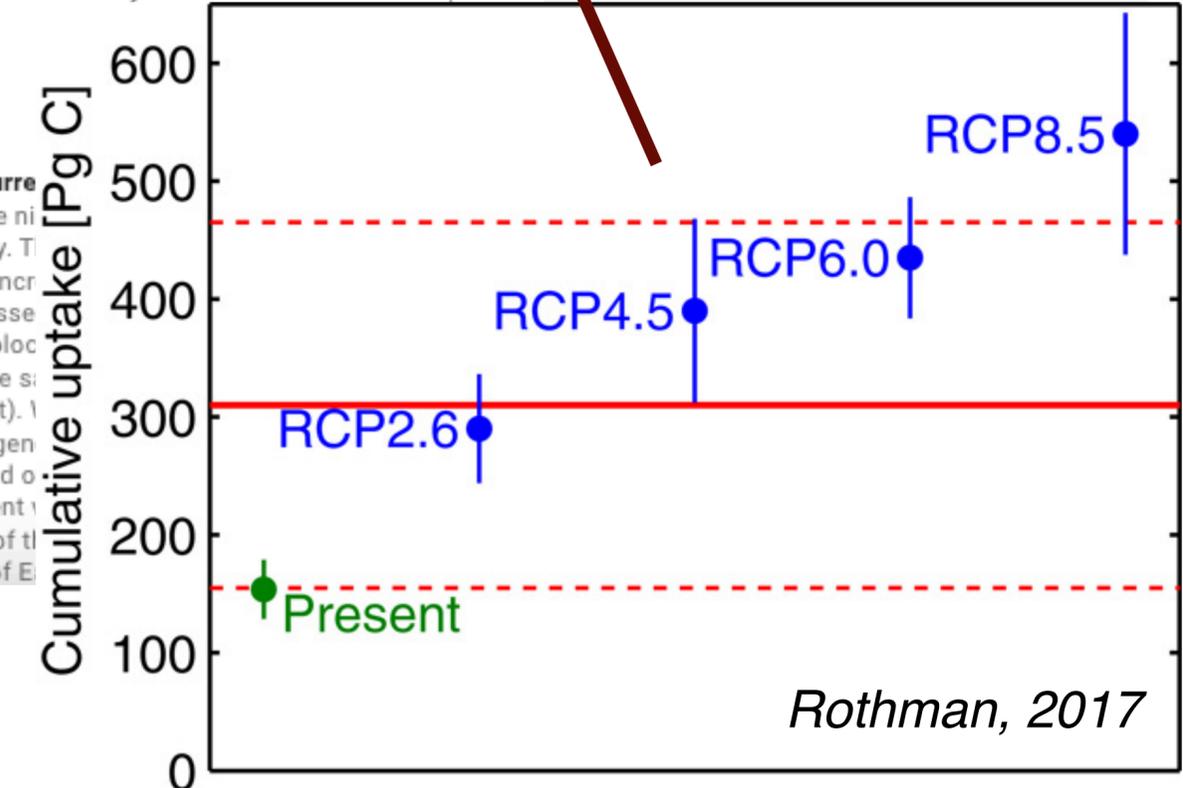
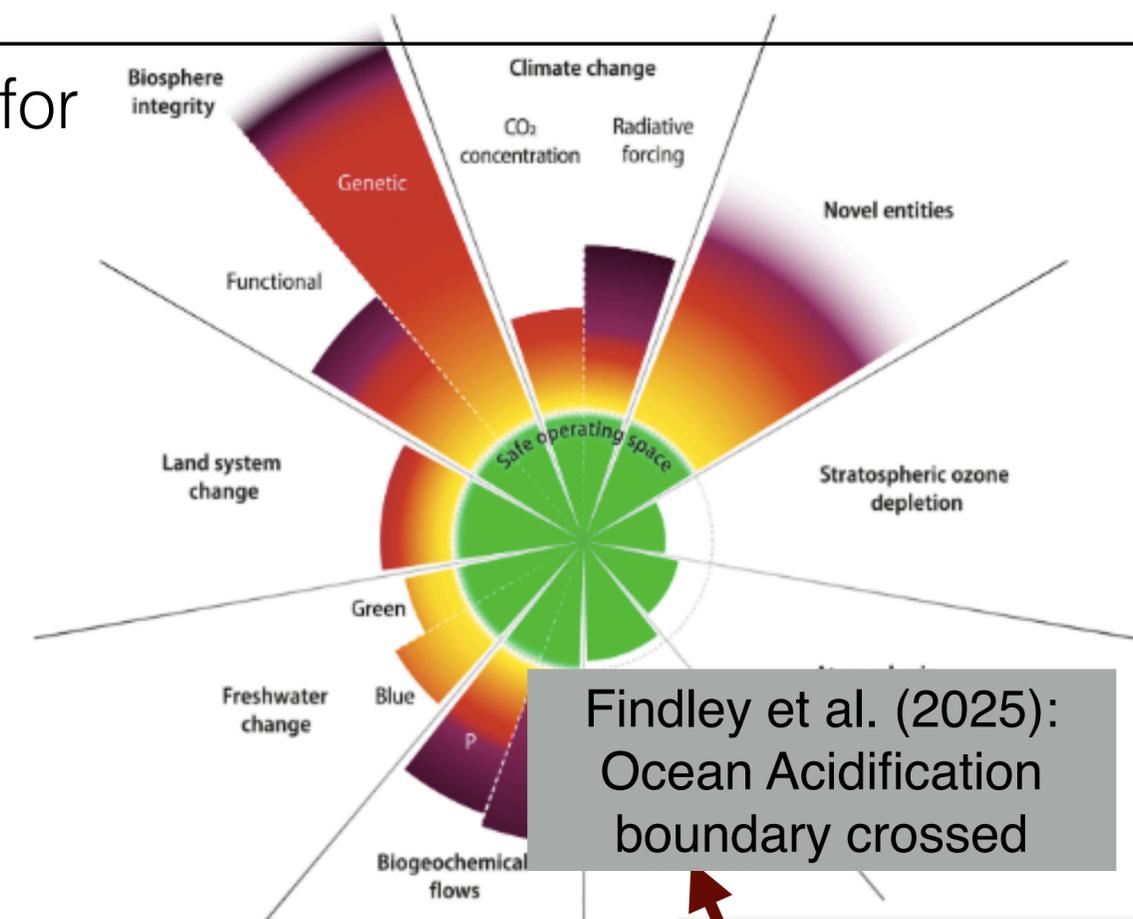
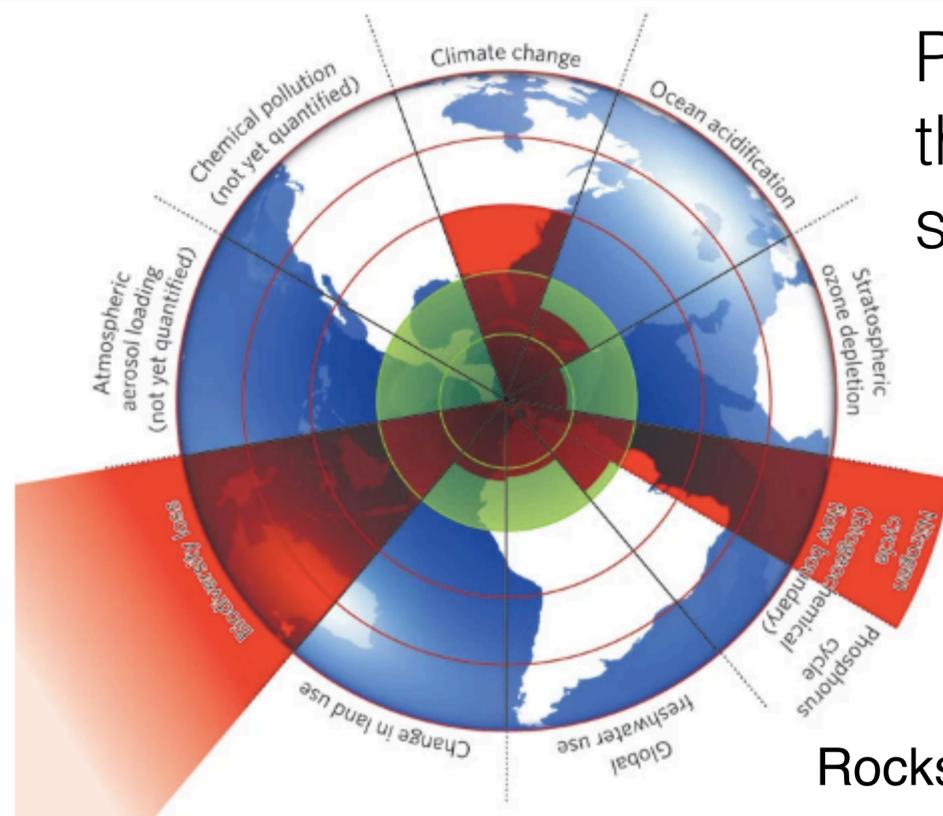


Fig. 1. Current cumulative CO₂ uptake. Six of the nine planetary boundaries have been transgressed. The zone of increasing transgression lies at the same time as the main text. The zone of increasing transgression lies at the same time as the main text. The zone of increasing transgression lies at the same time as the main text.

Rothman, 2017

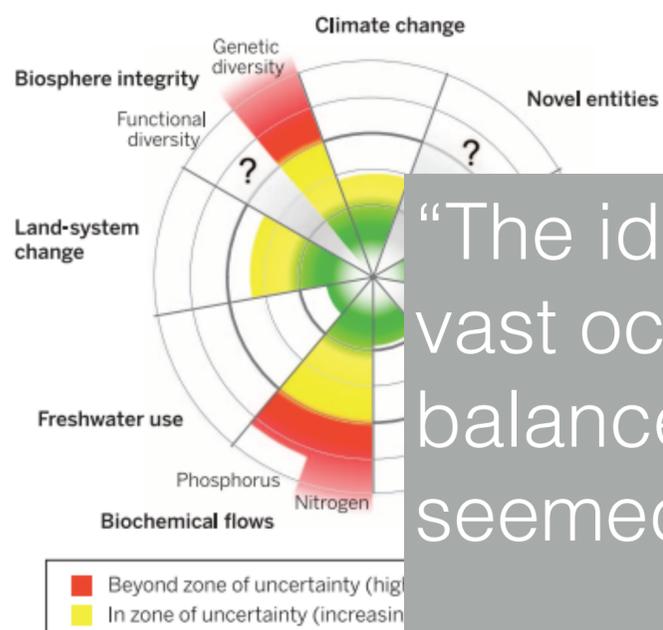
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“The idea that humans might also befoul the vast oceans, altering their ecology, chemical balance, and role within the Earth system also seemed unlikely – until now.”

Julian Gribb, Oct. 3, 2025

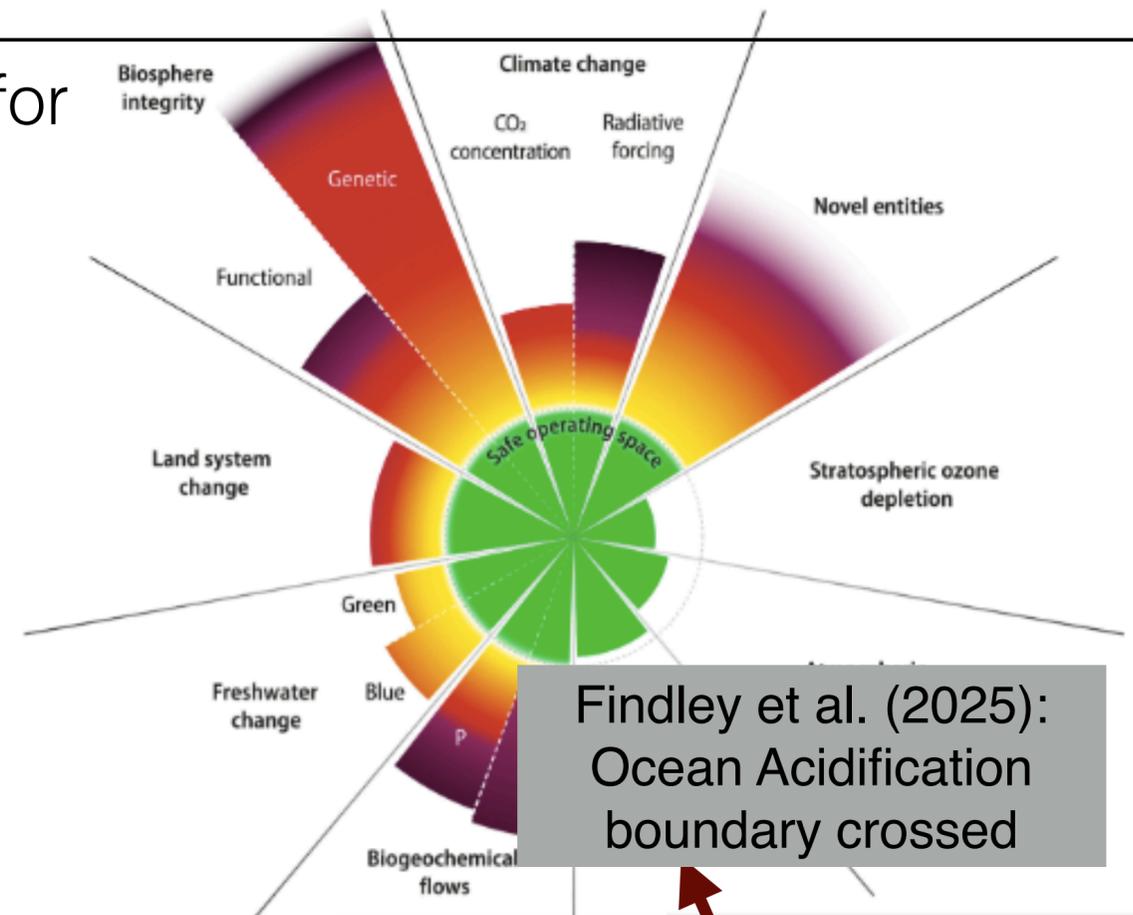
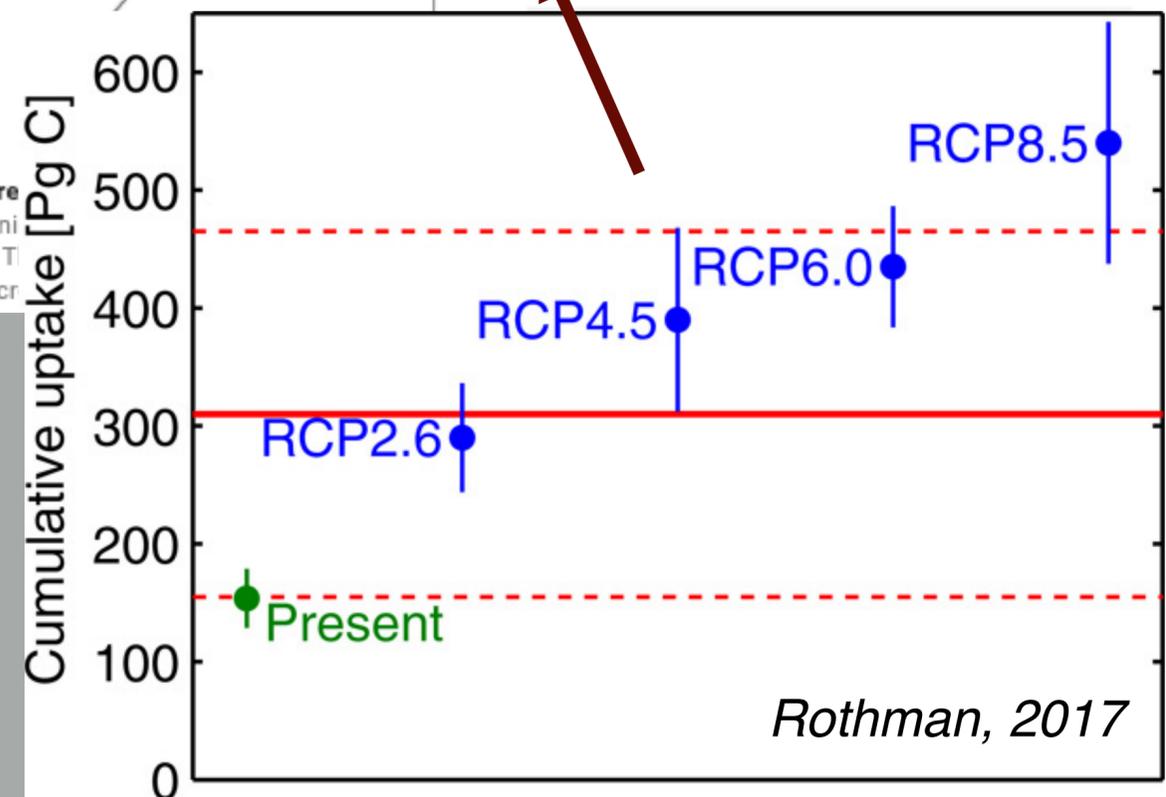


Fig. 1. Current cumulative CO₂ uptake. The red dashed line indicates the boundary. The blue dashed line indicates the zone of increasing uncertainty.



Rothman, 2017

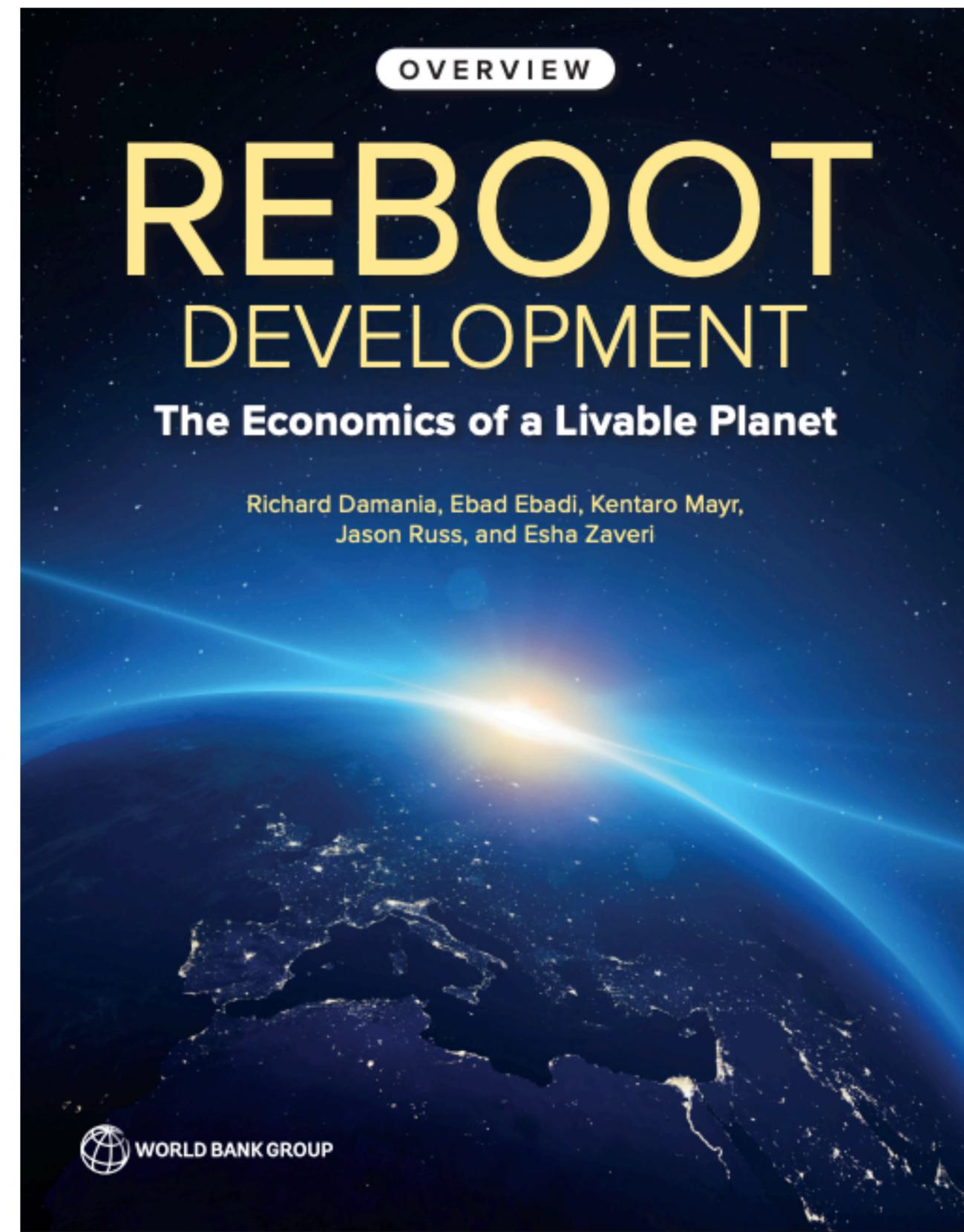
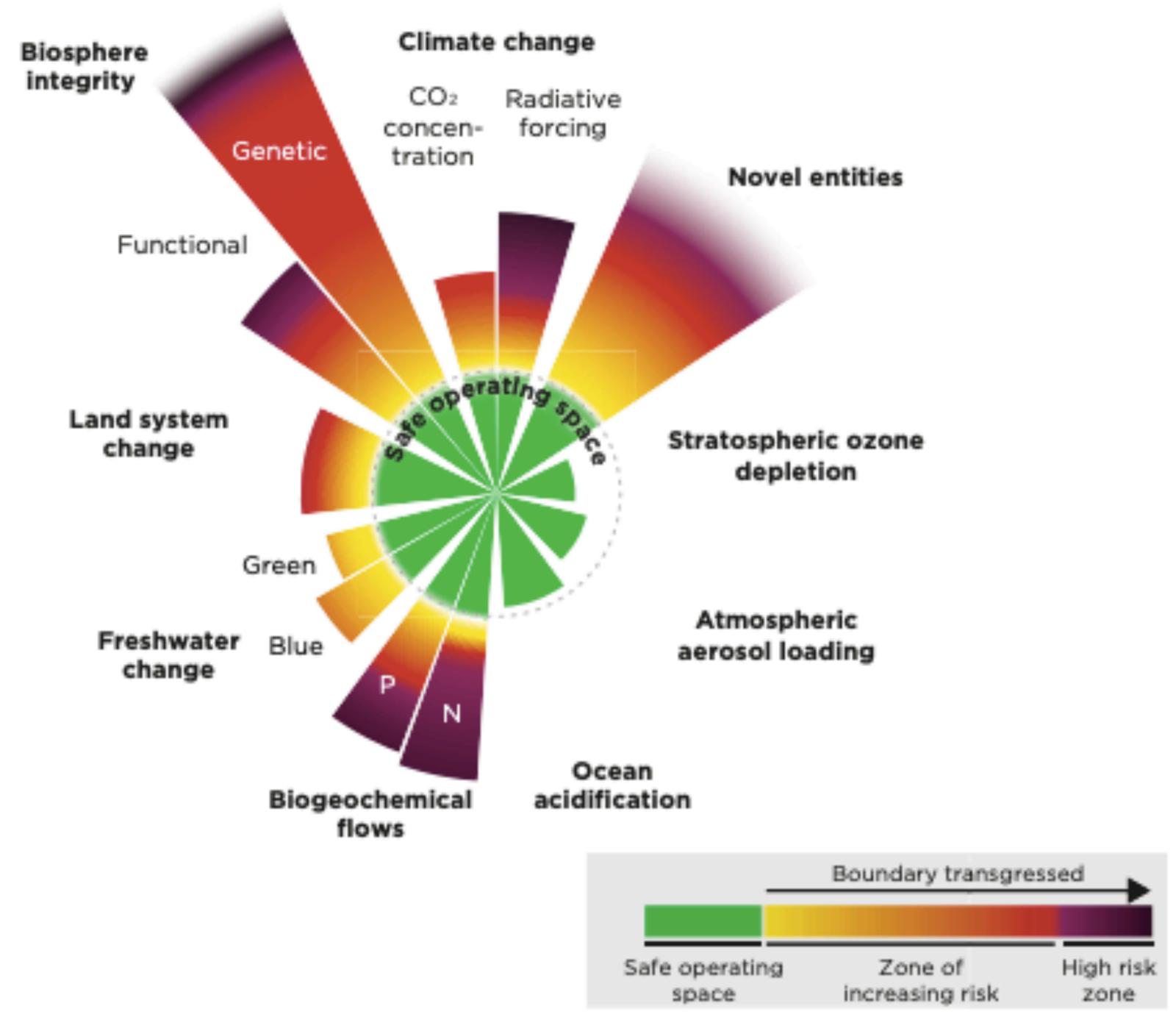


FIGURE 0.4 Humanity has crossed six of the nine planetary boundaries



Source: Azote for Stockholm Resilience Centre, based on analysis in Richardson et al. 2023.
Note: CO₂ = carbon dioxide; N = nitrogen; P = phosphorus.¹

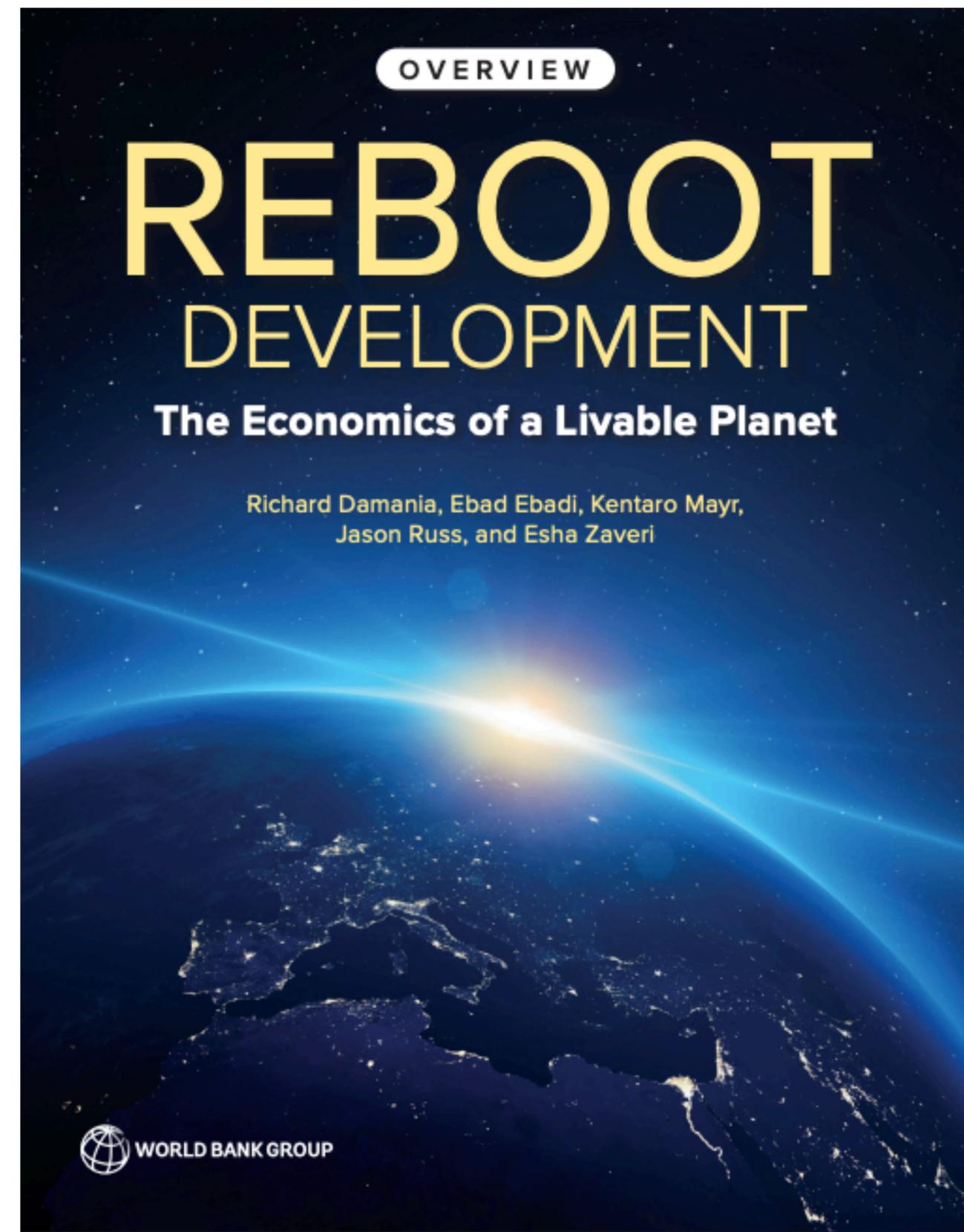
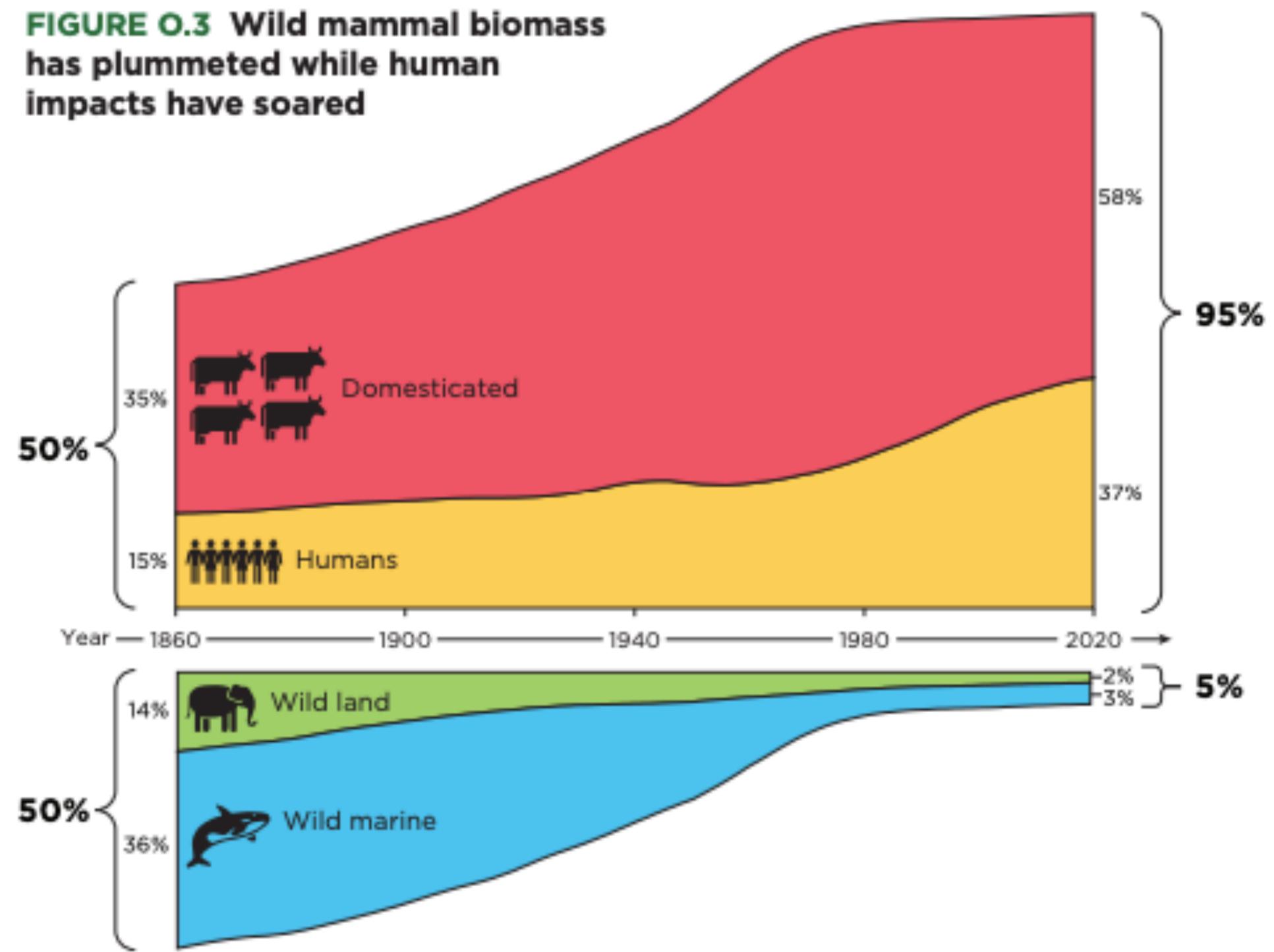


FIGURE 0.3 Wild mammal biomass has plummeted while human impacts have soared



Source: Adapted from Greenspoon et al. (forthcoming)
 Note: Refer to chapter 1 for details.¹

OVERVIEW

REBOOT DEVELOPMENT

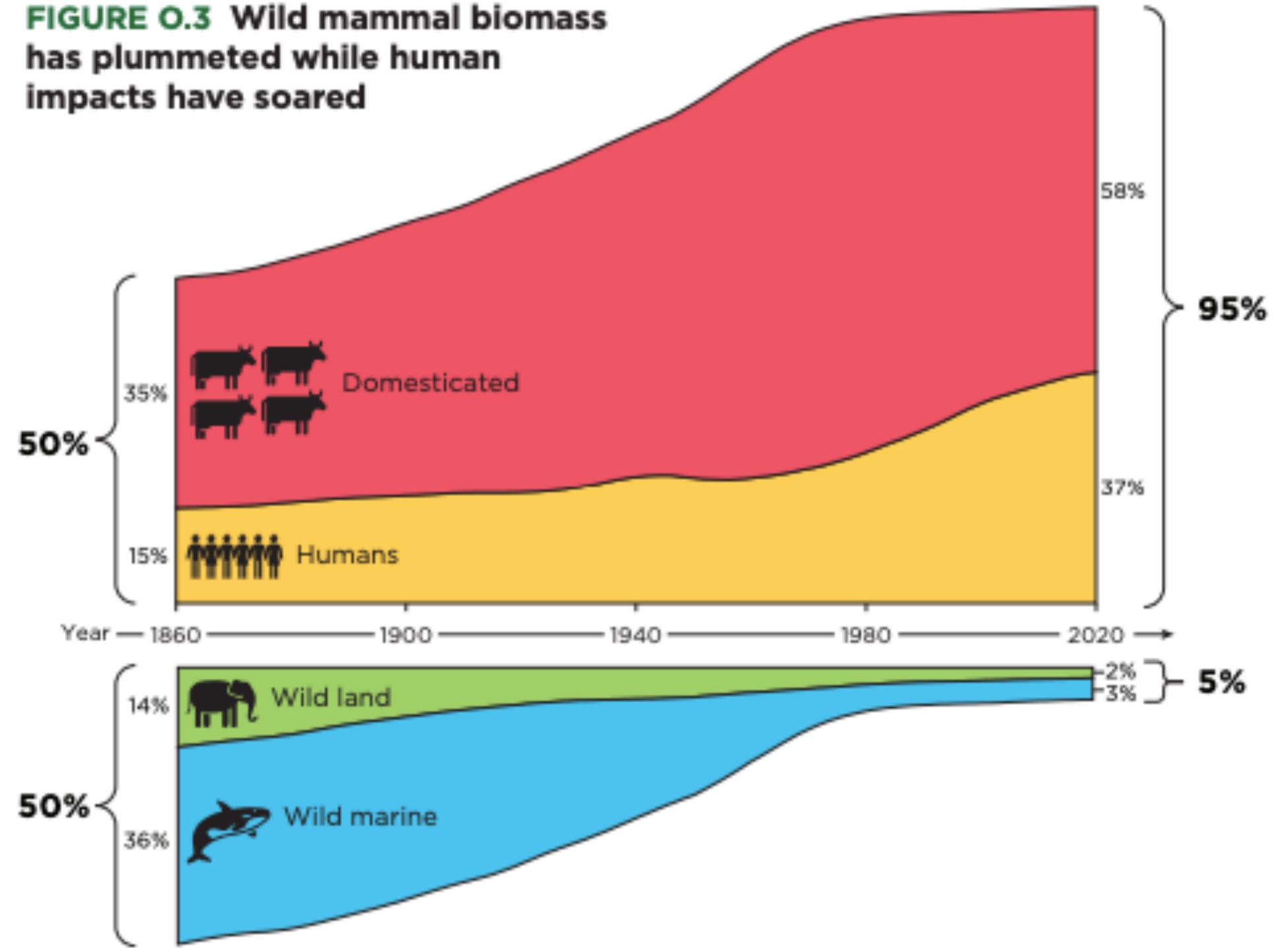
The Economics of a Livable Planet

Richard Damania, Ebad Ebadi, Kentaro Mayr, Jason Russ, and Esha Zaveri

Yet, in reshaping the world for prosperity, humanity is unsettling the foundations of progress. The very forces that have fueled economic growth—industrial expansion, energy consumption, and large-scale agriculture—now strain the planet’s ability to sustain this prosperity



FIGURE 0.3 Wild mammal biomass has plummeted while human impacts have soared



Source: Adapted from Greenspoon et al. (forthcoming)
 Note: Refer to chapter 1 for details.¹

