Modern Climate Change:
A Symptom of a Human-Caused High-Energy Pulse

(Virtual) Lecture Series at the
Christ and St. Luke's Episcopal Church, Norfolk
May 2020

May 3: Part 1: The Baseline
May 10: Part 2: The Syndrome and Diagnosis
May 17: Part 3: The Prognosis and Therapy

Hans-Peter Plag
Old Dominion University
Norfolk, VA, USA

Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable.

The Holocene was a “safe operating space for humanity” allowing the emergence of a dominant species

Syndrome

During the last few hundred years, humanity has made large and rapid planetary changes, accelerated existing and introduced new flows in the planetary physiology.

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene.

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.

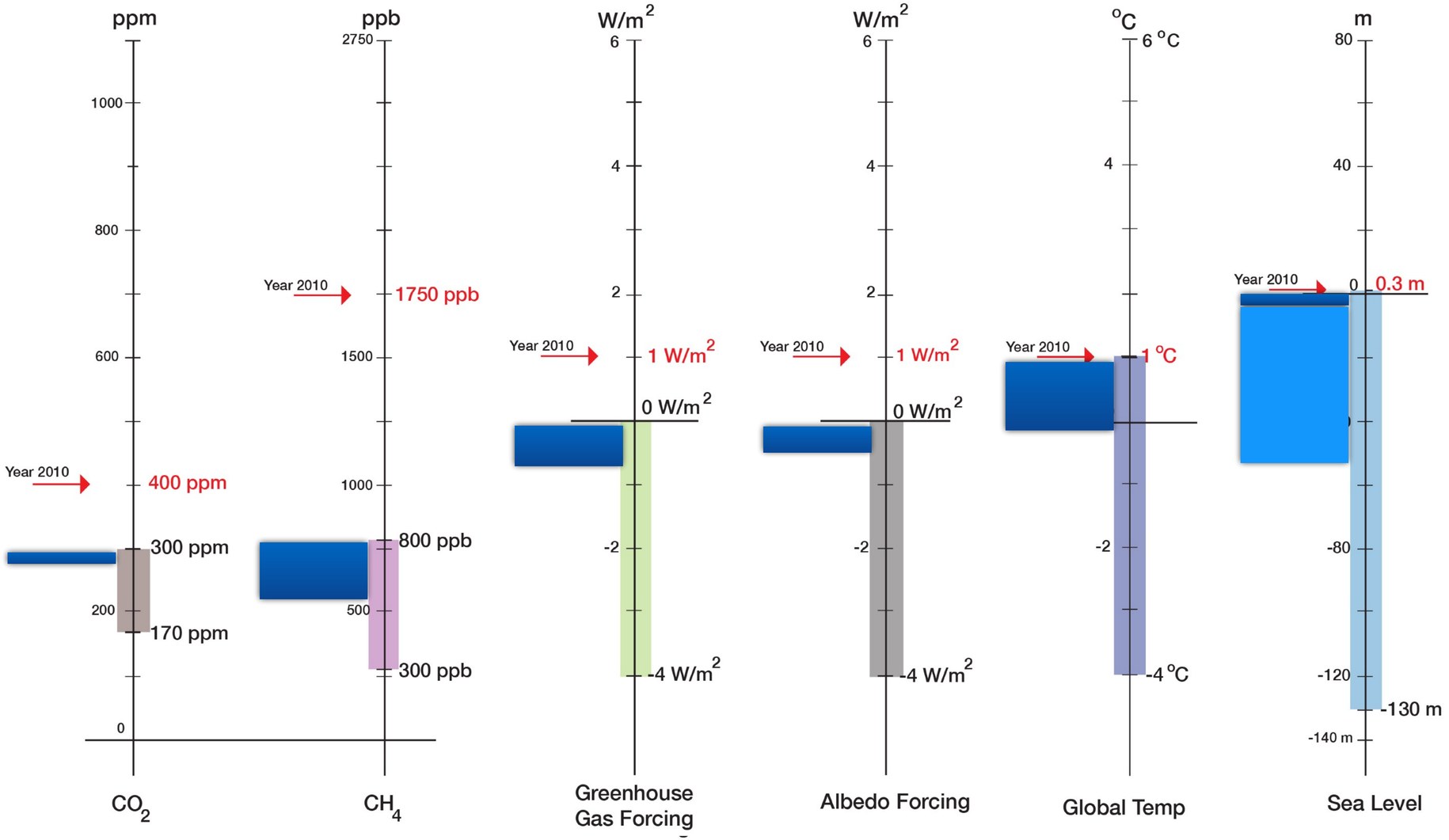
The new mainstream economic model and a changed global order has turned humans into the “Anthropogenic Cataclysmic Virus” (ACV) in the Earth’s life-support system.

Modern Climate Change:
A Symptom of a Human-Caused High-Energy Pulse

Contents

- The Baseline: Past Climate Changes
- The Syndrome: Modern Climate and Global Change
- The Diagnosis: A new Economy and Global Order
- The Prognosis: Leaving the “Safe Operating Space” and into the Unknown
- The Therapy: A new Ethics, Economy, and Global Governance

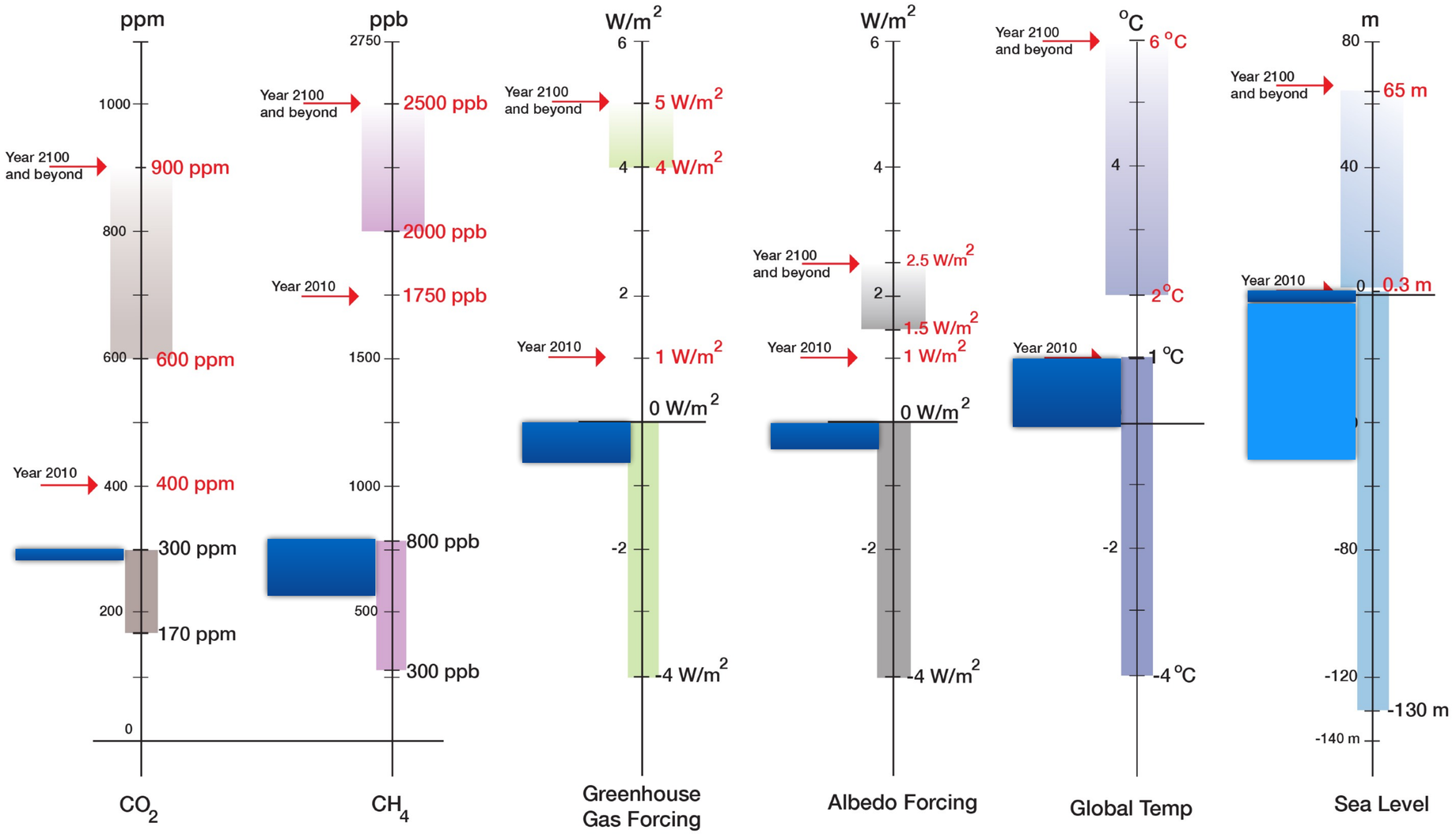
Prognosis: Leaving the “Safe Operating Space” and into the Unknown



“Current State”

“Normal Range”
(800,000 years)

Prognosis: Leaving the “Safe Operating Space” and into the Unknown



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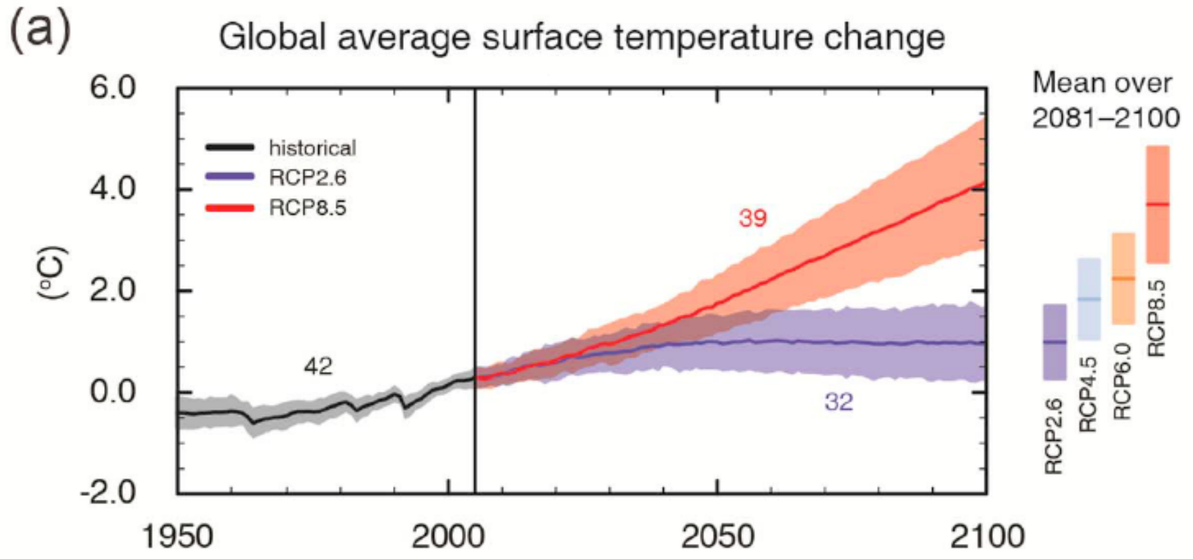

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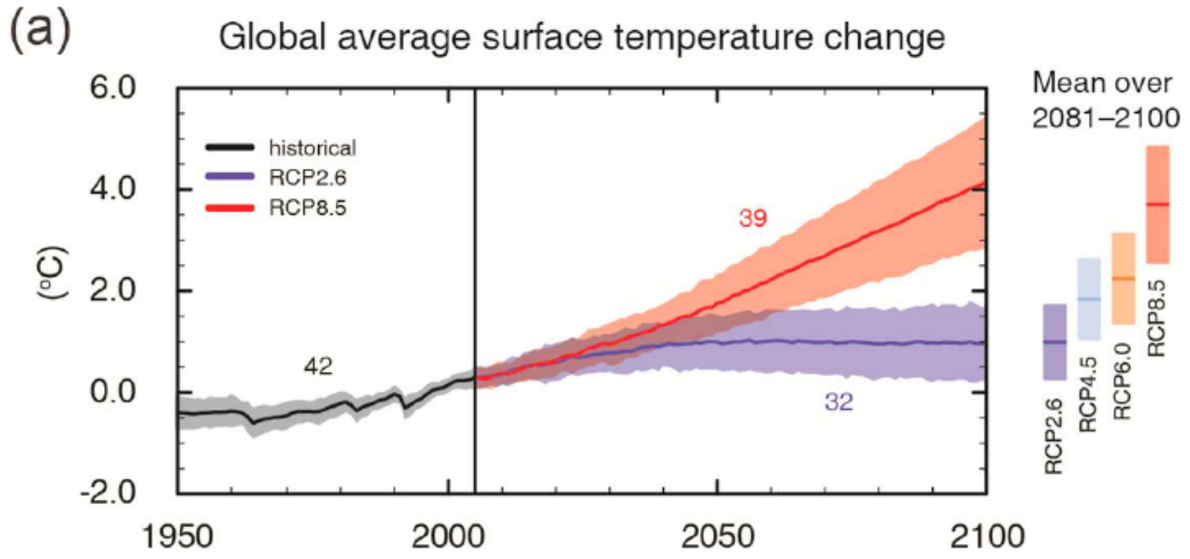

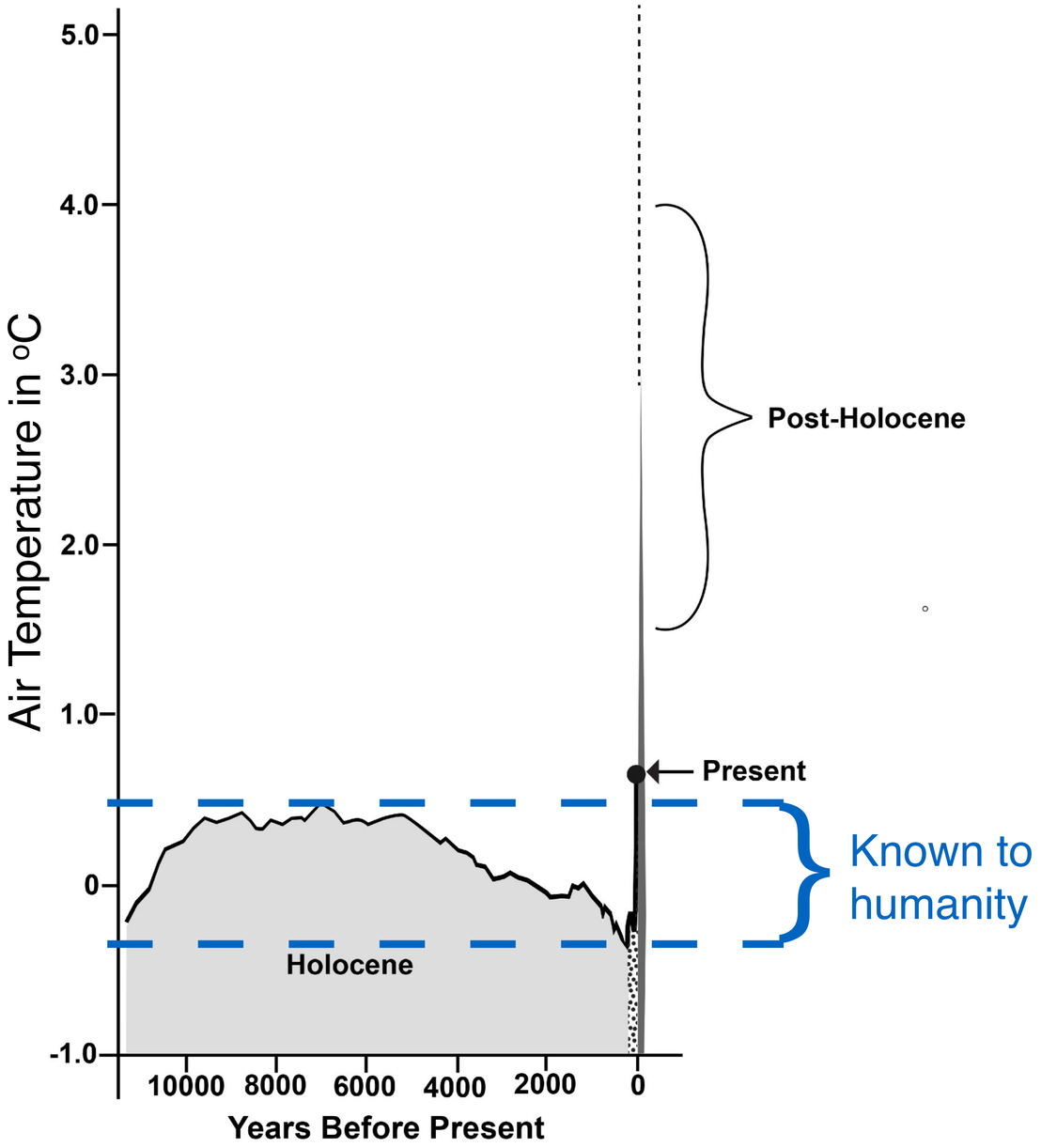

Prognosis: Leaving the “Safe Operating Space” and into the Unknown

Longer-term:

- 1^{o}C corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

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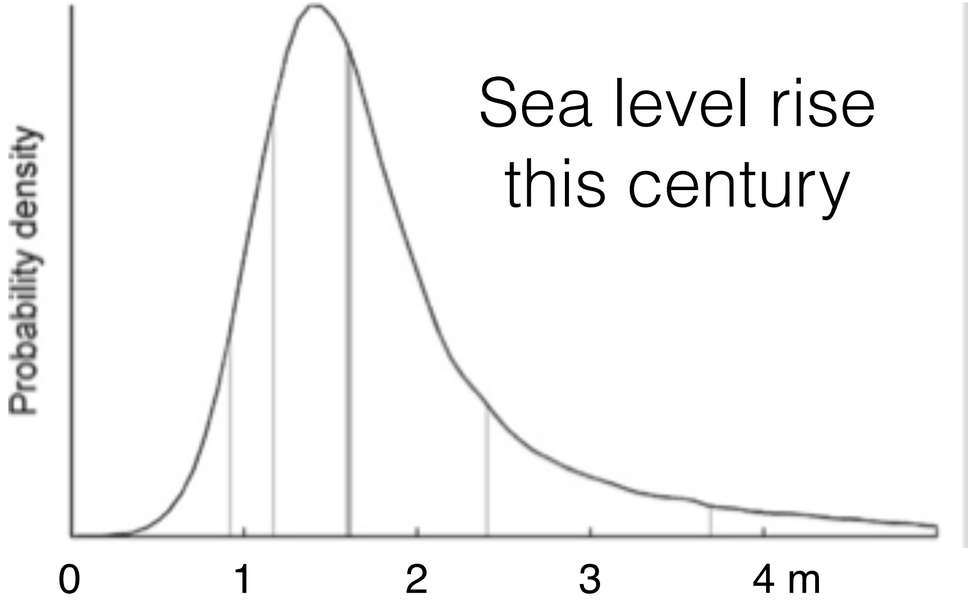

Sea level rise this century

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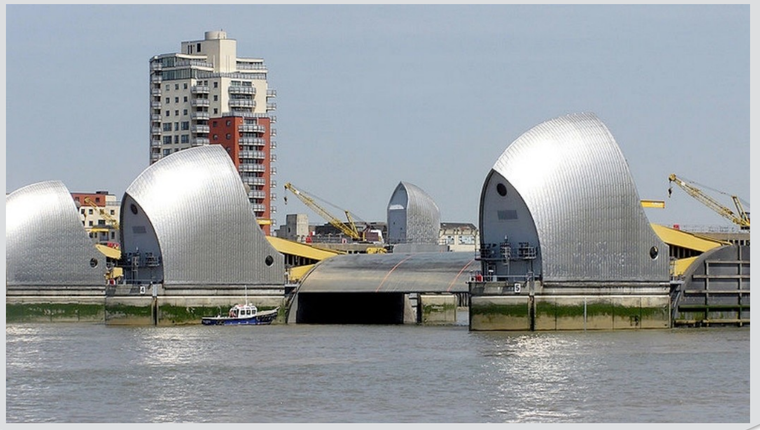
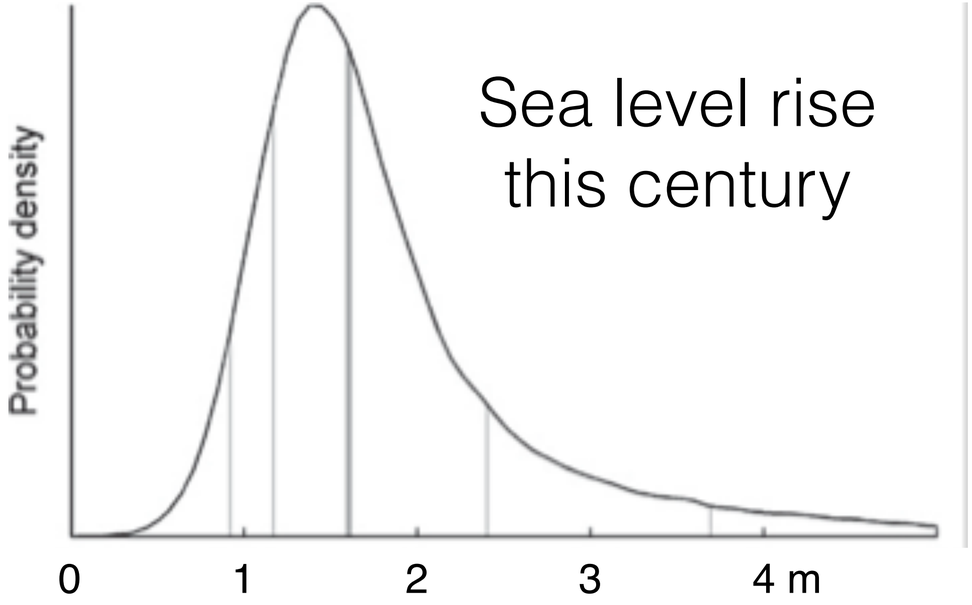
Eventually, protections will fail





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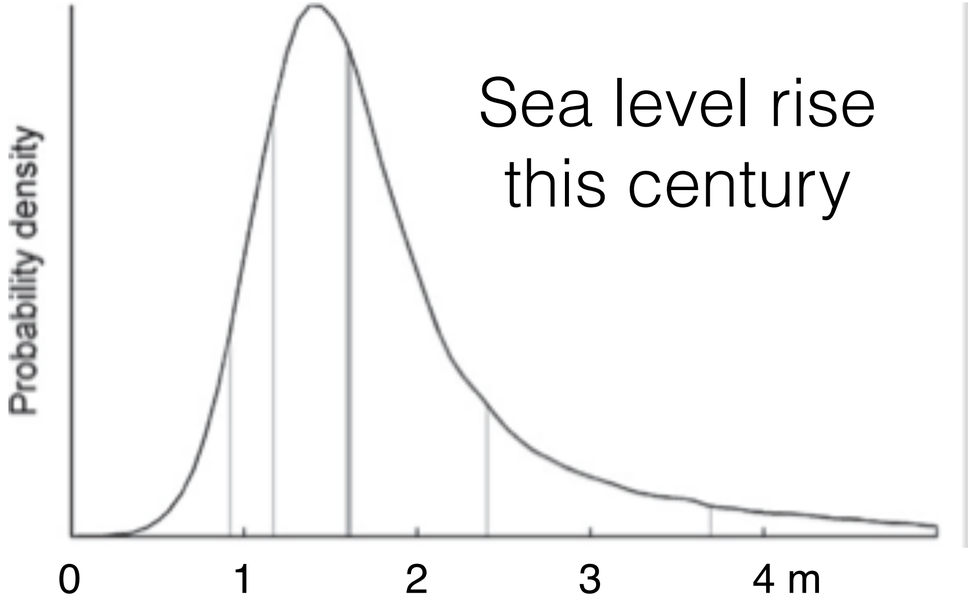
Slowly divest in exposed coastal areas



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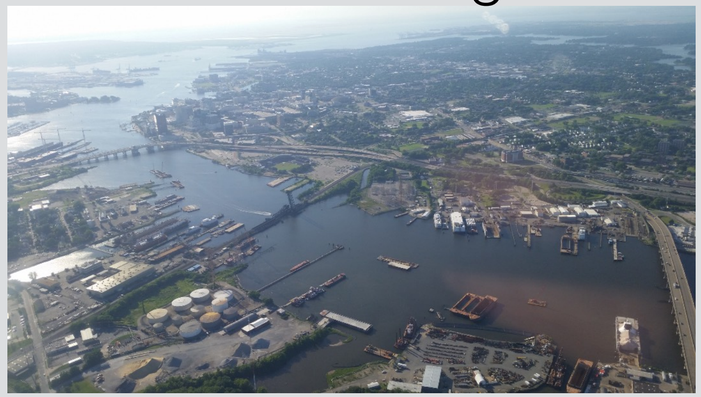
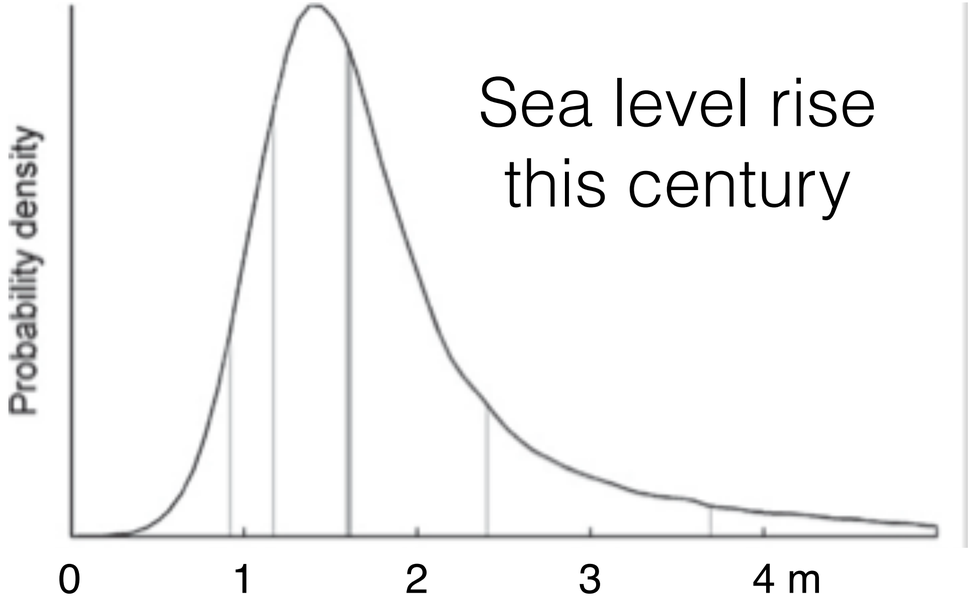
Build mobile infrastructure and buildings





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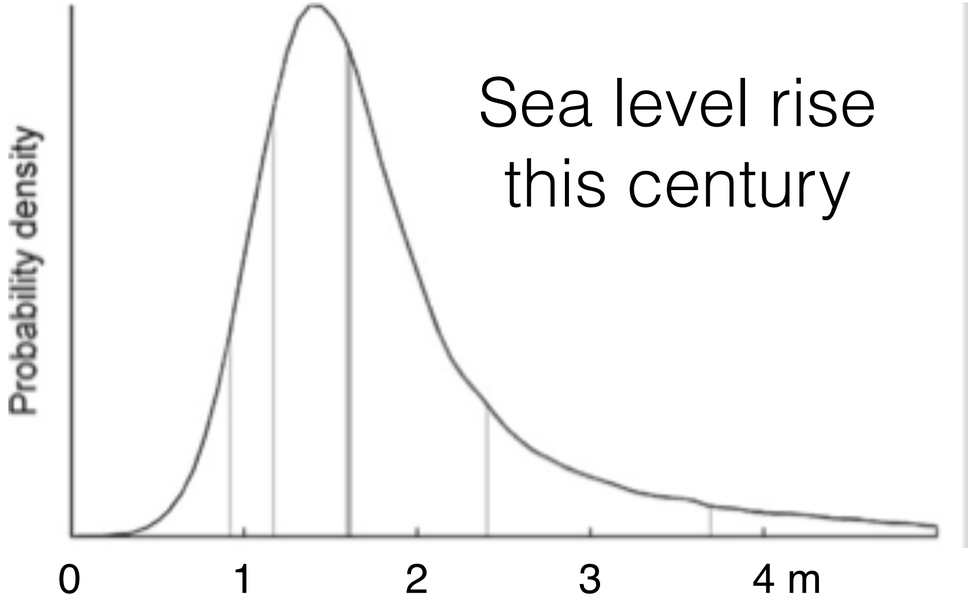

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Clean up the coastal zone

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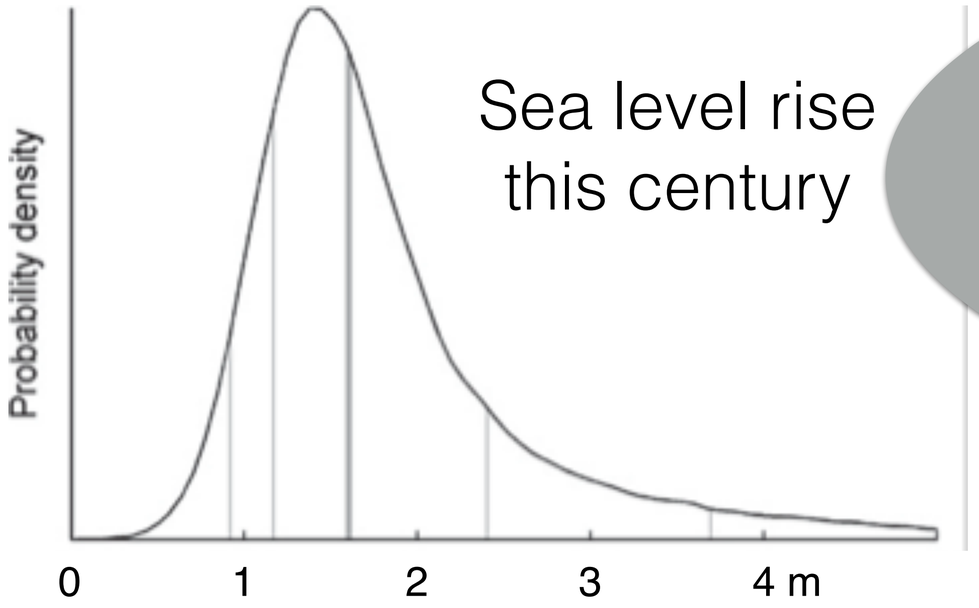

Sea level rise this century

Will a rising tide sink all homes?

Zillow

Nationwide, almost 1.9 million homes (or roughly 2 percent of all U.S. homes) worth a combined $882 billion are at risk of being underwater by 2100 if sea levels rise by six feet. Some states will be hit harder than others.

State	Number of Potentially Underwater Properties	Fraction of Total Housing Stock Underwater	Total Value of Potentially Underwater Properties
California	42,353	0.44%	$49.2B
Texas	46,804	0.61%	$12B
New York	96,708	2.10%	$71B
Florida	934,411	12.56%	$413B
Pennsylvania	2,661	0.06%	$730M
Georgia	24,379	0.75%	$10.2B
North Carolina			$20.6B
Maine			$3.1B
New Hampshire	4,064	0.71%	$1.7B
Rhode Island	4,853	1.47%	$2.9B
Delaware	11,670	3.09%	$3.6B

Source: National Oceanic and Atmospheric Administration (NOAA); Zillow data

Zillow study:

- 1.8 m by 2100
- 36 U.S. Coastal Cities lost;
- more than 50 cities lose at least 50% of residential real estate
- $1 Trillion in loss (2% of residential real estate value)

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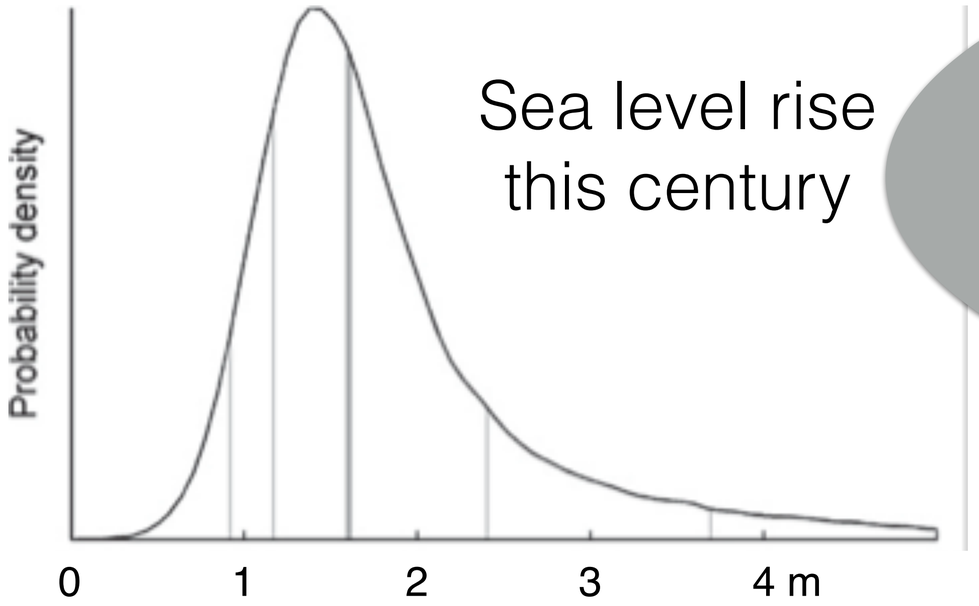

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Costs might be very high

Rising ocean waters from global warming could cost trillions of dollars

We'll need to mitigate and adapt to global warming to avoid massive costs from sea level rise

▲ Waterfront condo buildings are seen June 3, 2014 in Miami, Florida. Photograph: Joe Raedle/Getty Images

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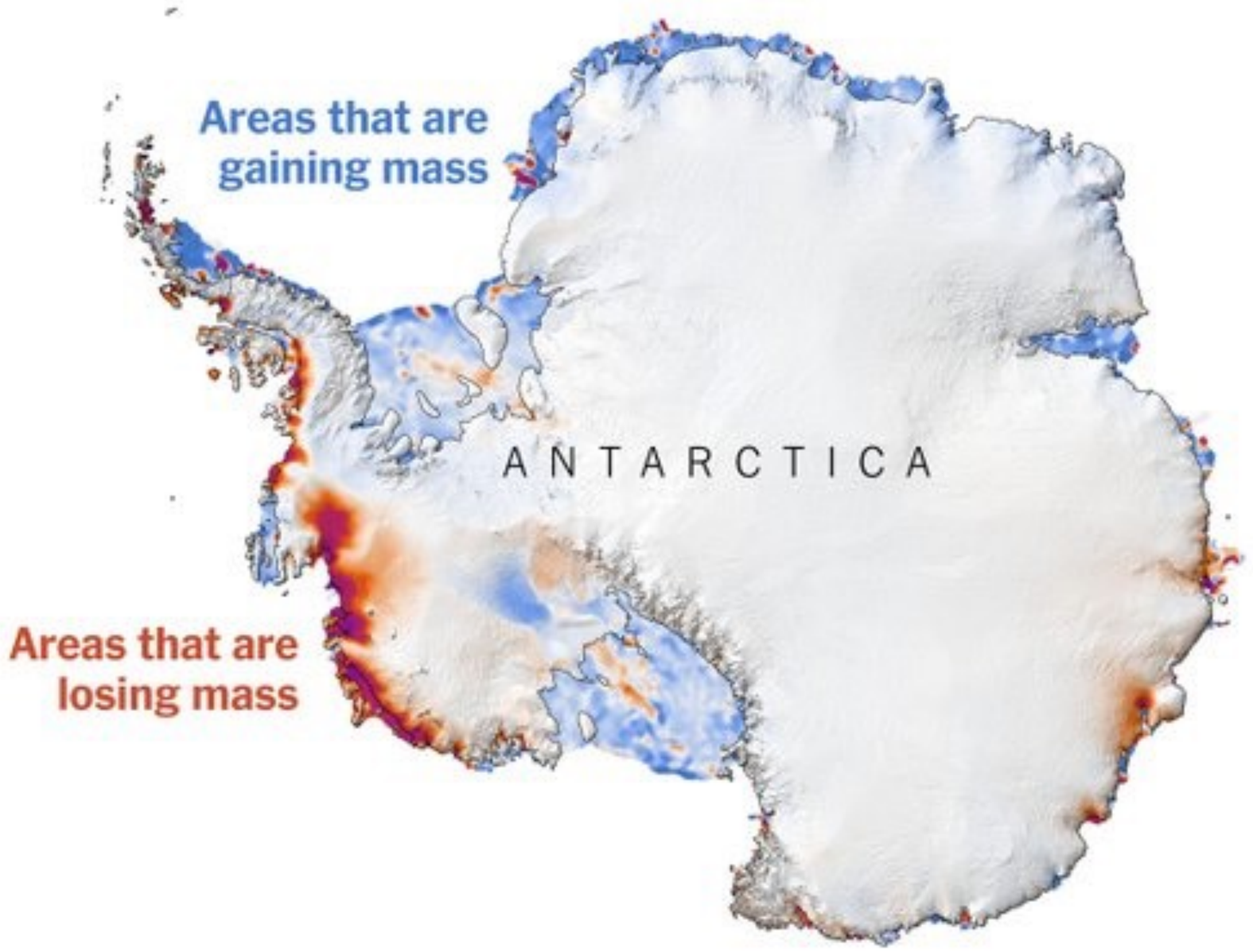

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PNAS
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RESEARCH ARTICLE