OVERVIEW

REBOOT DEVELOPMENT

The Economics of a Livable Planet

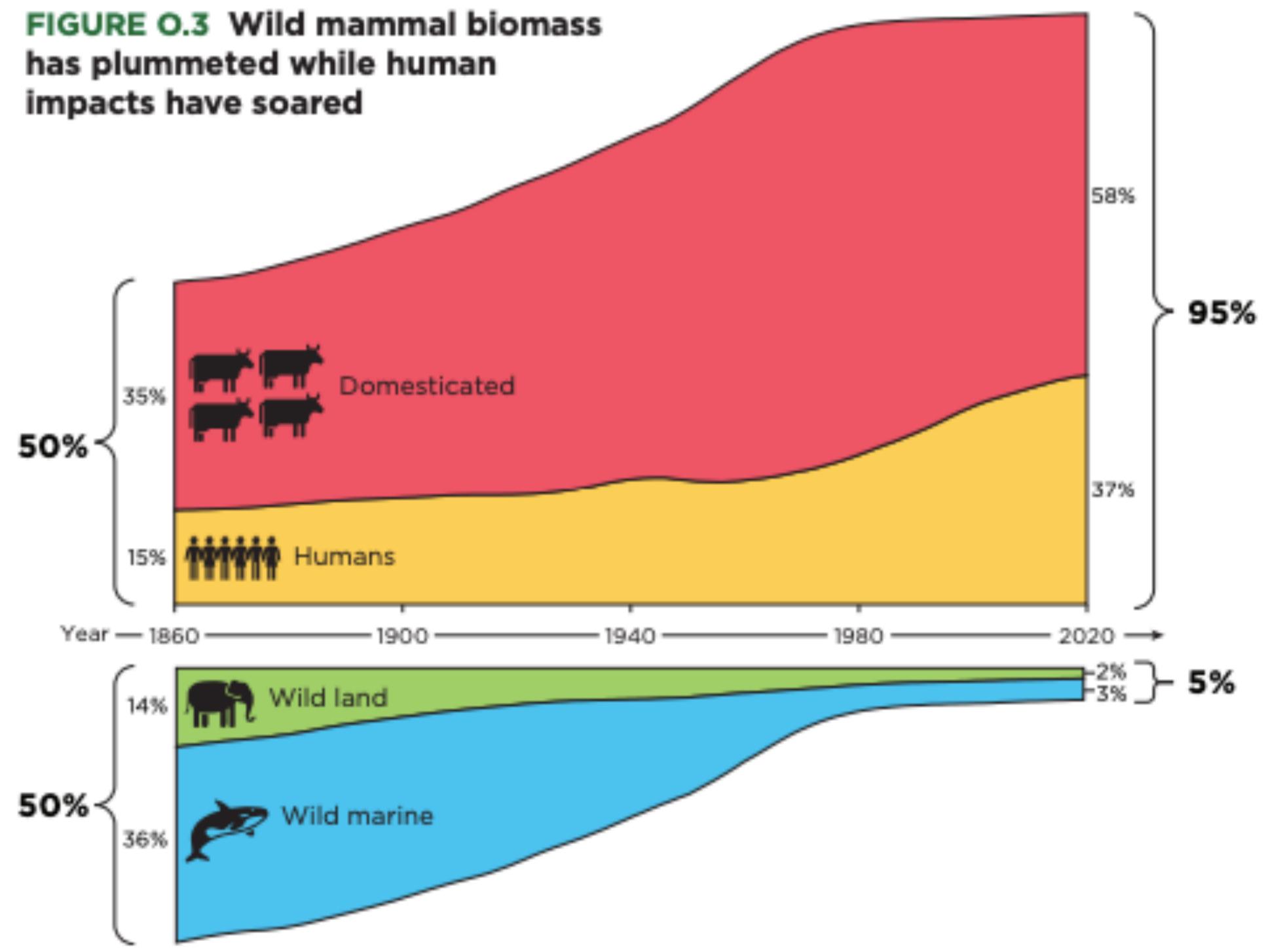
Richard Damania, Ebad Ebadi, Kentaro Mayr, Jason Russ, and Esha Zaveri

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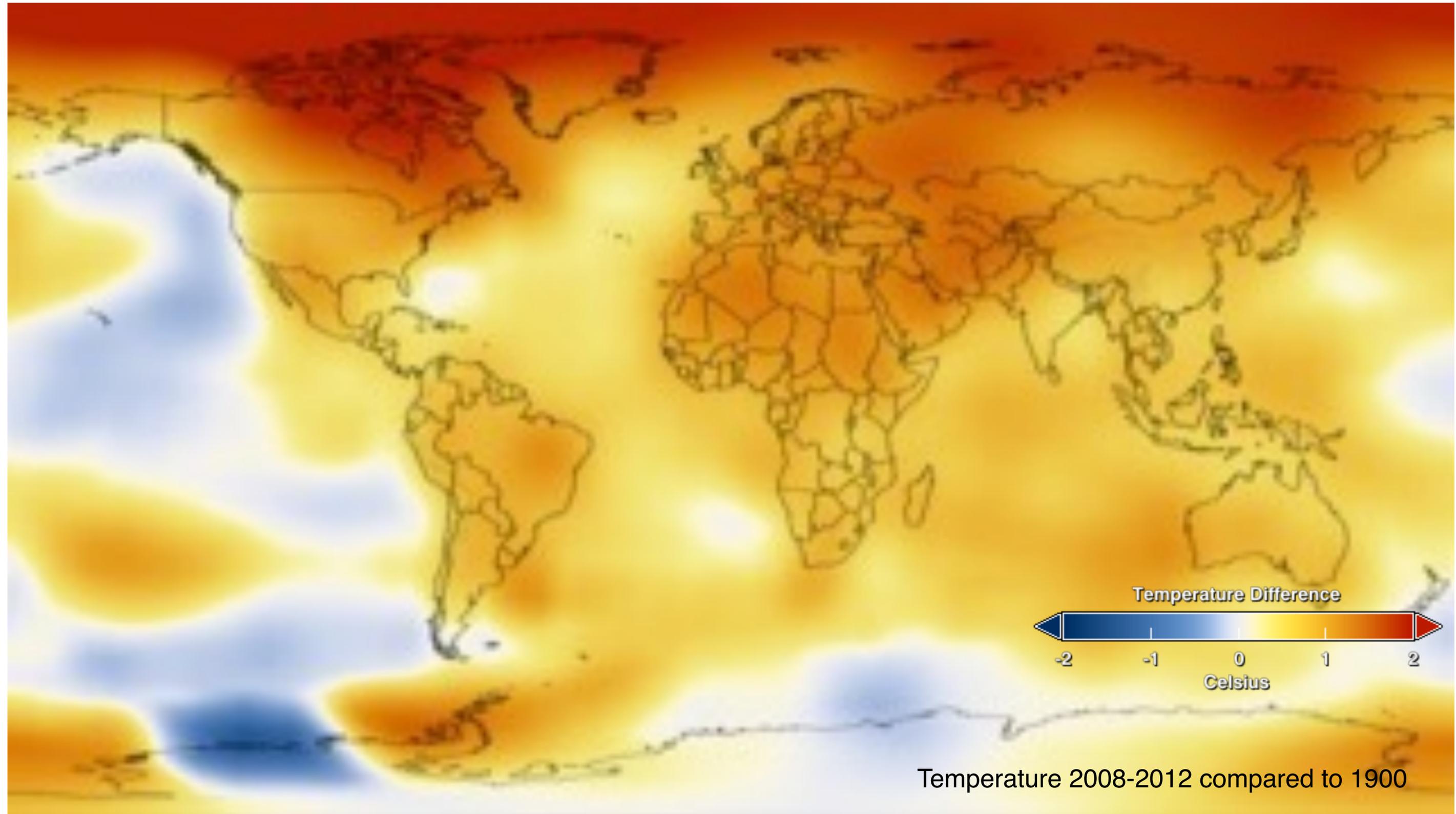
Is the World Bank getting it?



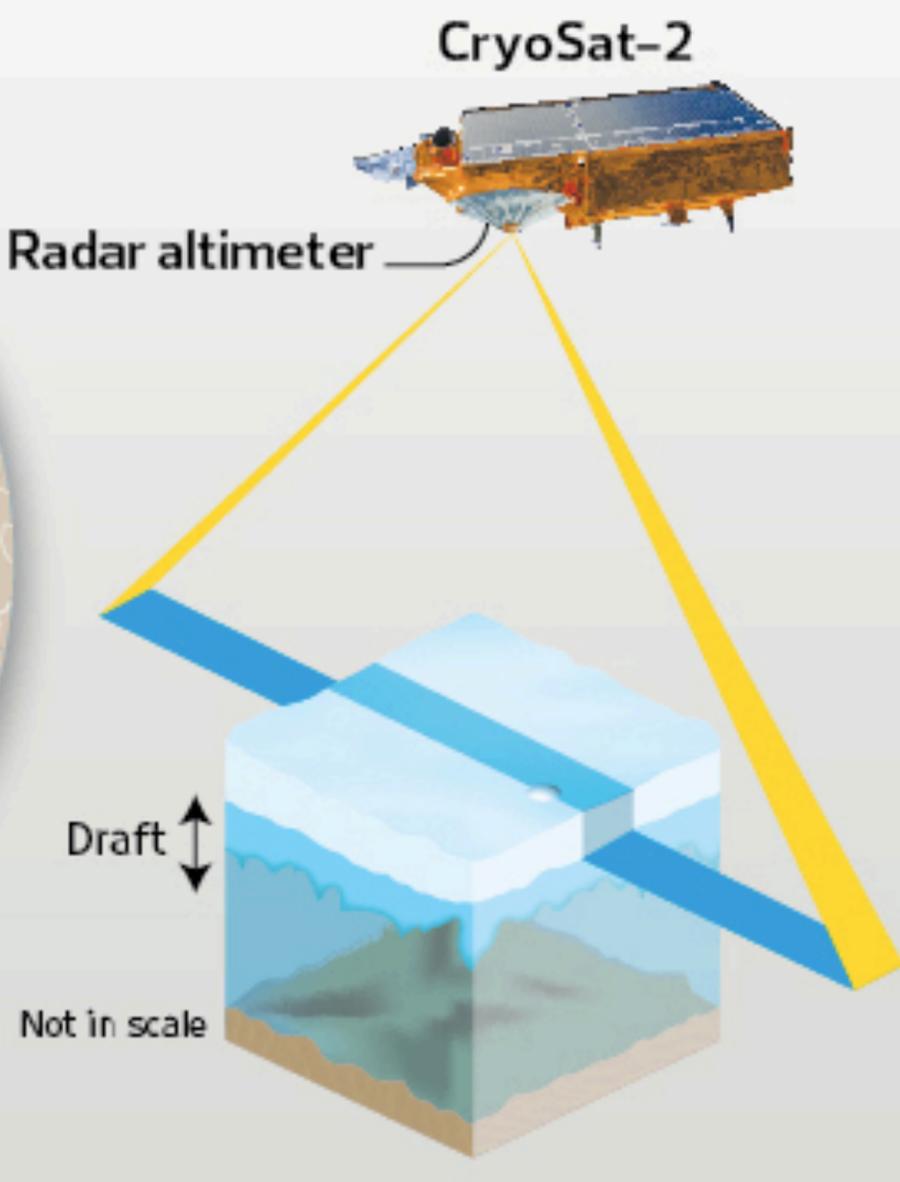
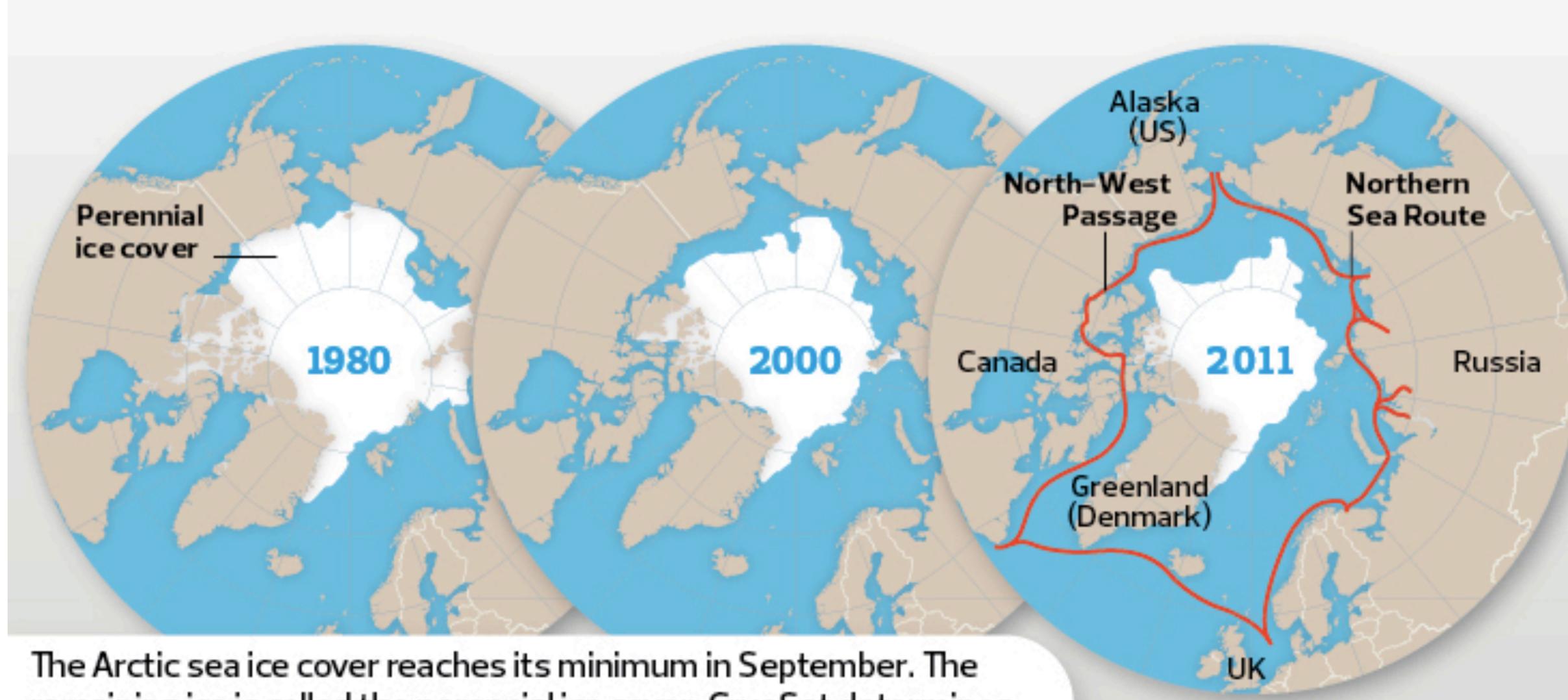
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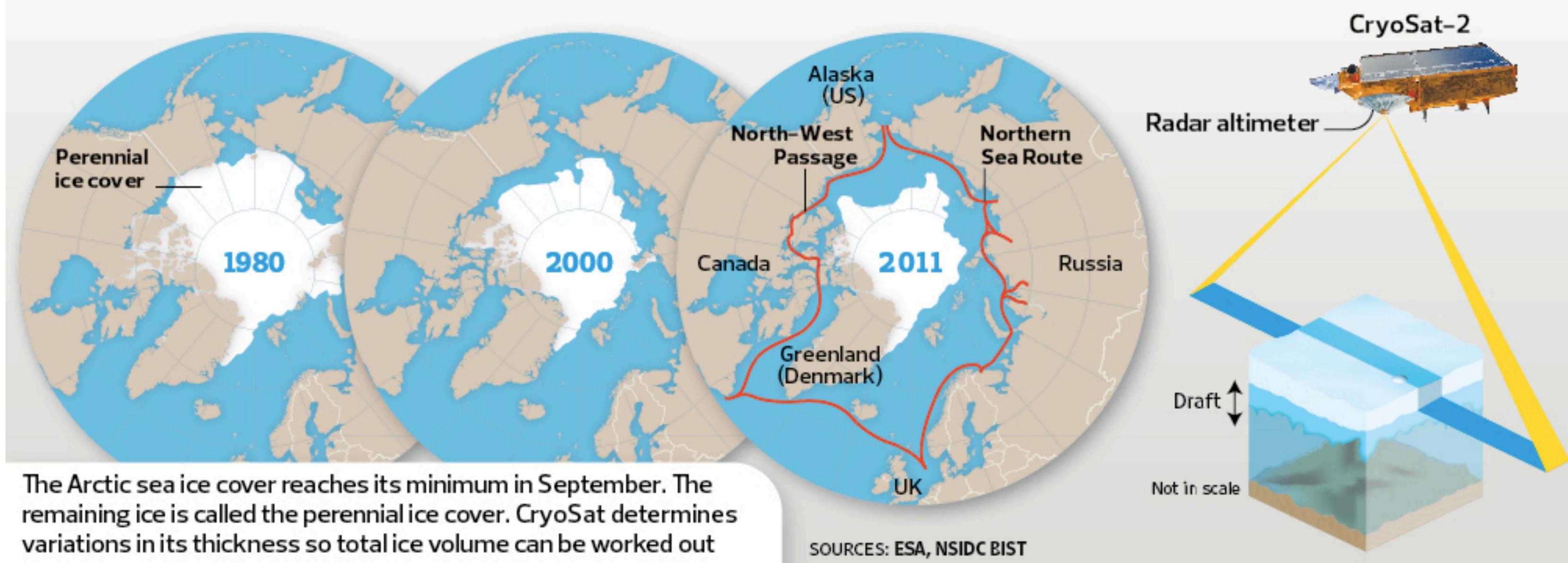
SHRINKING ICE CAPS



The Arctic sea ice cover reaches its minimum in September. The remaining ice is called the perennial ice cover. CryoSat determines variations in its thickness so total ice volume can be worked out

SOURCES: ESA, NSIDC BIST

SHRINKING ICE CAPS



Positive Feedback Loops:
Sea Ice melting (Albedo change)
Permafrost melting: More Greenhouse Gases

The Syndrome: Recent Climate and Global Change

Rainfall and floods



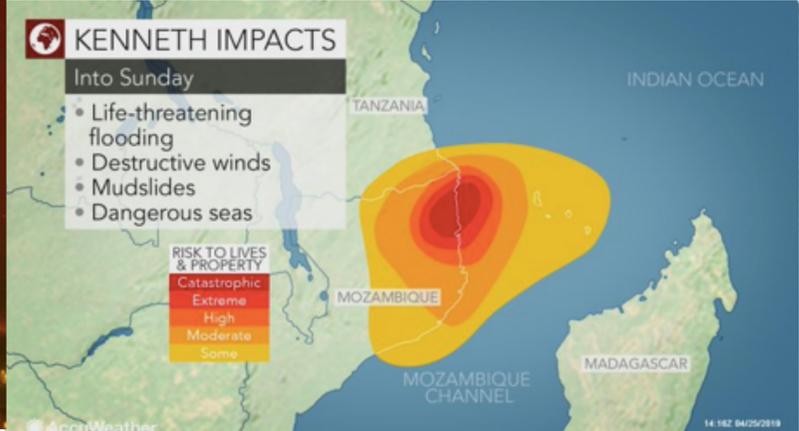
Hurricane Dorian
September 1, 2019

Cyclones and storms

Cyclone Idai,
March 15, 2019



Cyclone Kenneth,
April 22, 2019



Heat waves and droughts



Wildfires



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Rainfall and floods



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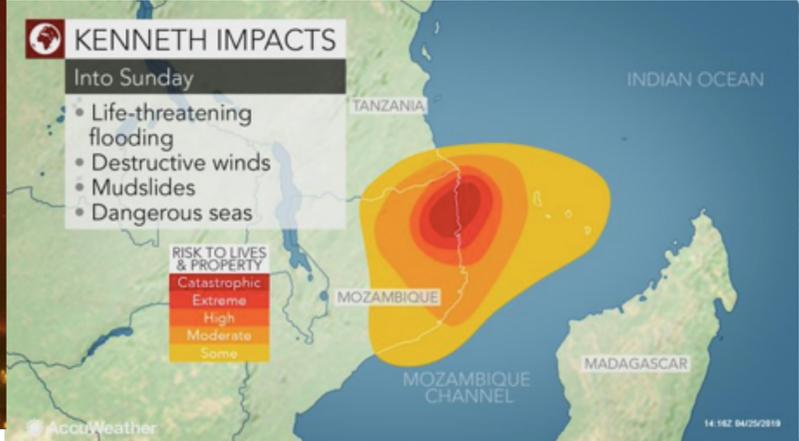
Extreme weather-related disasters are increasing
Normalcy Biases: We get used to it very fast!

Heat waves and droughts



Wildfires

Cyclone Kenneth,
April 22, 2019



The Syndrome: Recent Climate and Global Change

Rainfall and floods



The west is ignoring Pakistan's super-floods. Heed this warning: tomorrow it will be you
Fatima Bhutto



Fri 9 Sep 2022 06.00 BST



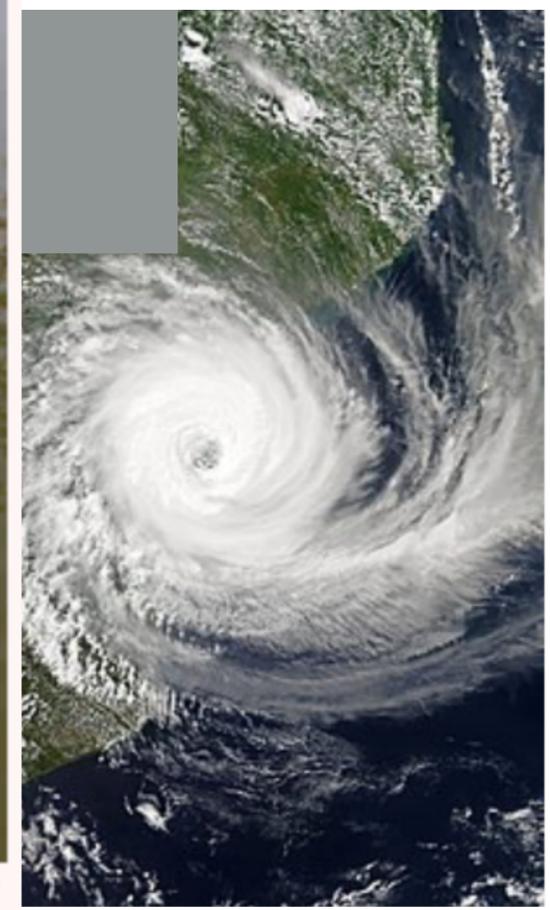
Those who don't die from the floods risk death by starvation - yet you've probably heard little about the devastation



Victims of flooding from monsoon rains carry belongings salvaged from their flooded home in the Dadu district of Sindh province. Photograph: Fareed Khan/AP

Hurricane Dorian September 1, 2019

storms



Heat waves and drought



The Syndrome: Recent Climate and Global Change

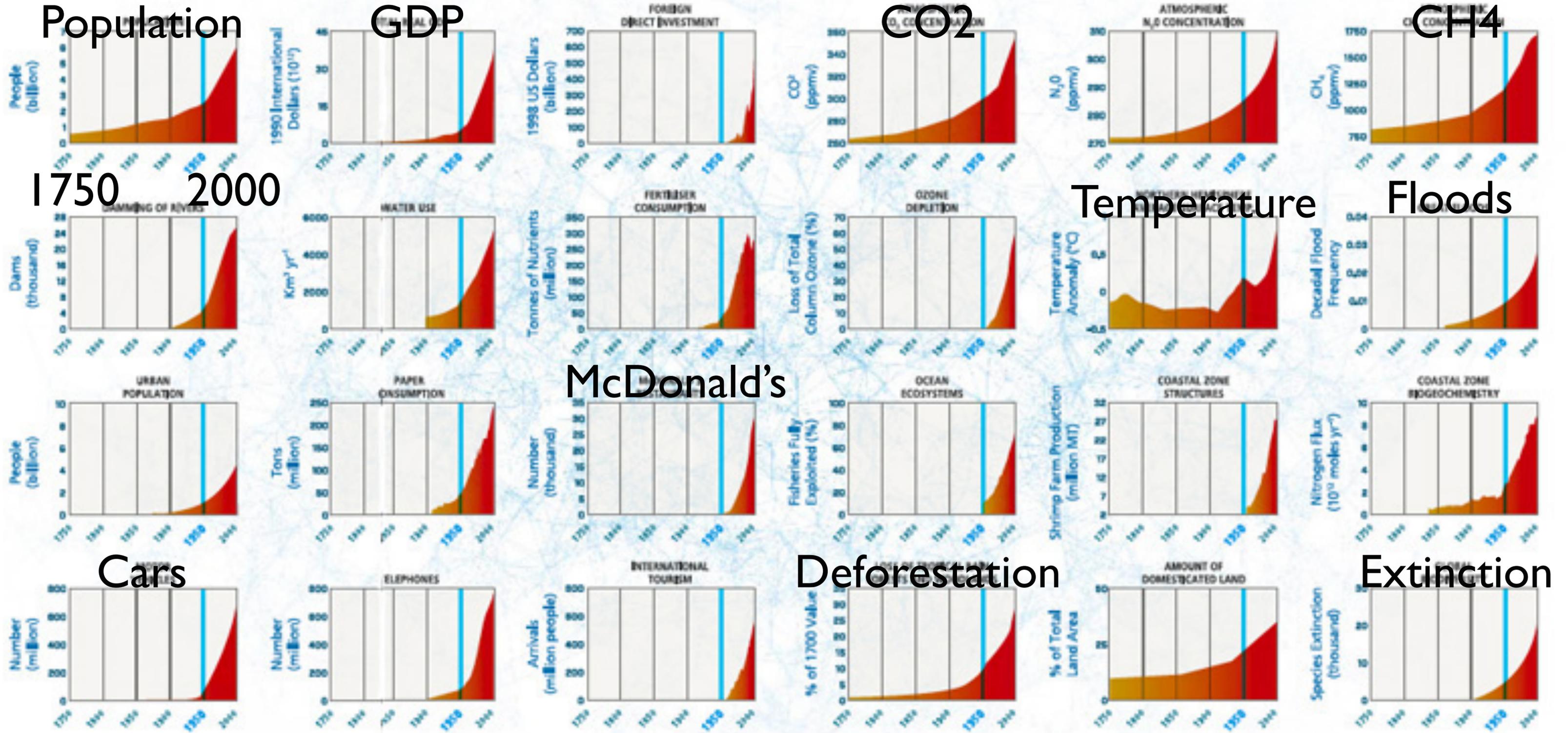


Figure 1. An enterprise to reckon with. Human manipulation of their environment began in earnest during the Industrial Revolution and accelerated markedly after the 1950s, as IGBP's Great Acceleration graphs show. Modified after Steffen W et al. (2004).

The Syndrome: Recent Climate and Global Change

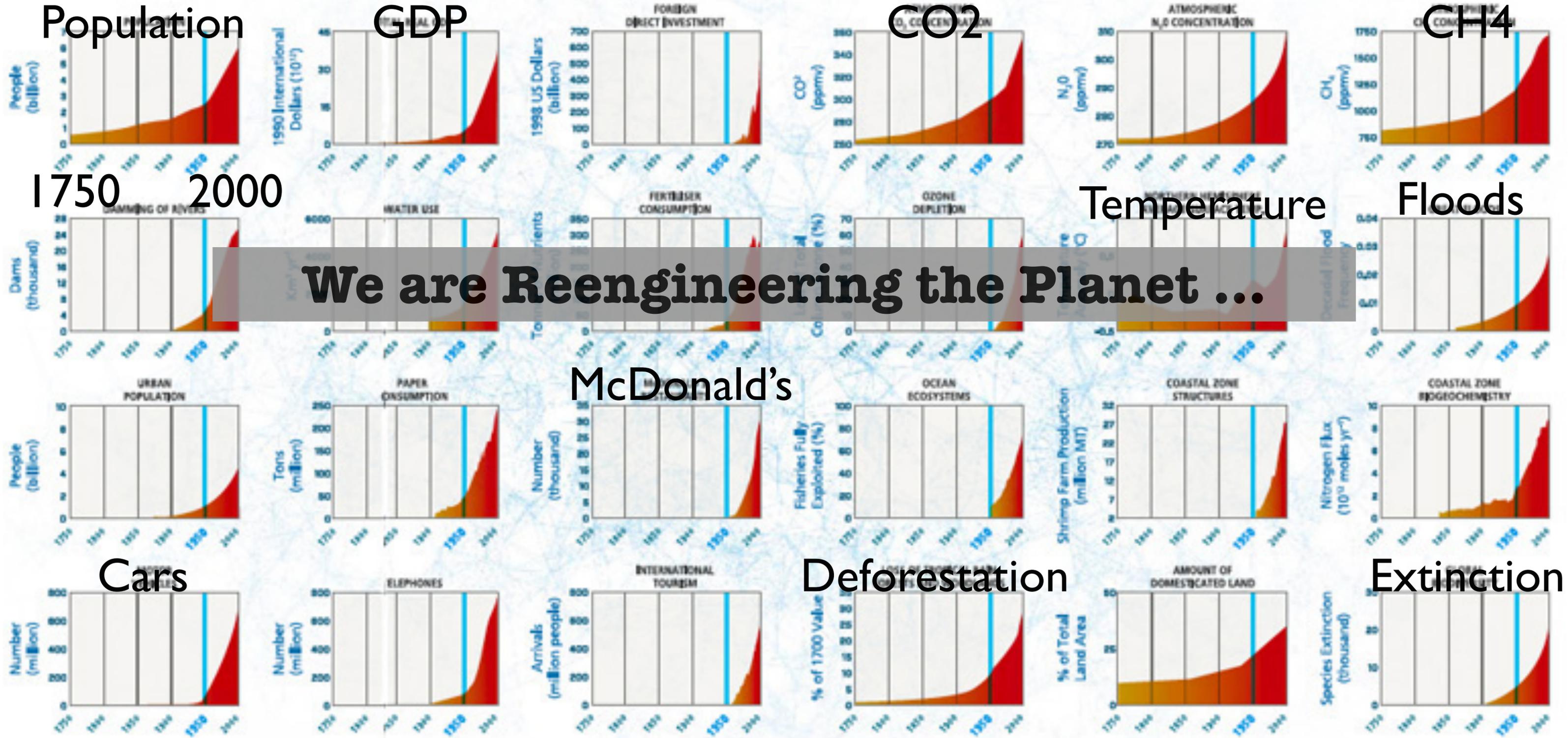
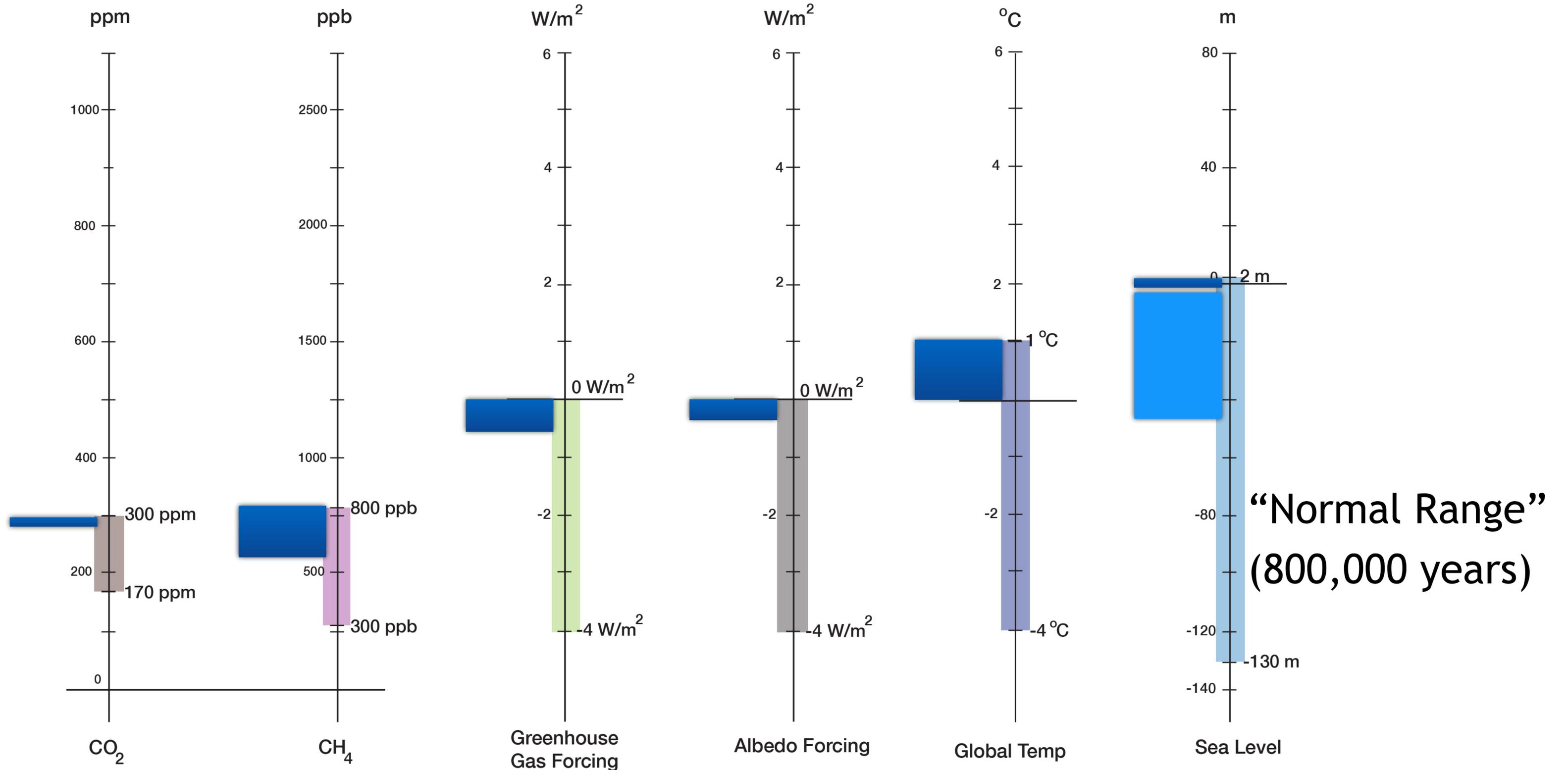


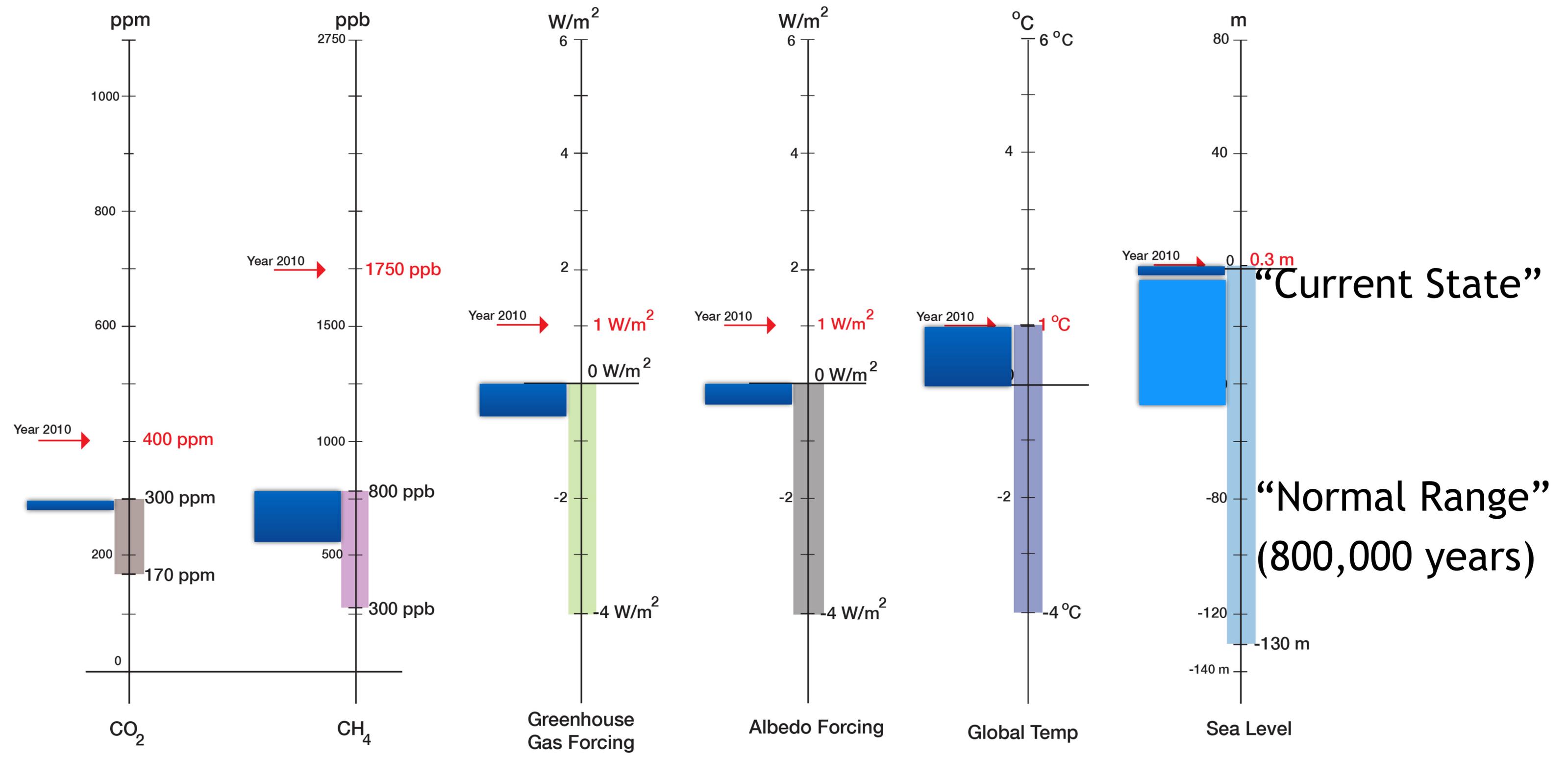
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The Syndrome of Modern Global Change