Future of the human climate niche

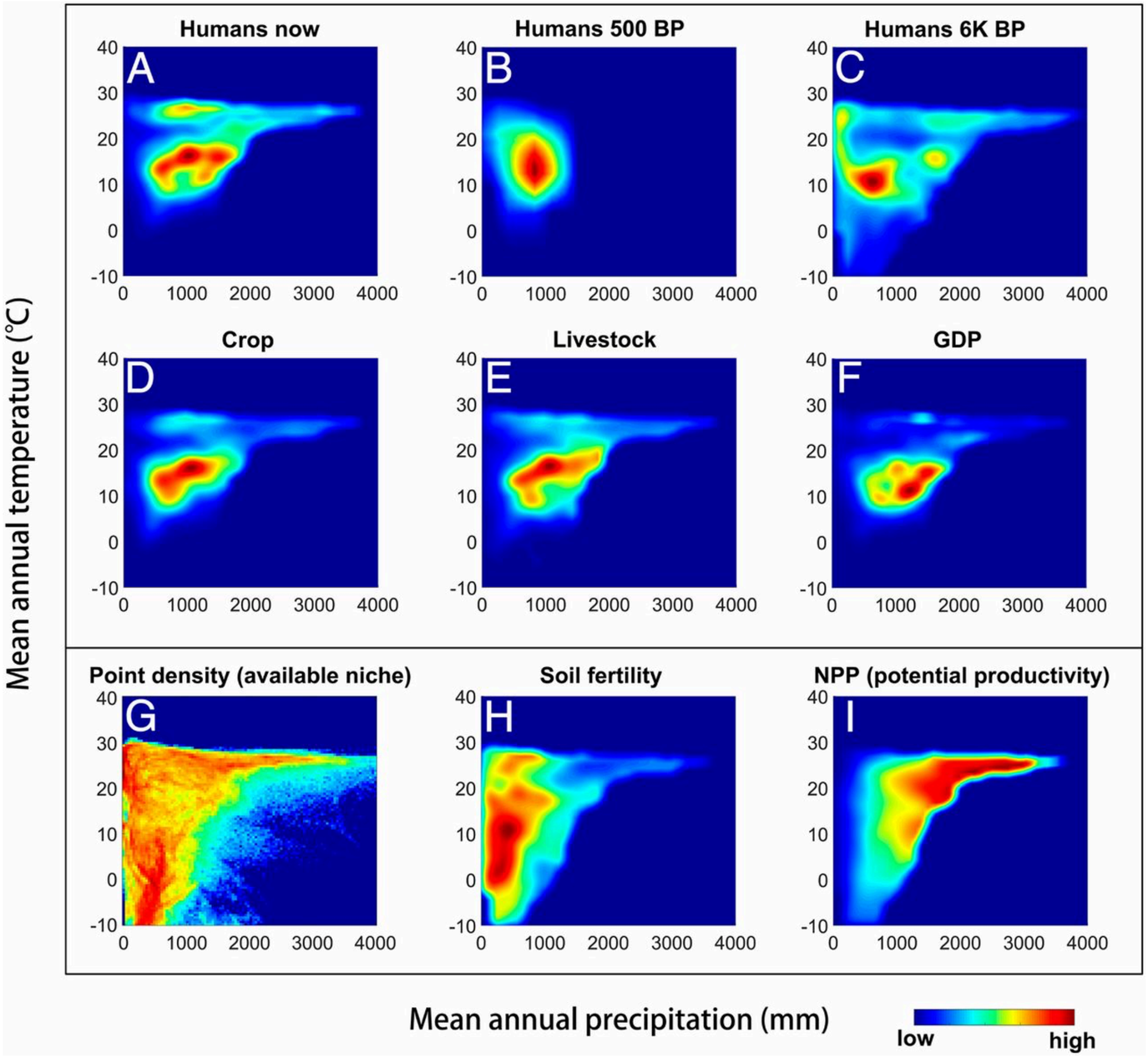
Chi Xu, Timothy A. Kohler, Timothy M. Lenton, Jens-Christian Svenning, and Marten Scheffer

PNAS first published May 4, 2020 https://doi.org/10.1073/pnas.1910114117

Contributed by Marten Scheffer, October 27, 2019 (sent for review June 12, 2019; reviewed by Victor Galaz and Luke Kemp)

Significance

We show that for thousands of years, humans have concentrated in a surprisingly narrow subset of Earth’s available climates, characterized by mean annual temperatures around ~13 °C. This distribution likely reflects a human temperature niche related to fundamental constraints. We demonstrate that depending on scenarios of population growth and warming, over the coming 50 y, 1 to 3 billion people are projected to be left outside the climate conditions that have served humanity well over the past 6,000 y. Absent climate mitigation or migration, a substantial part of humanity will be exposed to mean annual temperatures warmer than nearly anywhere today.



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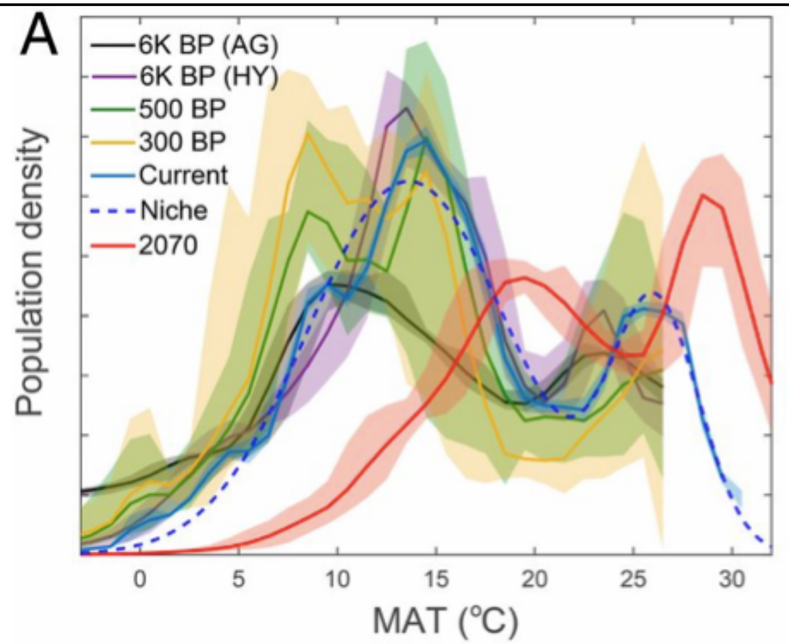

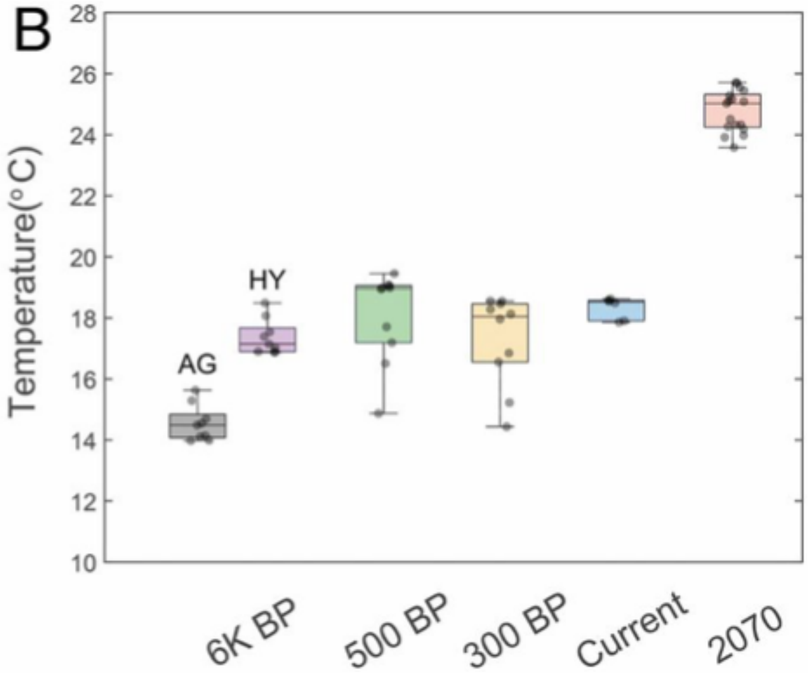

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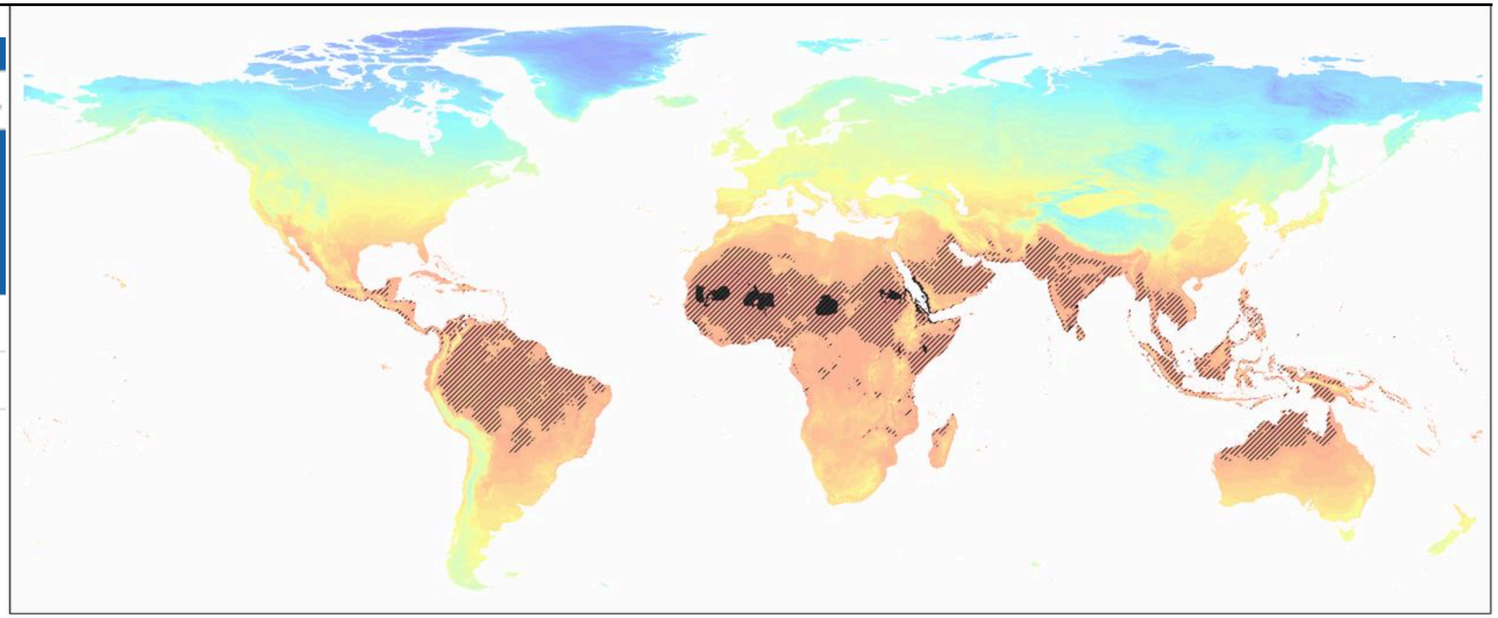

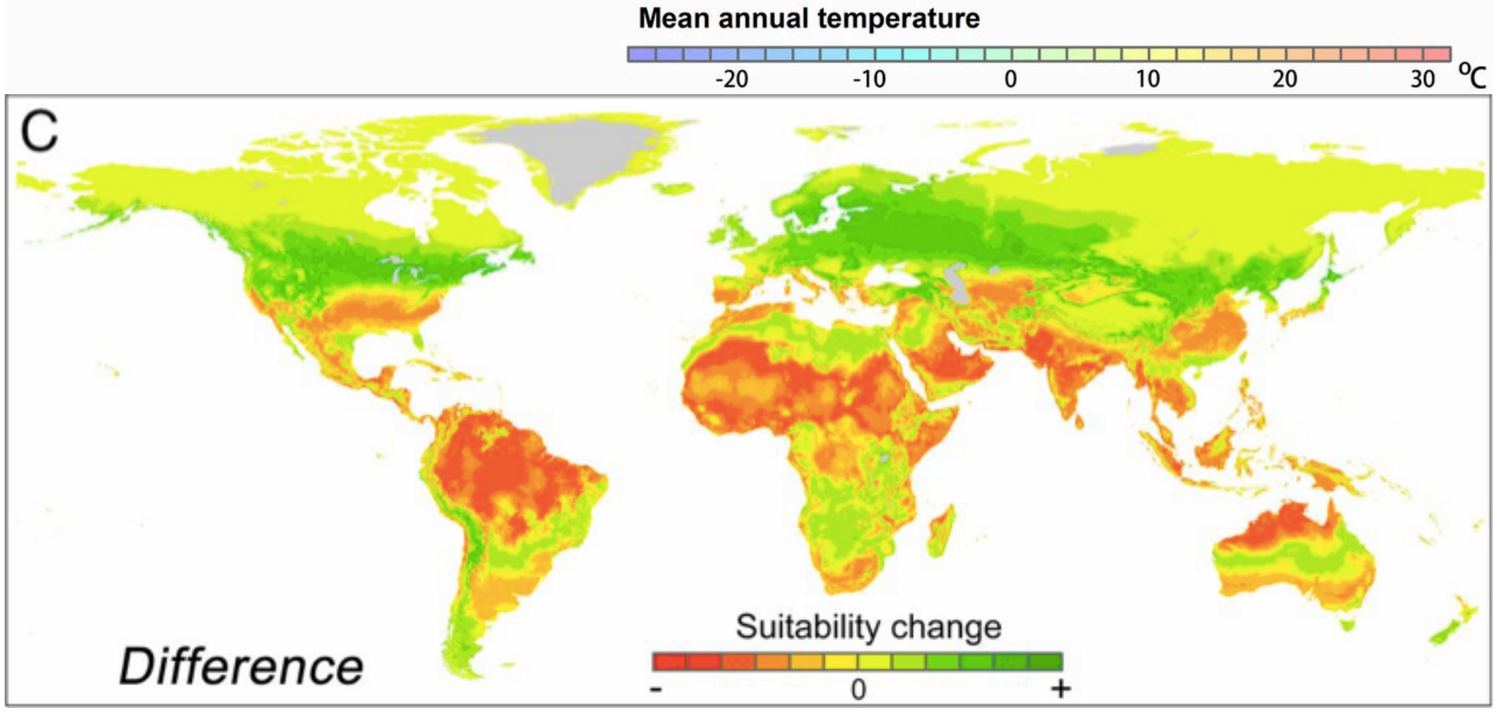

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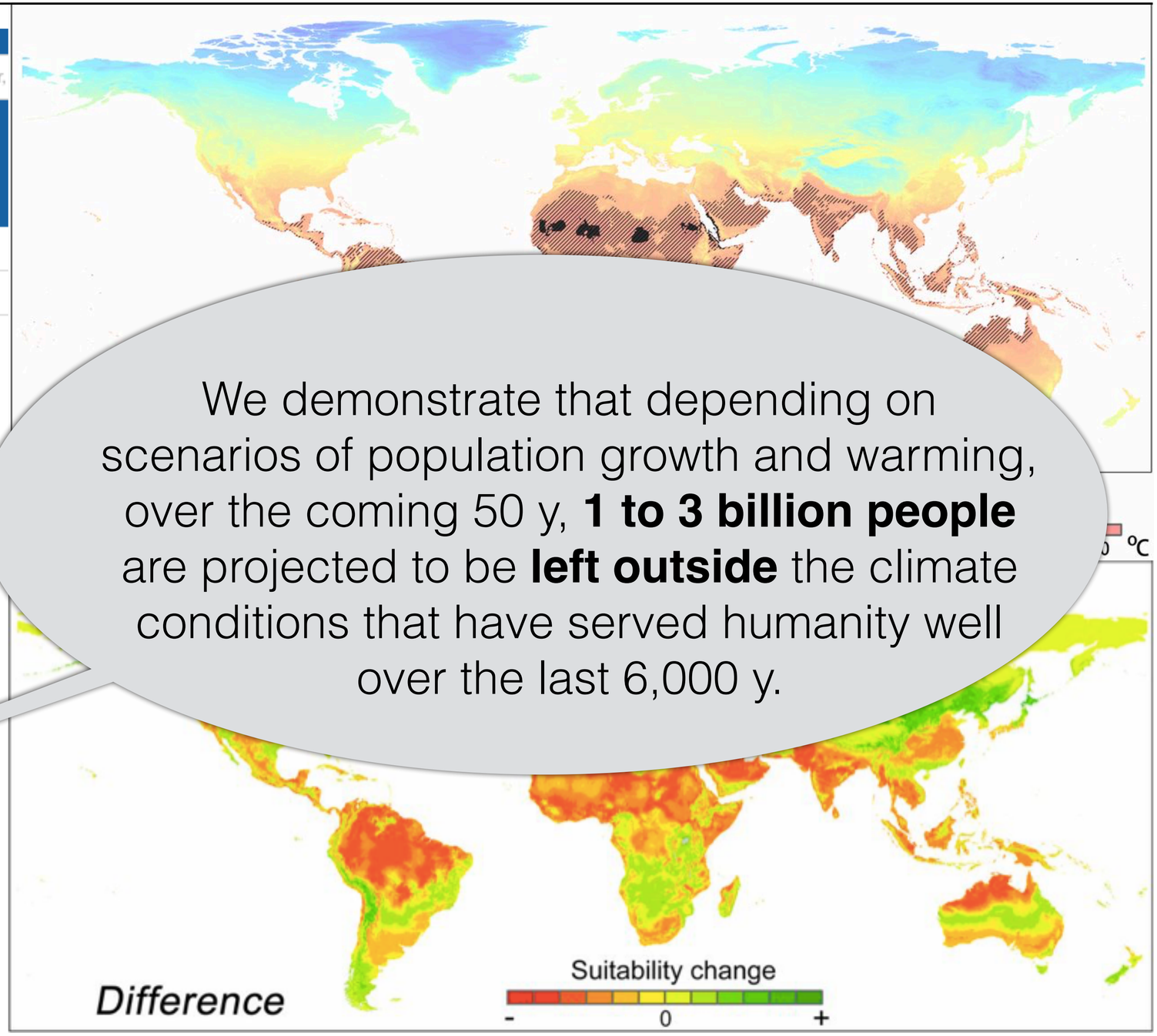

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Environment

Potentially fatal bouts of heat and humidity on the rise, study finds

Scientists identify thousands of extreme events, suggesting stark warnings about global heating are already coming to pass

Nina Lakhani

Fri 8 May 2020 14.00 EDT

▲ The number of potentially fatal humidity and heat events doubled between 1979 and 2017, and are increasing in both frequency and intensity. Photograph: Dave Hunt/AAP

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RESEARCH ARTICLE | CLIMATOLOGY

The emergence of heat and humidity too severe for human tolerance

Colin Raymond[1,2,*], Tom Matthews[3] and Radley M. Horton[2,4]
+ See all authors and affiliations

Science Advances 08 May 2020:
Vol. 6, no. 19, eaaw1838
DOI: 10.1126/sciadv.aaw1838

Abstract

Humans’ ability to efficiently shed heat has enabled us to range over every continent, but a wet-bulb temperature (TW) of 35°C marks our upper physiological limit, and much lower values have serious health and productivity impacts. Climate models project the first 35°C TW occurrences by the mid-21st century. However, a comprehensive evaluation of weather station data shows that some coastal subtropical locations have already reported a TW of 35°C and that extreme humid heat overall has more than doubled in frequency since 1979. Recent exceedances of 35°C in global maximum sea surface temperature provide further support for the validity of these dangerously high TW values. We find the most extreme humid heat is highly localized in both space and time and is correspondingly substantially underestimated in reanalysis products. Our findings thus underscore the serious challenge posed by humid heat that is more intense than previously reported and increasingly severe.