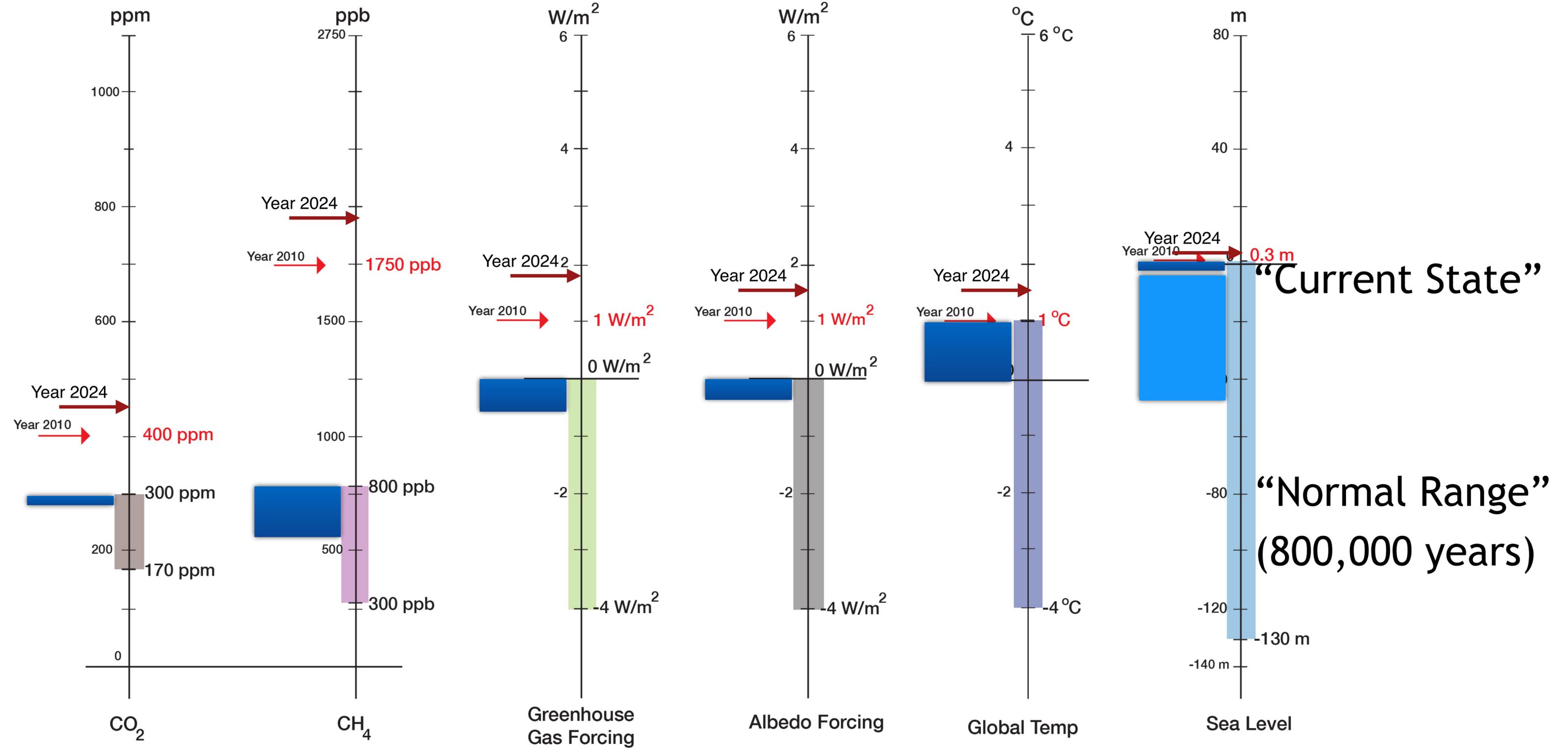
The Syndrome of Modern Global Change

The Lab Results for "Patient Earth"



The Syndrome of Modern Global Change

The Lab Results for "Patient Earth"



Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a “safe operating space for humanity”

Syndrone

During the last few hundred years, humanity has introduced rapid and large changes

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene; we have increasing disequilibrium

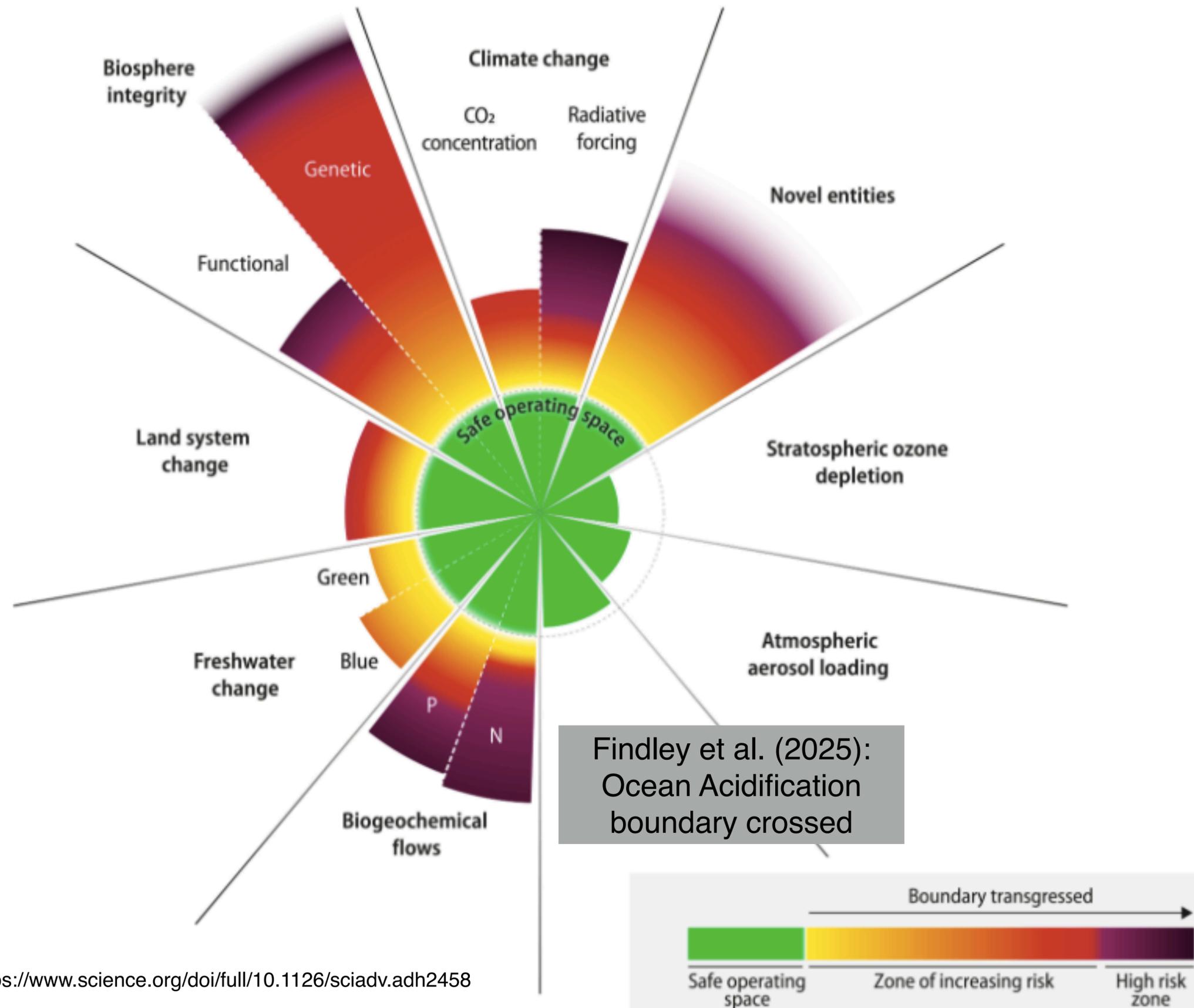
Are we in a Human and Planetary Existential Emergency? If so, what can we do about it?

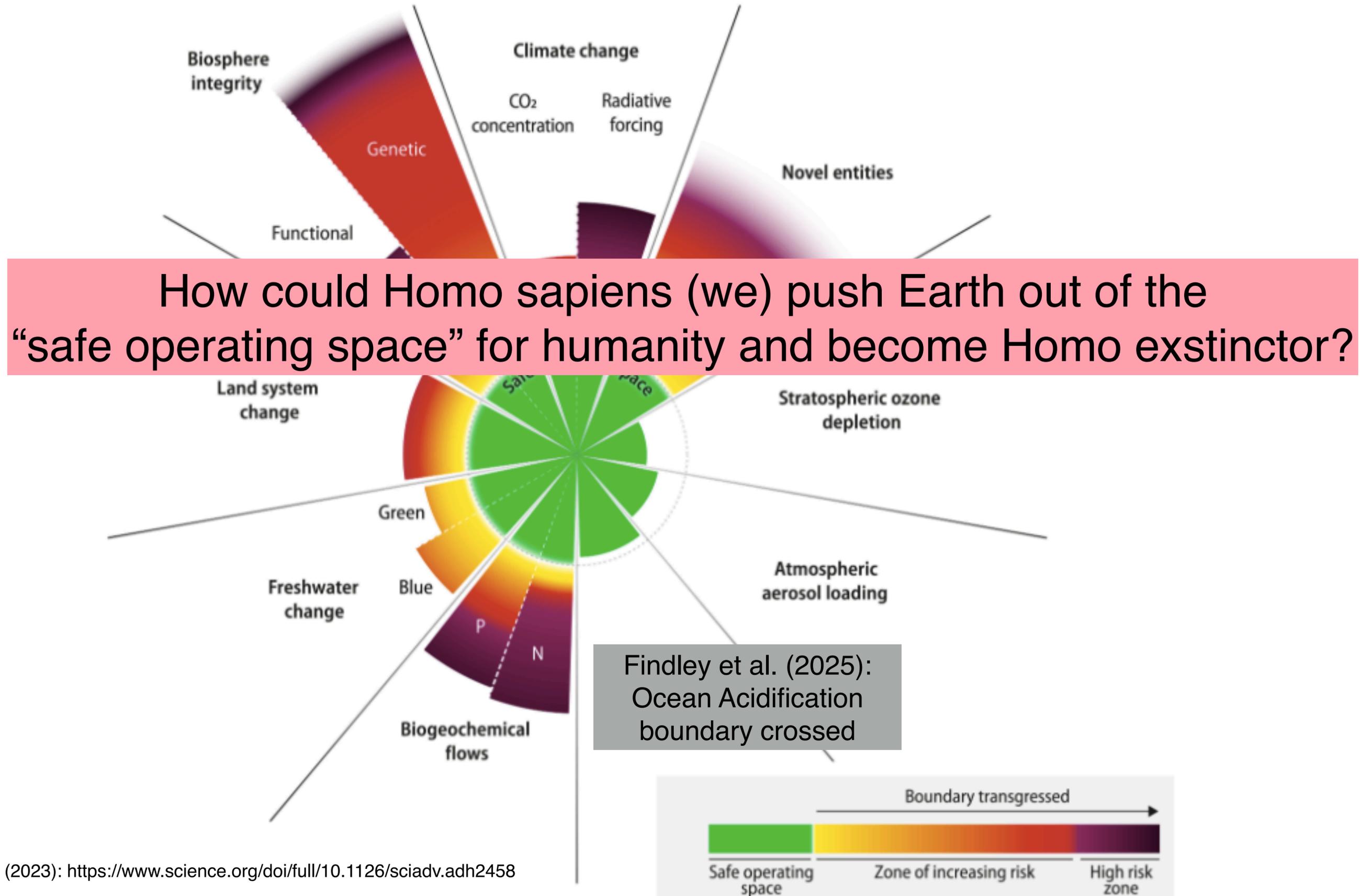
Contents

- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Official Purpose of “Economy”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes



The Diagnosis: Official Purpose of "Economy"



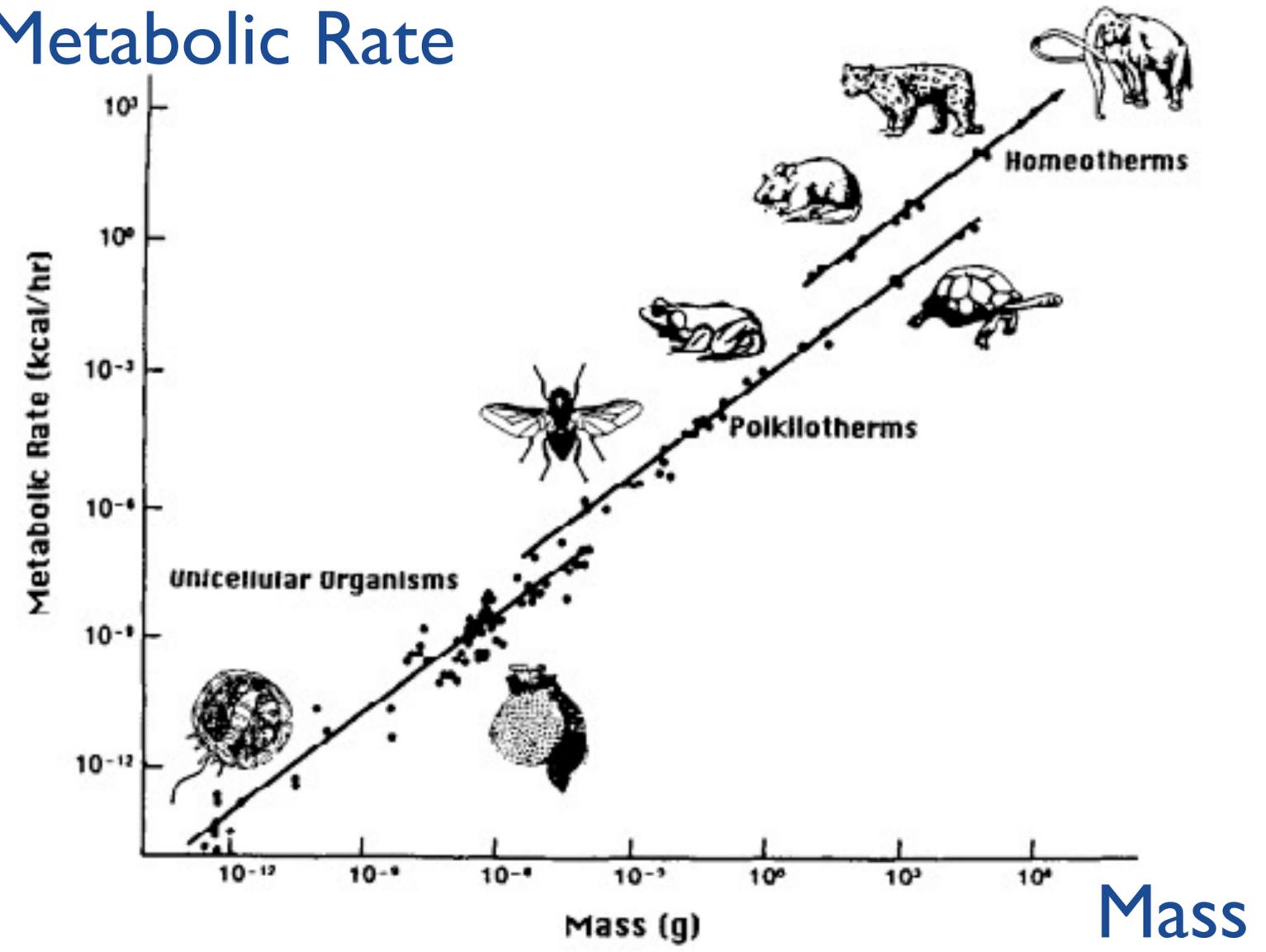


The Diagnosis: Official Purpose of "Economy"

Out of Scale

Scaling law for metabolic rate:
 $Y = Y_0 * M^{(3/4)}$

Metabolic Rate



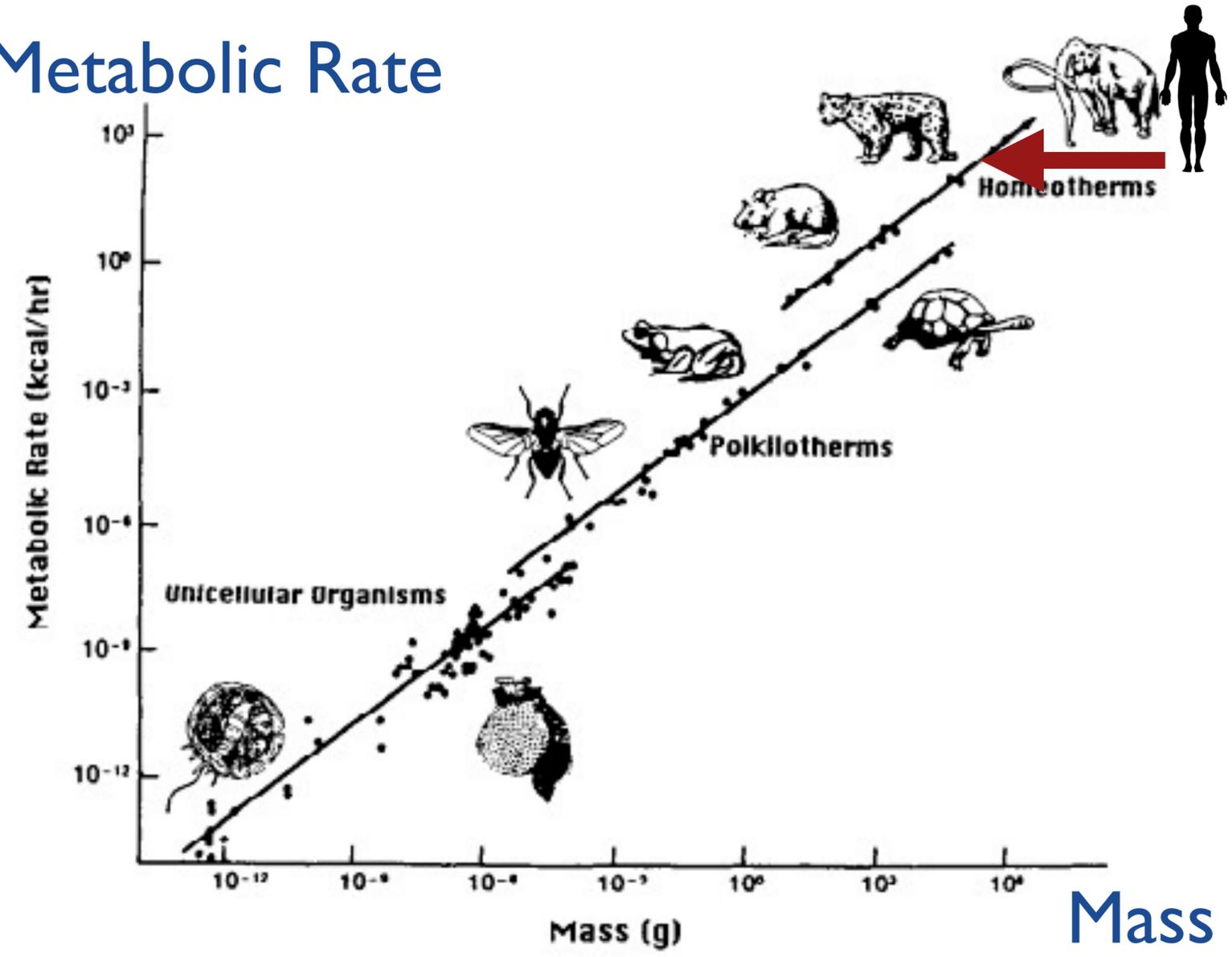
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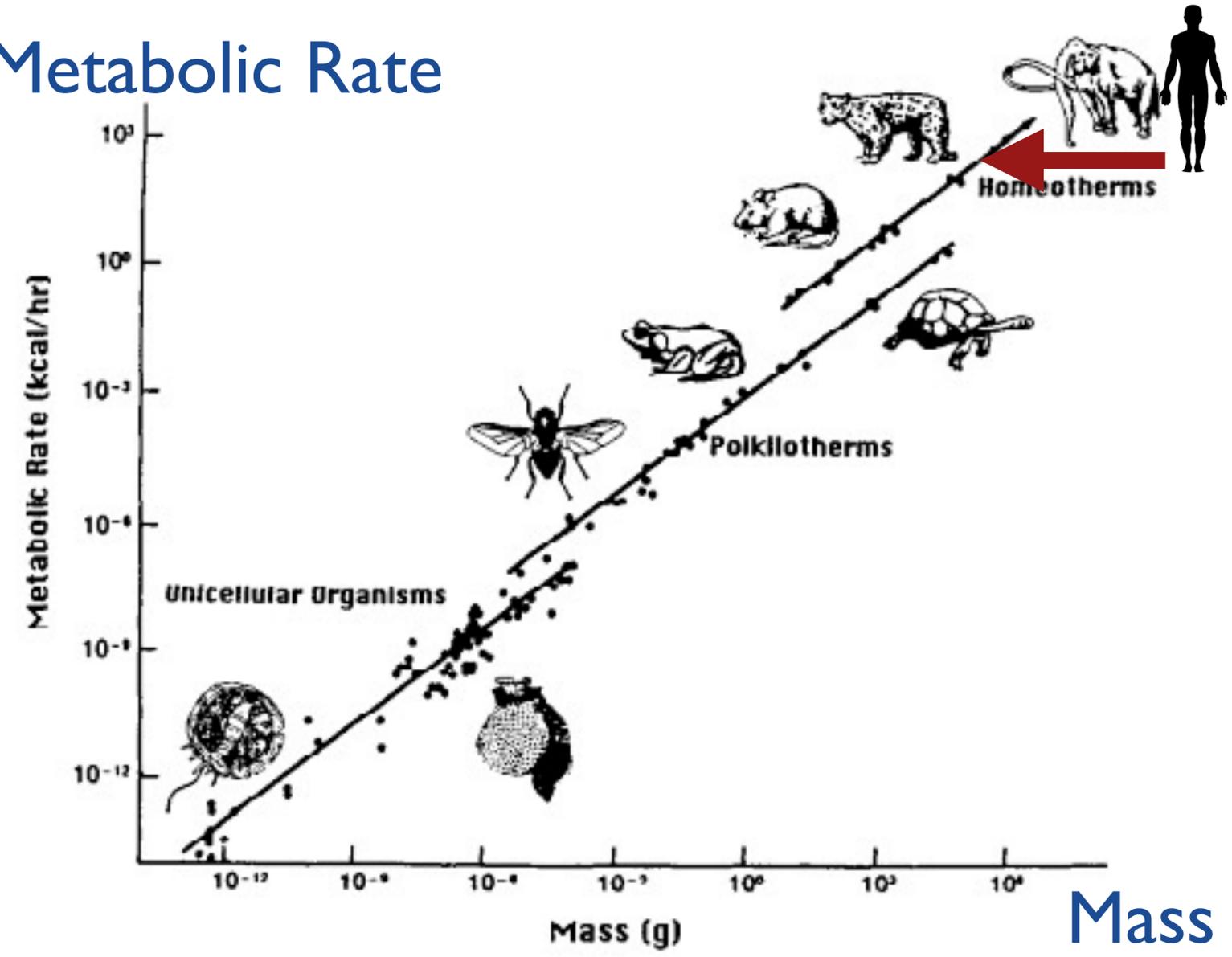
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Extended metabolic rate:
 $Y_E = Y + C_E$
(C_E : total energy consumption)

Metabolic Rate



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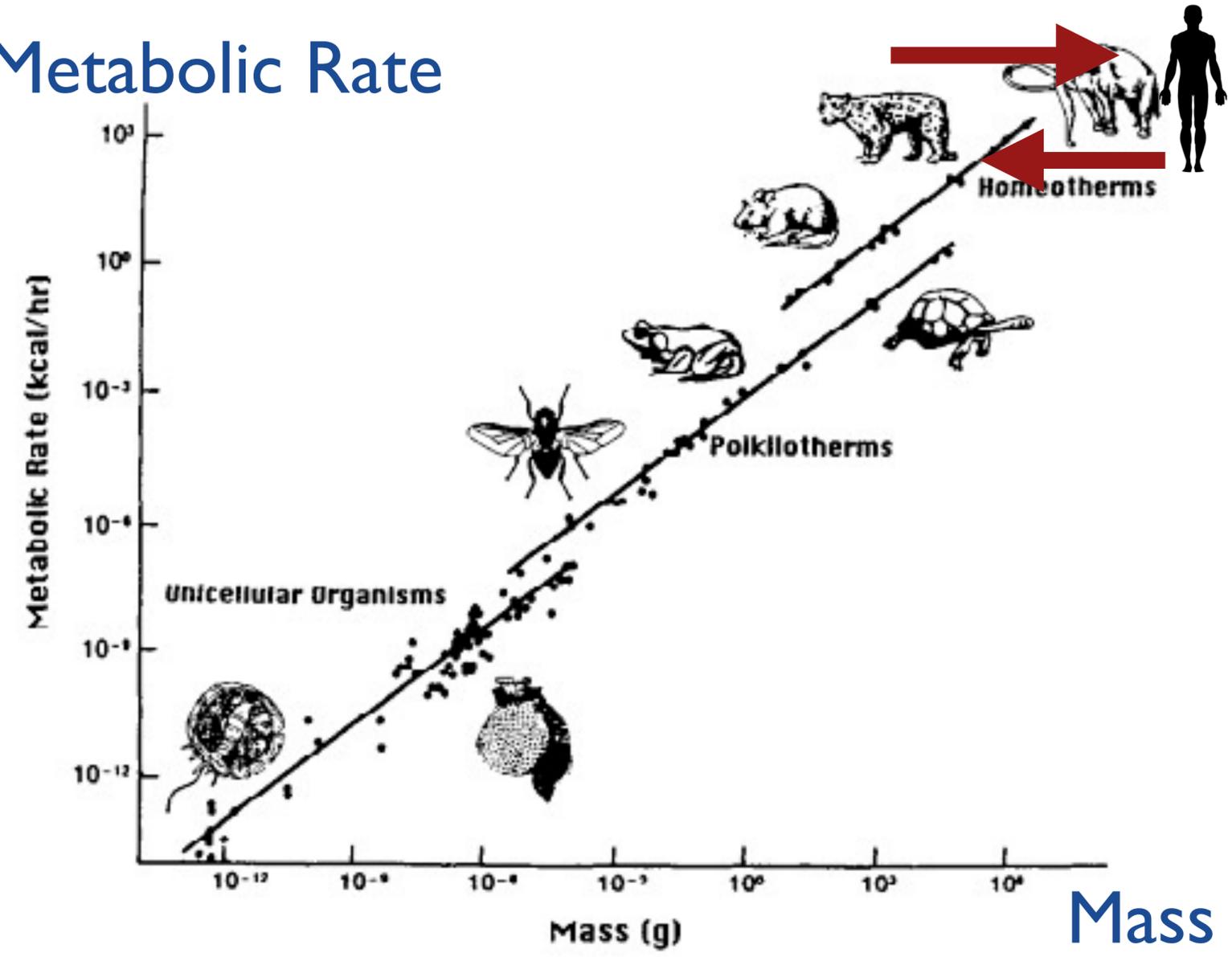
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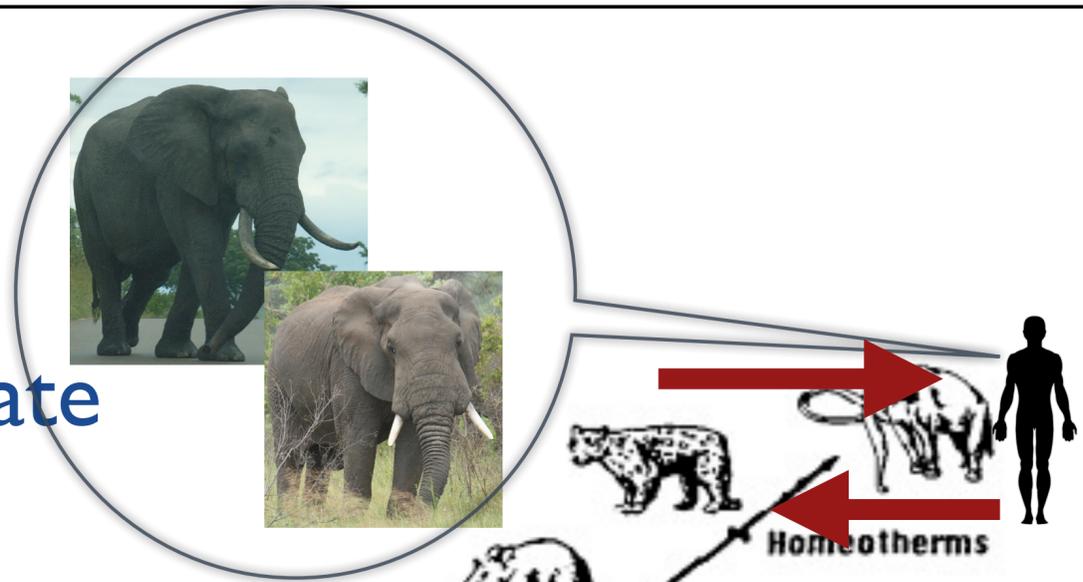
Energy consumption per capita:
Global Average: $Y_E = 2,835$ Watt
 $M = 10$ metric tons

Metabolic Rate

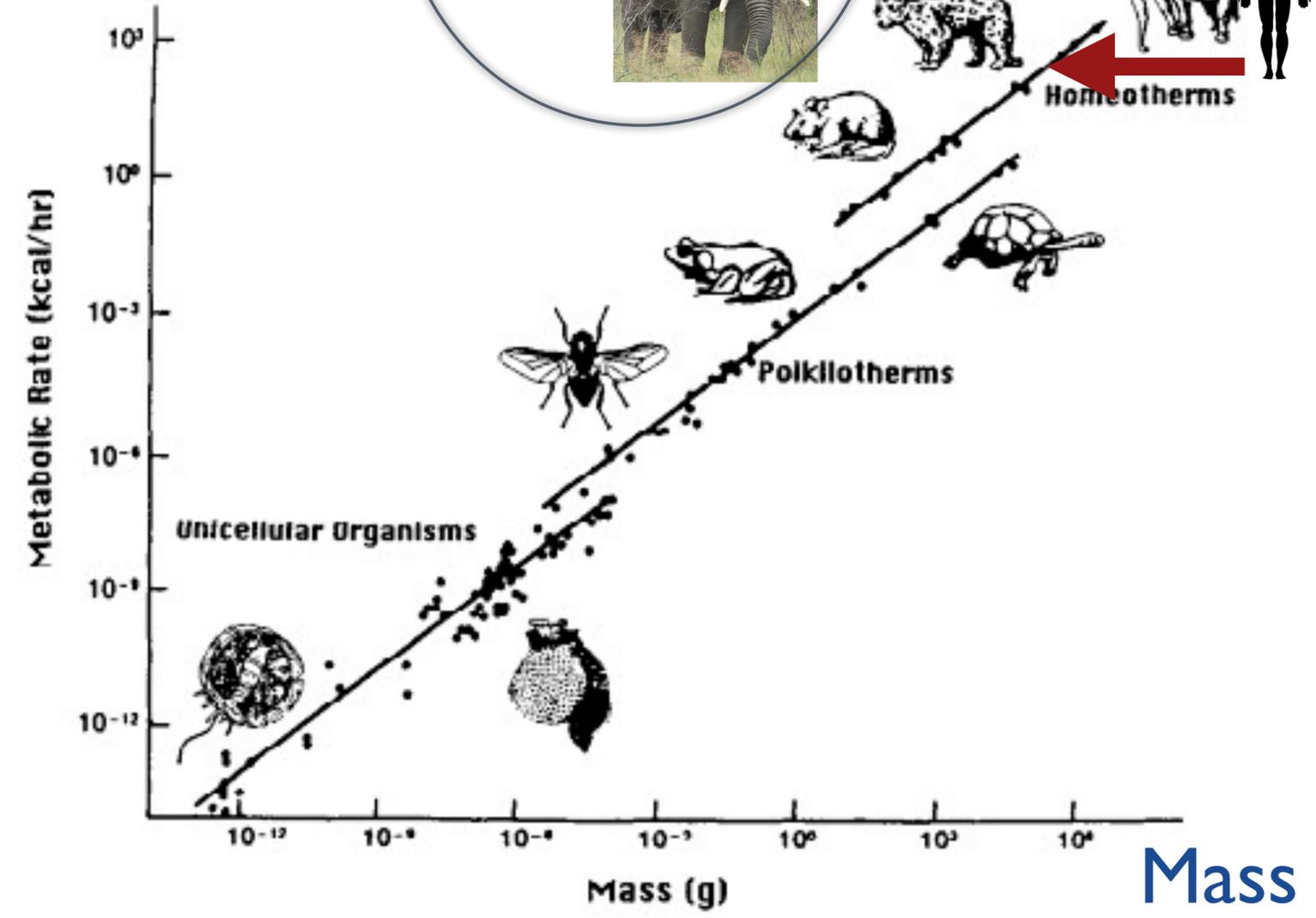


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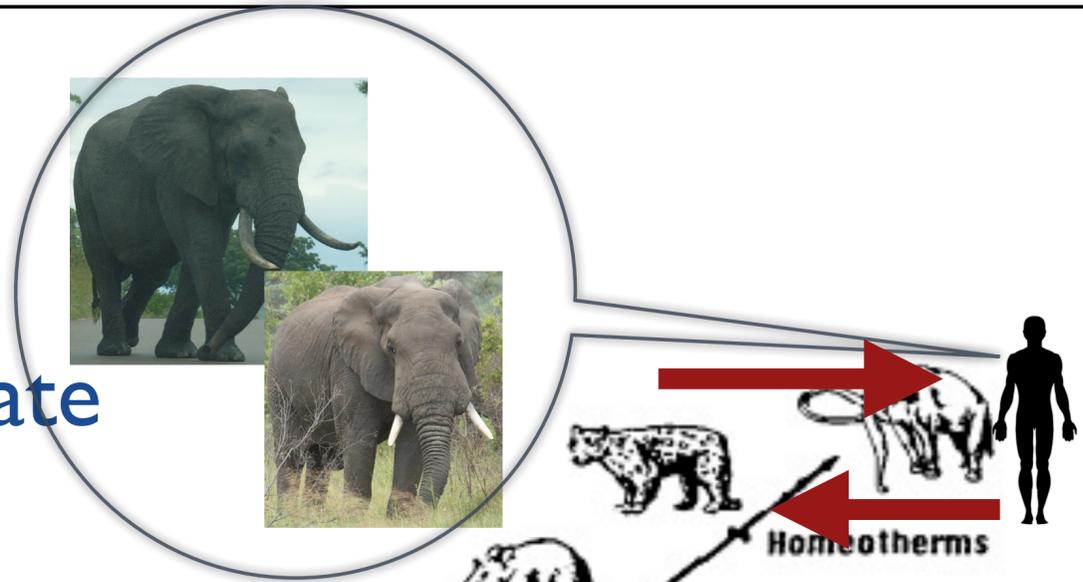
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Humanity has an extended metabolic rate equivalent to 14 Billion elephants
 (2.7 Billion for the U.S. alone)

The Diagnosis: Official Purpose of "Economy"

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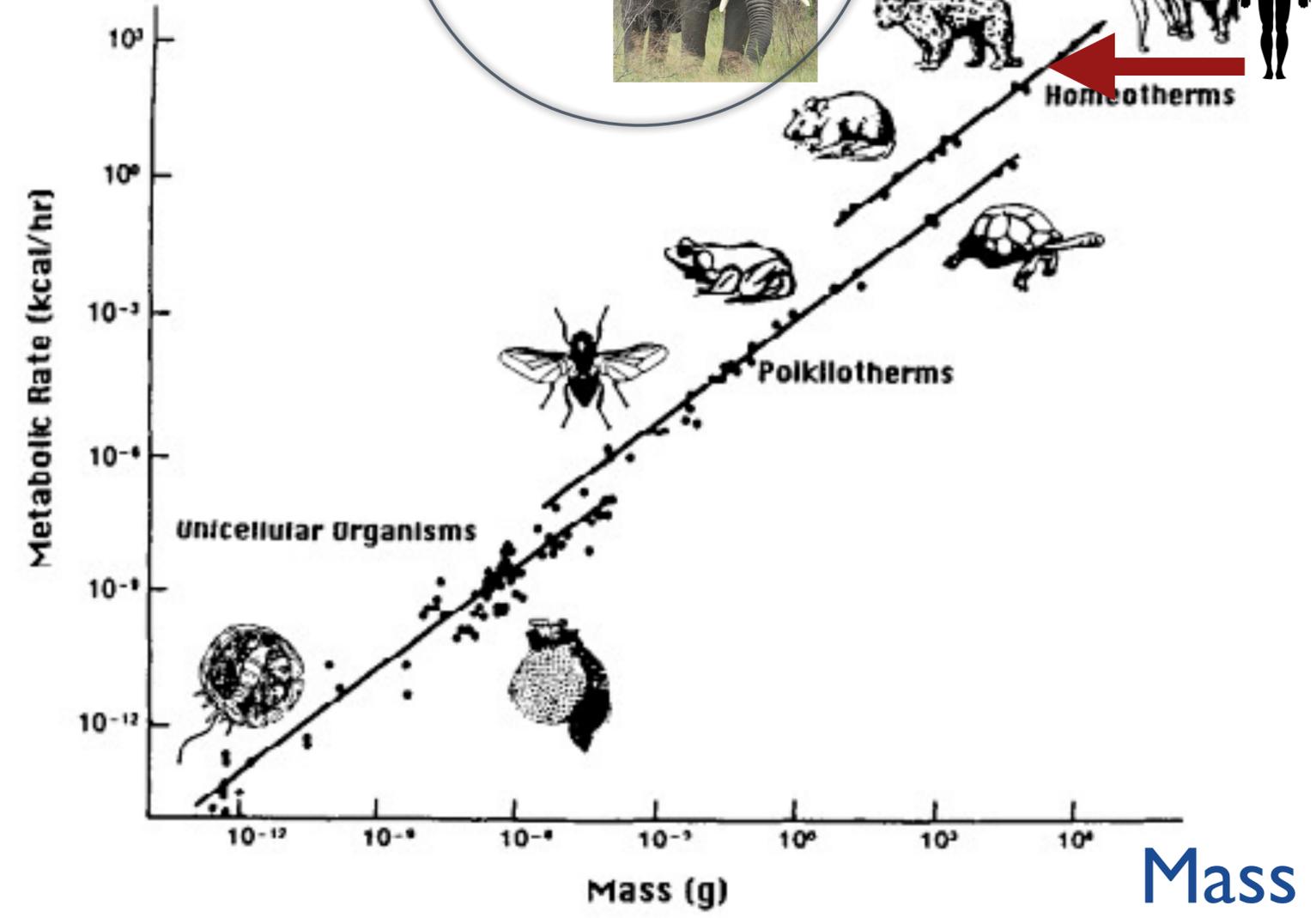