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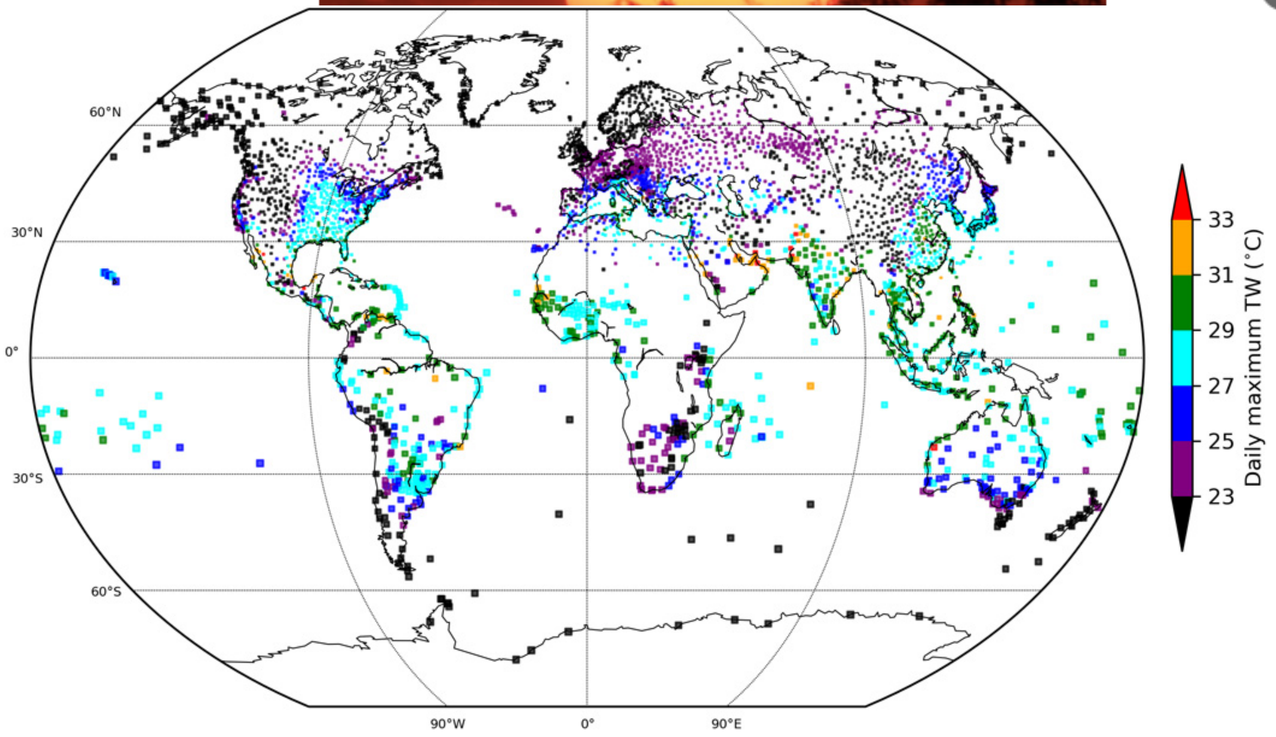

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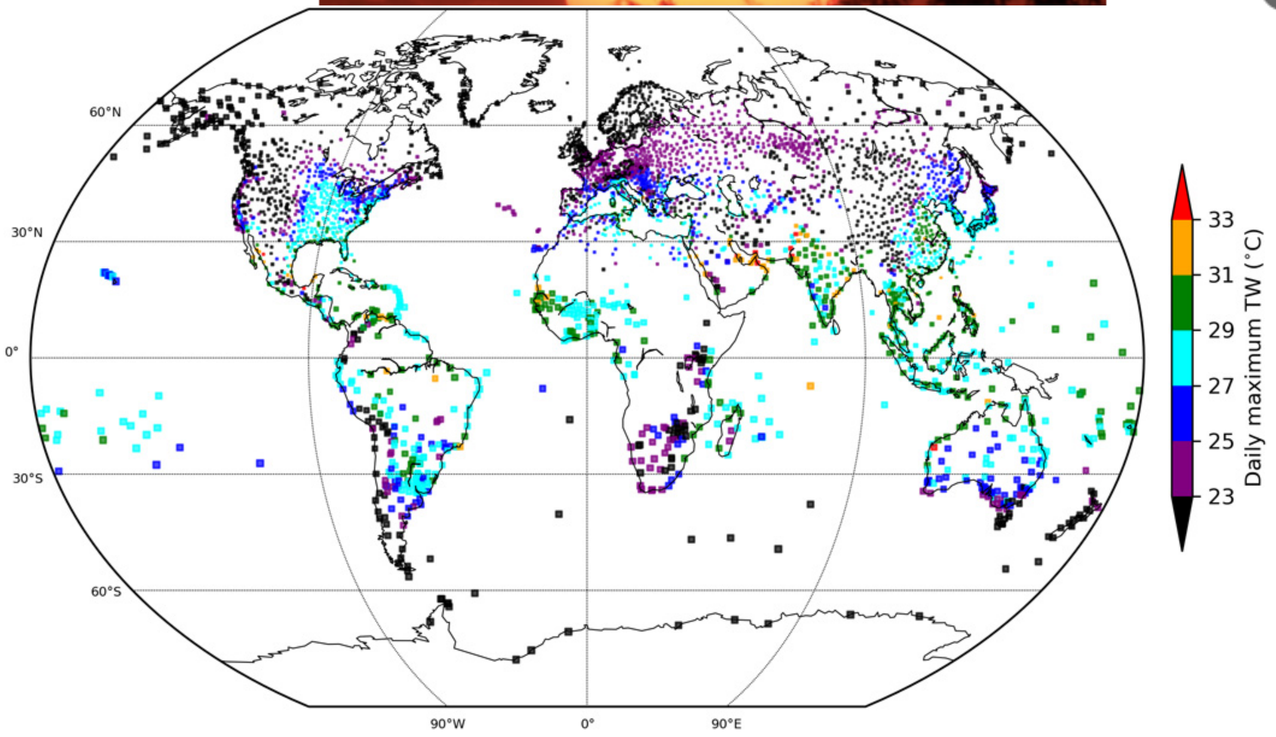

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Article

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"It only rained three times, and the crops all died. Normally, it rains so much you lose count, but this year it didn't rain at all," says Pascuala Súchite, of the village of El Potrerito in the municipality of Jocotán, Chiquimula.

PHOTOGRAPH BY GENA STEFFENS

ENVIRONMENT

Changing climate forces desperate Guatemalans to migrate

Drought and shifting weather are making it difficult for many small-scale farmers to feed their families, fueling a human crisis.

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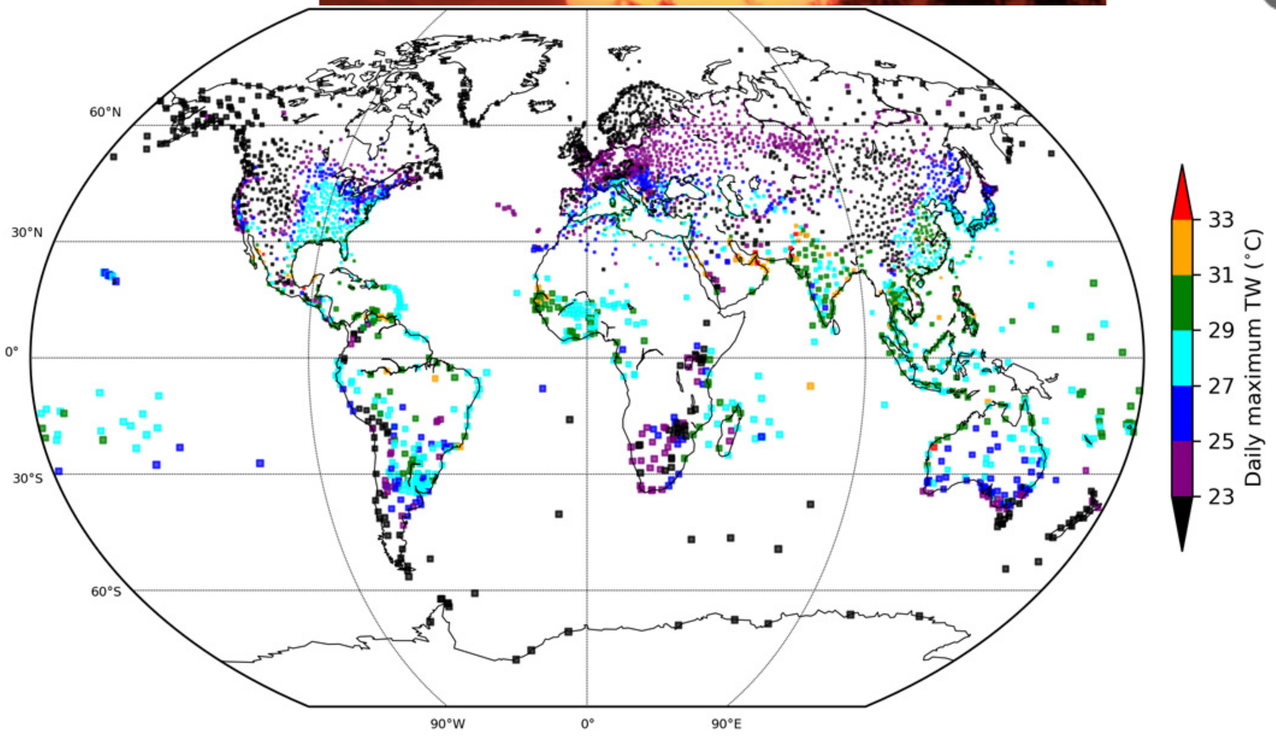

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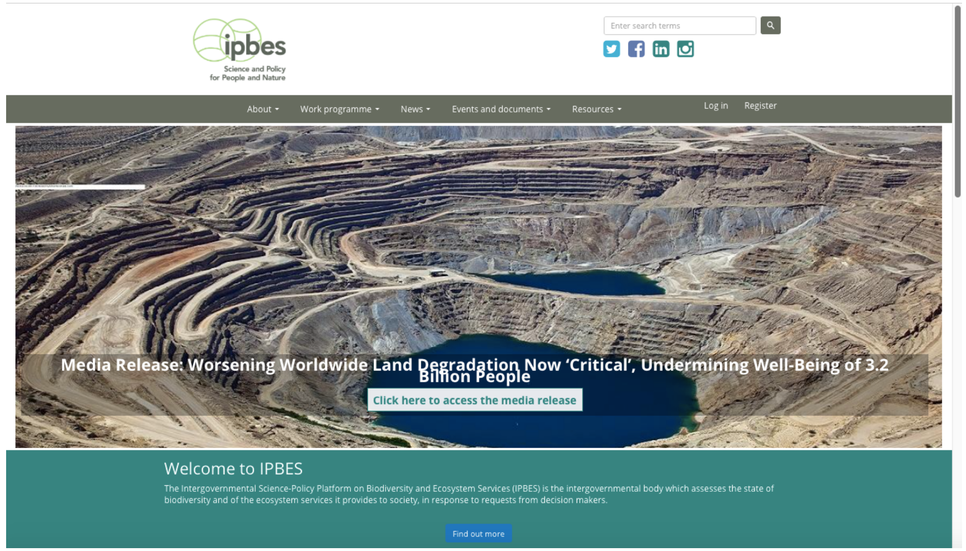
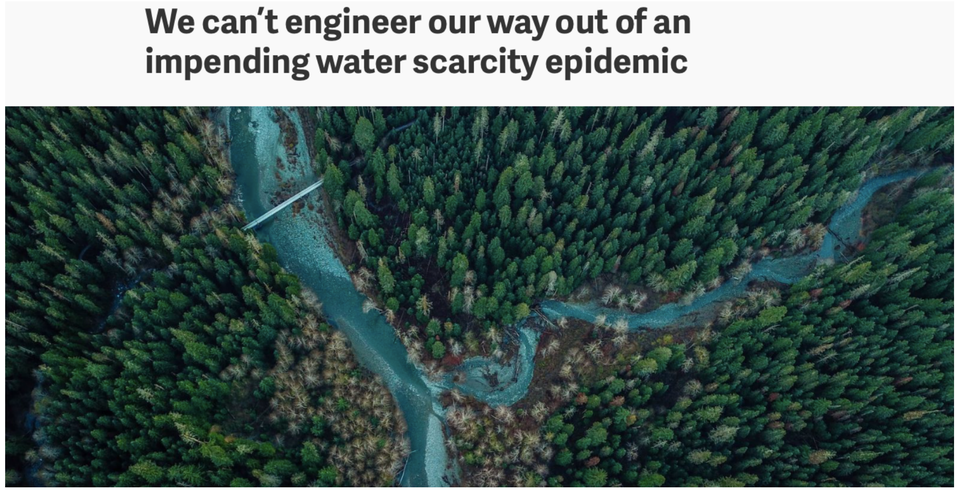
Assessing the risk …





Homo sapiens have a huge amount of data and knowledge

ipcc
INTERGOVERNMENTAL PANEL ON climate change

GLOBAL WARMING OF 1.5 °C

an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

Summary for Policymakers

This Summary for Policymakers was formally approved at the First Joint Session of Working Groups I, II and III of the IPCC and accepted by the 48th Session of the IPCC, Incheon, Republic of Korea, 6 October 2018.

Mammal diversity will take millions of years to recover from the current biodiversity crisis

Matt Davis, Søren Faurby, and Jens-Christian Svenning

PNAS published ahead of print October 15, 2018 https://doi.org/10.1073/pnas.1804906115

Climate-driven declines in arthropod abundance restructure a rainforest food web

Bradford C. Lister and Andres Garcia

PNAS published ahead of print October 15, 2018 https://doi.org/10.1073/pnas.1722477115

Prognosis: Leaving the “Safe Operating Space” and into the Unknown

Assessing the risk …

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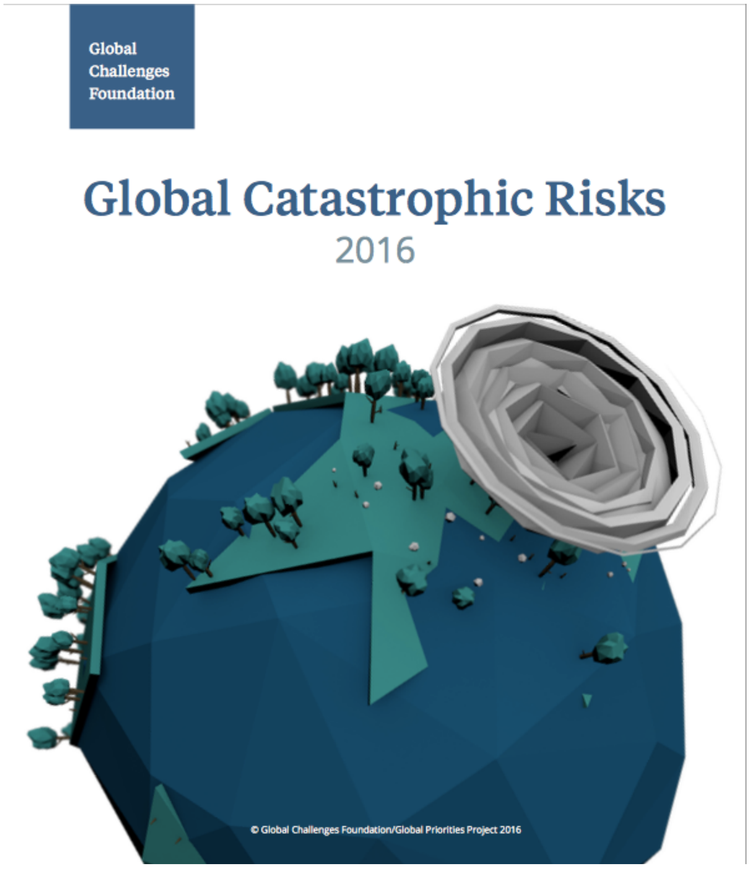

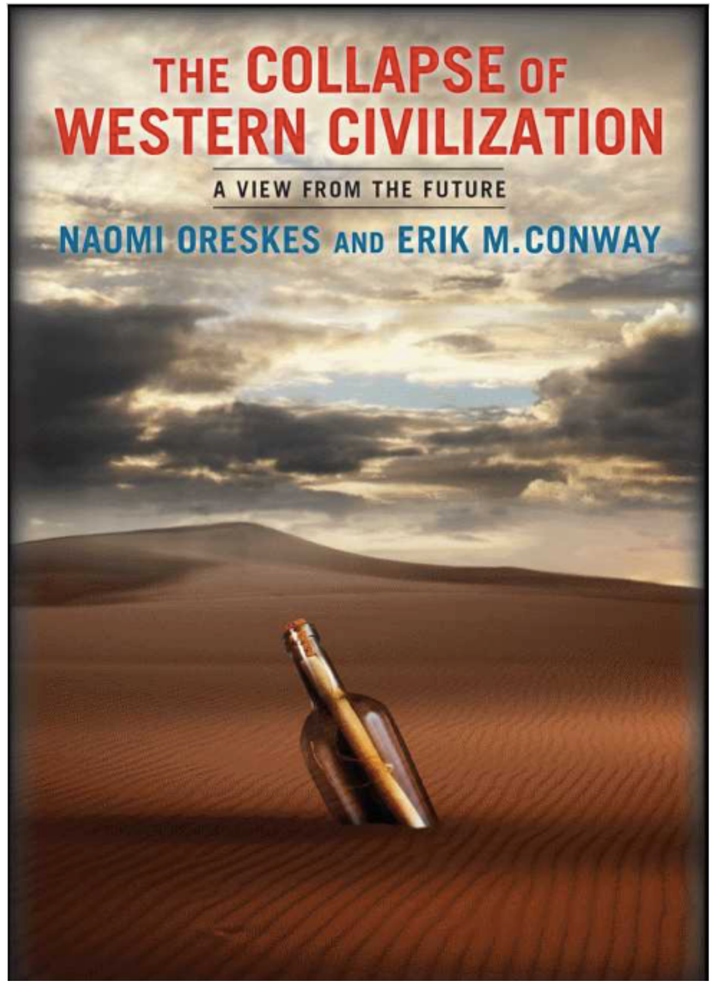

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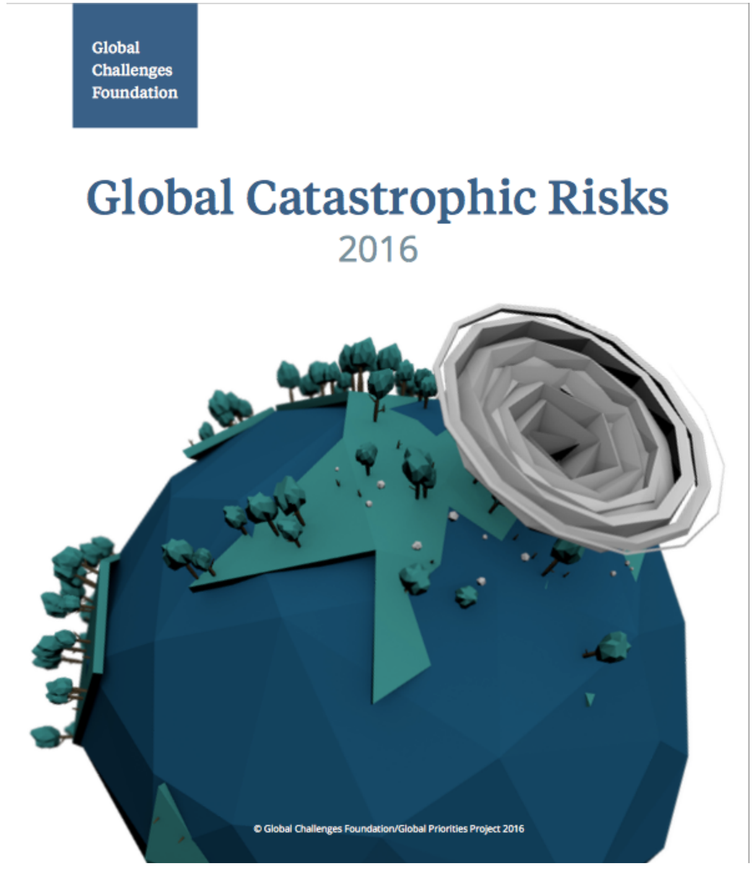
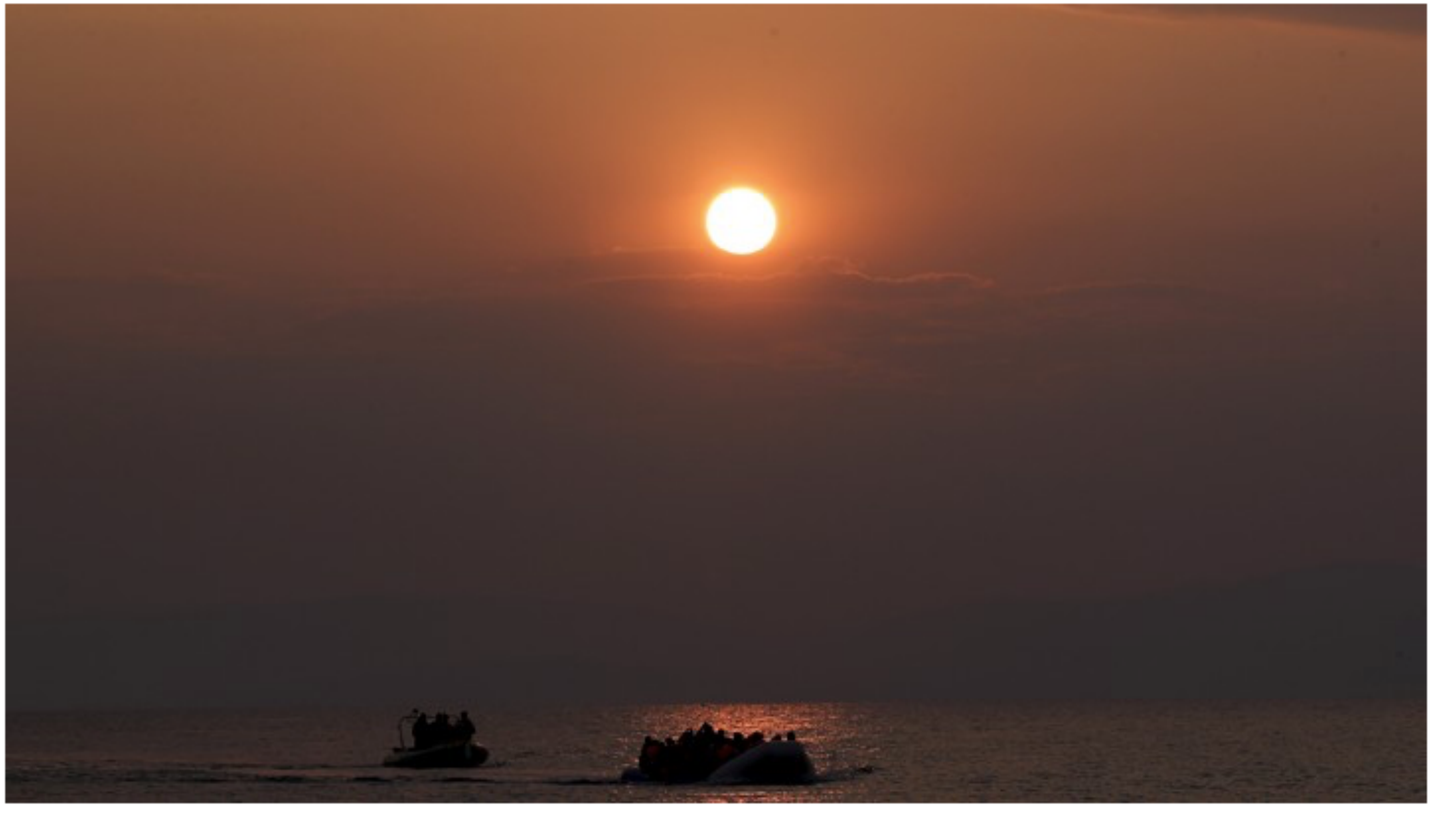


TECHNOLOGY

Human Extinction Isn't That Unlikely

“A typical person is more than five times as likely to die in an extinction event as in a car crash,” says a new report.

ROBINSON MEYER APR 29, 2016



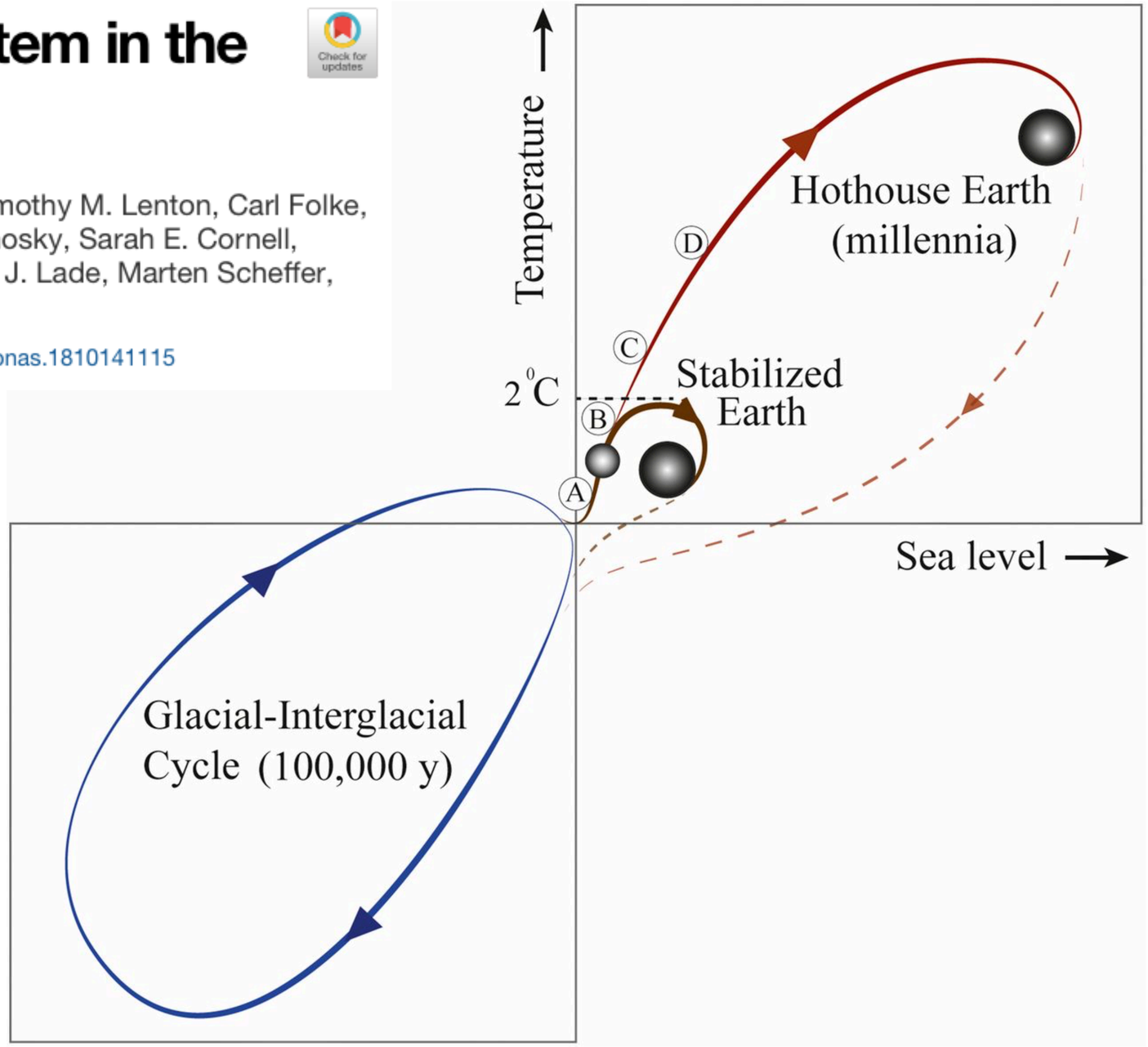
The sun rises as a dinghy carrying refugees and migrants approaches the shores of the Greek island of Lesbos. (ALKIS KONSTANTINIDIS / REUTERS)

Prognosis: Leaving the “Safe Operating Space” and into the Unknown

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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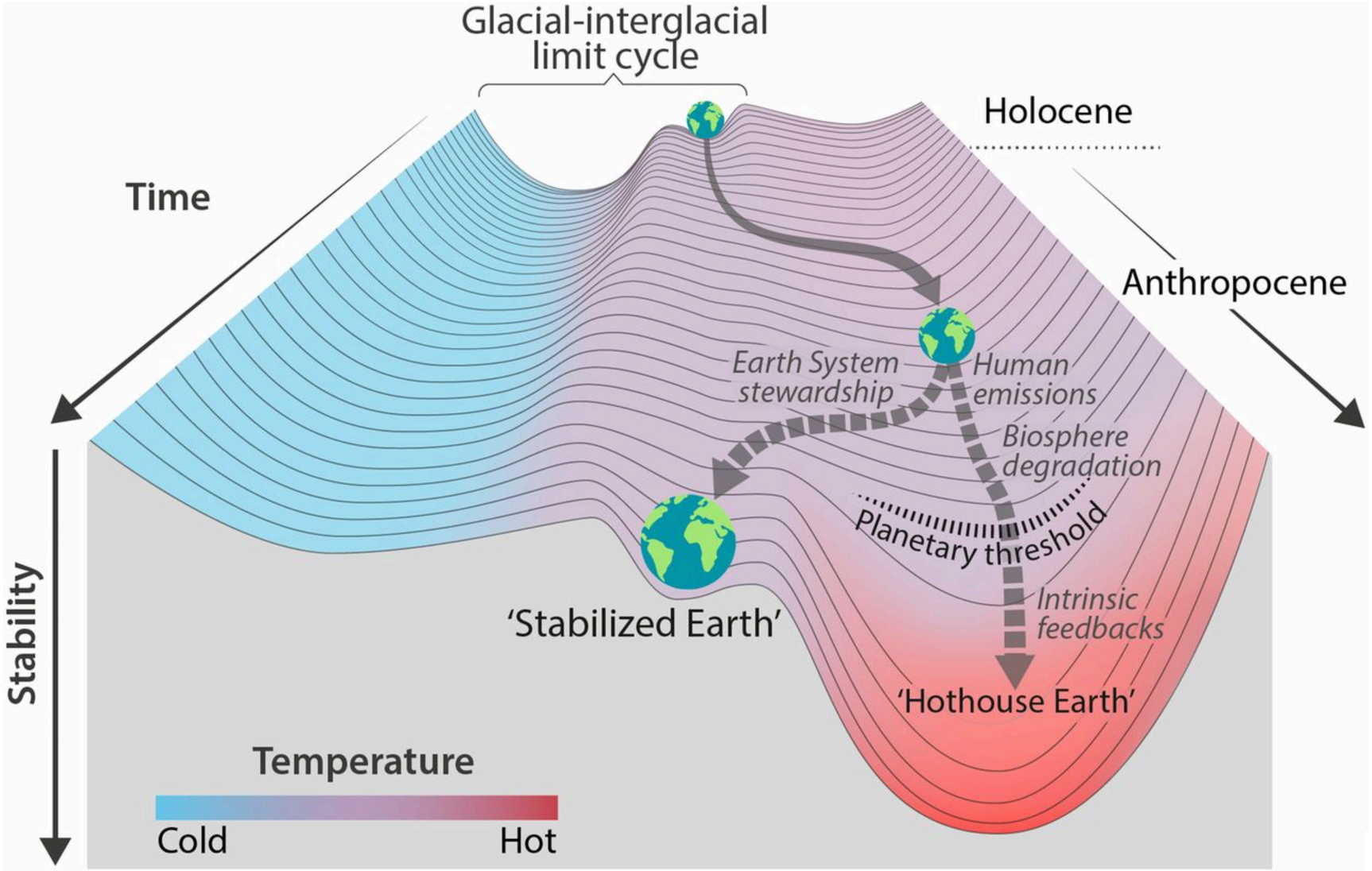

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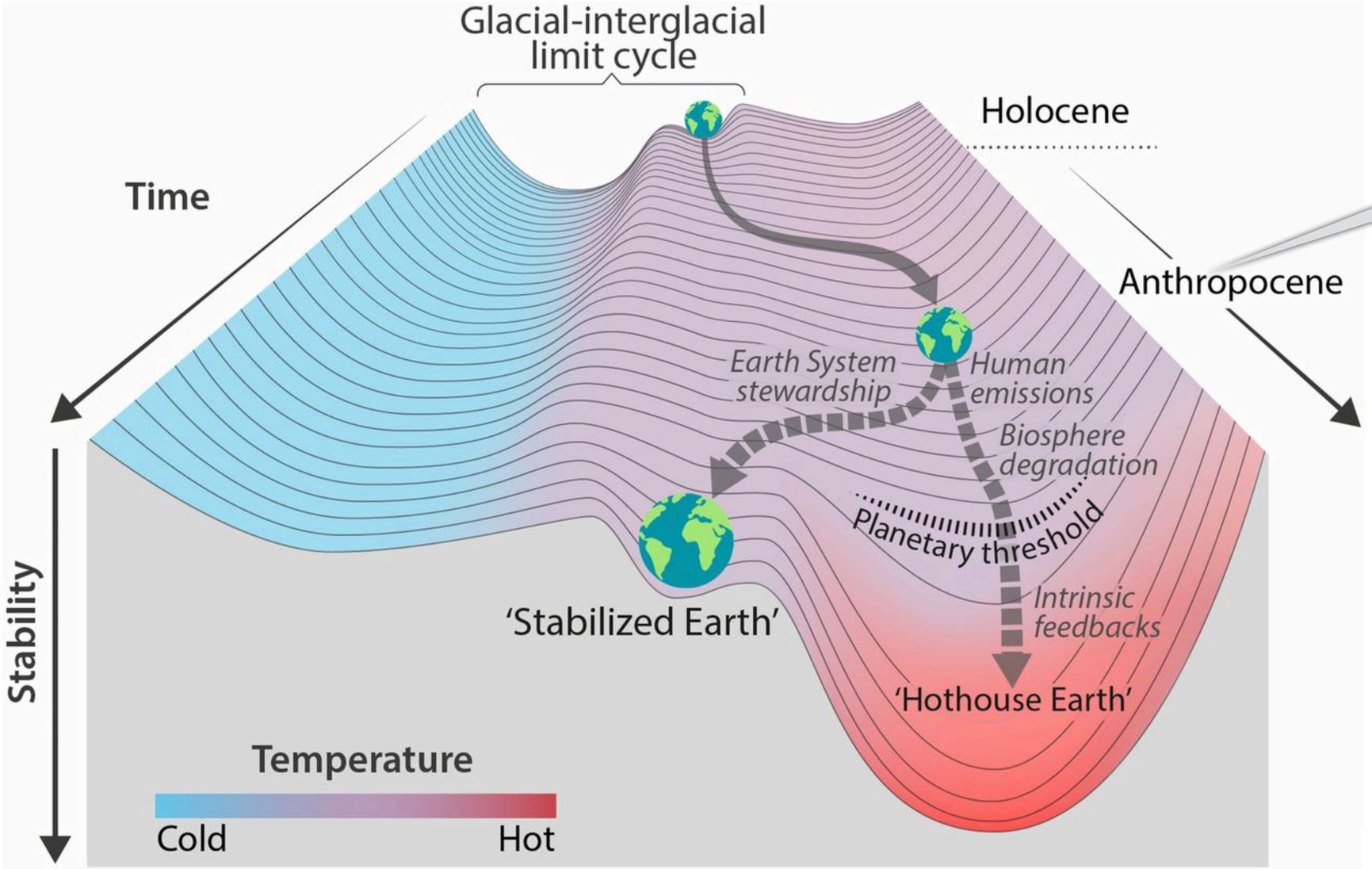

Anthropocene or Post-Holocene?