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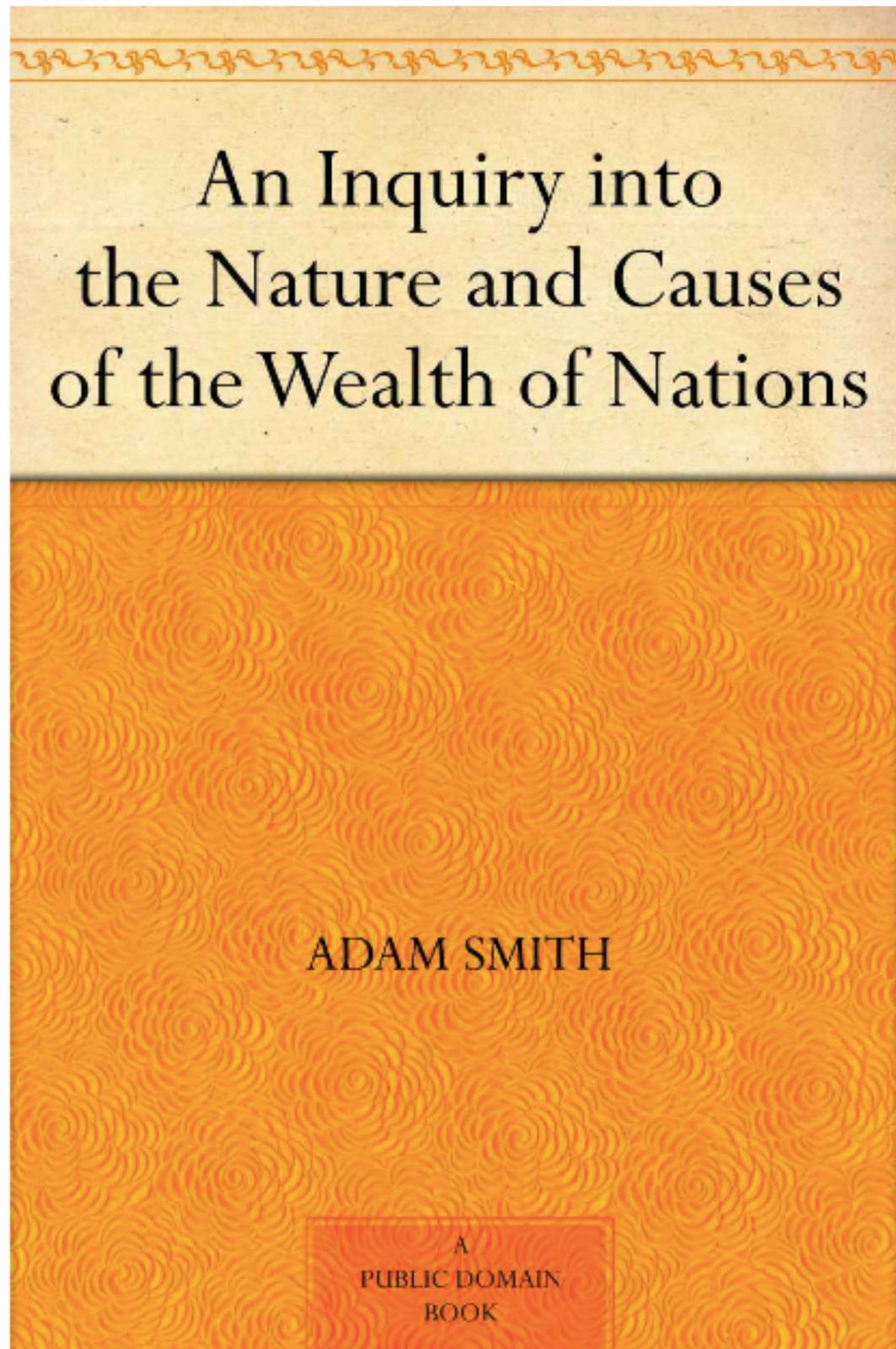
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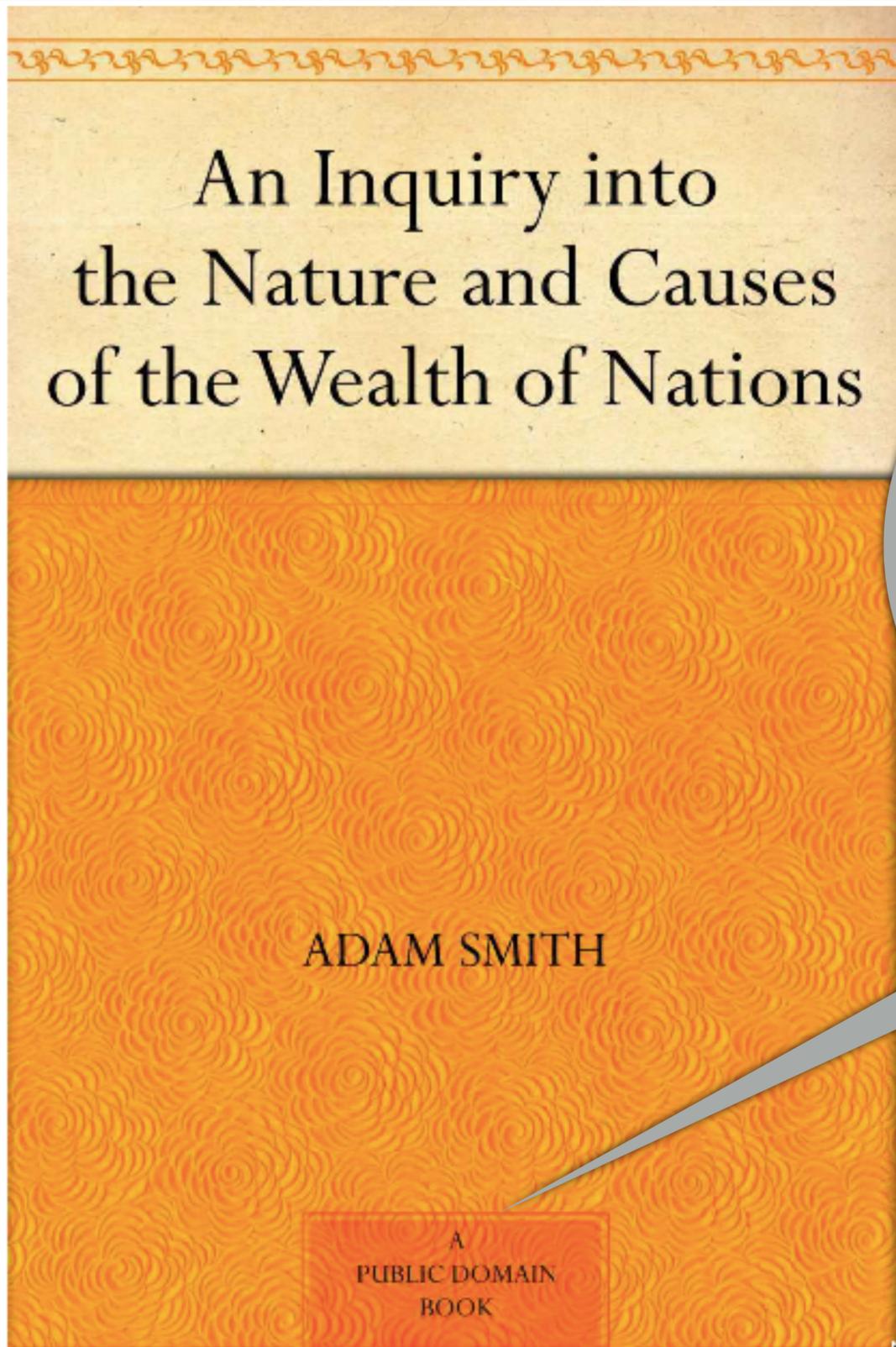
16 Billion elephants: a heavy "load" for Earth



- Purpose of economy is to increase human wealth;
- Earth and its natural wealth is basically infinite.

Smith (1776)

Published in 1776



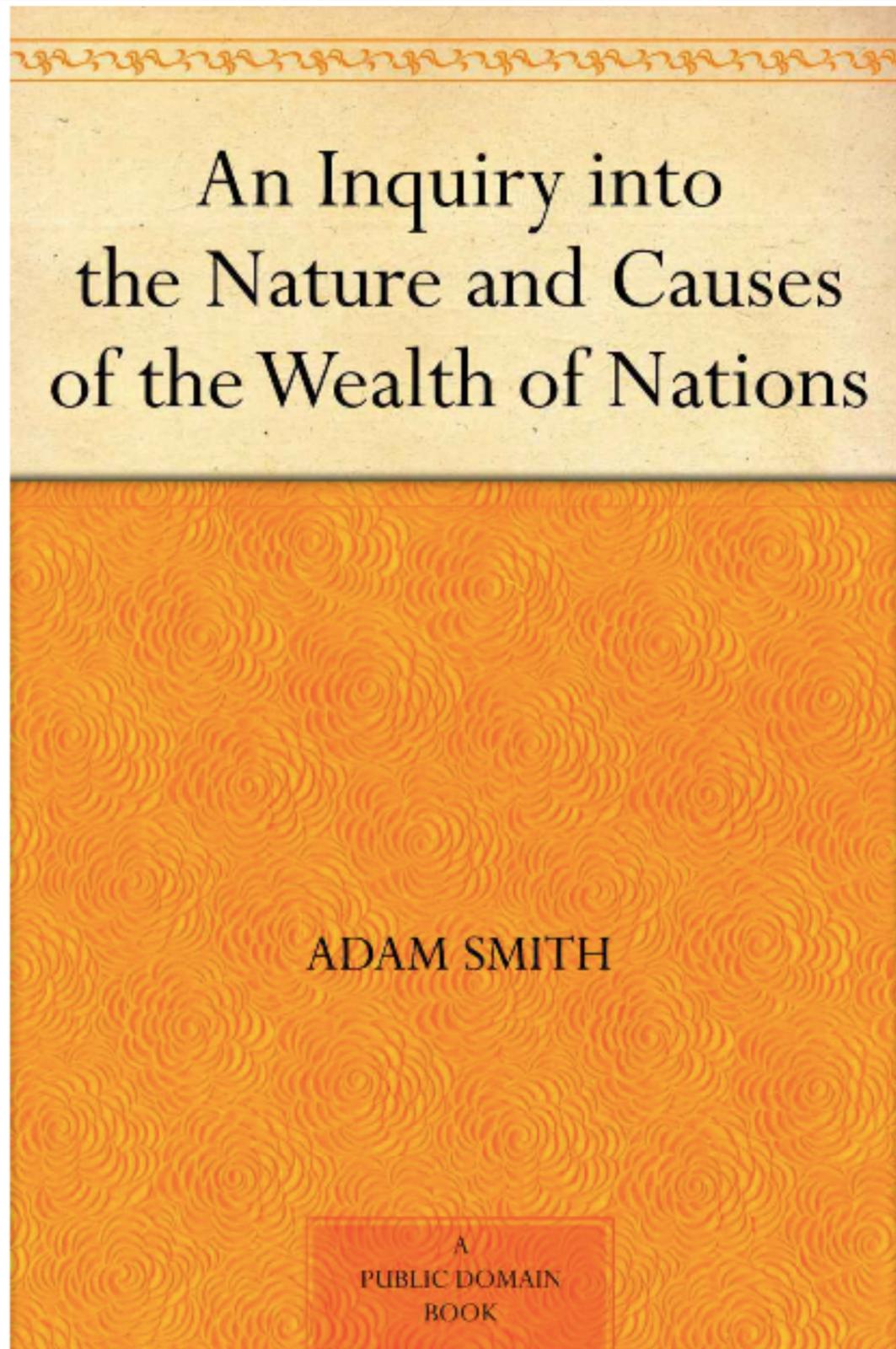
- Purpose of ... wealth;
- Earth ...

Official Purpose of Economy:
Create human wealth
(1776)
(very different from the “de facto” purpose)

Economy: the “invisible hand”

Assumptions:
The planet is infinite
Agents independently seeking their own gain will
produce the overall best result for society.

Published in 1776



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- Earth and its natural wealth is basically infinite.

Smith (1776)

Published in 1776

The Diagnosis: Official Purpose of “Economy”

Role of Mainstream Economic Model

For more than a century, the **consumption of products has been the dominant paradigm and mindset.**

John Maynard Keynes (*“The General Theory of Employment, Interest and Money”*, 1936): *“I should support at the same time all sorts of policies for increasing the propensity to consume. For it is unlikely that full employment can be maintained, whatever we may do about investment, with the existing propensity to consume.”*

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Victor Lebow (1955): *“Our enormously productive economy ... demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we **seek our spiritual satisfaction, our ego satisfaction, in consumption ... we need things consumed, burned up, replaced and discarded at an ever-accelerating rate.**”*

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In 1970, Milton Friedman argued that businesses’ sole purpose is to generate profit for shareholders.

This led to globalization ...

The Diagnosis: Official Purpose of “Economy”

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Neglecting the reciprocity of humans and the Earth’s life-support system

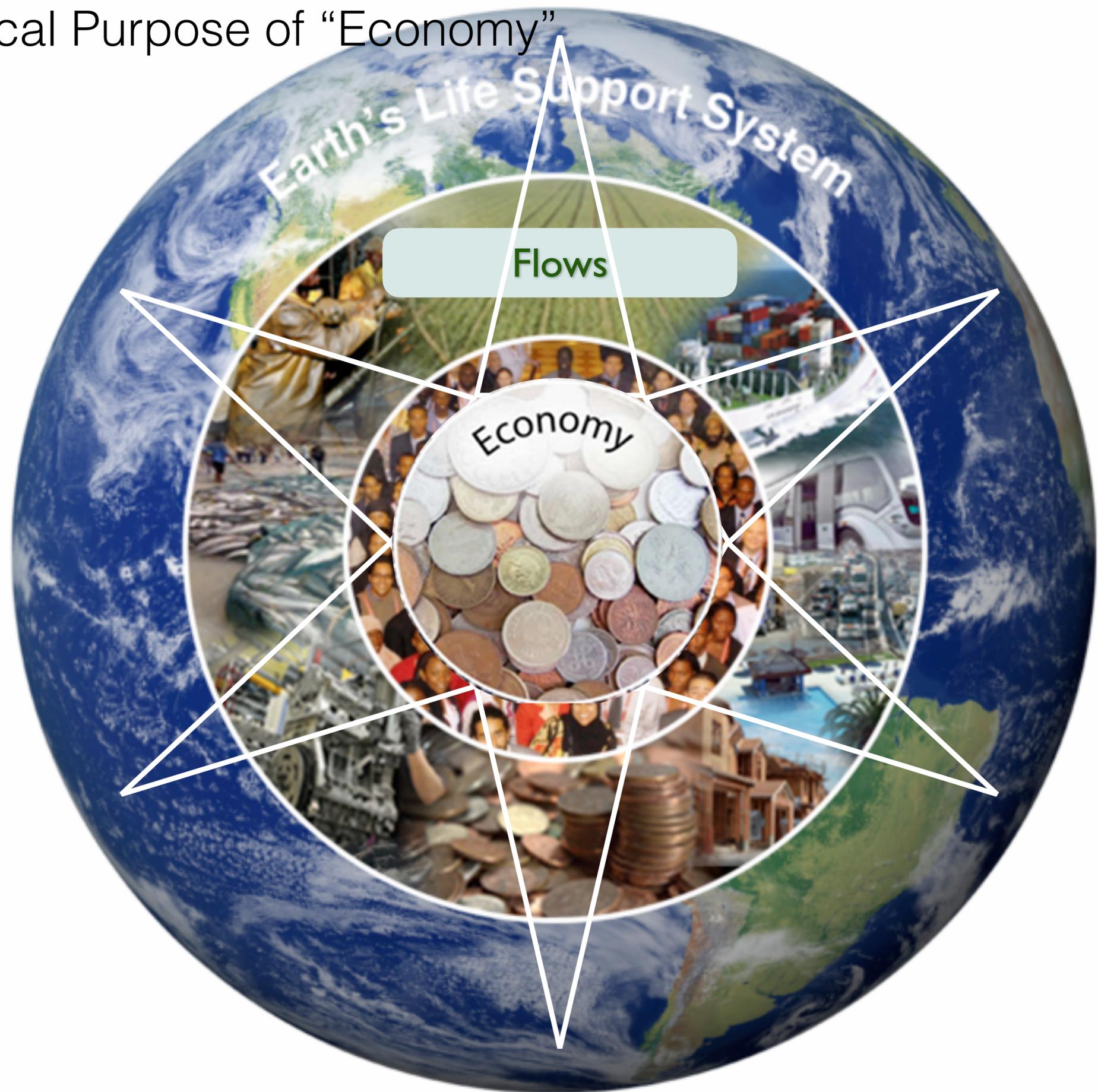
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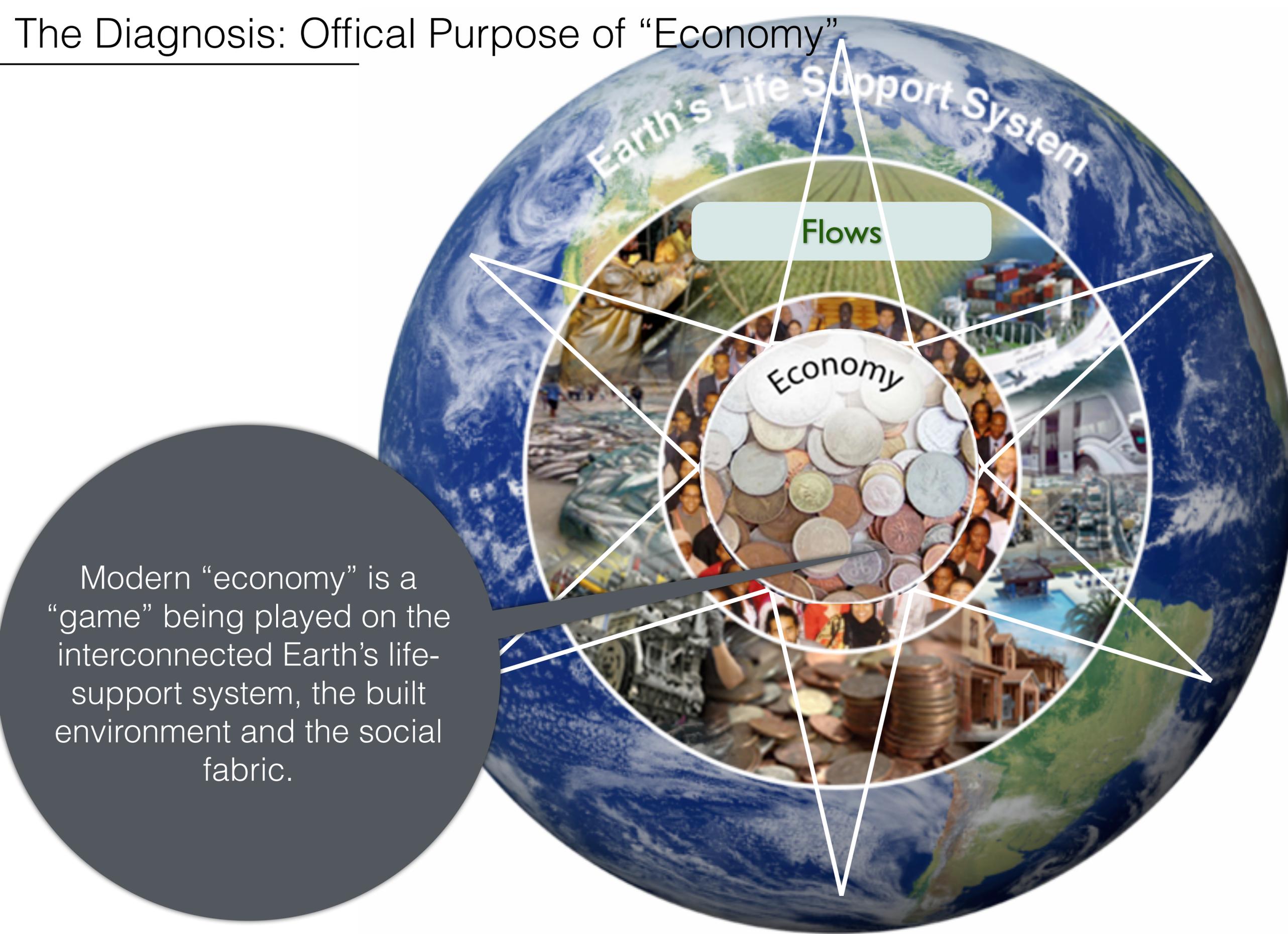
The Diagnosis: Official Purpose of "Economy"



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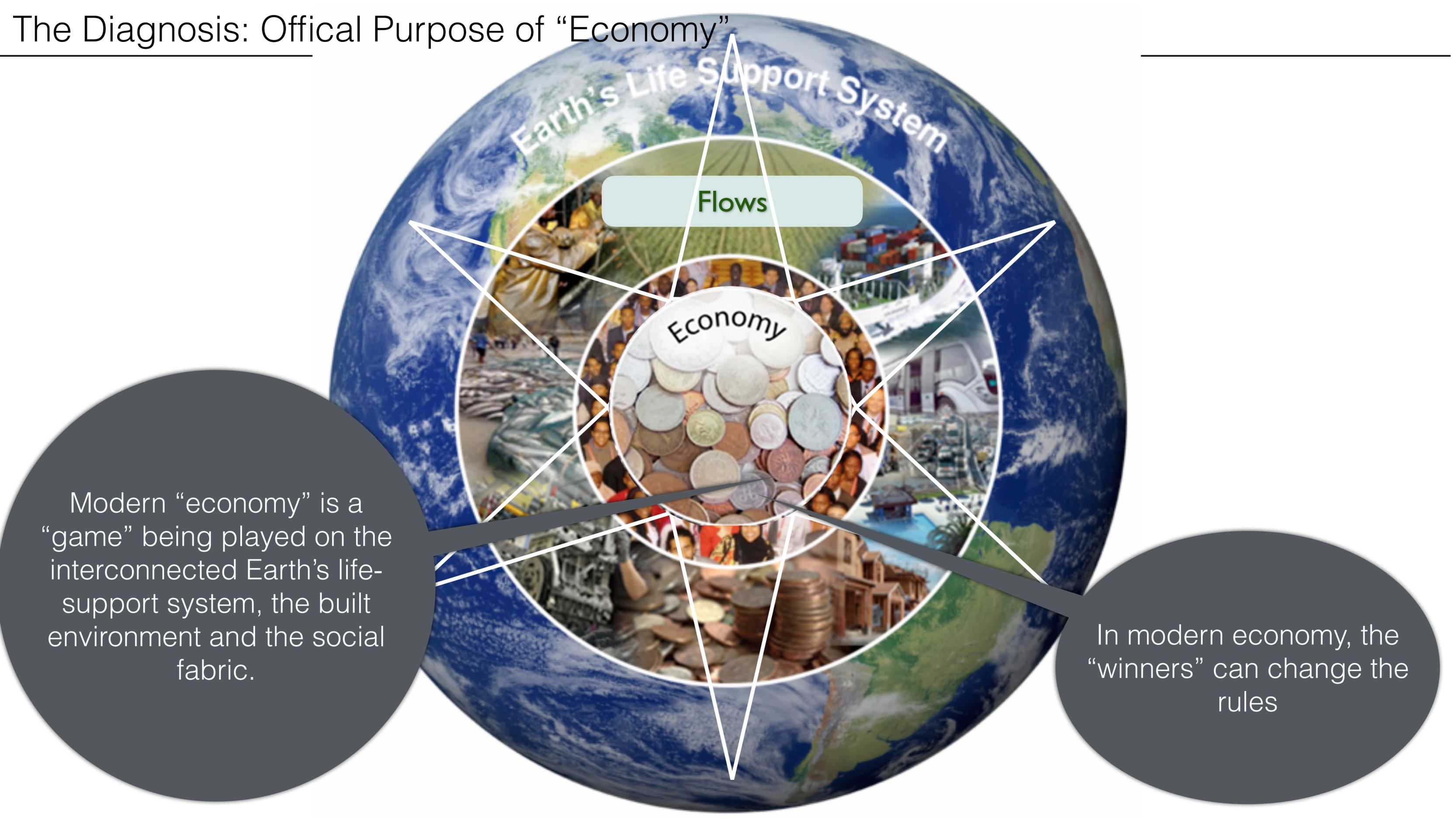


The Diagnosis: Official Purpose of "Economy"



Modern "economy" is a "game" being played on the interconnected Earth's life-support system, the built environment and the social fabric.

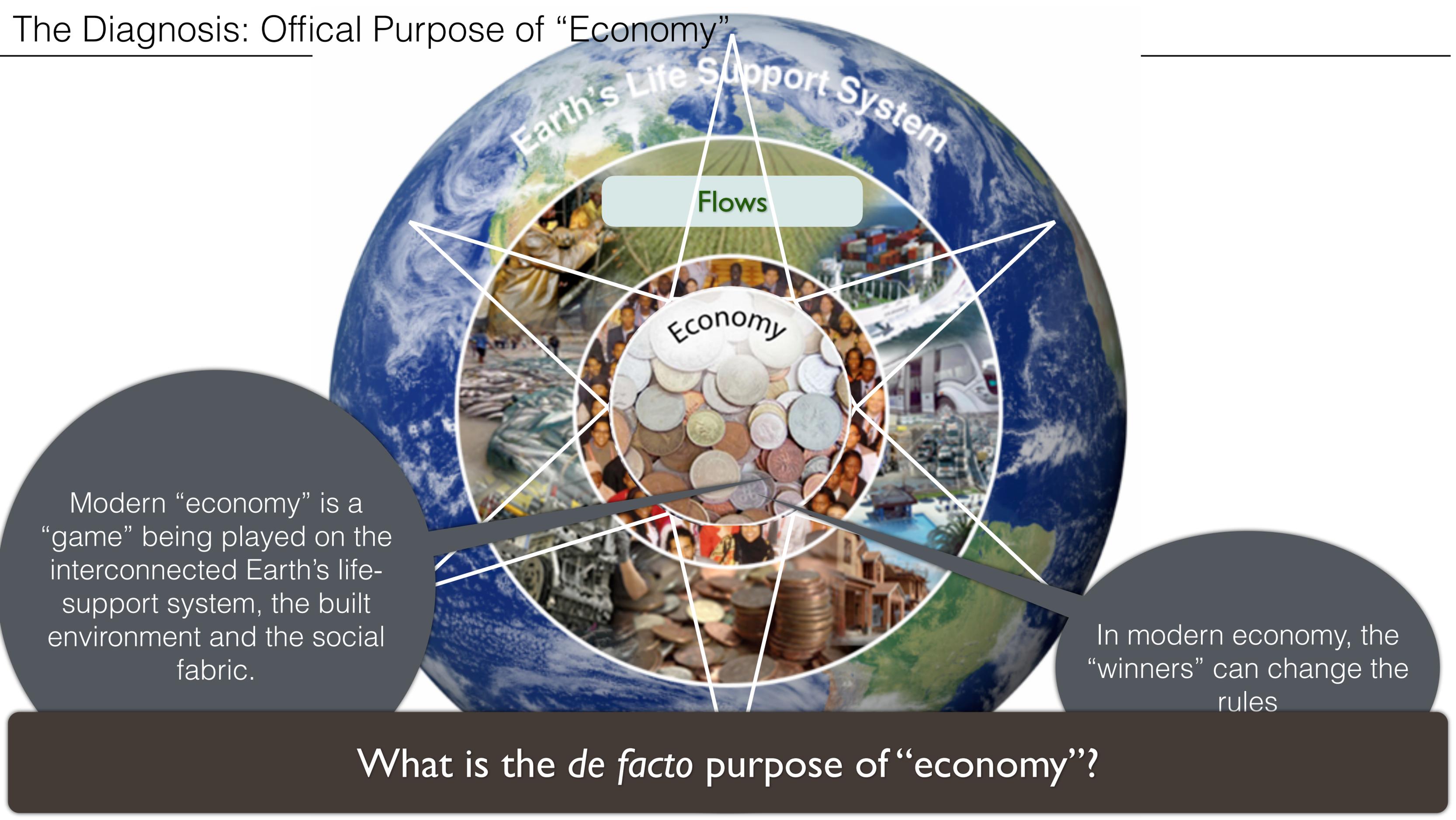
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In modern economy, the "winners" can change the rules

The Diagnosis: Official Purpose of “Economy”



Earth's Life Support System

Flows

Economy

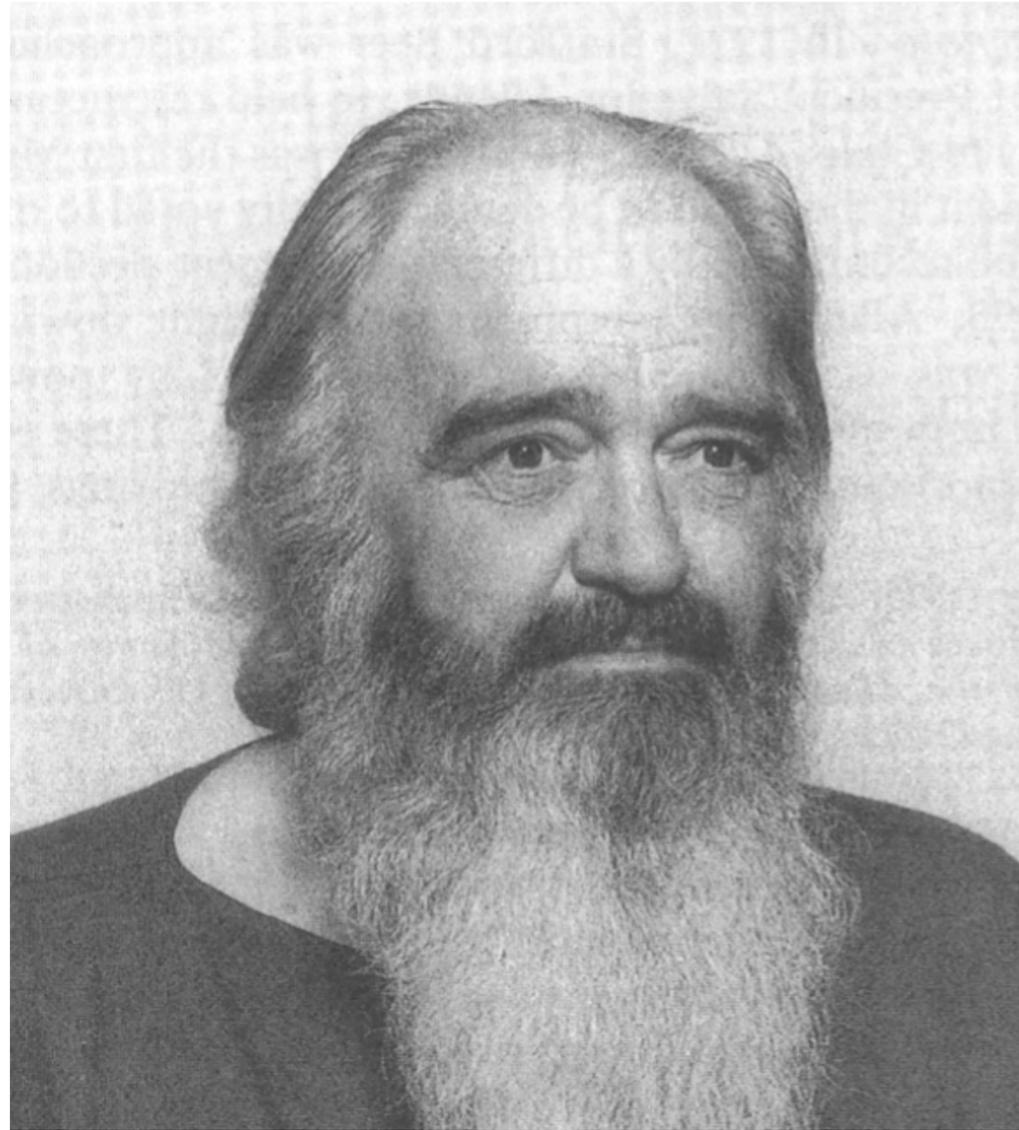
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What is the *de facto* purpose of “economy”?

The Diagnosis: Official Purpose of “Economy”

Purpose of a System



Stafford Beer

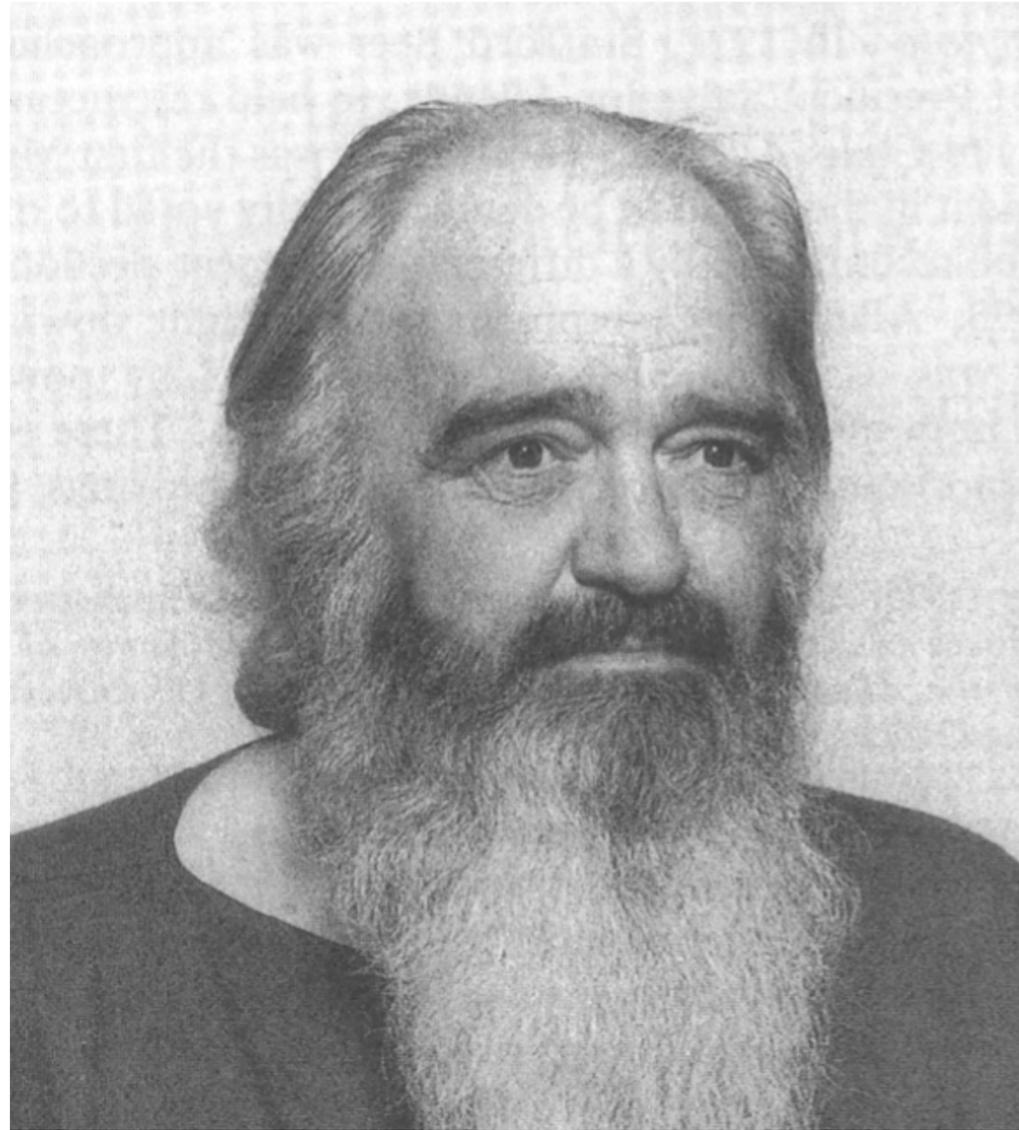
1926 - 2002

Among others:

President of the World Organization of Systems and
Cybernetics

The Diagnosis: Official Purpose of “Economy”

Purpose of a System



The Purpose of a System Is What It Does - POSIWID

Stafford Beer

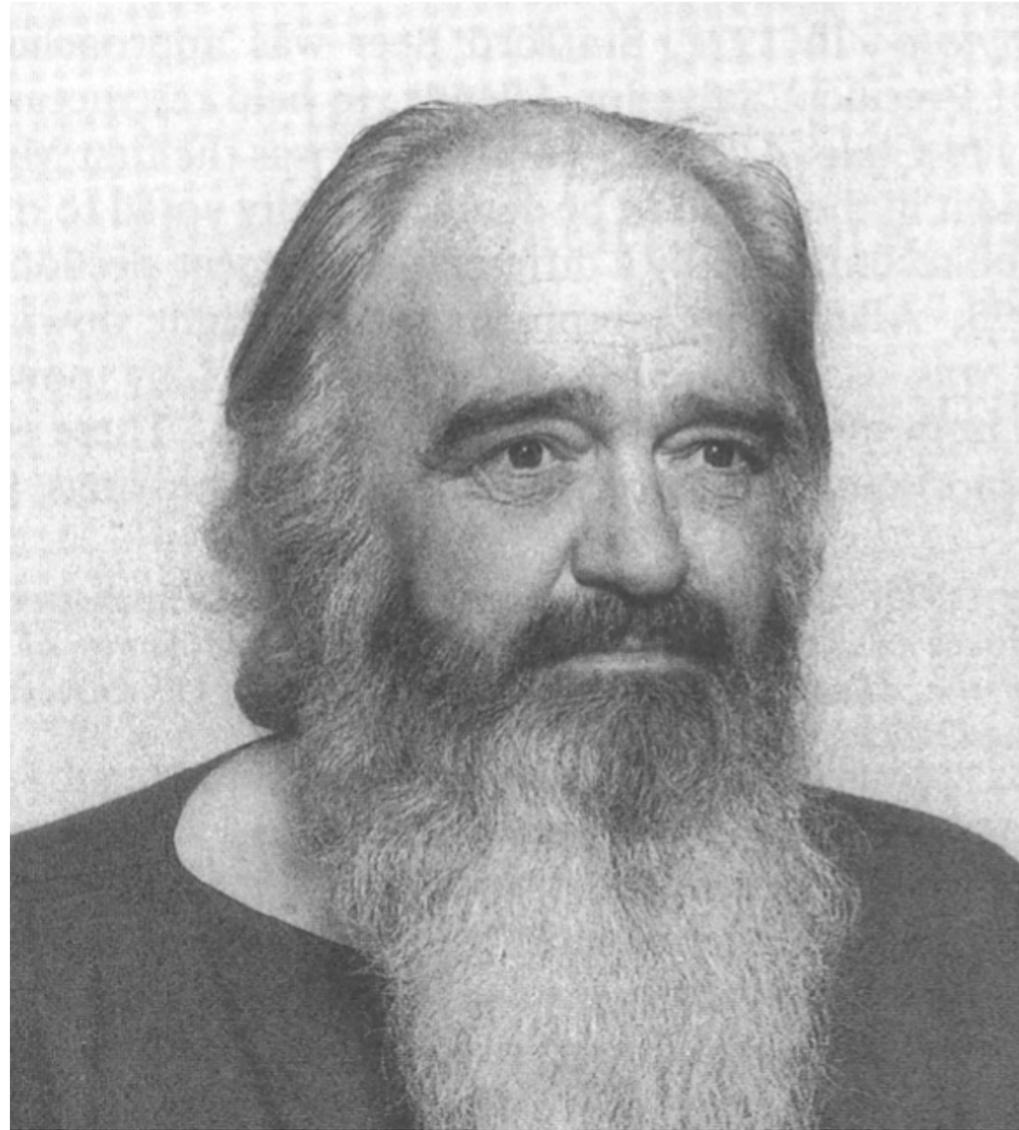
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1926 - 2002

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The Purpose of a System Is What It Does - POSIWID

This is the *de facto* purpose.