Trajectories of the Earth System in the Anthropocene

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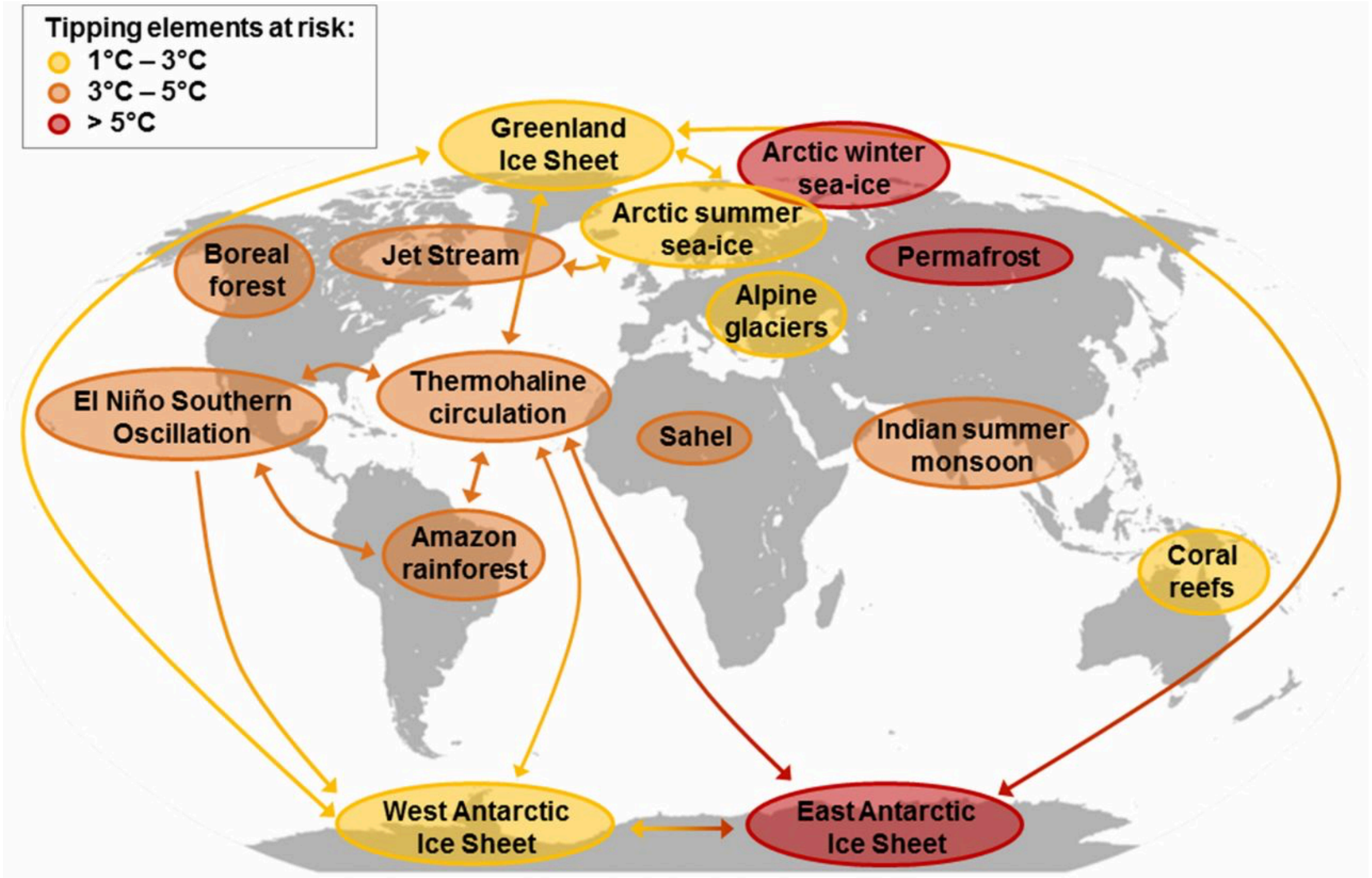

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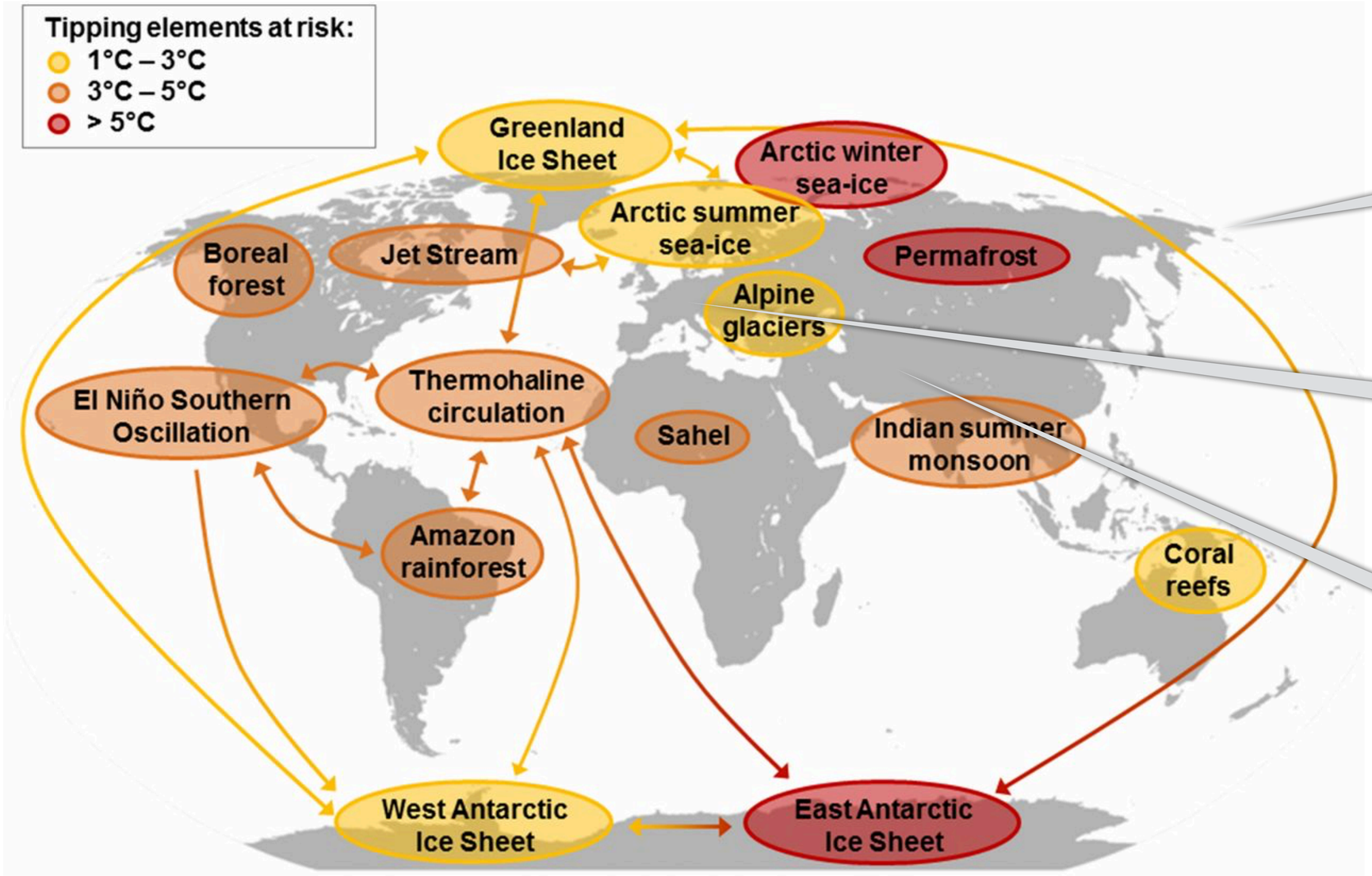

Extinction of mammals and birds

Extinction of insects

Loss of soil

Trajectories of the Earth System in the Anthropocene

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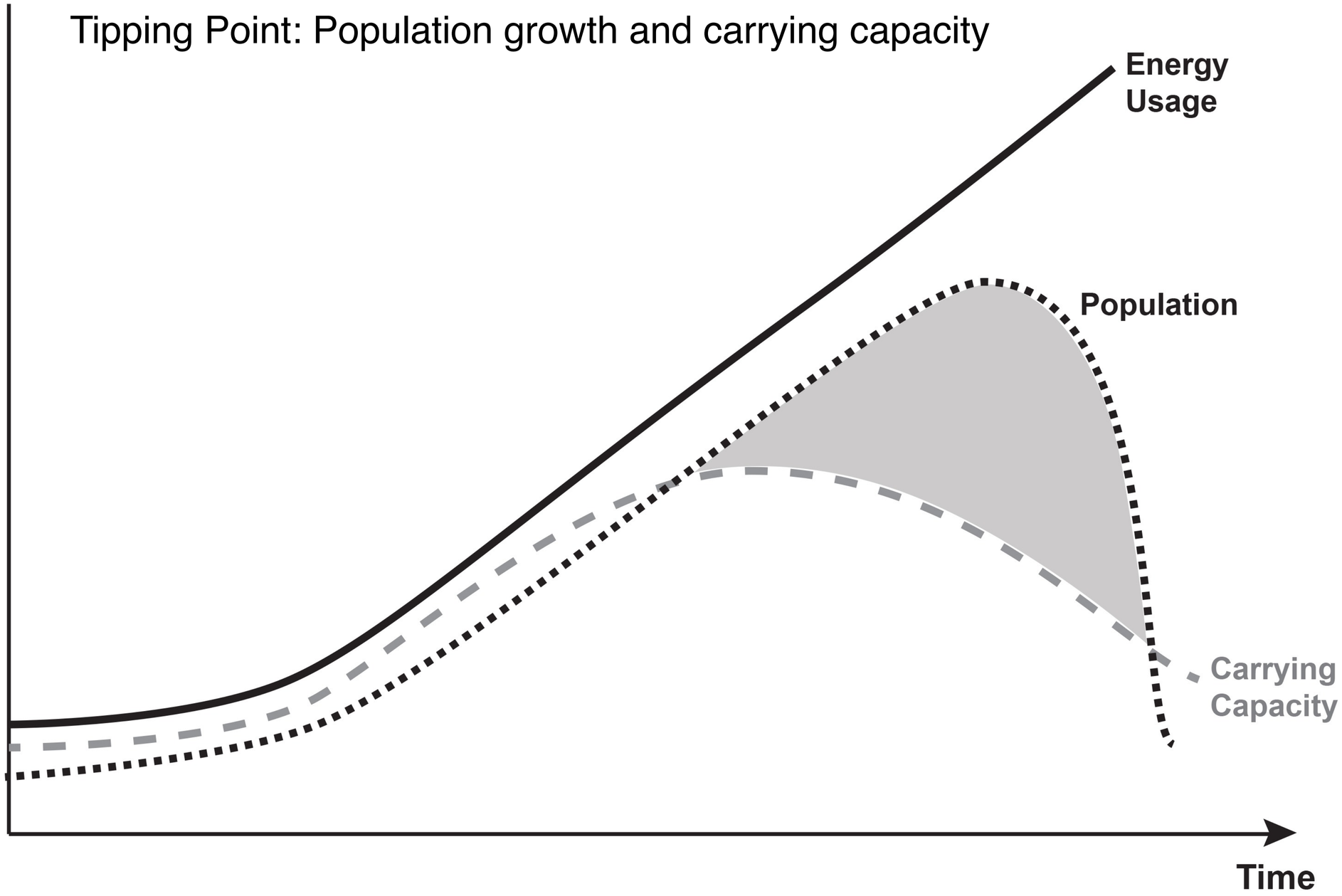

Plag, 2019

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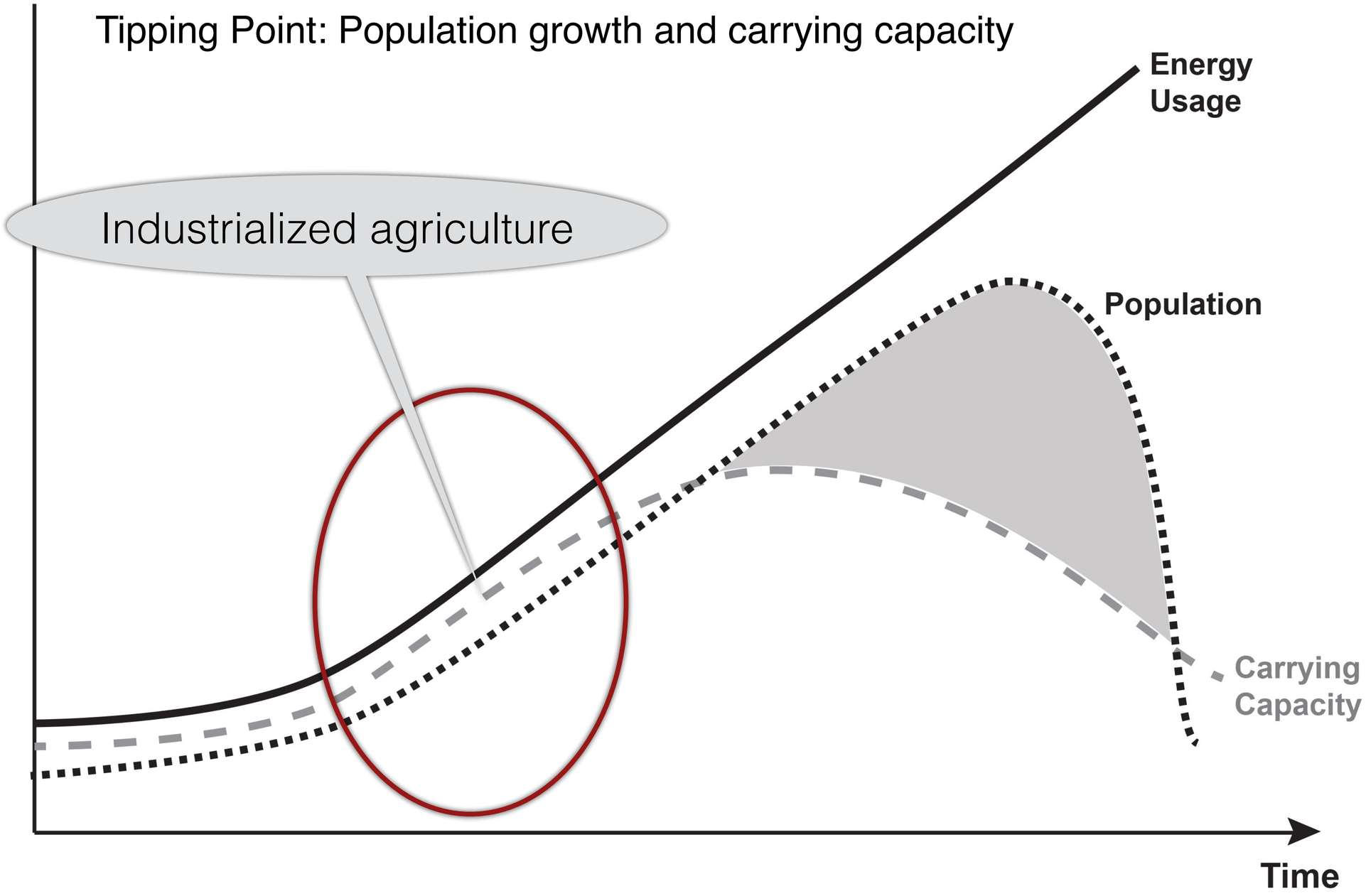

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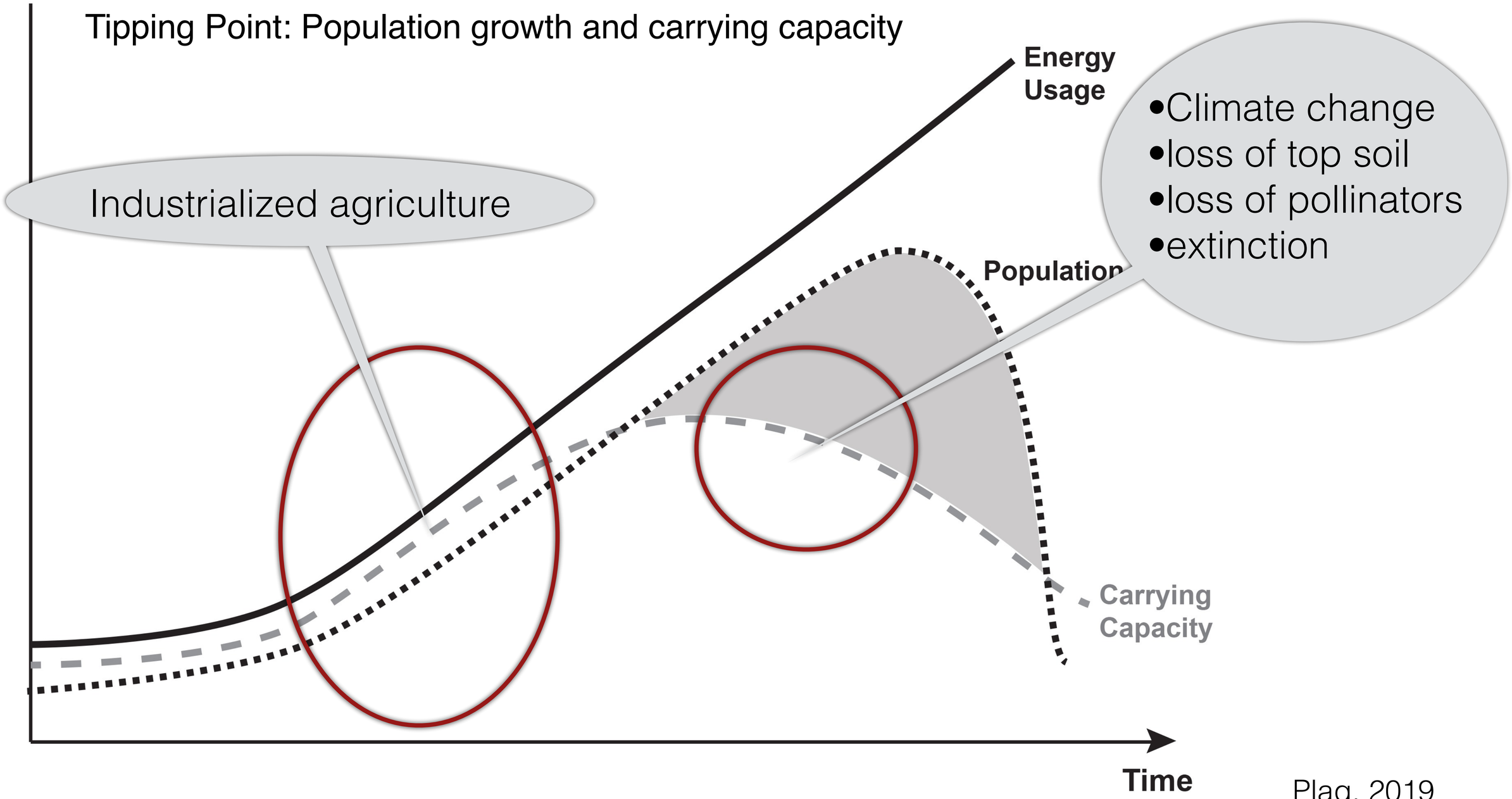

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Prognosis: Leaving the “Safe Operating Space” and into the Unknown

Global development

West Africa facing food crisis as coronavirus spreads

Pandemic adds to jihadi and climate change threats to present ‘immense challenge’ for region

- Coronavirus - latest updates
- See all our coronavirus coverage

Emmanuel Akinwotu *West Africa correspondent*

Fri 15 May 2020 12.20 EDT

▲ Hausa-Fulani pastoralists in the outskirts of Sokoto. In Nigeria climate change has hit agricultural yields while insecurity has made some areas harder to farm. Photograph: Luis Tato/AFP via Getty Images

More than 43 million people in west Africa are likely to be in urgent need of food assistance in the coming months - double the initial estimates - as the Covid-19 outbreak accelerates, the World Food Programme has said.

Prognosis: Leaving the “Safe Operating Space” and into the Unknown

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Mix of
- Pandemic,
- Unrest
- Climate change:

40 million people need food assistance

Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable.

The Holocene was a “safe operating space for humanity” allowing the emergence of a dominant species

Syndrome

During the last few hundred years, humanity has made large and rapid planetary changes, accelerated existing and introduced new flows in the planetary physiology.

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene.

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.

The new mainstream economic model and a changed global order has turned humans into the “Anthropogenic Cataclysmic Virus” (ACV) in the Earth’s life-support system.

Prognosis

The planet is heading rapidly towards tipping points and a very different system state (Post-Holocene, Anthropocene, Pyrocene, …).

Our knowledge about trends, tipping points and risks is changing rapidly; the risk is very high; foresight is needed.

The planetary life-support system is rapidly degrading and overheating; ;
They are heading for a mono-species system

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A few humans keep accumulating “wealth” while destroying the life-support system of all

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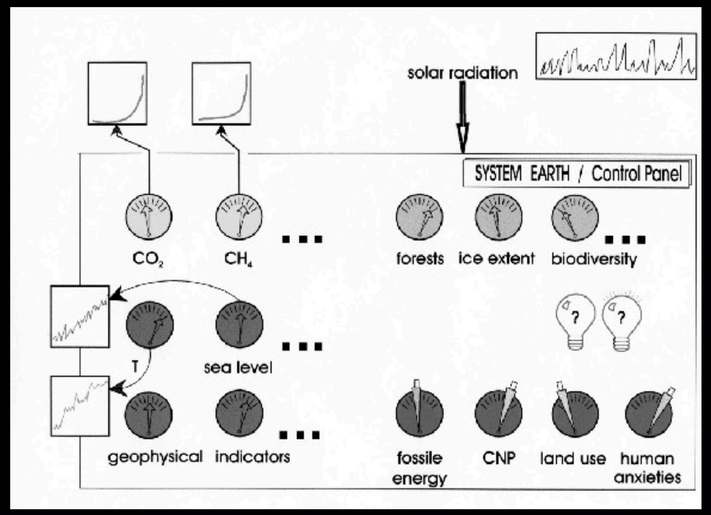
But they don’t have the control panel, the cockpit to control and operate the system



Plag, 2000

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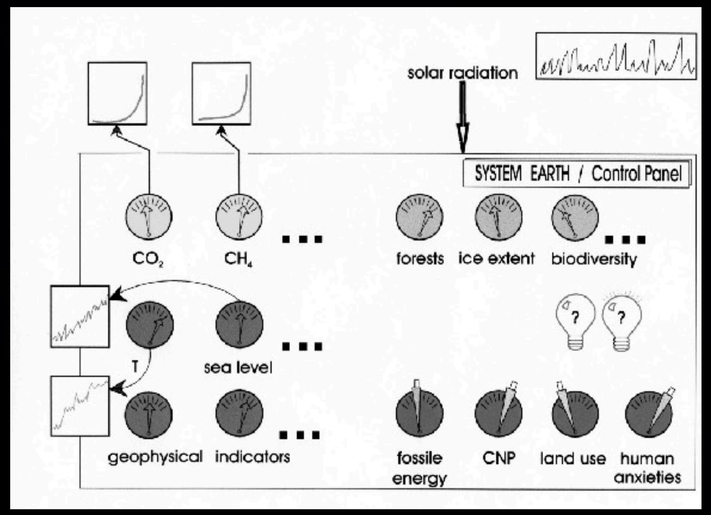

Plag, 2000

Importantly,

- they discount the future;
- they don’t have a design plan;
- there is no planetary governance to take the system to a future desirable for Homo sapiens

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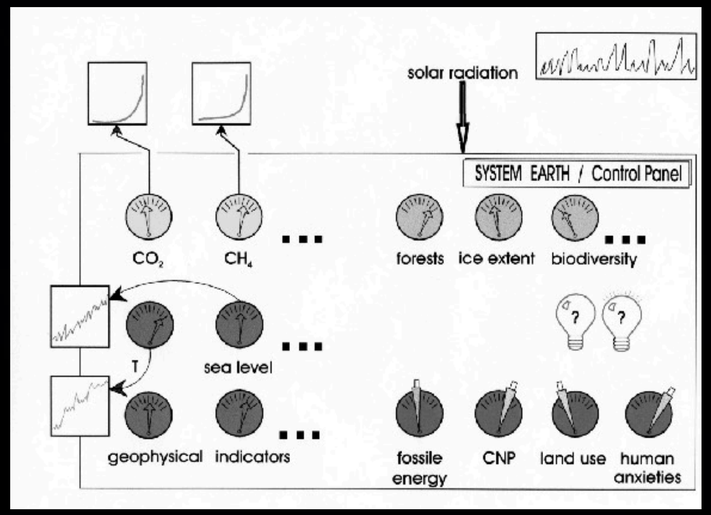


Plag, 2000

Before we leave, a recommendation for humanity …

Importantly,

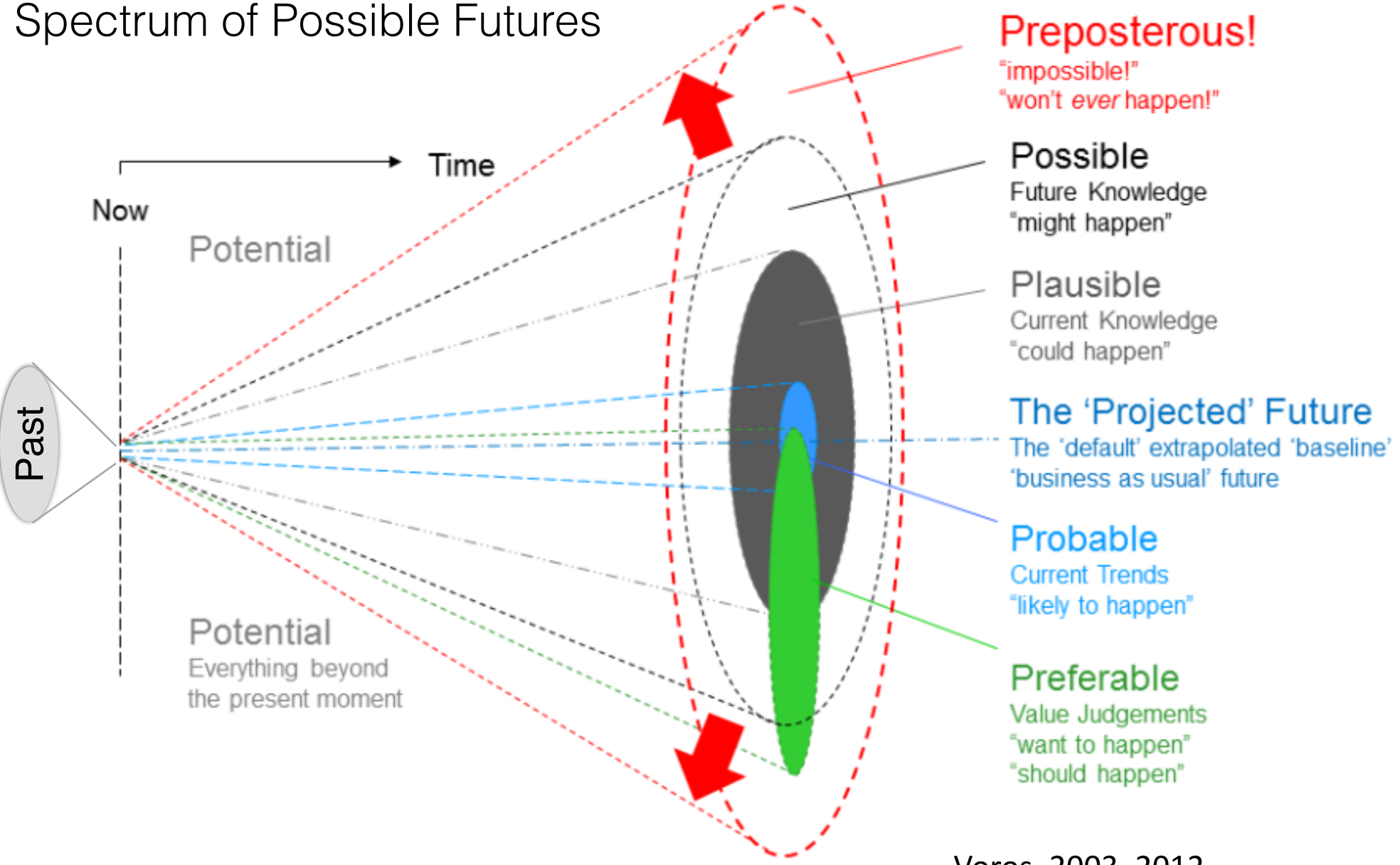
- they discount the future;
- they don’t have a design plan;
- there is no planetary governance to take the system to a future desirable for Homo sapiens

Modern Climate Change:
A Symptom of a Human-Caused High-Energy Pulse

Contents

- The Baseline: Past Climate Changes
- The Syndrome: Modern Climate and Global Change
- The Diagnosis: A new Economy and Global Order
- The Prognosis: Leaving the “Safe Operating Space” and into the Unknown
- The Therapy: A new Ethics, Economy, and Global Governance

Spectrum of Possible Futures



Preposterous!
"impossible!"
"won't *ever* happen!"

Possible
Future Knowledge
"might happen"

Plausible
Current Knowledge
"could happen"

The 'Projected' Future
The 'default' extrapolated 'baseline'
'business as usual' future

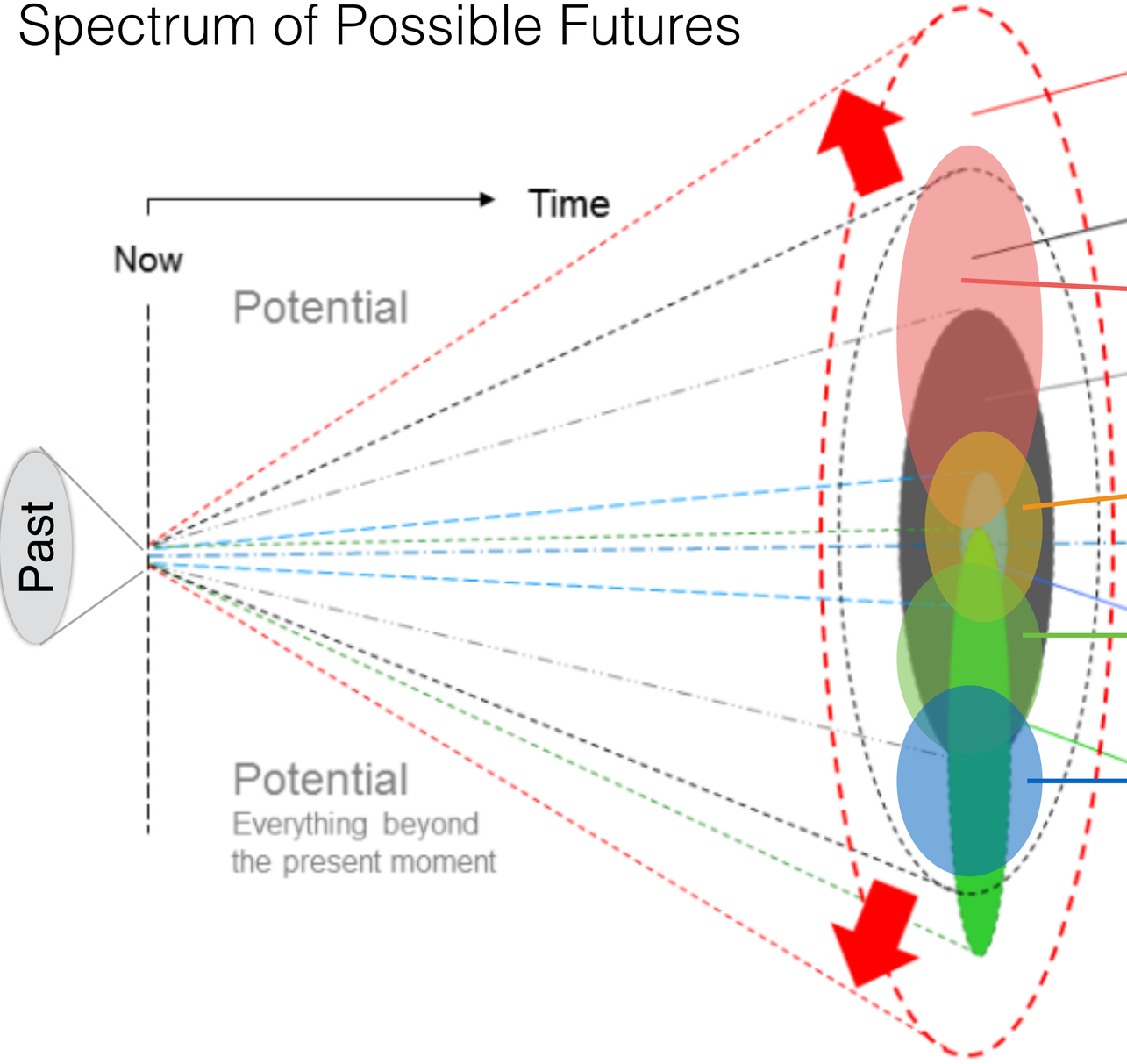
Probable
Current Trends
"likely to happen"

Preferable
Value Judgements
"want to happen"
"should happen"

Voros, 2003, 2012

The Therapy: A new Ethics, Economy, and Global Governance

Spectrum of Possible Futures



Archetypal futures

Preposterous!
"impossible!"
"won't *ever* happen!"

Possible
Future Knowledge
"might happen"

Collapse

Plausible
Current Knowledge
"could happen"

Continue

The 'Projected' Future
The 'default' extrapolated 'baseline'
'business as usual' future

Discipline

Probable
Current Trends
"likely to happen"

Transformation

Preferable
Value Judgements
"want to happen"
"should happen"

Voros, 2003, 2012

Dator, 2009;
Bengtson, 2018

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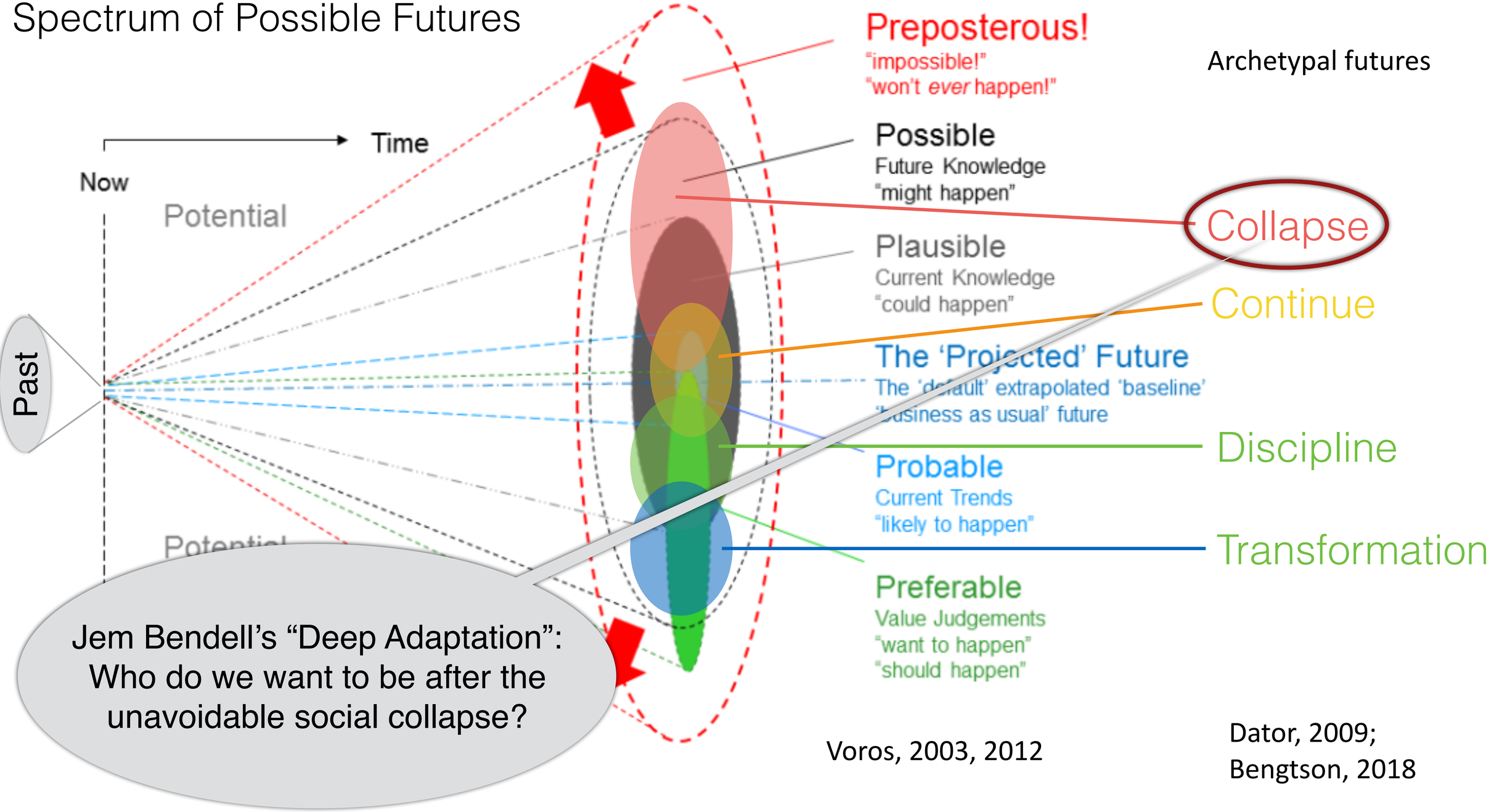
Spectrum of Possible Futures



Archetypal futures

Jem Bendell's "Deep Adaptation": Who do we want to be after the unavoidable social collapse?

Voros, 2003, 2012

Dator, 2009;
Bengtson, 2018

Please, let's not go back to normal

Par Collectif

Publié le 06 mai 2020 à 06h00

TRIBUNE | **If we want to avoid ecological disaster, world leaders and citizens must act now, write actress Juliette Binoche and astrophysicist Aurélien Barrau in a call to arms signed by more than 200 artists and scientists.**

The Covid-19 pandemic is a tragedy. This crisis is, however, inviting us to examine what is essential. And what we see is simple : *« adjustments »* are not enough. The problem is systemic.

The ongoing ecological catastrophe is a meta-crisis : the massive extinction of life on Earth is no longer in doubt, and all indicators point to a direct existential threat. Unlike a pandemic, however severe, a global ecological collapse will have immeasurable consequences.

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200 artistes et scientifiq

The pursuit of consumerism and an obsession with productivity have led us to deny the value of life itself : that of plants, that of animals, and that of a great number of human beings. Pollution, climate change, and the destruction of our remaining natural zones has brought the world to a breaking point.