Humans often attribute an “official” purpose to a system that is not aligned to the *de facto* purpose.

Questions to ask:

What does economy?

What did economy throughout human history?

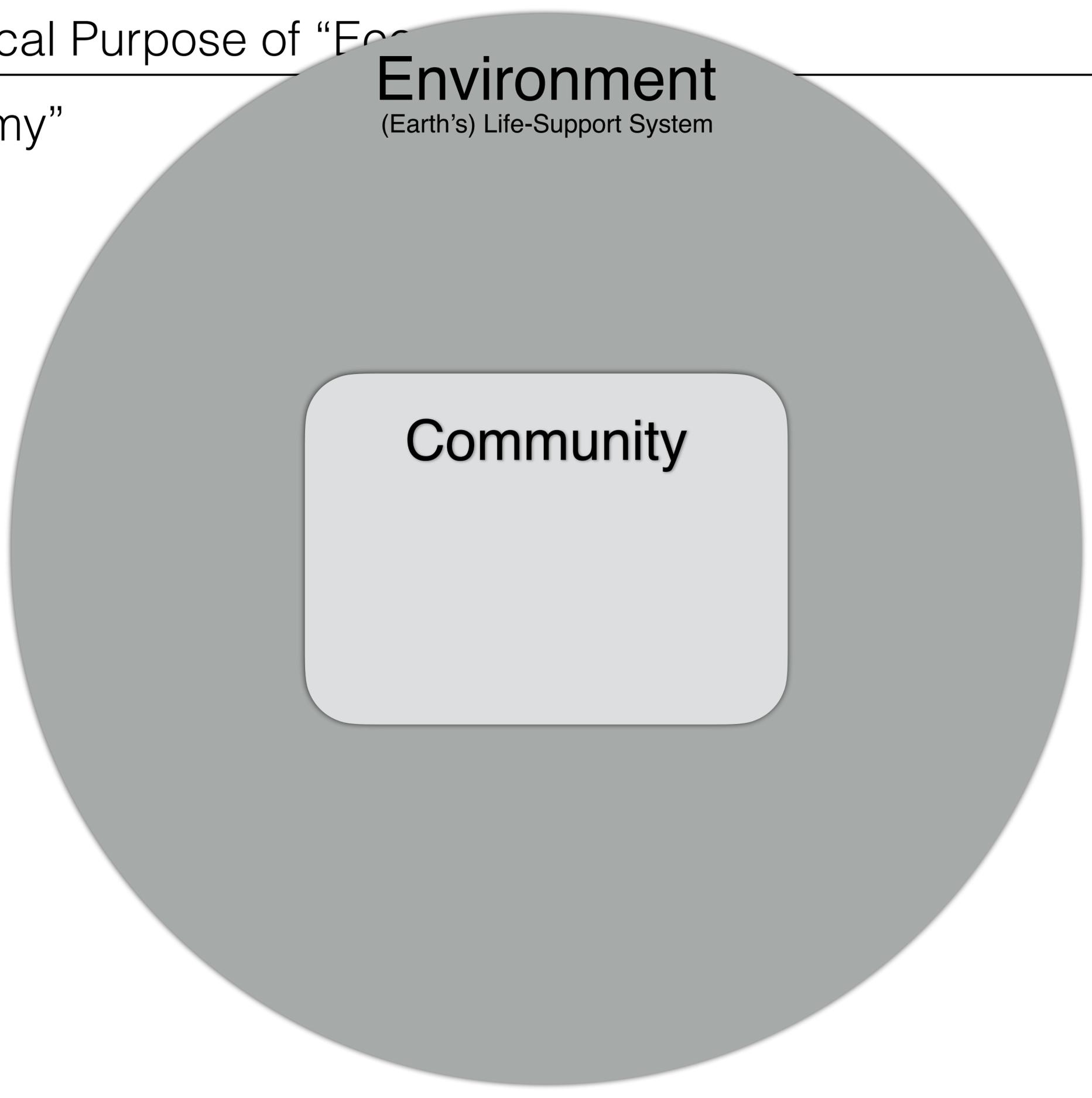
What does “economy” for non-human animals?

The Diagnosis: Official Purpose of “Eco

Purpose of “economy”

Environment
(Earth's) Life-Support System

Community



Environment

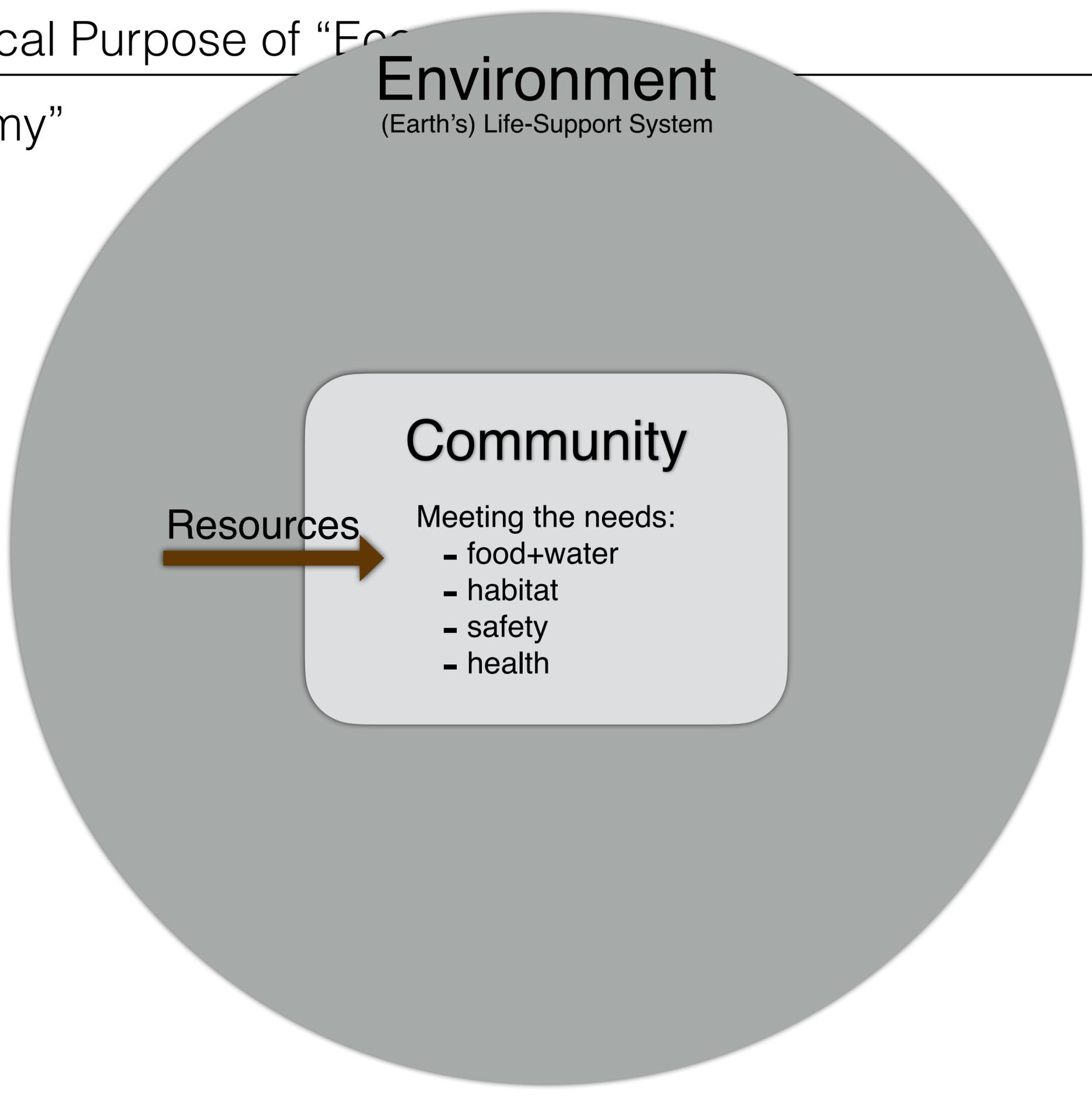
(Earth's) Life-Support System

Community

Meeting the needs:

- food+water
- habitat
- safety
- health

Environment
(Earth's) Life-Support System

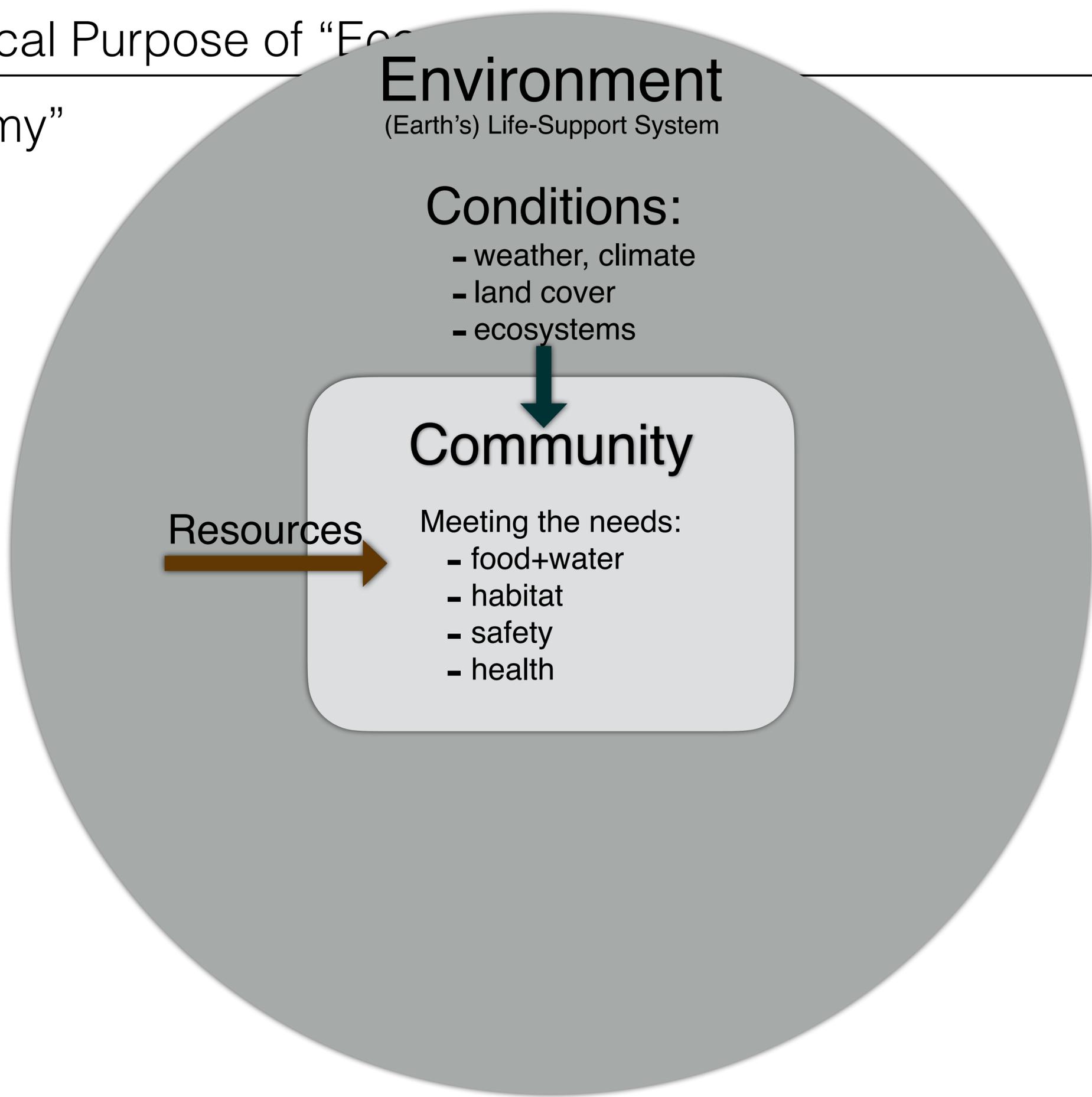


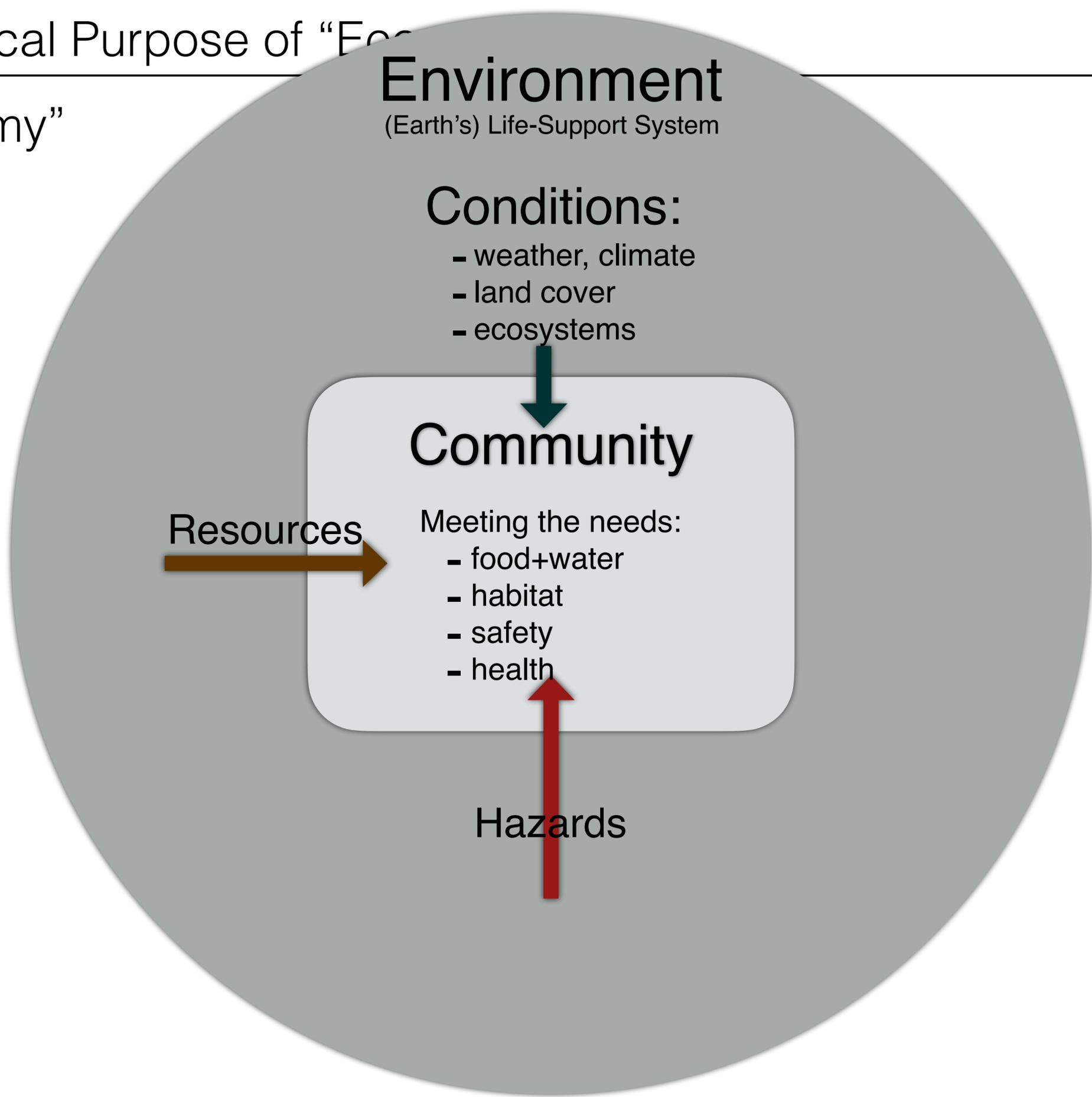
Community

Resources

Meeting the needs:

- food+water
- habitat
- safety
- health





Environment
(Earth's) Life-Support System

Conditions:

- weather, climate
- land cover
- ecosystems

Community

Meeting the needs:

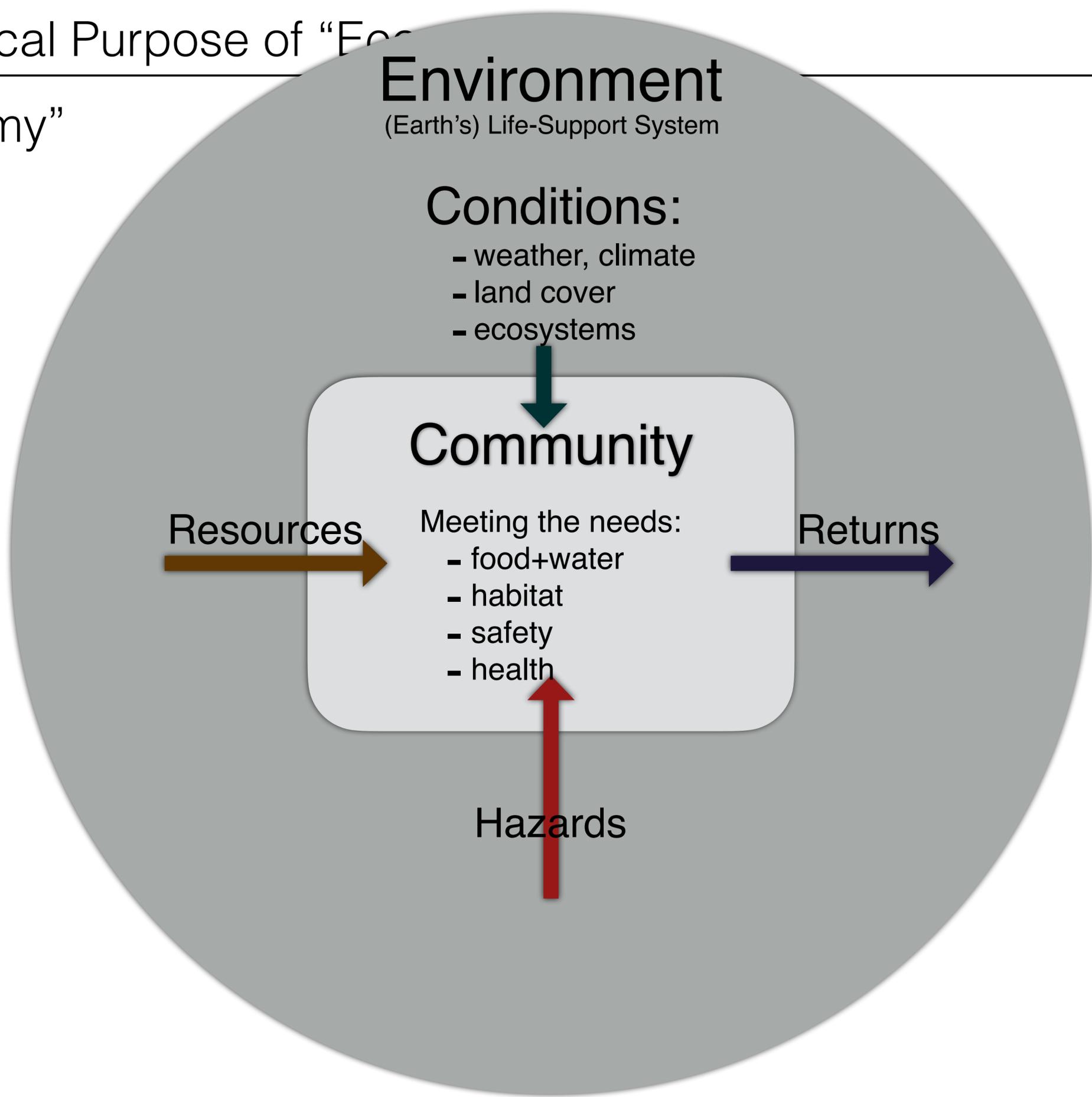
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Resources →

Hazards ↑

The Diagnosis: Official Purpose of “Eco

Purpose of “economy”



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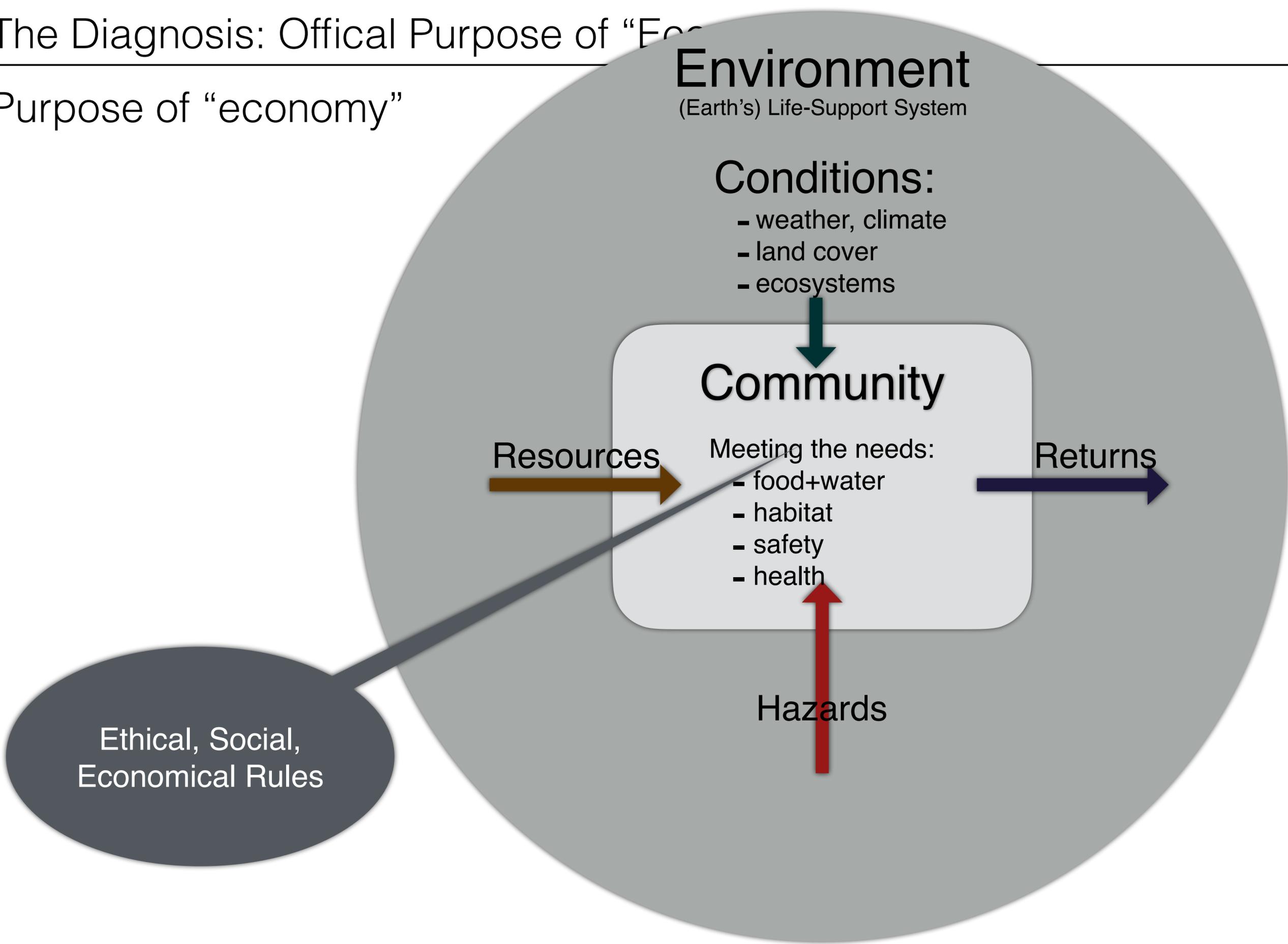
Resources

Returns

Hazards

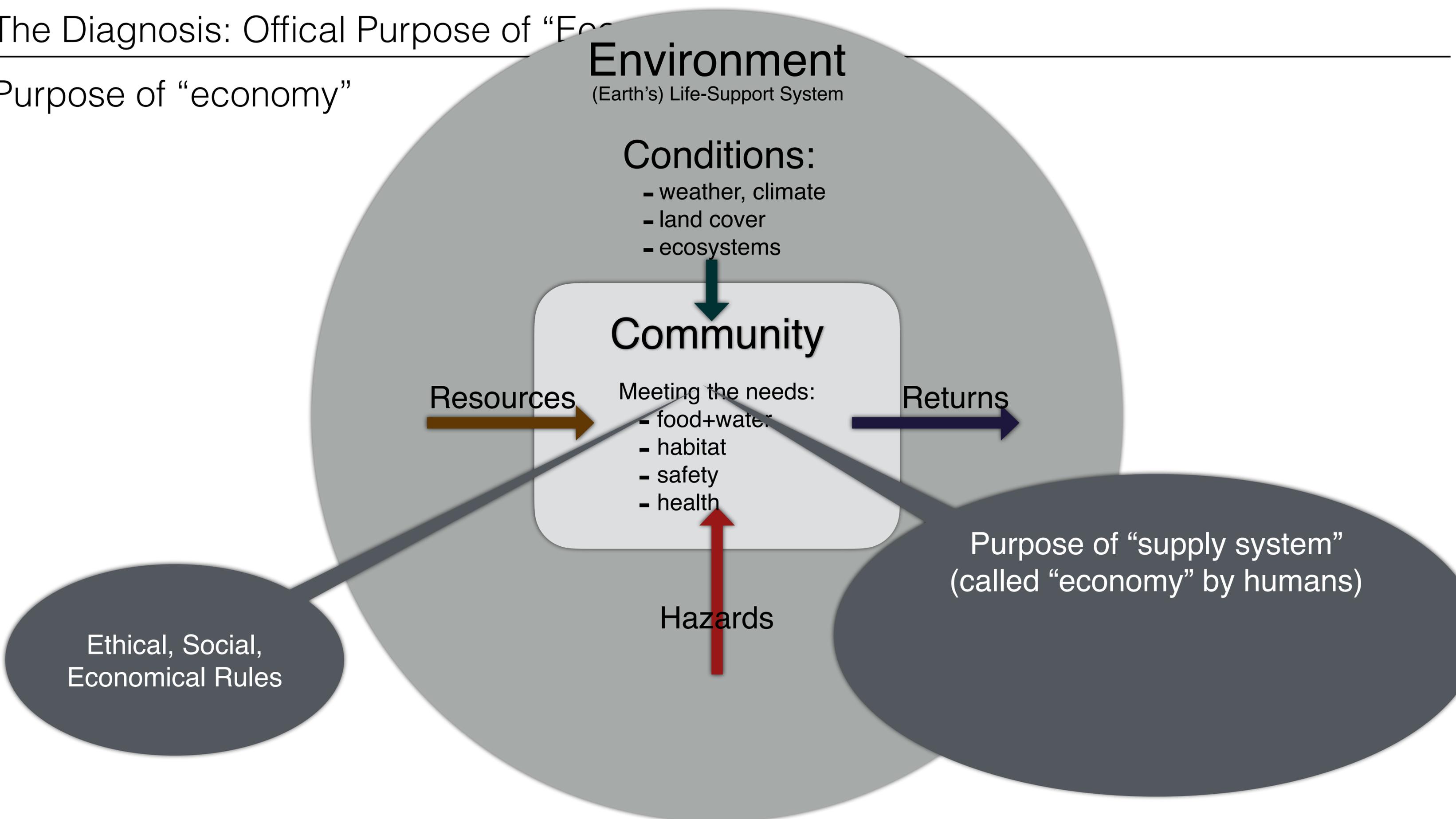
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Purpose of “economy”



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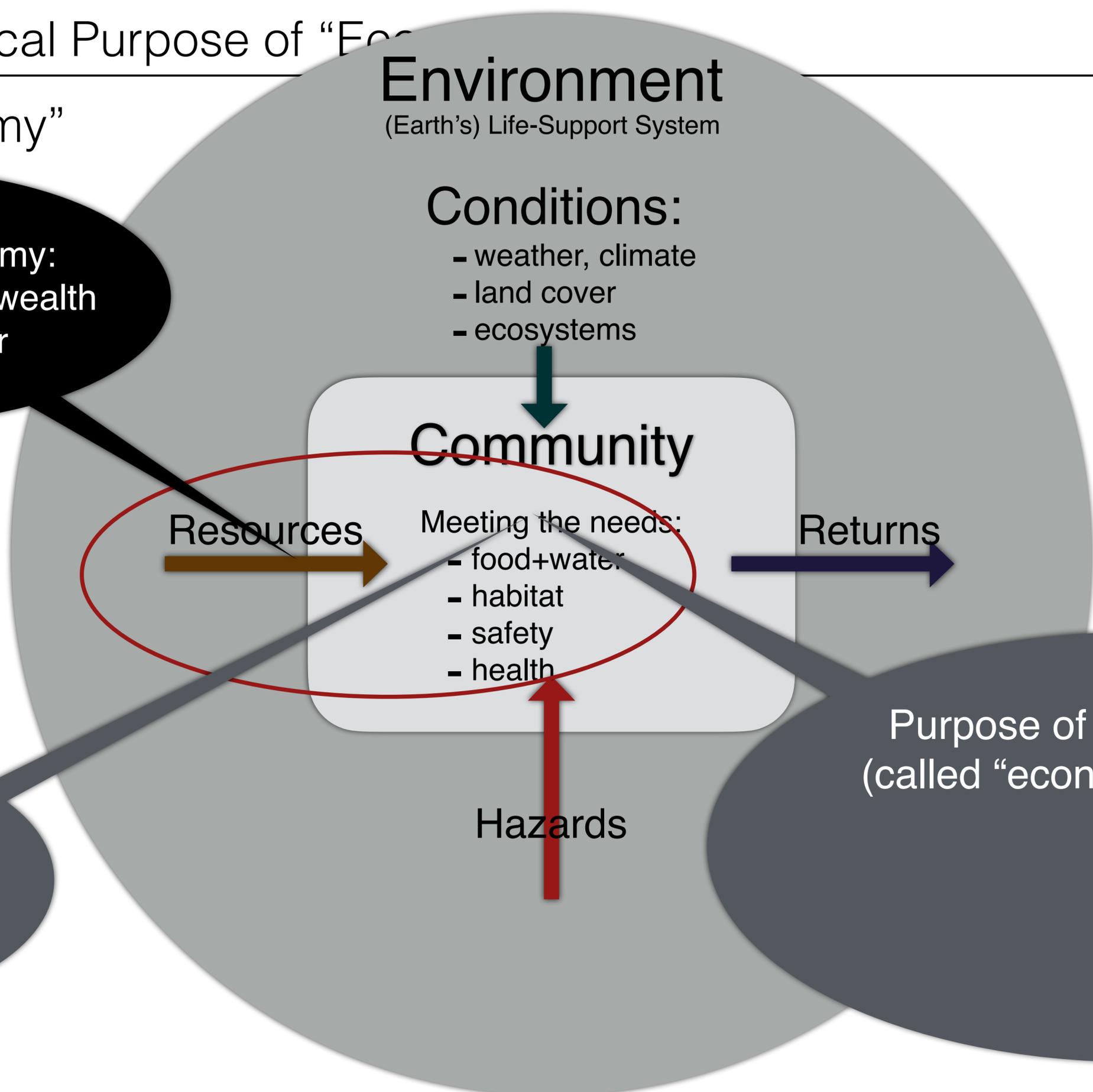


The Diagnosis: Official Purpose of "Economy"

Purpose of "economy"

Mainstream economy:
Reduction of natural wealth
unaccounted for

Ethical, Social,
Economical Rules



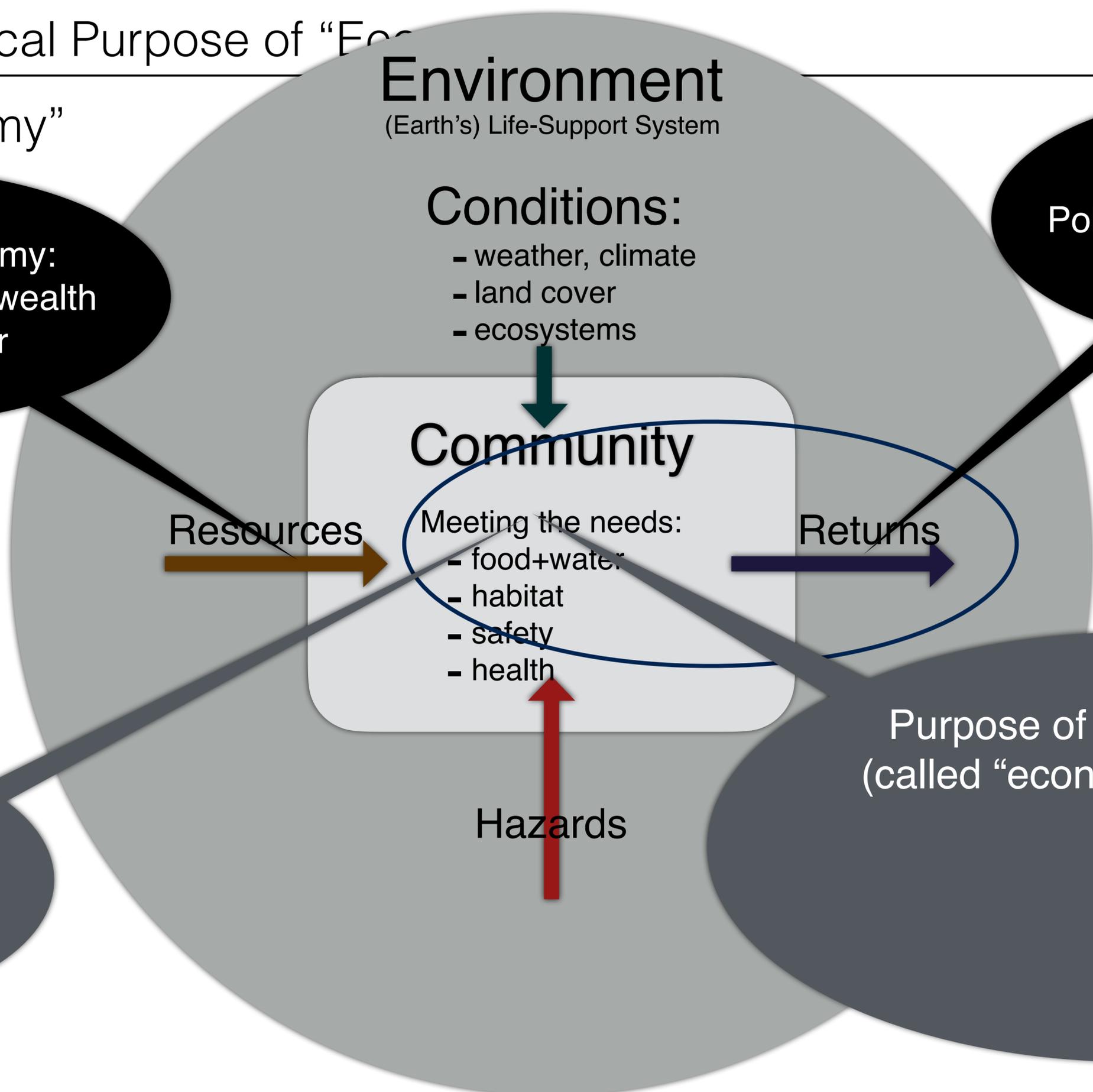
Purpose of "supply system"
(called "economy" by humans)

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Pollution mostly socialized

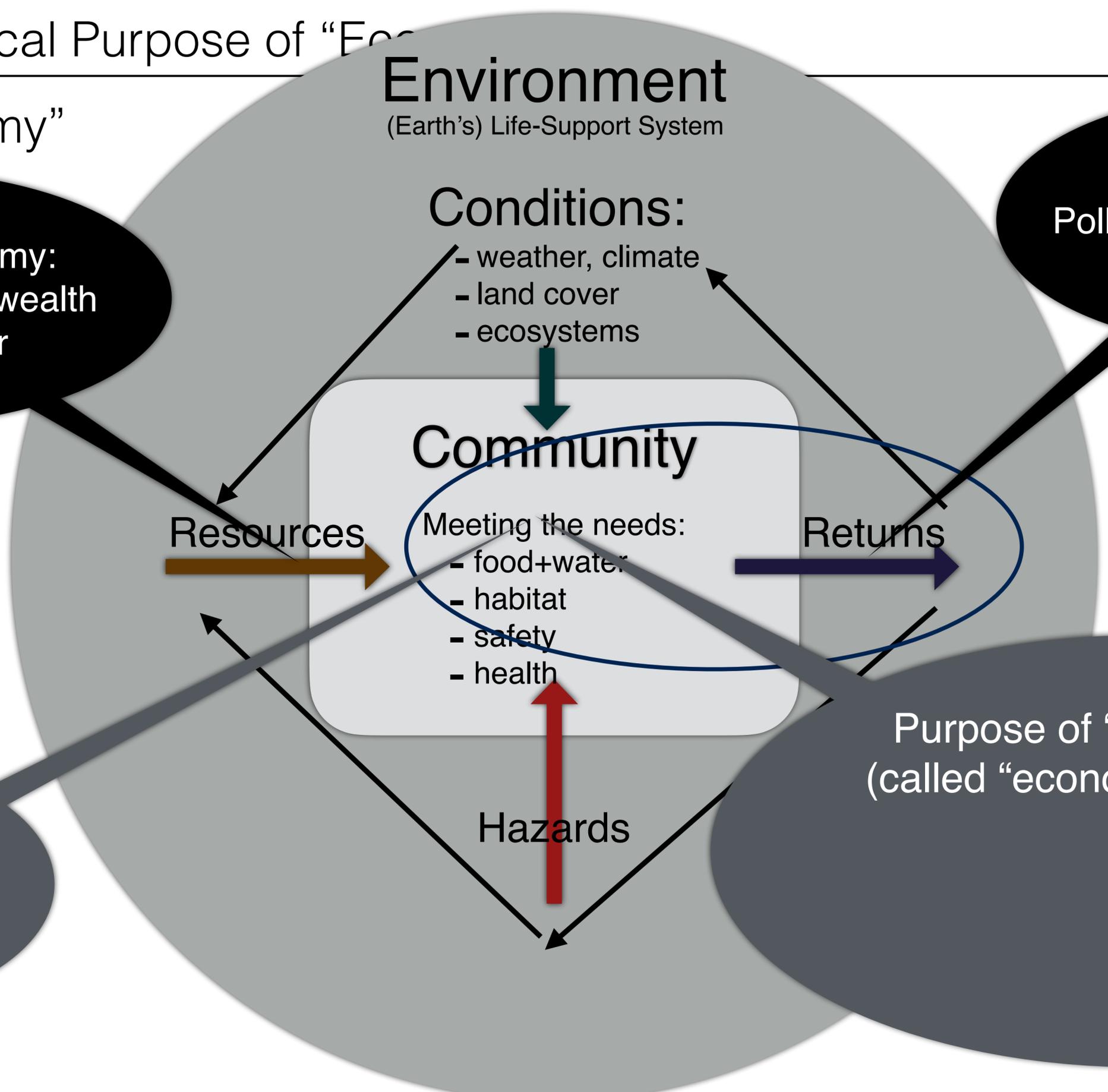
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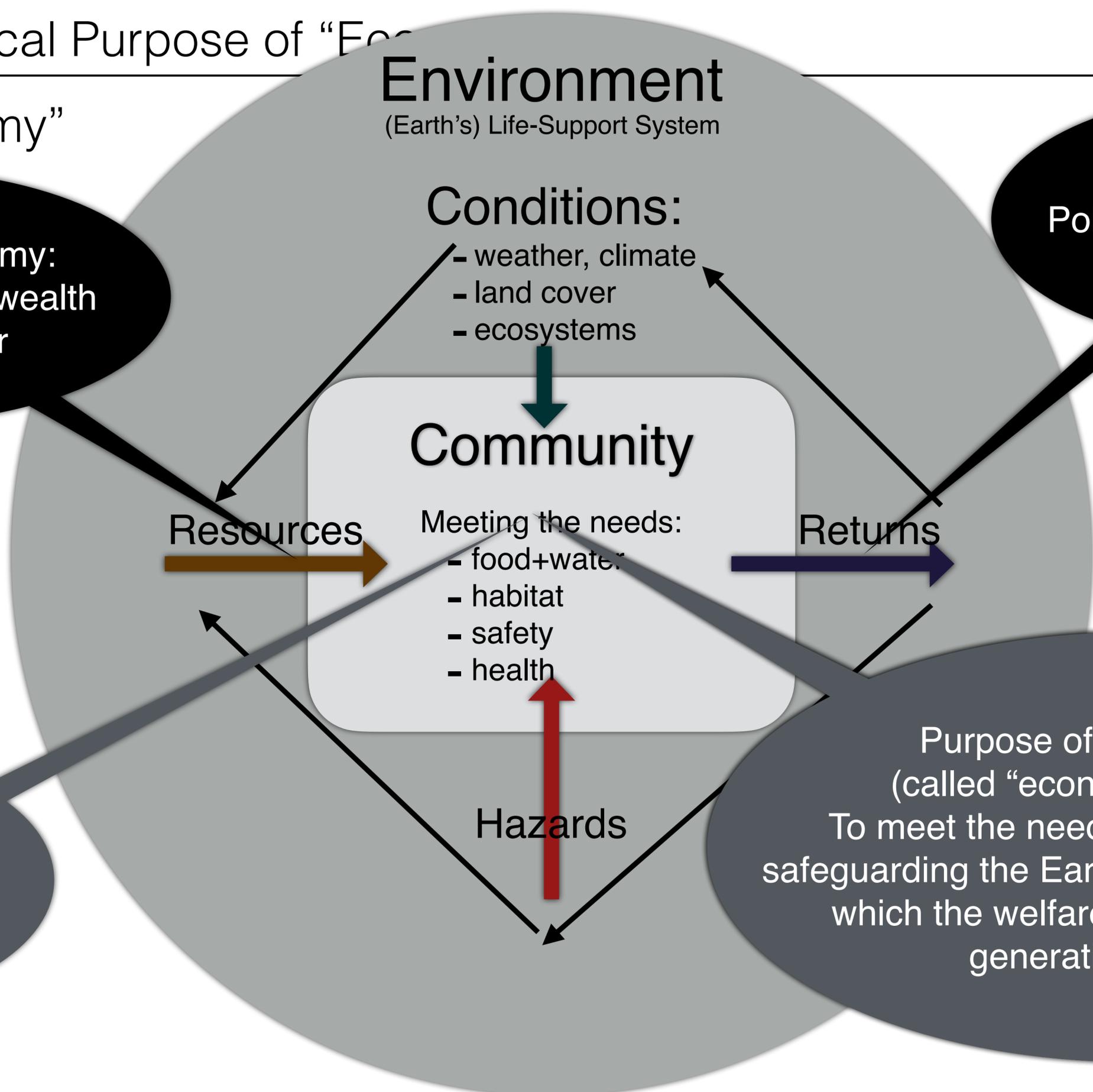
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Purpose of "supply system"
(called "economy" by humans):
To meet the needs of the present while
safeguarding the Earth's life-support system on
which the welfare of current and future
generations depends

Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a “safe operating space for humanity”

Syndrome

During the last few hundred years, humanity has introduced rapid and large changes

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene; we have increasing disequilibrium

Diagnosis

Easy access to **seemingly unlimited energy** allowed humans to accelerate flows in the Earth’s life-support system, develop a **growth-addicted consumption-based economy**, **sustain rapid population growth**, push humanity **out of the safe operating space**

Are we in a Human and Planetary Existential Emergency? If so, what can we do about it?

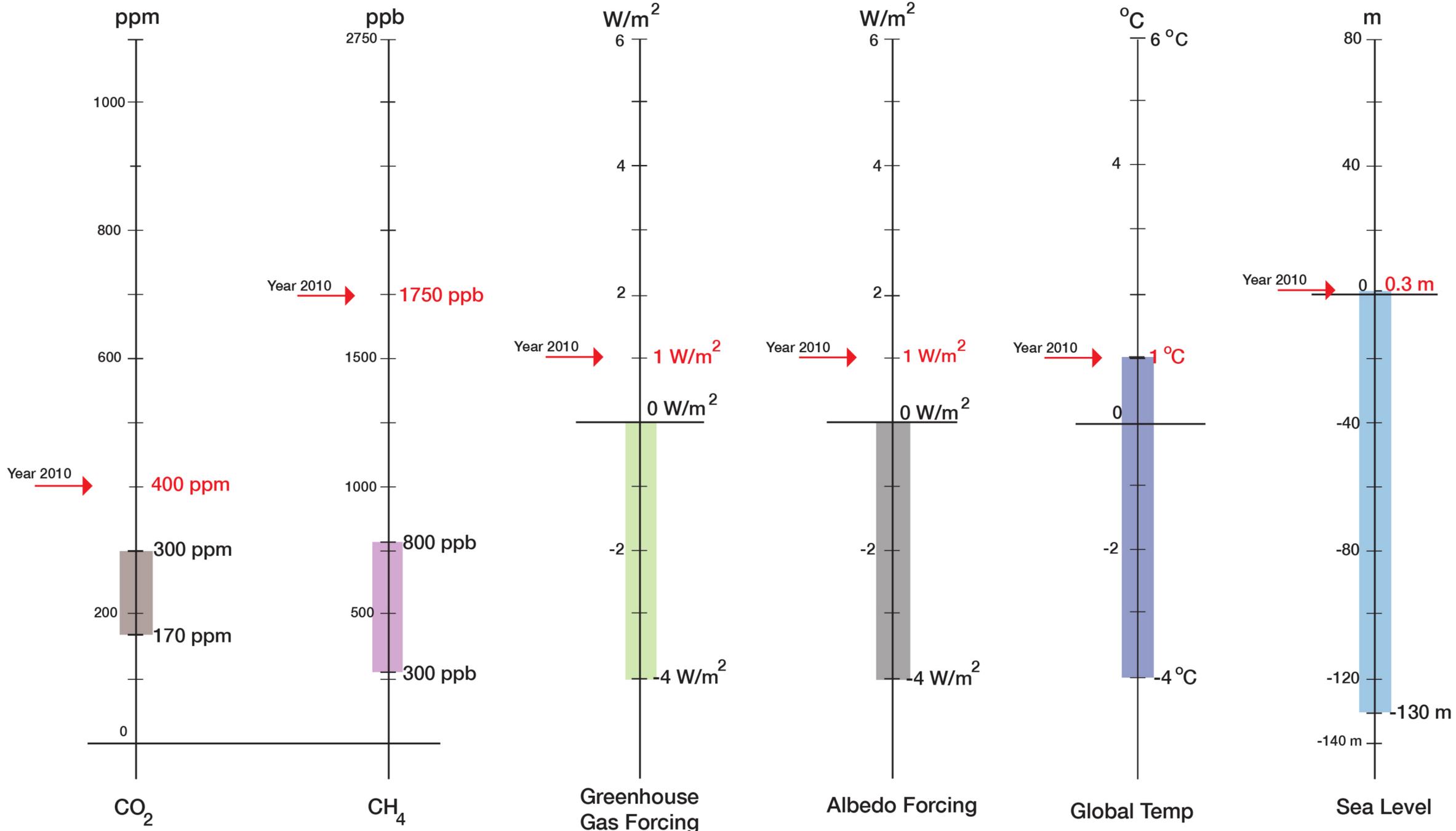
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Prognosis: Journey into the Unknown

Baseline and Changes

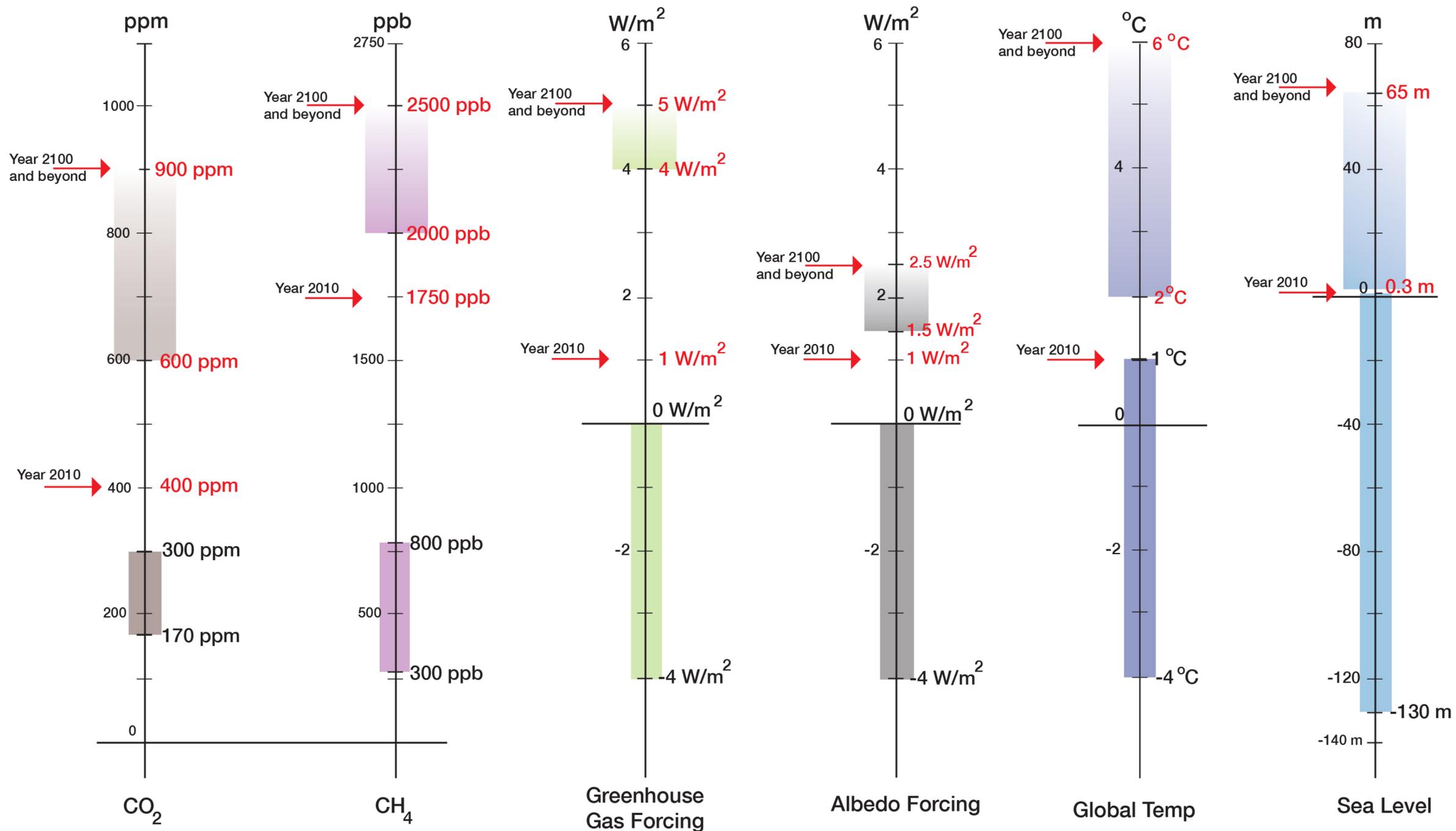


“Current State”

“Normal Range”
(800,000 years)

Prognosis: Journey into the Unknown

Baseline and Changes



“Prognosis”

“Current State”

“Normal Range”
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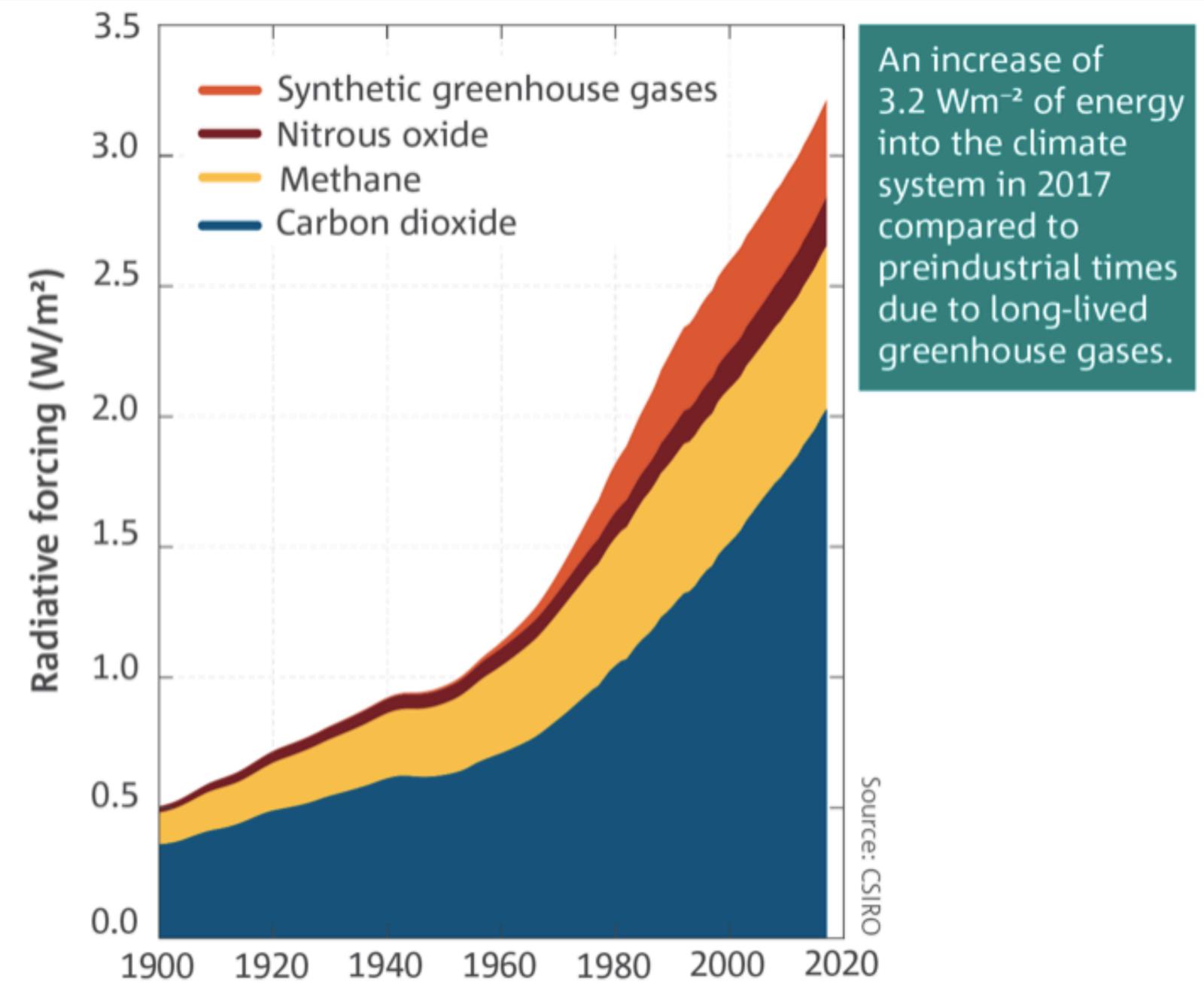
Fossil fuels

Surge of new US-led oil and gas activity threatens to wreck Paris climate goals

World's fossil-fuel producers on track to nearly quadruple output from newly approved projects by decade's end, report finds



📷 Emissions from an oil refinery in Houston, Texas. Photograph: Brandon Bell/Getty Images



Oliver Milman <https://www.theguardian.com/environment/2024/mar/28/oil-and-gas-fossil-fuels-report>

Prognosis: Journey into the Unknown

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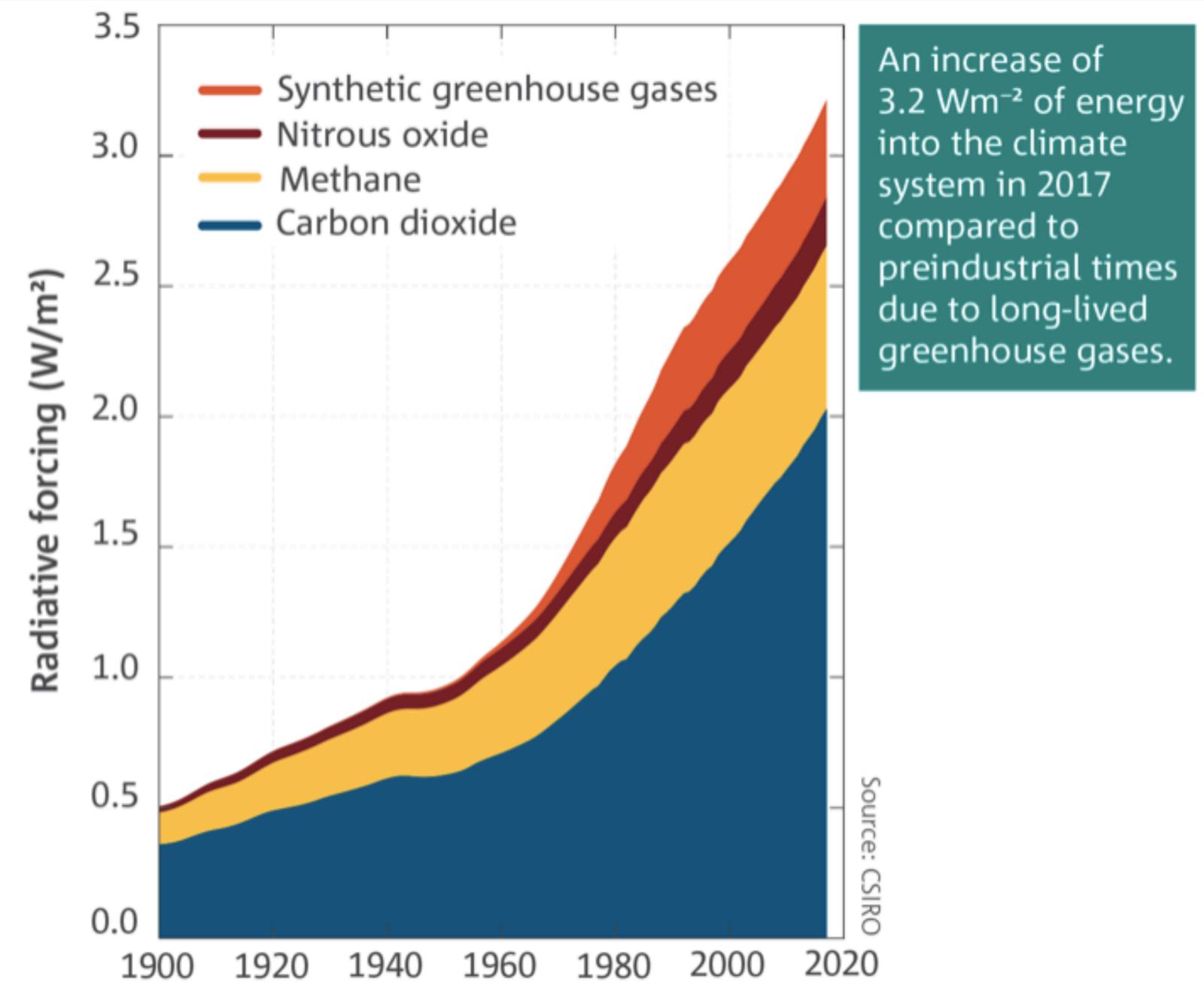
World's fossil-fuel producers on track to nearly quadruple output from newly approved projects by decade's end, report finds



📷 Emissions from an oil refinery in Houston, Texas. Photograph: Brandon Bell/Getty Images

Oliver Milman <https://www.theguardian.com/environment/2024/mar/28/oil-and-gas-fossil-fuels-repo>

Thu 28 Mar 2024 02.00 EDT



Emissions are still increasing!

Prognosis: Journey into the Unknown

Smithsonian
MAGAZINE

SMART NEWS

Launching Dust From the Moon Could Help Cool Earth, Scientists Say

Proposals to fight climate change by blocking sunlight aren't new, but some experts argue the answer lies closer to home

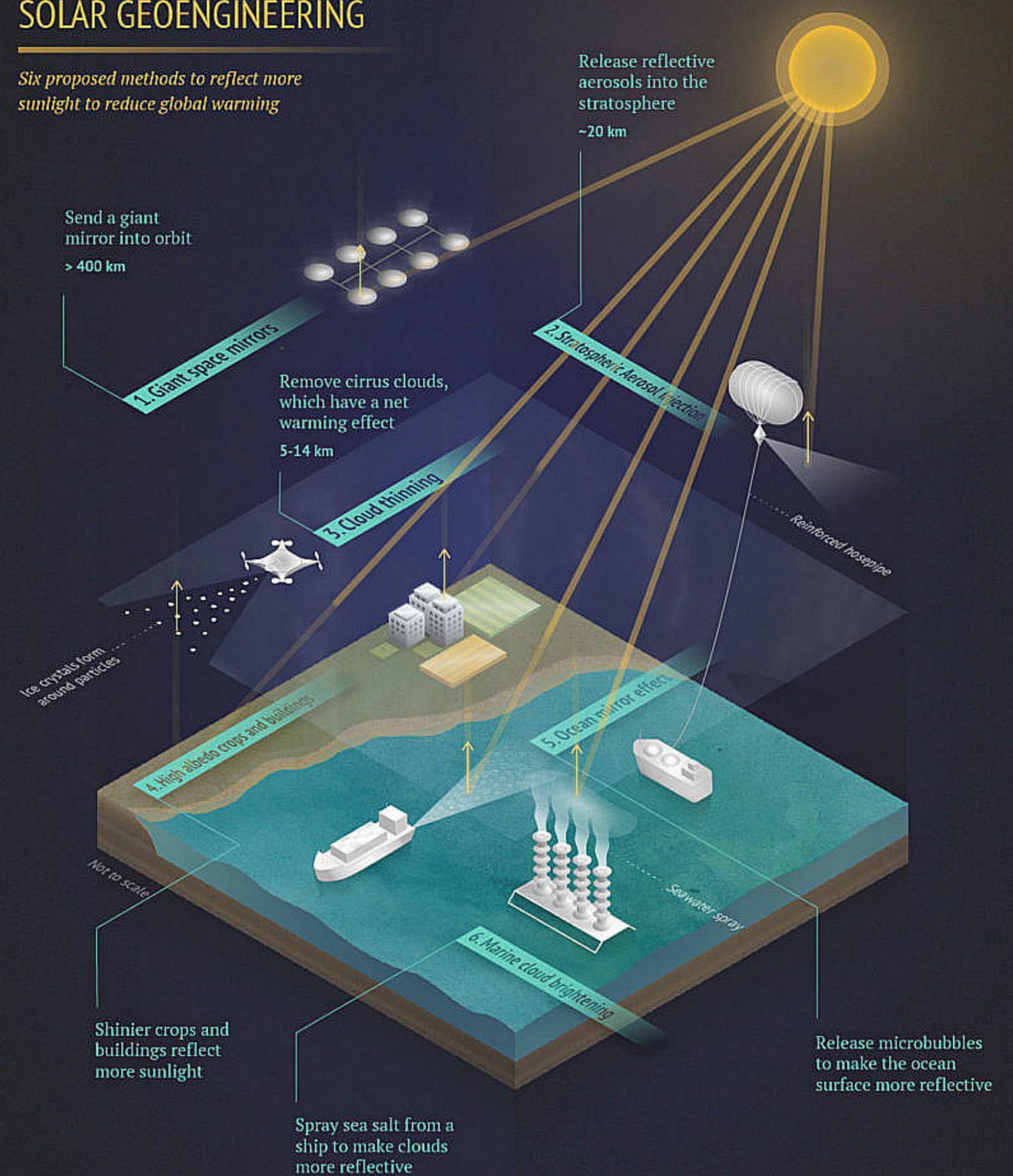
 Will Sullivan
February 13, 2023



The moon contains lots of dust, which scientists say could help block some sunlight from reaching Earth, cooling the planet. BAY ISMOYO / AFP via Getty Images

SOLAR GEOENGINEERING

Six proposed methods to reflect more sunlight to reduce global warming

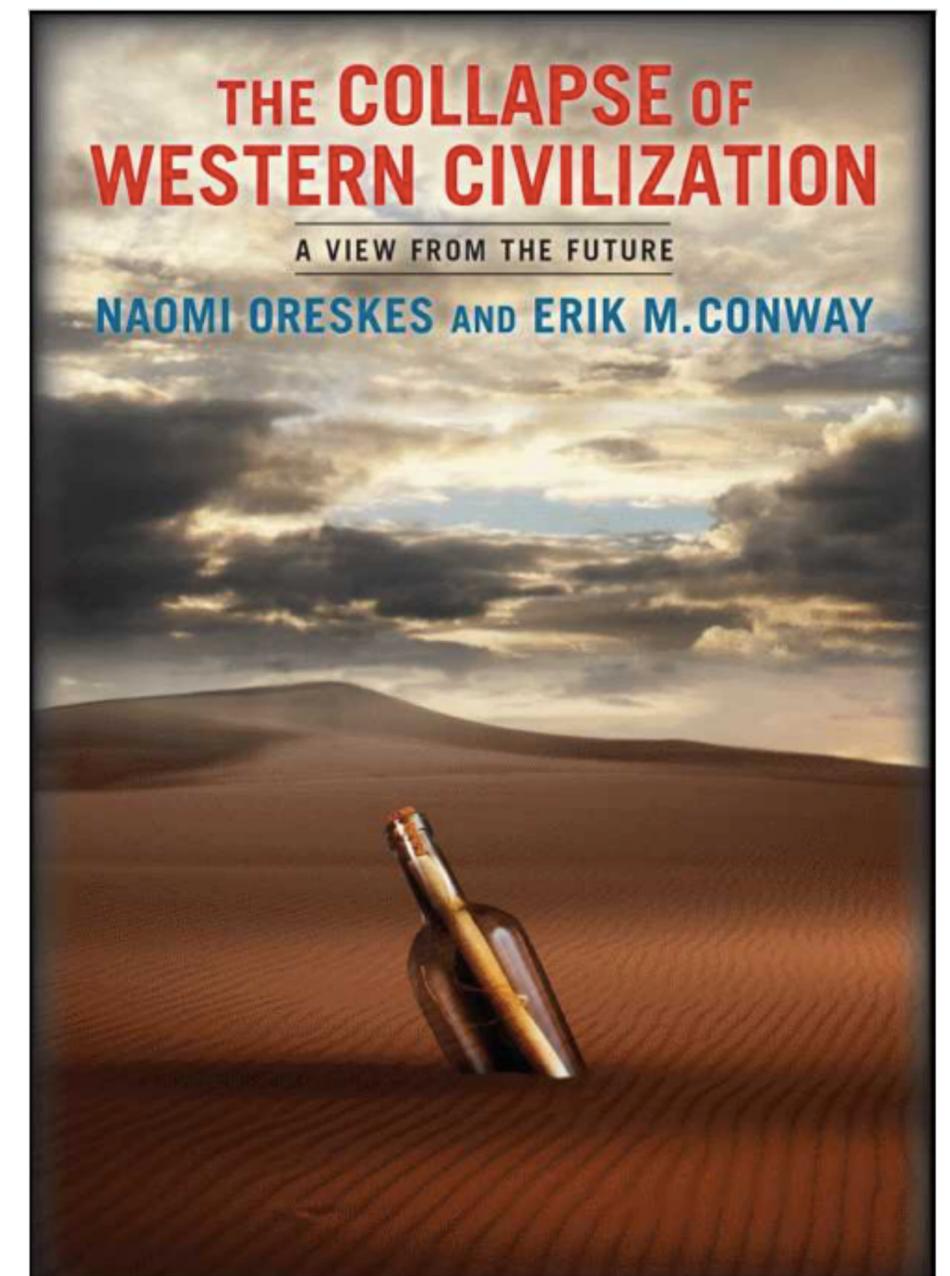
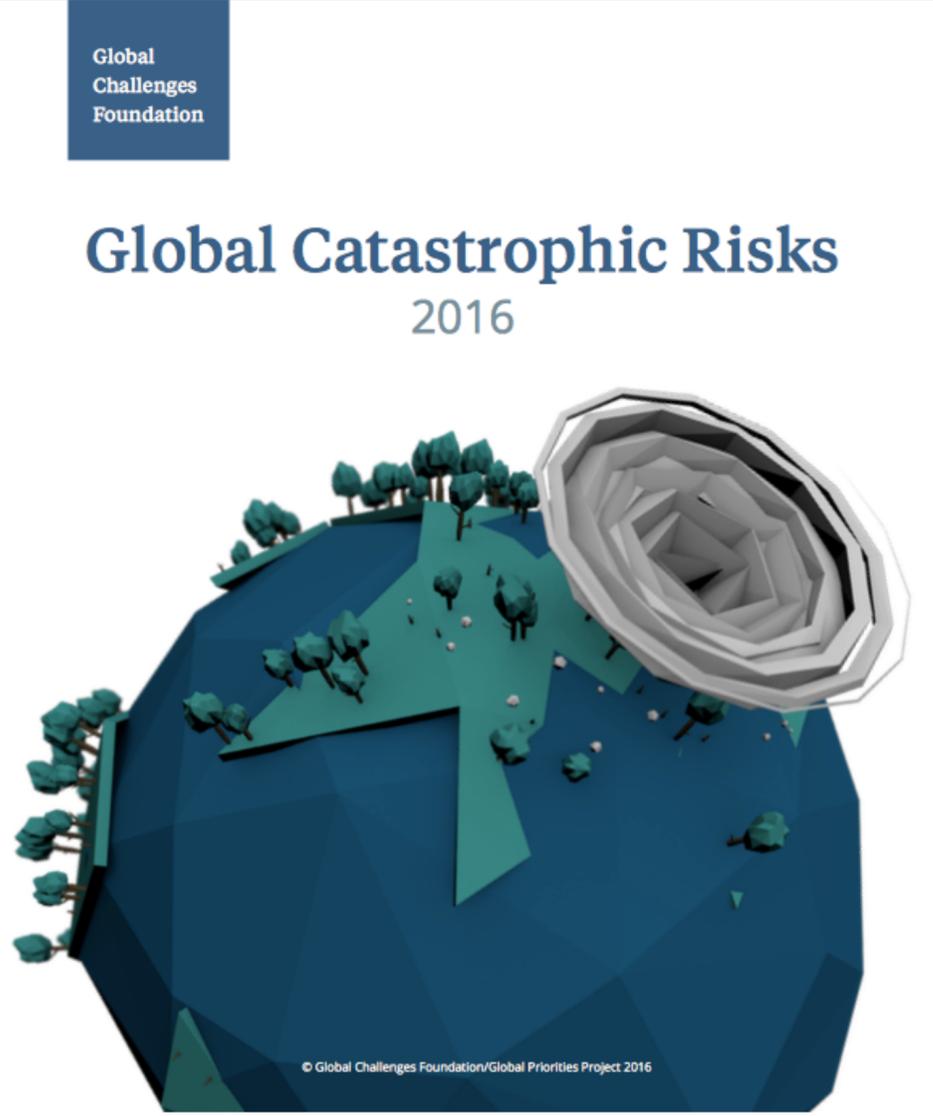


The Prognosis: Journey Into the Unknown

Assessing the risk ...

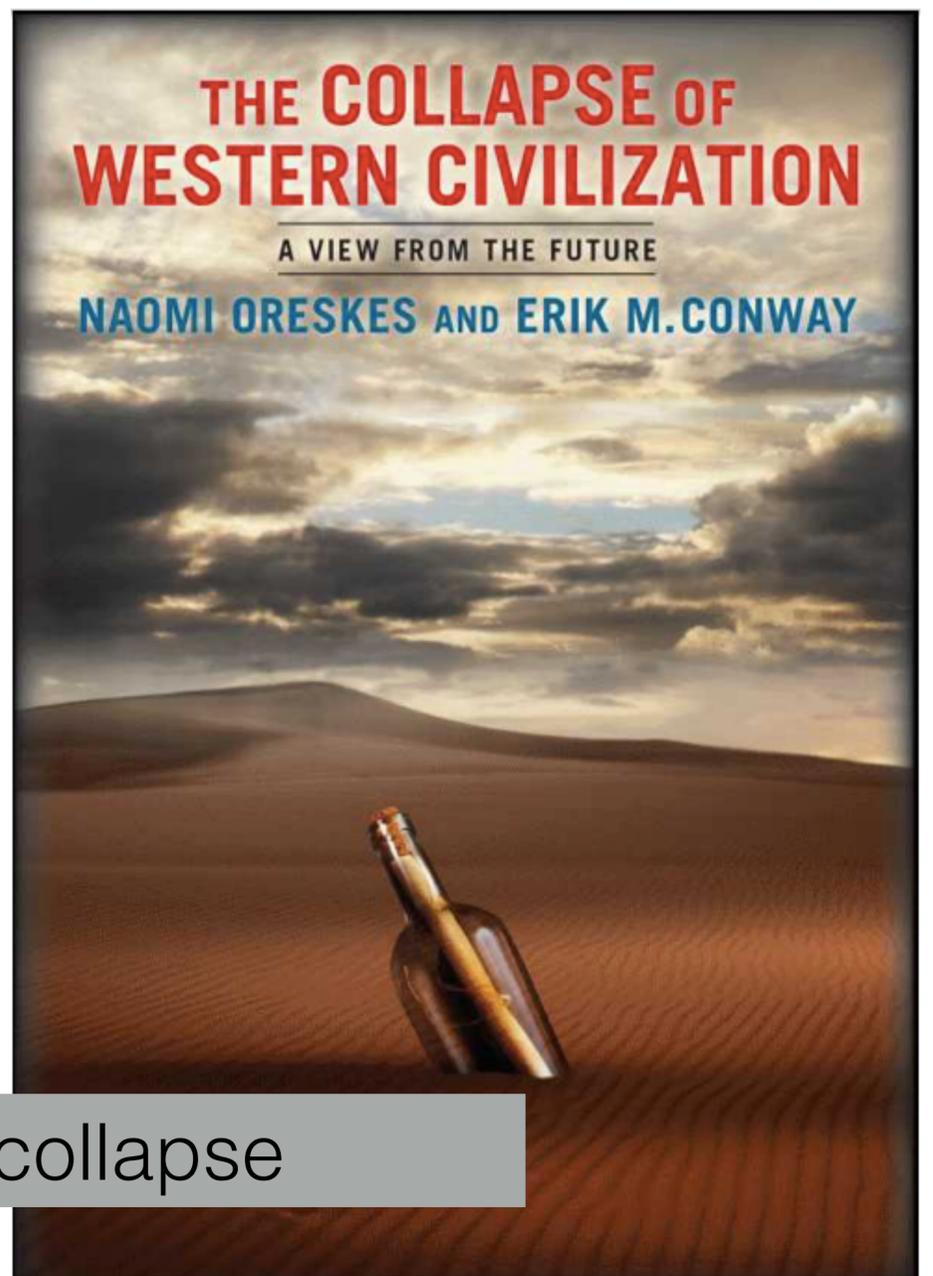
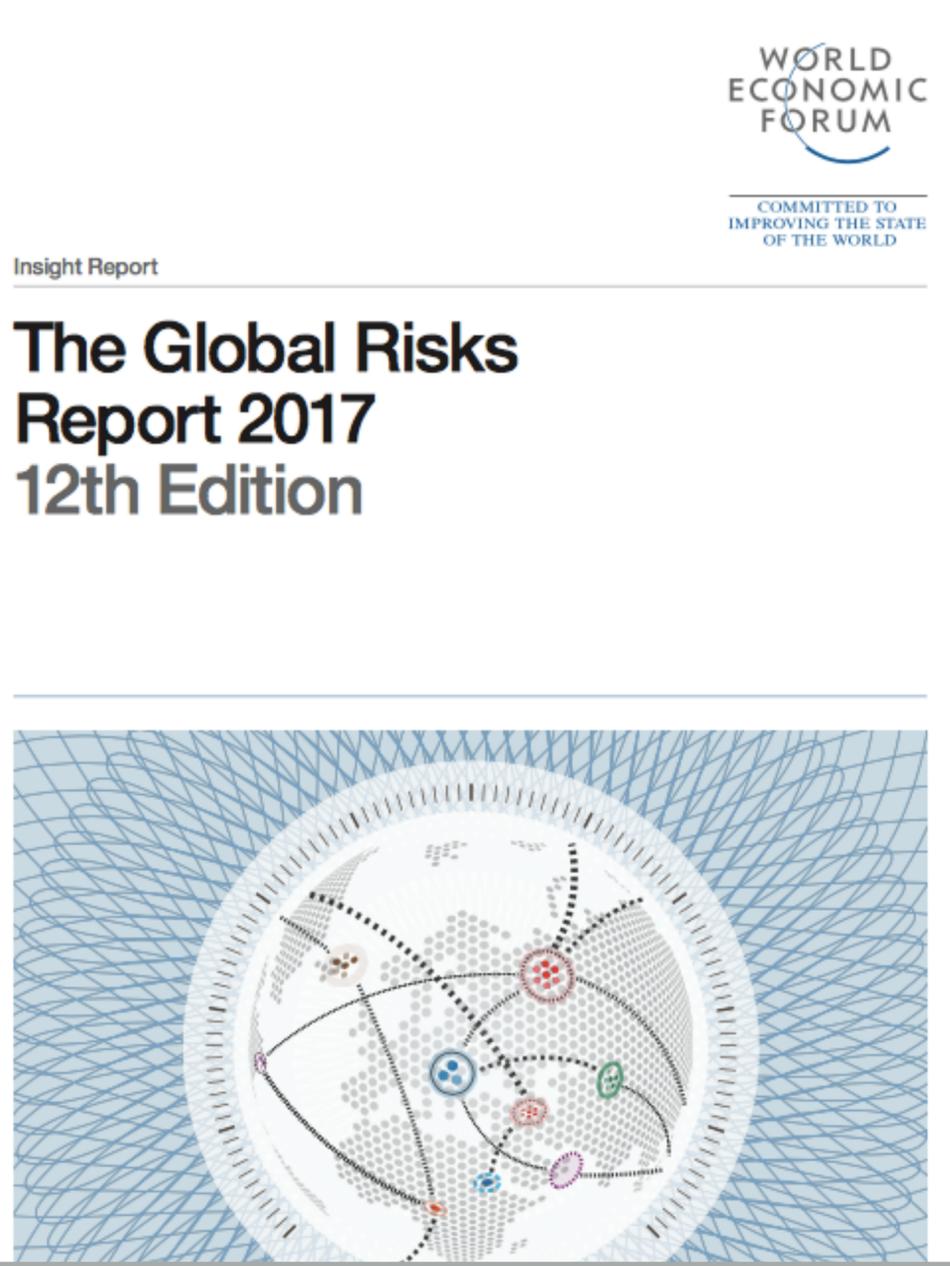
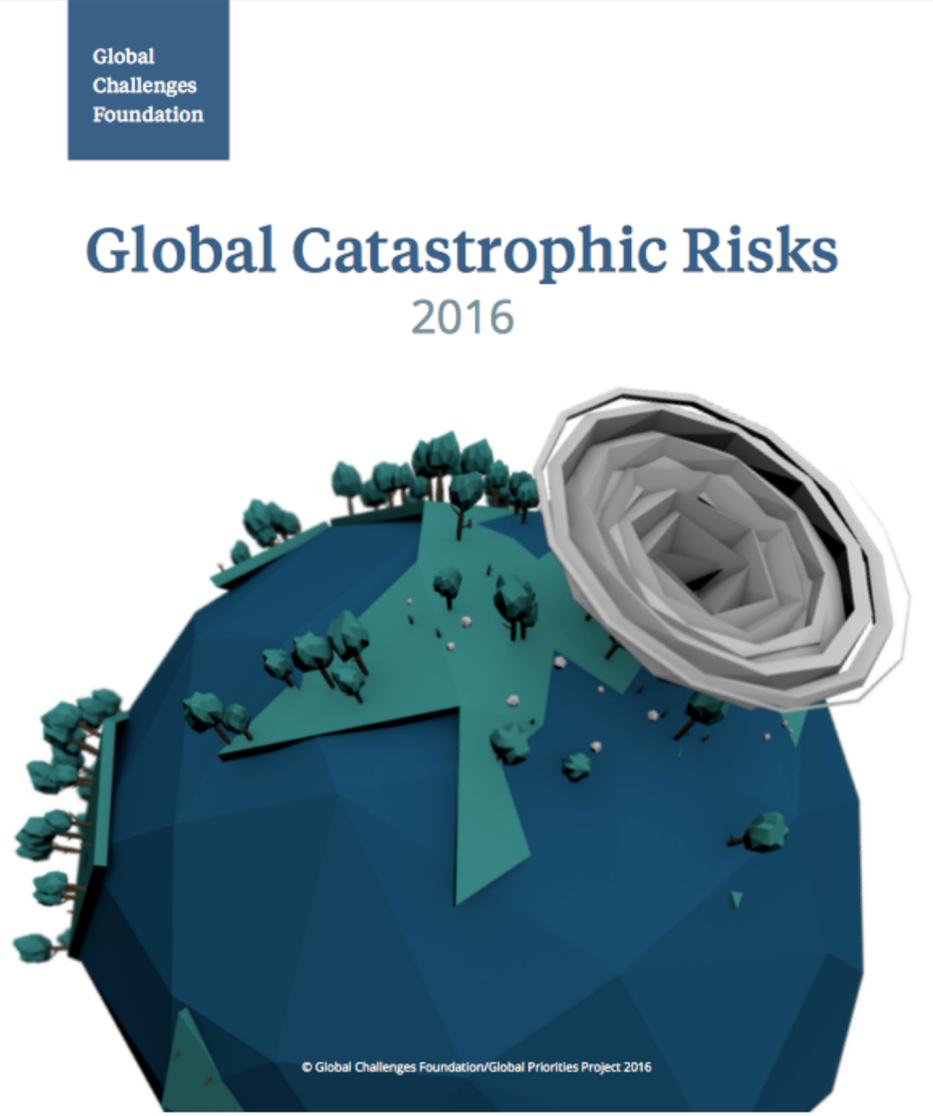
The Prognosis: Journey Into the Unknown

Assessing the risk ...



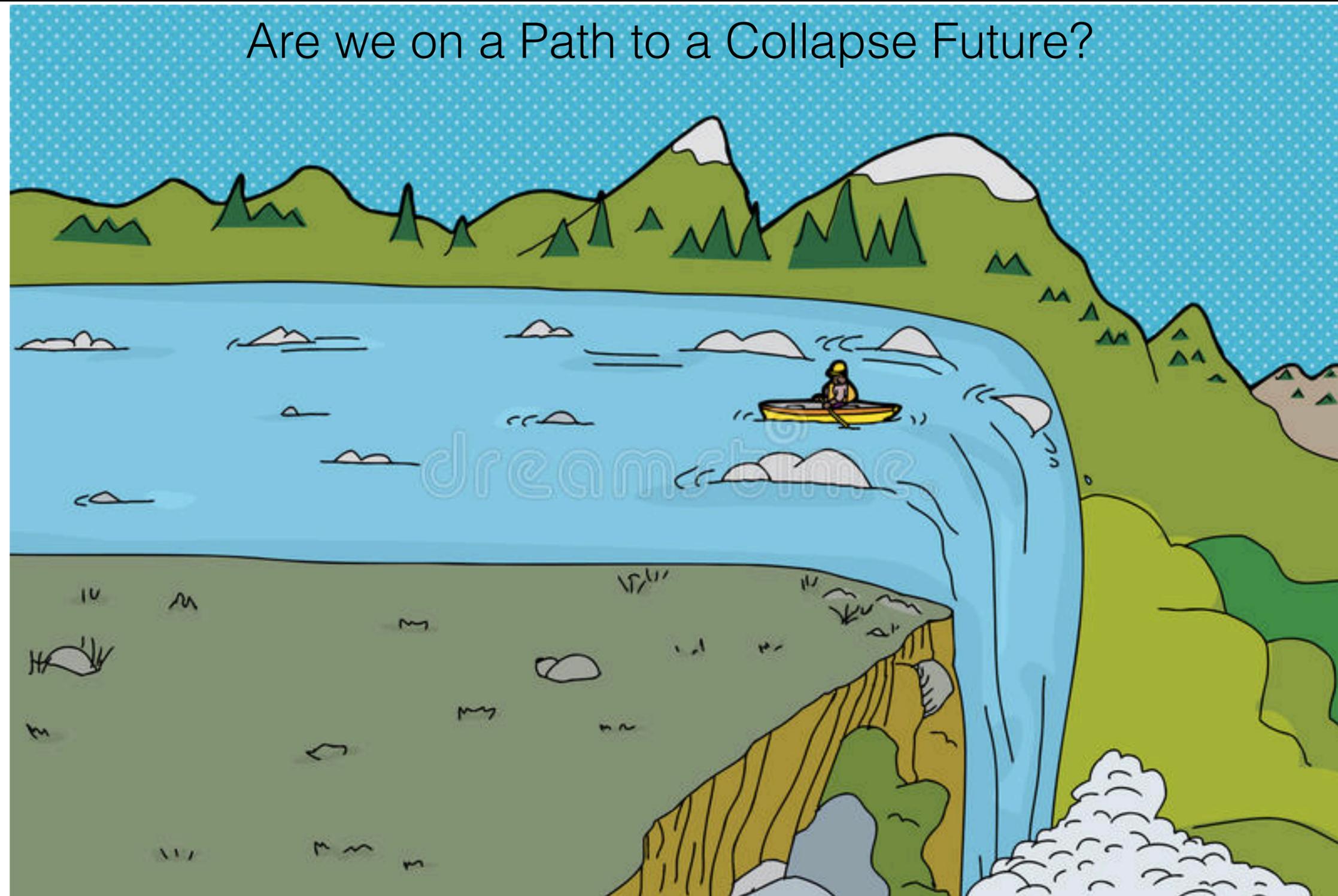
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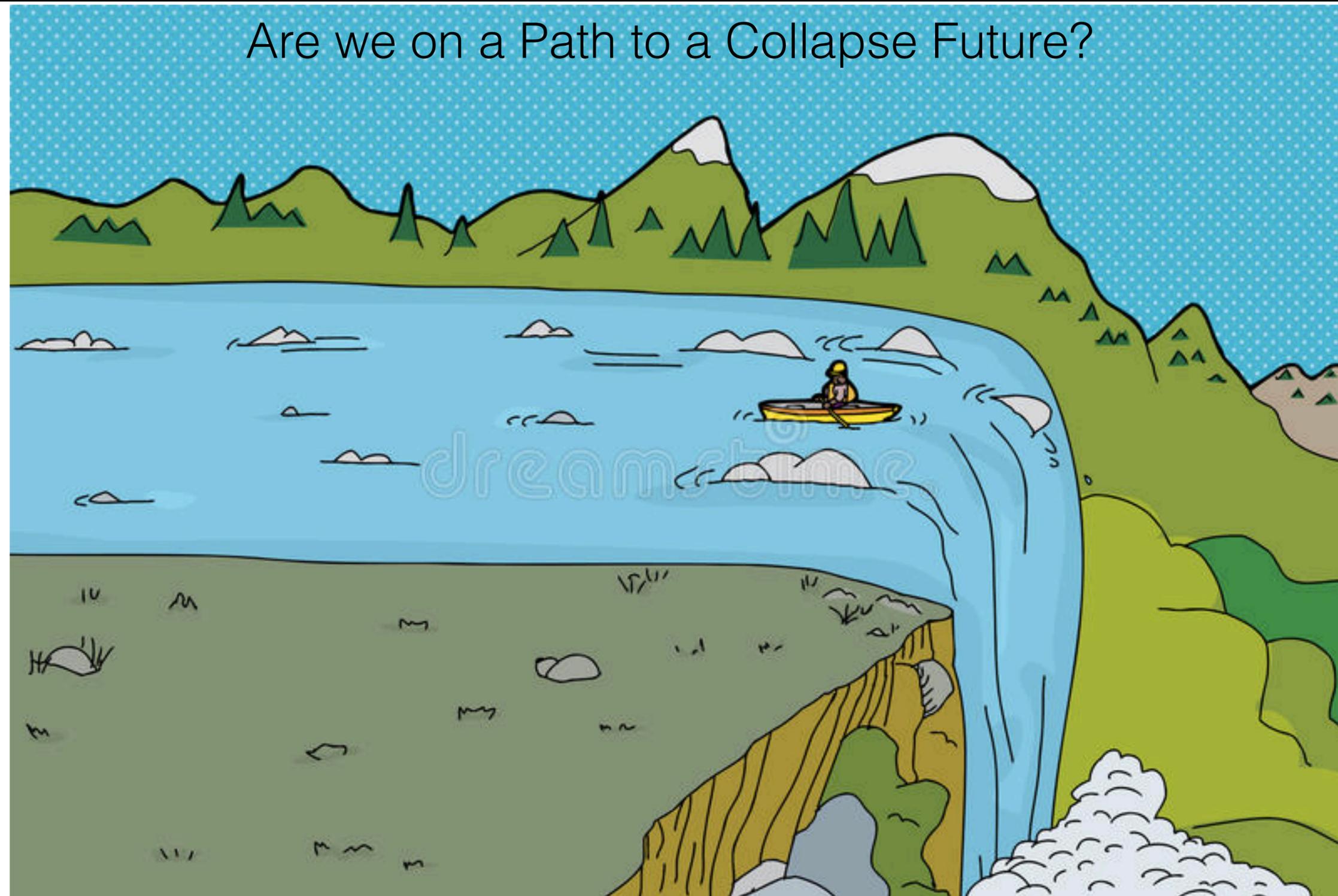


All detailed assessment point towards potential collapse

Are we on a Path to a Collapse Future?



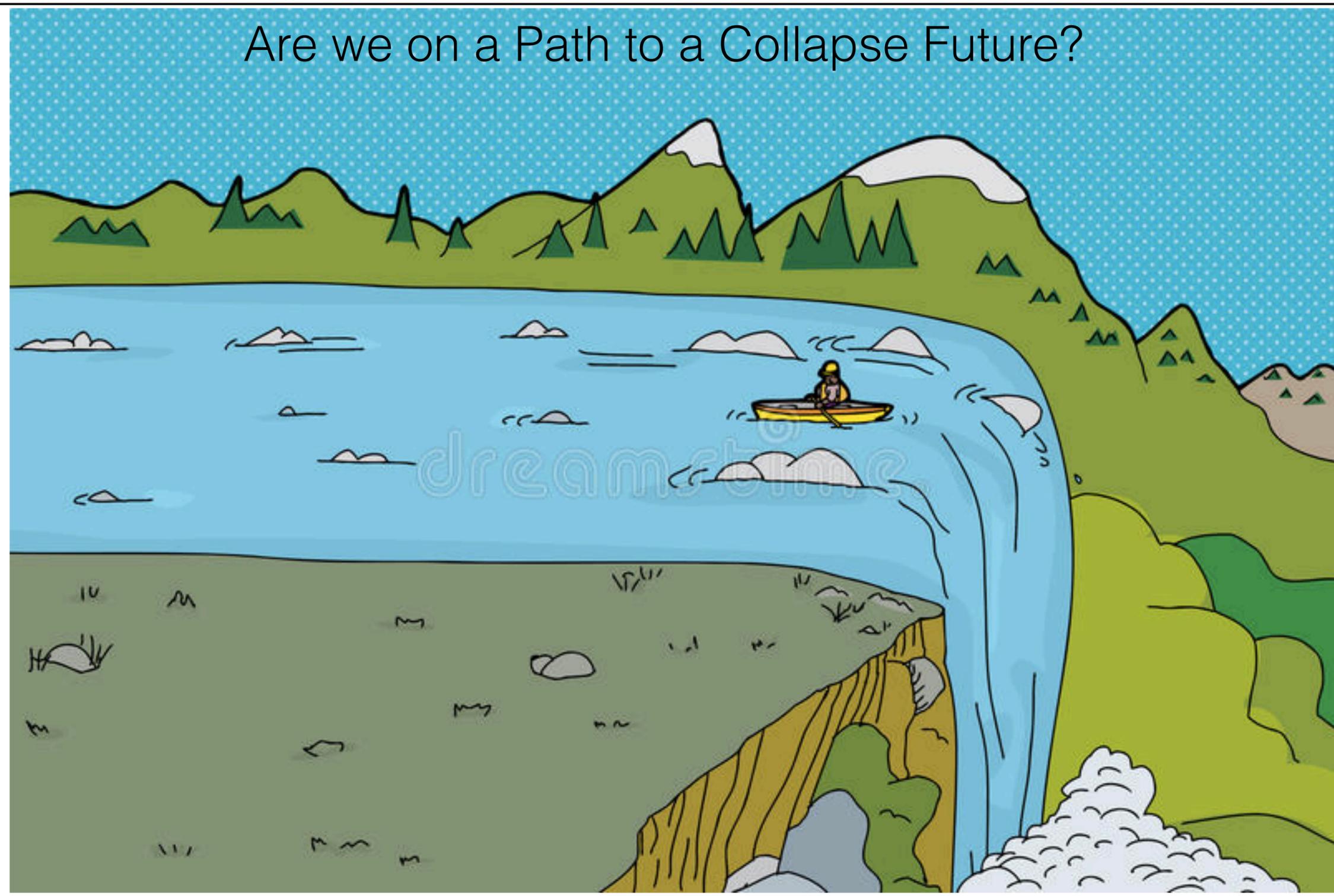
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Have we crossed the threshold where we lost the option to bring the boat safely to the shore?

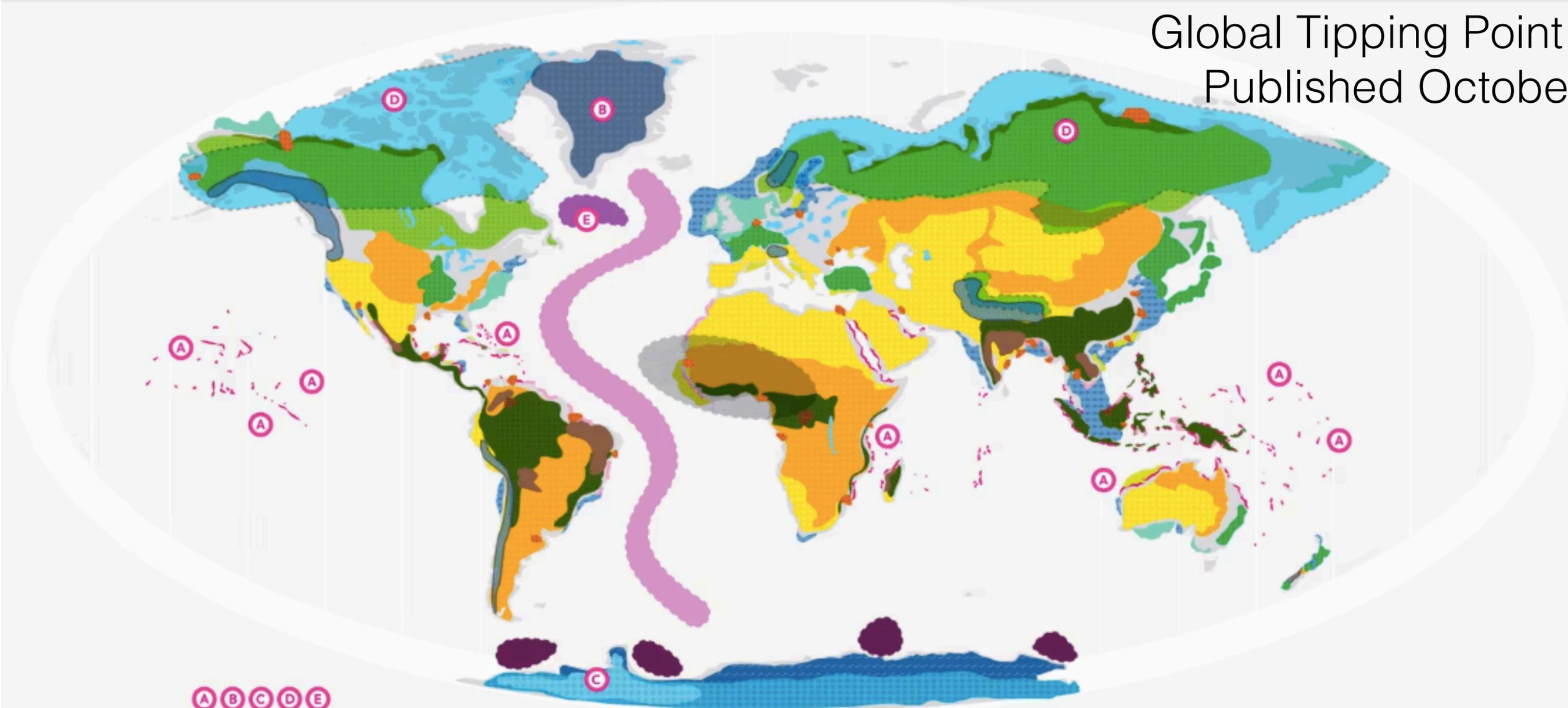
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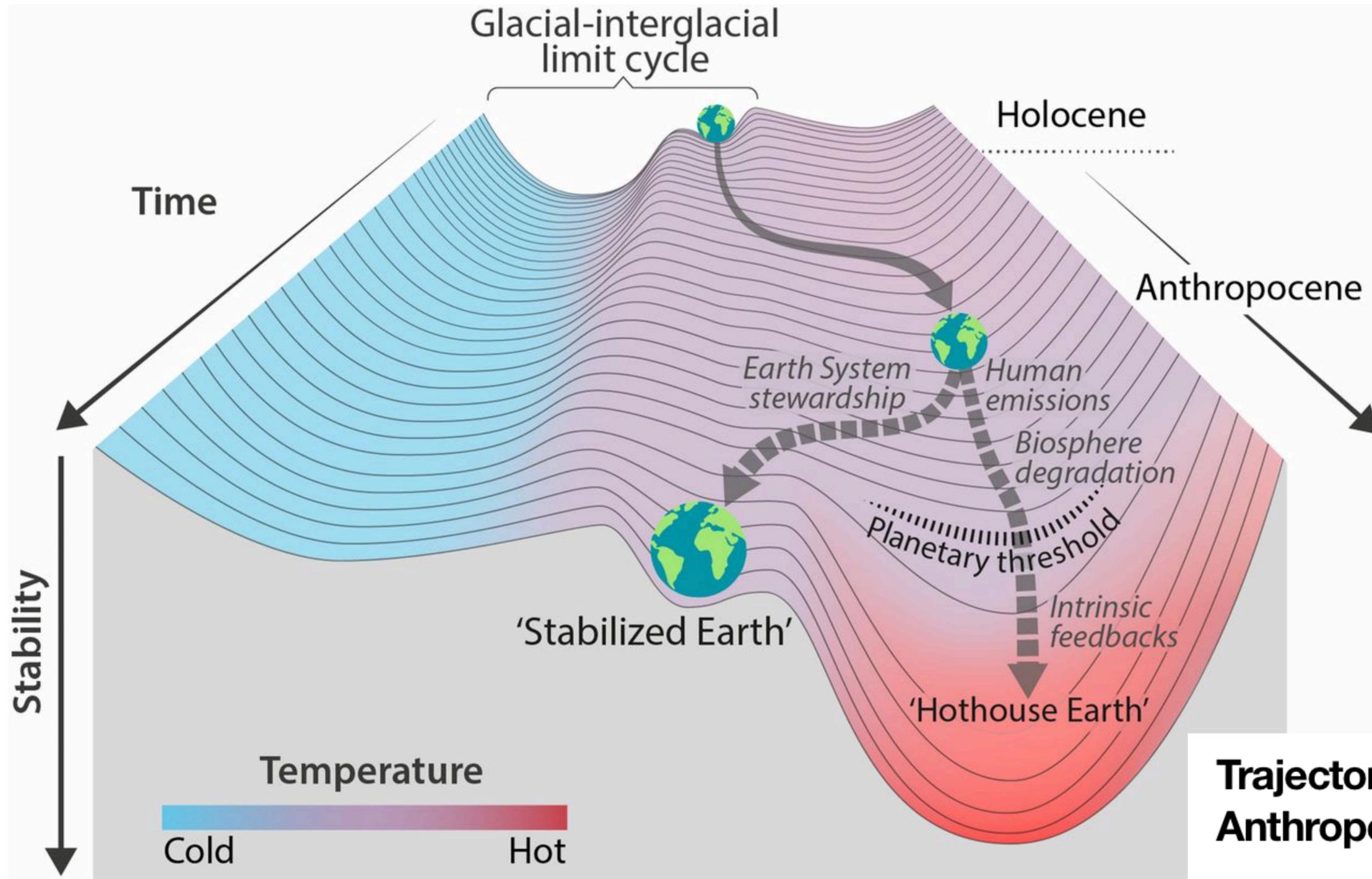
Have we crossed the threshold where we lost the option to bring the boat safely to the shore?

Are we too busy with keeping the party going and not seeing the water fall?



A B C D E
Closest to tipping - due to global warming

- | BIOSPHERE | CRYOSPHERE | OCEAN & ATMOSPHERE CIRCULATIONS |
|------------------------|-------------------------------------|--|
| Tropical dry forest | Greenland Ice Sheet (B) | Atlantic Meridional Overturning Circulation (AMOC) |
| Tropical rainforest | West Antarctic Ice Sheet (C) | Subpolar Gyre (SPG) (E) |
| Boreal forest | Non-marine East Antarctica | Southern Ocean Overturning |
| Tundra | Marine basins East Antarctica | West African monsoon |
| Savannas & grasslands | Permafrost (D) | |
| Drylands | Mountain glaciers | |
| Temperate forests | | |
| Peat bogs | | |
| Lakes | | |
| Coral reefs (A) | | |
| Mangroves | | |
| Fisheries | | |
| Seagrass | | |
| Kelp forest | | |
| Delta | | |



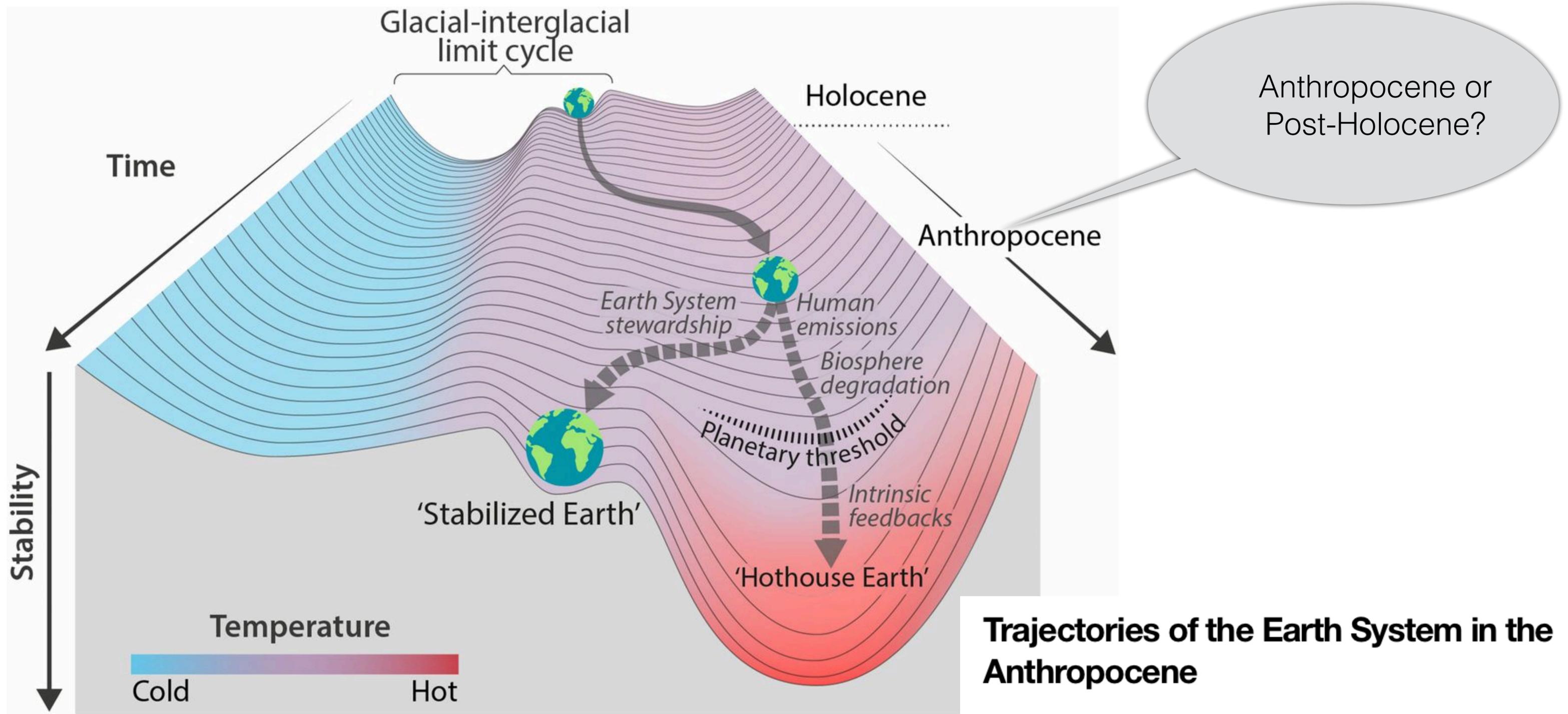
Trajectories of the Earth System in the Anthropocene



Will Steffen, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Ricarda Winkelmann, and Hans Joachim Schellnhuber

PNAS published ahead of print August 6, 2018 <https://doi.org/10.1073/pnas.1810141115>

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The age of extinction
Environment

Top scientists warn of 'ghastly future of mass extinction' and climate disruption

Sobering new report says world is failing to grasp the extent of threats posed by biodiversity loss and the climate crisis



Smoke and flames rise from an illegal fire in the Amazon rainforest reserve, south of Novo Progresso in Para state, Brazil. Photograph: Carl de Souza/AFP/Getty

The planet is facing a “ghastly future of mass extinction, declining health and climate-disruption upheavals” that threaten human survival because of ignorance and inaction, according to an international group of scientists, who warn people still haven’t grasped the urgency of the biodiversity and climate crises.

The 17 experts, including Prof Paul Ehrlich from Stanford University, author

Front. Conserv. Sci., 13 January 2021
Sec. Global Biodiversity Threats
<https://doi.org/10.3389/fcosc.2020.615419>

This article is part of the Research Topic
Frontiers in Conservation Science – Highlights From Its First Year.
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Underestimating the Challenges of Avoiding a Ghastly Future

-  Corey J. A. Bradshaw^{1,2*},  Paul R. Ehrlich^{3*},  Andrew Beattie⁴,  Gerardo Ceballos⁵,
-  Eileen Crist⁶,  Joan Diamond⁷,  Rodolfo Dirzo³,  Anne H. Ehrlich³,  John Harte^{8,9},
-  Mary Ellen Harte⁹,  Graham Pyke⁴,  Peter H. Raven¹⁰,  William J. Ripple¹¹,
-  Frédéric Saltré^{1,2},  Christine Turnbull⁴,  Mathis Wackernagel¹² and  Daniel T. Blumstein^{13,14*}

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- ¹⁰ Missouri Botanical Garden, St Louis, MO, United States
- ¹¹ Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR, United States
- ¹² Global Footprint Network, Oakland, CA, United States
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About this content

Phoebe Weston

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Wed 13 Jan 2021 00:01 EST



Prognosis: Journey into the Unknown

The age of extinction
Environment

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- ⁶ Department of Science, Technolo
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Self-termination is the most likely future.

Goliath's Curse



The History and Future
of Societal Collapse

Luke Kemp

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Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a “safe operating space for humanity”

Syndrome

During the last few hundred years, humanity has introduced rapid and large changes

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene; we have increasing disequilibrium

Diagnosis

Easy access to seemingly unlimited energy allowed humans to accelerate flows in the Earth’s life-support system, develop a growth-addicted consumption-based economy, sustain rapid population growth, push humanity out of the safe operating space

Prognosis

We are heading rapidly into a **very different system state** (tipping points; Post-Holocene)

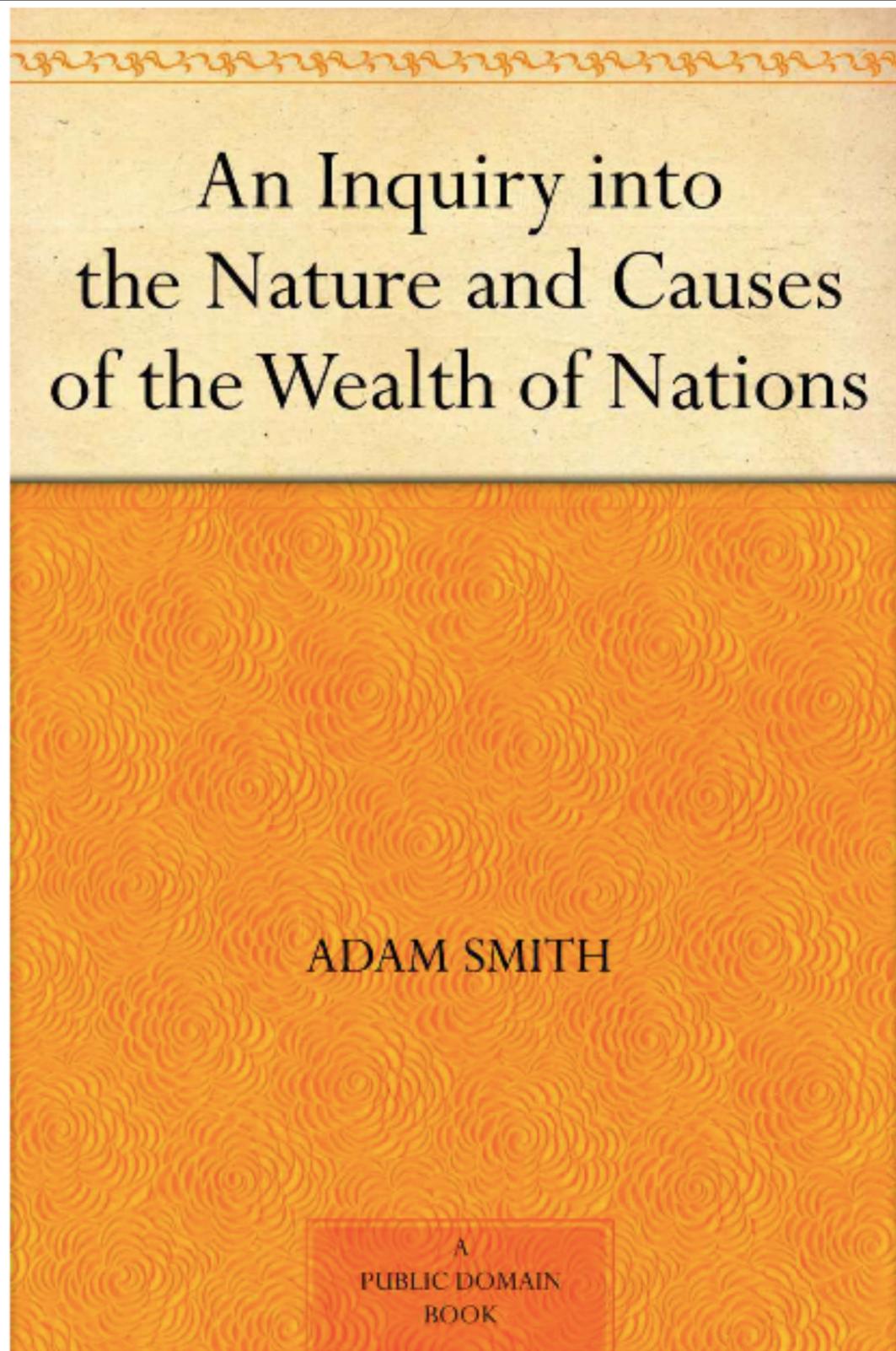
Our knowledge is changing rapidly; there is room for **surprises**; Foresight is needed

Are we in a Human and Planetary Existential Emergency? If so, what can we do about it?

Contents

- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Official Purpose of “Economy”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes





- Purpose of economy is to increase human wealth;
- Earth and its natural wealth is basically infinite.

Smith (1776)

Published in 1776

OUR COMMON FUTURE

THE WORLD COMMISSION
ON ENVIRONMENT
AND DEVELOPMENT

Published in 1987

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"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

WCED (1987)

COMMENT

ENVIRONMENT Conservationists call for a global zoning exercise for roads **p.200** | **HISTORY** Ripping yarn of the ape-man of Victorian England **p.210** | **EVOLUTION** First biography of W.D. Hamilton, the gentle giant of genetics **p.212** | **FINDING** Australia's grant system wastes centuries of researchers' time **p.214**

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Griggs et al. (2013)

Sustainable development goals for people and planet

Planetary stability must be integrated with United Nations targets to fight poverty and secure human well-being, argue **David Griggs** and colleagues.

The United Nations Rio+20 summit in Brazil in 2012 committed governments to create a set of sustainable development goals (SDGs) that would be integrated into the follow-up to the Millennium Development Goals (MDGs) after their 2015 deadline. Discussions on how to formulate these continue this week at UN headquarters in New York. We argue that the protection of Earth's

life-support system and poverty reduction must be the twin priorities for SDGs. It is not enough simply to extend MDGs, as some are suggesting, because humans are transforming the planet in ways that could undermine development gains. As mounting research shows, the stable functioning of Earth systems — including the atmosphere, oceans, forests, waterways, biodiversity and biogeochemical cycles — is

a prerequisite for a thriving global society. With the human population set to rise to 9 billion by 2050, definitions of sustainable development must be revised to include the security of people and the planet. Defining a unified set of SDGs is challenging, especially when there can be conflict between individual goals, such as energy provision and climate-change prevention. But we show here that it is possible. By ▶

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The Therapy: “Lifestyle” changes

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Example: Rivers

How to Safeguard the Earth's Life-Support System

The Purpose of a System Is What It Does!

How to Safeguard the Earth's Life-Support System

The Purpose of a System Is What It Does!

What does a **river** do? A river:

- transports water in the water cycle
- replenishes groundwater
- transports sediments
- creates topography and contributes to several mass cycles
- maintains wetlands and wets flood planes
- sustains complex freshwater ecosystems
- feeds land animals (including humans)
- ...



How to Safeguard the Earth's Life-Support System

The Purpose of a System Is What It Does!

How to Safeguard the Earth's Life-Support System

The Purpose of a System Is What It Does!

Humans have changed what the systems in the ELSS do:

What does a reengineered river? It

- provides hydro-energy
- removes water quickly
- absorbs pollution
- transports waste and pollutes the ocean
- ...



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Does the current Power Structure allow for this Therapy?

The Therapy: "Lifestyle" changes

Global Order: The "Global Ruling Class"



The study of futures, and the analysis of power

Bernd Hamm
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<https://doi.org/10.1016/j.futures.2010.08.017> [Get rights and content](#)

Abstract

This study attempts to find out in which direction global power distribution is shifting. This is expected to shed light on the chances we have to build a democratic, ecologically sustainable and socially just world future society. The paper raises and explores, to some extent, three questions: (1) Who is the emerging global ruling class, and does it develop some sort of class consciousness? (2) What are the means used by the global ruling class in the class struggle? and (3) What are likely consequences for the future of global society?

Power and the Global Ruling Class. Who Rules the World?

The End of Democracy as We Know It

By [Bernd Hamm](#)

Global Research, June 04, 2014

Region: USA
Theme: Global Economy, History, Religion, Terrorism, US NATO War Agenda

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This paper starts with summarizing the major theoretical elements in the definition of a global ruling class. It then examines how neoconservatives in the US took power and used regime change to create chaos in other regions. A strategy of tension is used to press the population into conformity. But the real revolution is to what extent factual politics escape any attempt to democratic control. Three case studies show how far the Deep State already goes. Democracy is on the brink of survival.

The Therapy: "Lifestyle" changes

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The study of futures, and the analysis of power

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**Bernd Hamm:
Global Ruling Class of approximately 350 billionaires**

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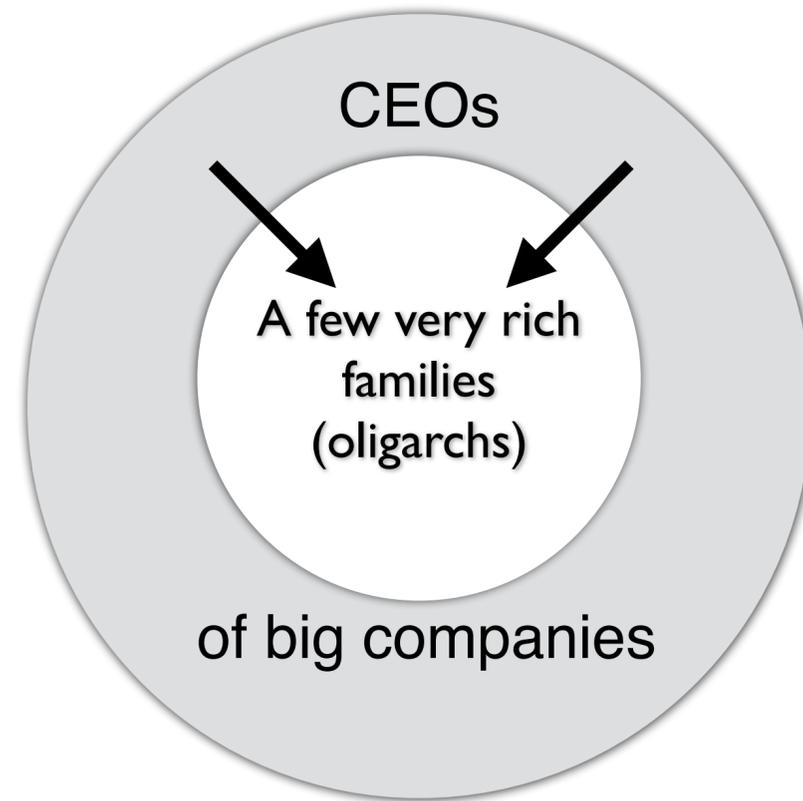
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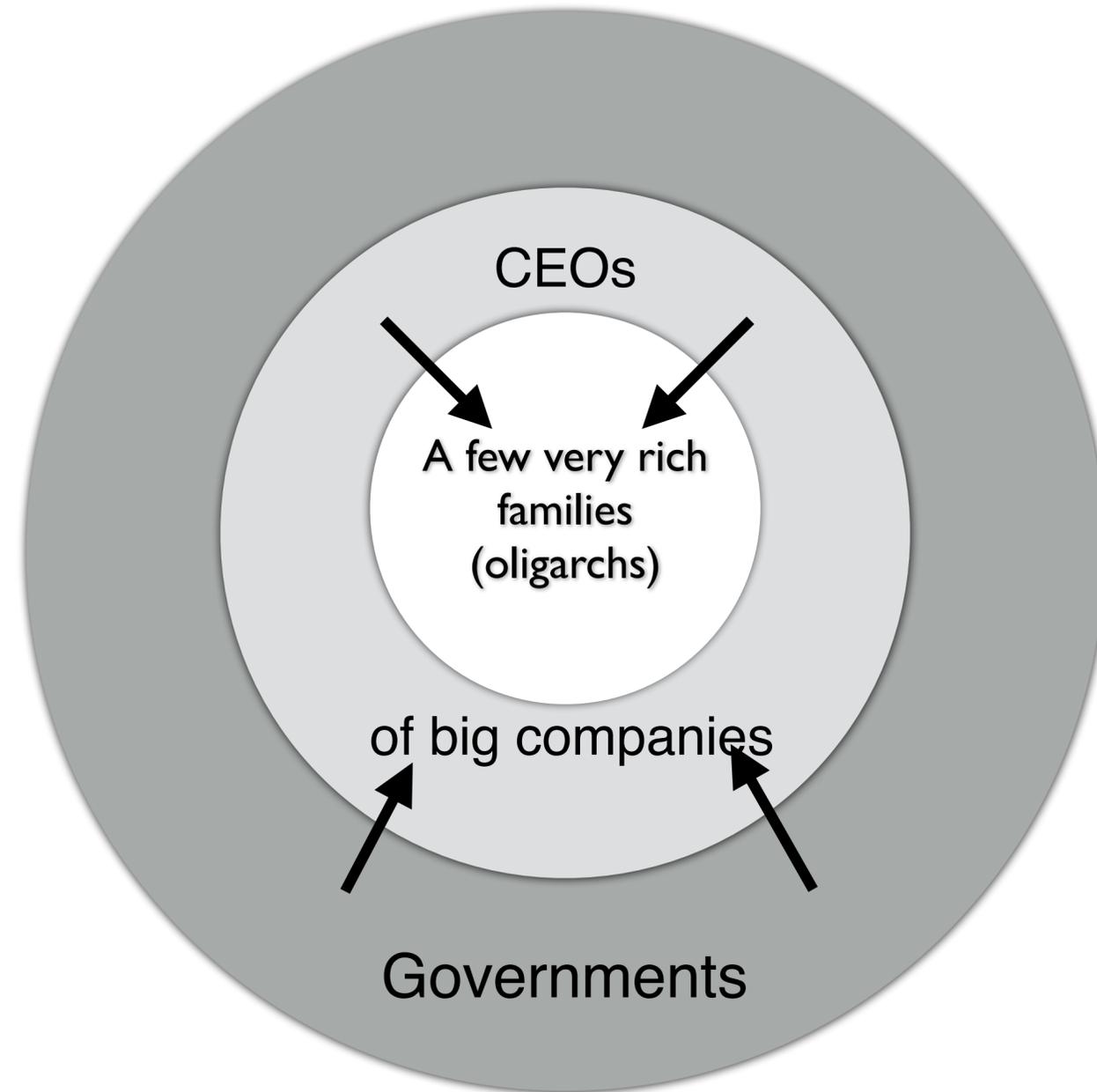


A few very rich
families
(oligarchs)

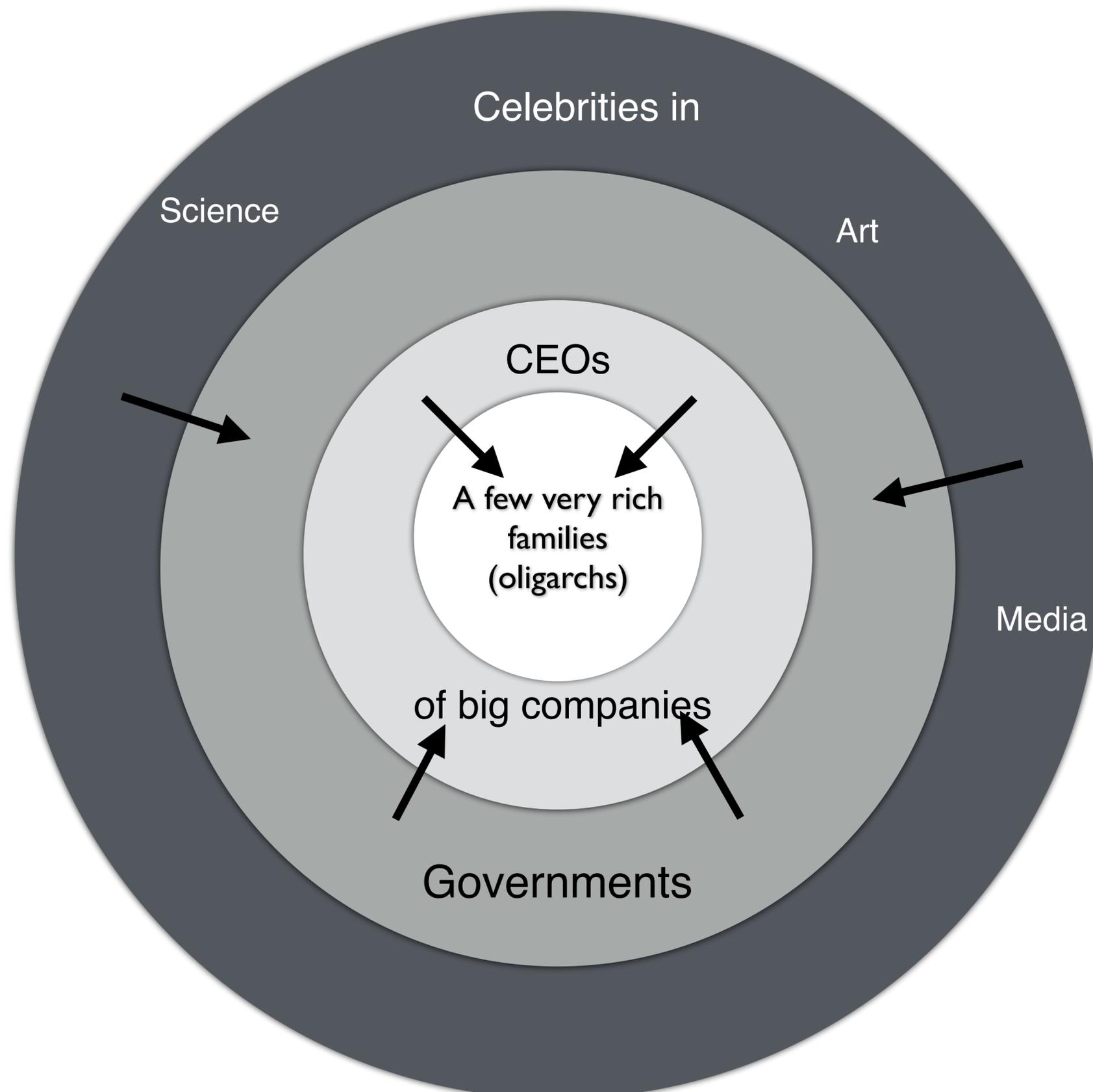
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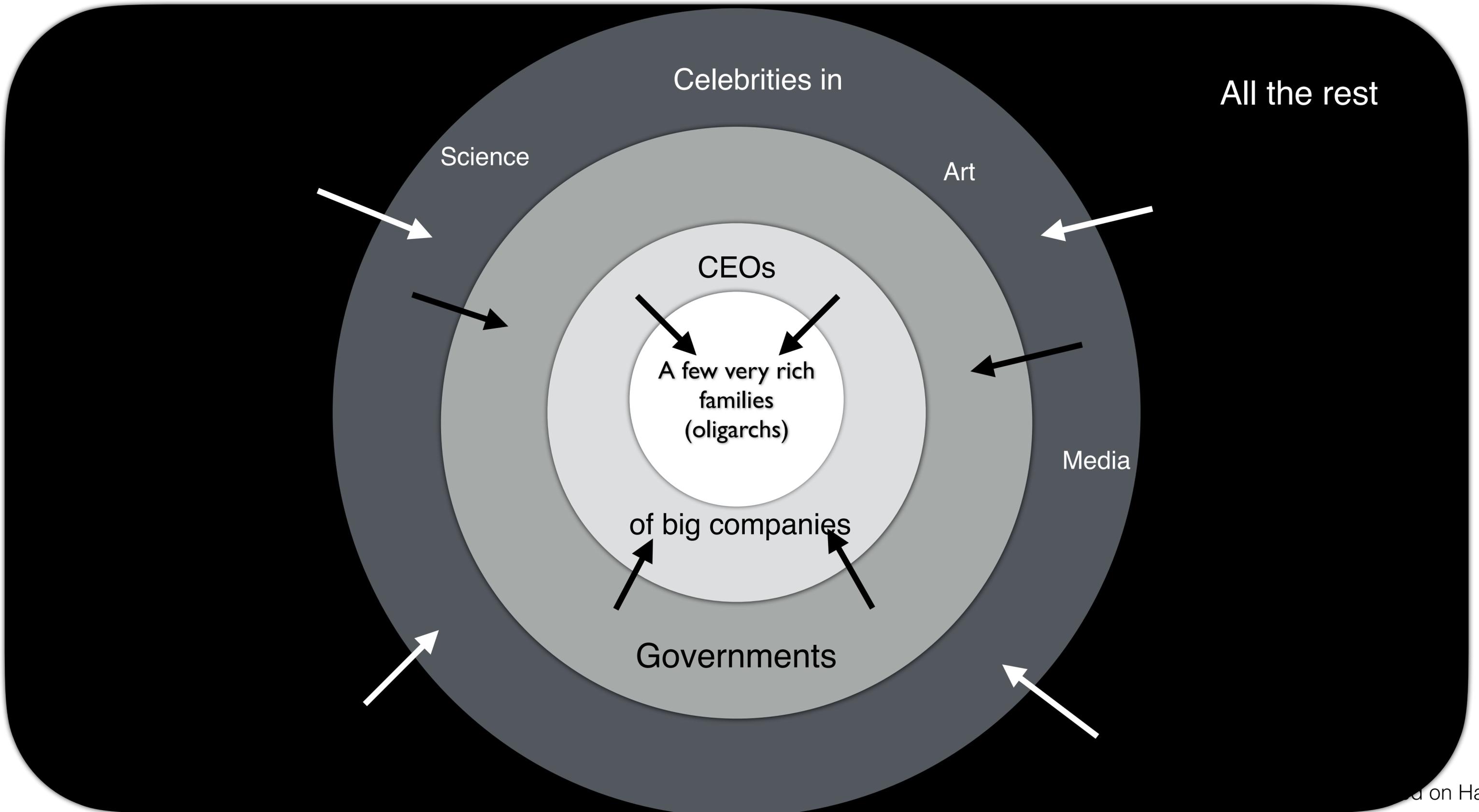
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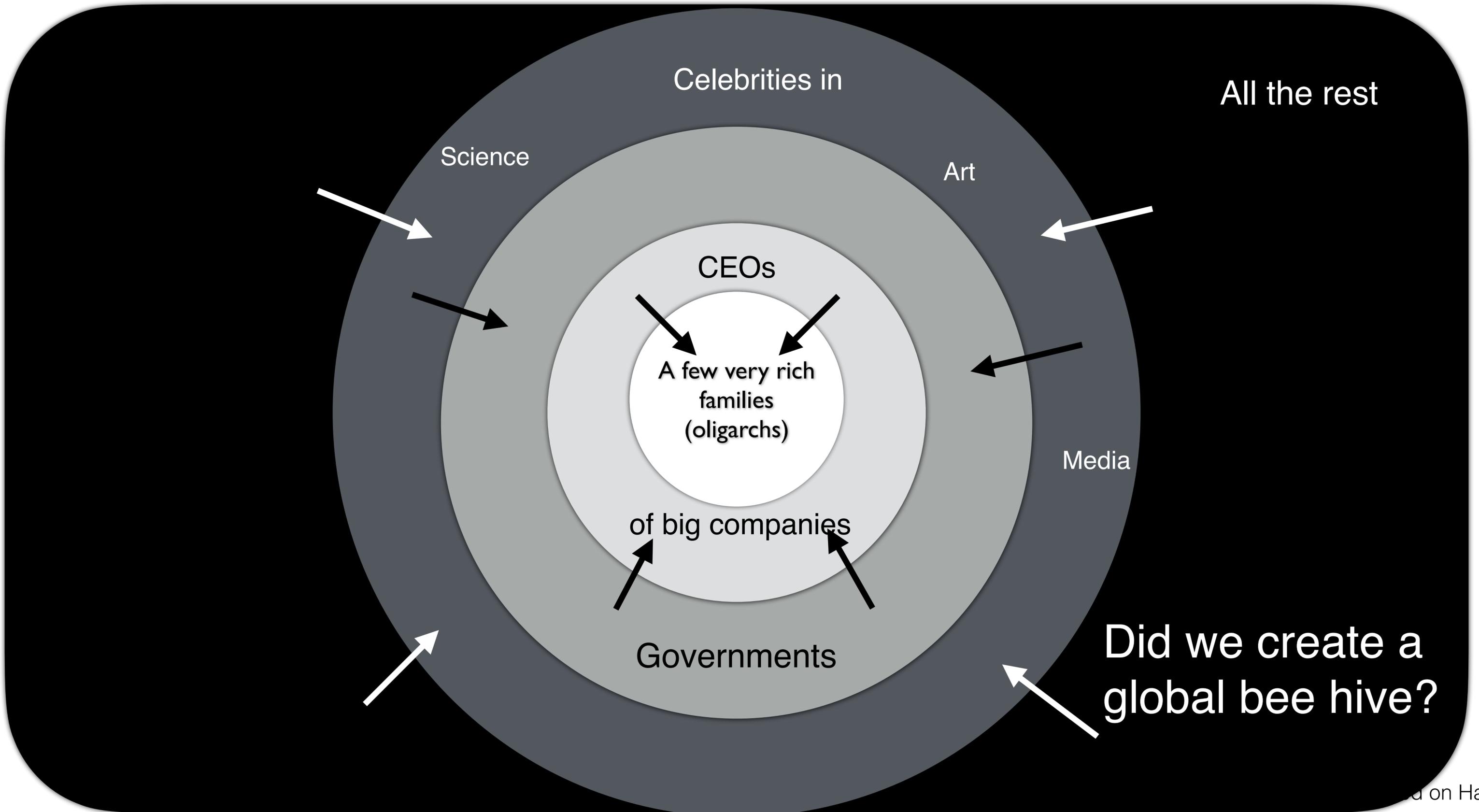
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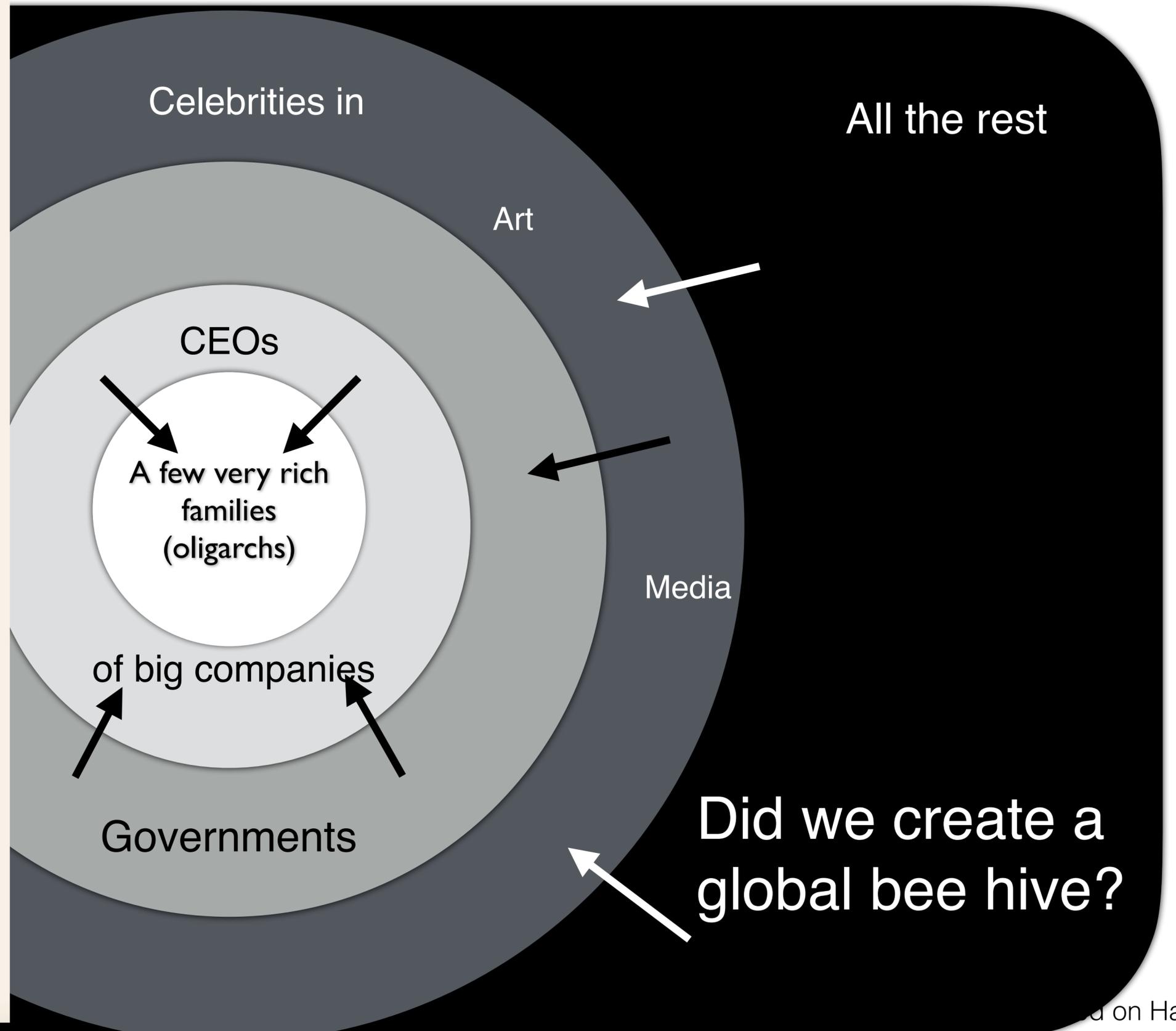


Goliath's Curse



The History and Future
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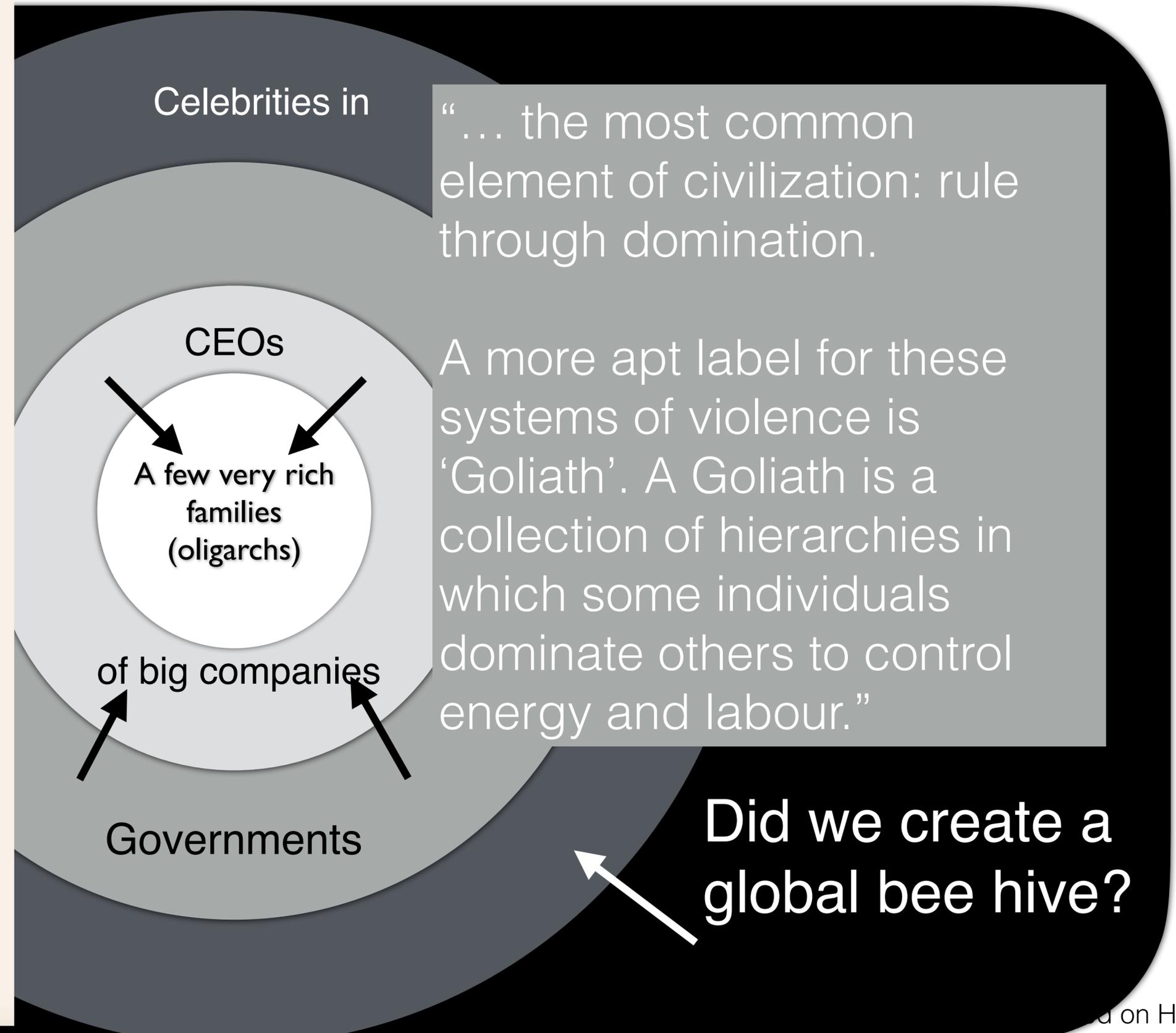


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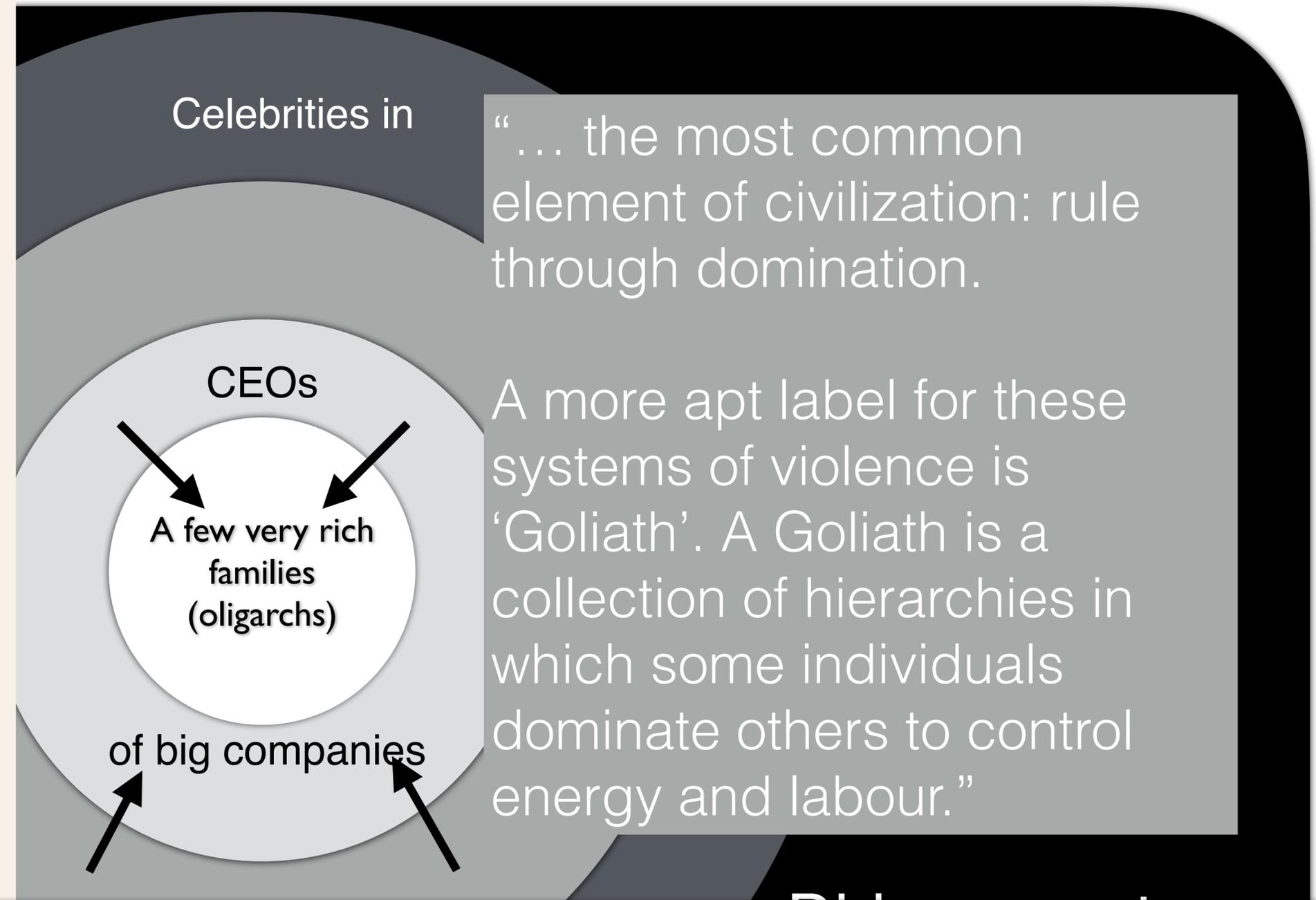
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Goliath's Curse



The History and Future



“... the most common element of civilization: rule through domination.”

A more apt label for these systems of violence is ‘Goliath’. A Goliath is a collection of hierarchies in which some individuals dominate others to control energy and labour.”

Can we change the official purpose of economy in the current governance structure?

Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a “safe operating space for humanity”

Syndrome

During the last few hundred years, humanity has introduced rapid and large changes

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene; we have increasing disequilibrium

Diagnosis

Easy access to seemingly unlimited energy allowed humans to accelerate flows in the Earth’s life-support system and sustain rapid population growth and increasing demands

Humans are the “Anthropogenic Cataclysmic Virus” (ACV) in the Earth’s life-support system

Prognosis

We are heading rapidly into a very different system state (thresholds; Post-Holocene)

Our knowledge is changing rapidly; there is room for surprises; Foresight is needed

Therapy

Changing the official purpose of economy from growing human wealth (growth addiction) to meeting our needs while safe-guarding the Earth’s life-support system





Beam me up!
Let's leave!



Summary for Humanity:

“The vast accumulation of evidence shows that the human impact on Planet Earth has attained geological scale. We have become an ‘event’ with the destructive force of a supervolcano or large asteroid impact, but one that appears to be happening in slow-motion in terms of our own limited perceptions. Nevertheless, it is rapidly approaching the point of irreversibility - and there is, as yet, no sign that humans collectively understand what they have unleashed, or how to repair the damage. Indeed, most societies are focussed on redoubling the destruction and ensuring their grandchildren have no future.” *Julian Cribb,*
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No Doubt, humanity is in a Human and Planetary Existential Emergency



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