For these reasons, along with the urgency of renewing with a politics of social equity, we believe it is unthinkable to *« go back to normal »*. The radical transformation we need – at all levels – demands boldness and courage. It will not take place without a massive and determined commitment. We must act now. It is as much a matter of survival as of dignity and coherence.

The Therapy: A new Ethics, Economy, and Global Governance

Le Monde | ACTUALITÉS | ÉCONOMIE | VIDÉOS | OPINIONS | CULTURE

Please, let's not go back to normal

boldness and courage: The pandemic has taught us that if we need to change, we can change.

citizens … astrophysicist Au… …m
200 artists and scientists.

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The Therapy: A new Ethics, Economy, and Global Governance

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ON THE EDGE

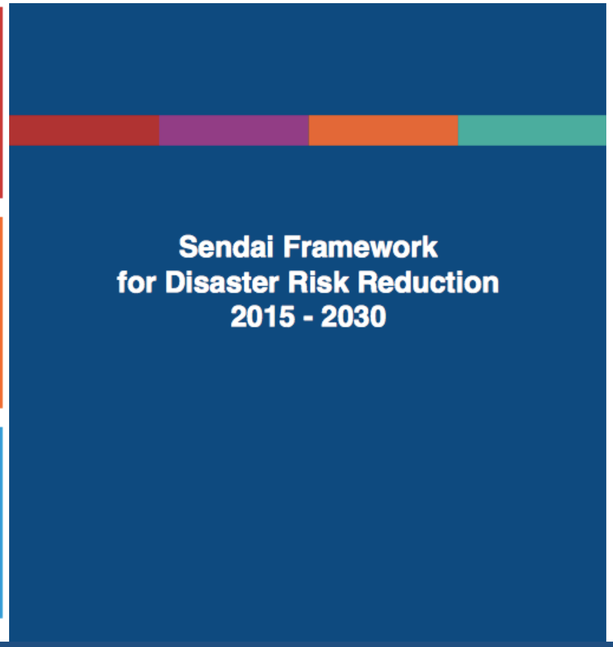
The Year 2015: The Start of a New Decade of Making it Right?

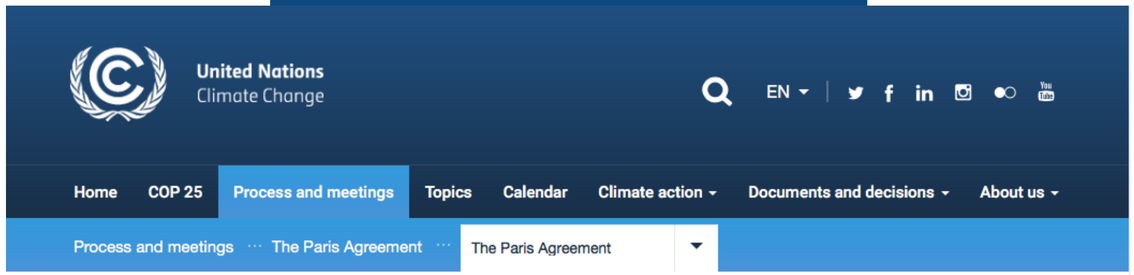
Building a global resilient community

Posted by Prof. Hans-Peter Plag, PhD on October 3, 2014 in Columns, Fall 2014, On the Edge

Finally, in August this year it was published: "The Collapse of Western Civilization – A View from the Future".1 Taking the view of a historian in the Second Peoples Republic of China, who in 2393 looks back and analyzes why 300 years earlier the western culture collapsed, Naomi Oreskes and Erik M. Conway (yes, the same authors who worked together on Merchants of Doubt)2 paint a beautifully scary picture of what might happen in the 21th Century.

The Therapy: A new Ethics, Economy, and Global Governance





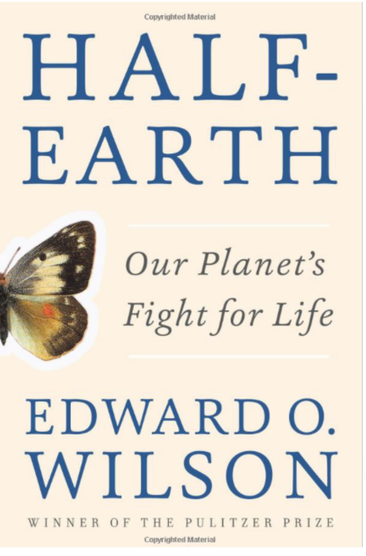
The Paris Agreement

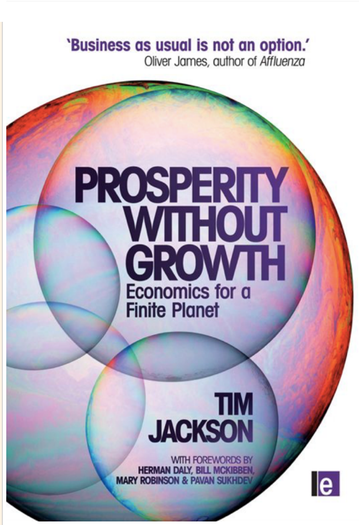
Paris Agreement: essential elements

The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

Arabic
Chinese
English
French
Russian

Homo sapiens: An Exceptional Success Story





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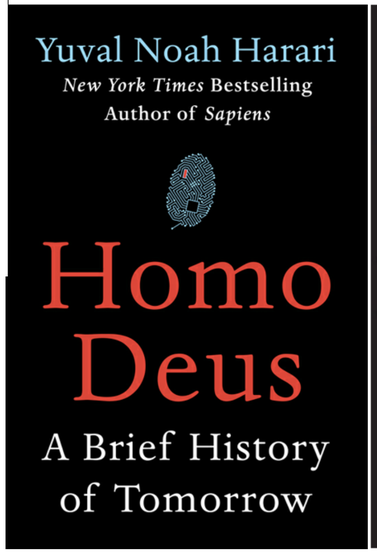
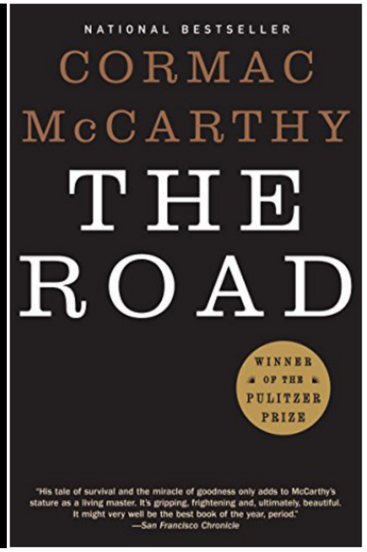
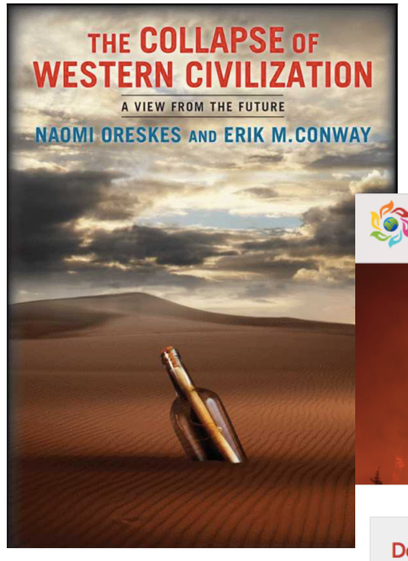
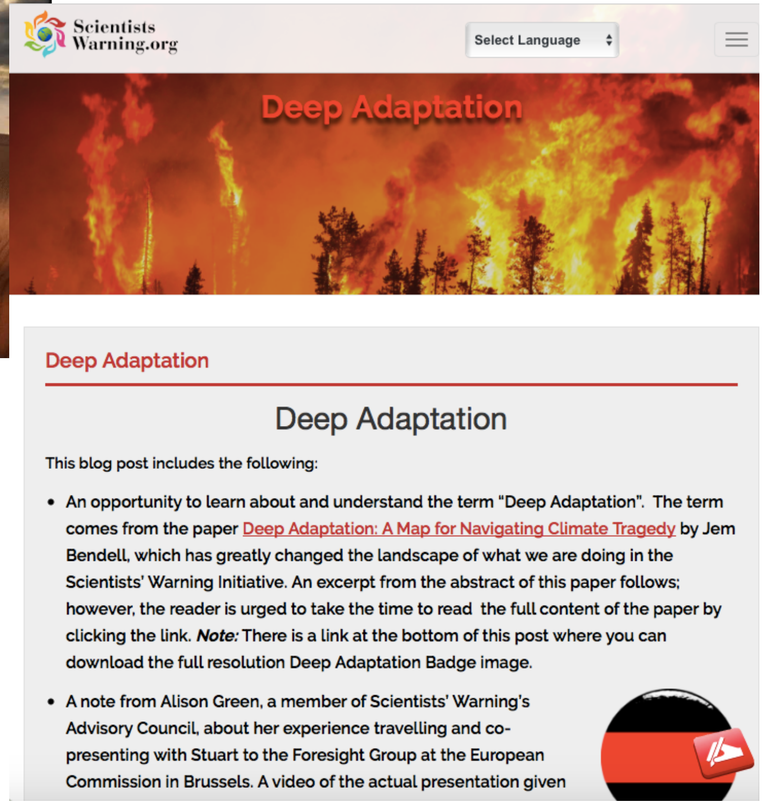




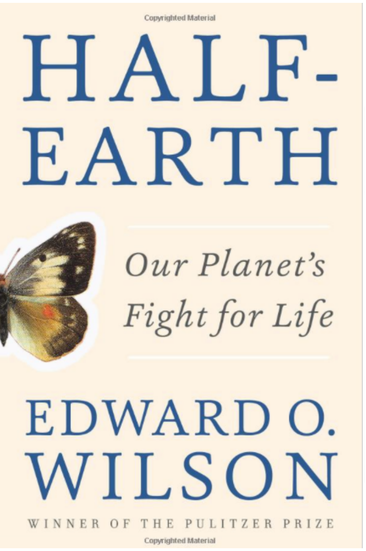


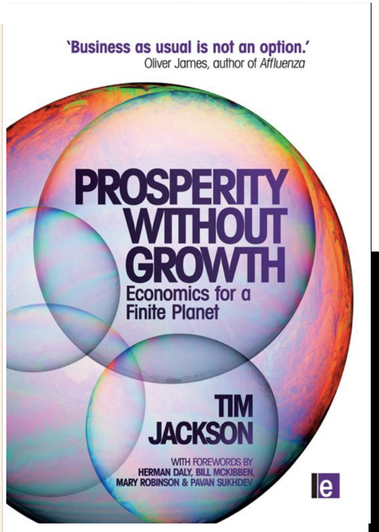


Science-based warnings to humanity

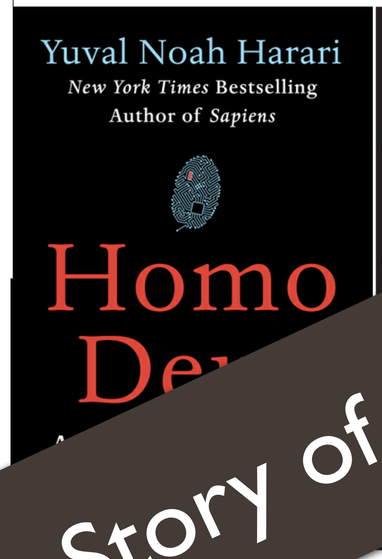
Deep Adaptation: Preparing for the time after the total social collapse - Who do we want to be then?

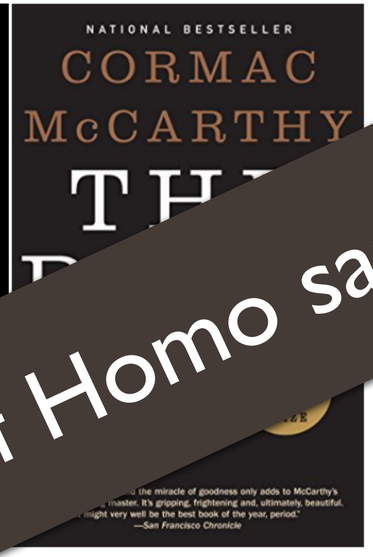
Homo sapiens: An Exceptional Success Story

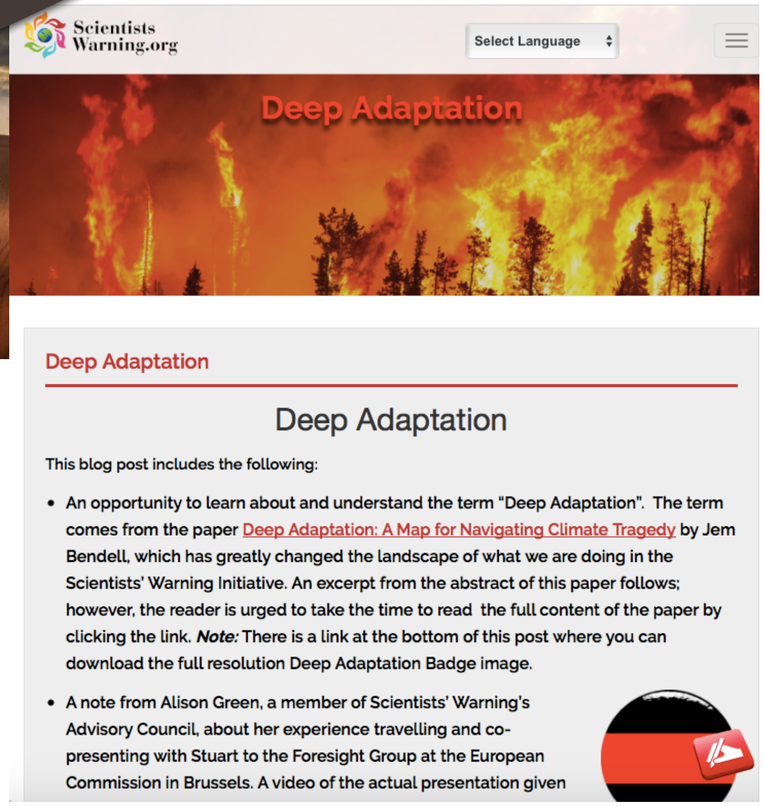




Spectrum of Possible Futures







Is the Success Story of Homo sapiens going to continue?

Sci… …lings to humanity

…ptation: Preparing for the time after the total …l collapse - Who do we want to be then?

Importance of flows

Strategies for Sustainability:

1. To consume nature's flows while conserving the stocks (that is, live off the 'interest' while conserving natural capital).
2. To increase society's stocks (human resources, civil institutions) and limit the flow of materials and energy.

Brown et al. (2004)

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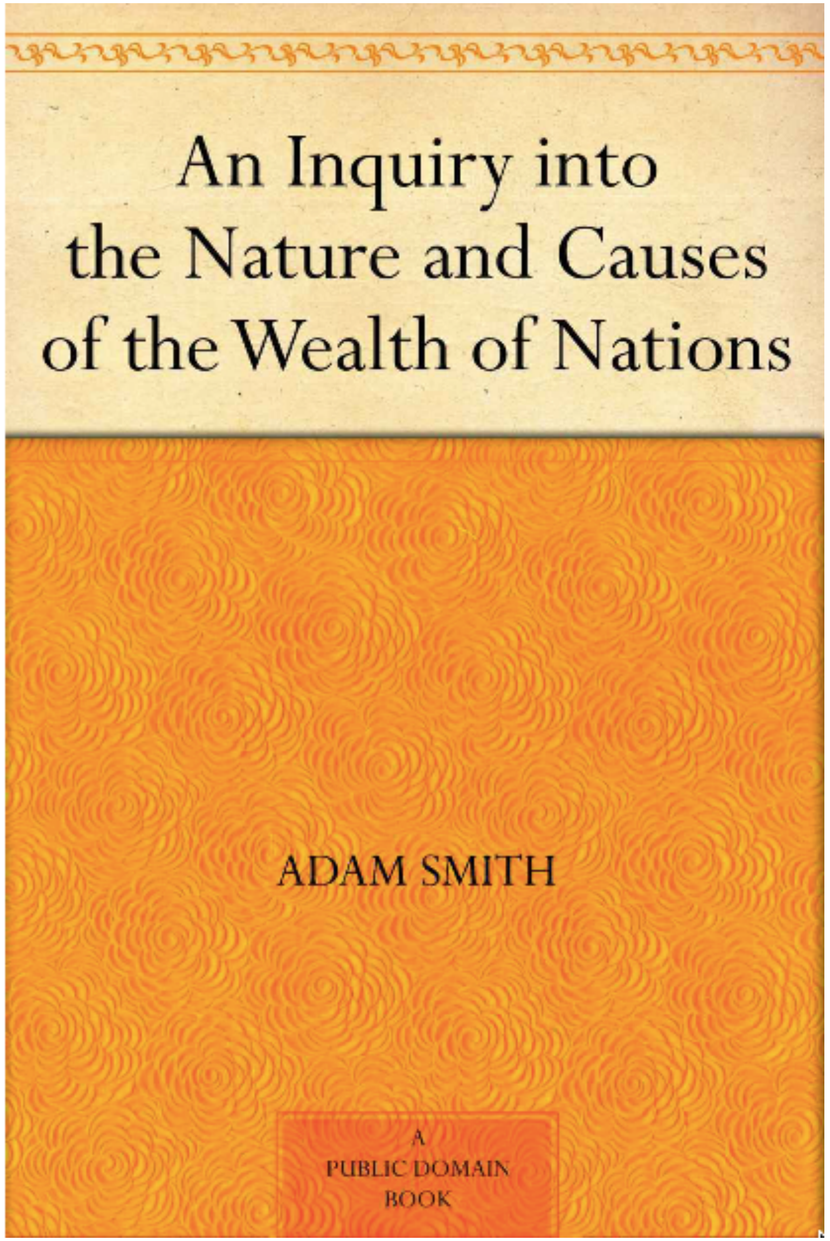
Importance of Mainstream Economic Model

The Therapy: A new Ethics, Economy, and Global Governance



Published in 1776

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COMMENT

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ILLUSTRATION BY PHIL DISLEY

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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- Changing the purpose of economy
- Limiting consumption to the planetary "interests"

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The current pandemic is a minor stress test compared to what the future may hold for us

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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” allowing the emergence of a dominant species

Syndrome

During the last few hundred years, humanity has made large and rapid planetary changes, accelerated existing and introduced new flows in the planetary physiology.

The system is outside the “normal range” and in the dynamic transition into the Post-Holocene.

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.

The new mainstream economic model and a changed global order has turned humans into the “Anthropogenic Cataclysmic Virus” (ACV) in the Earth’s life-support system.

Prognosis

The planet is heading rapidly towards tipping points and a very different system state (Post-Holocene, Anthropocene, Pyrocene, …).

Our knowledge about trends, tipping points and risks is changing rapidly; the risk is very high; foresight is needed.

Therapy

Change in the purpose of economy from growing human wealth (growth addiction) to meeting our needs while safe-guarding the life-support system

A new global order and governance that can handle the coming social, economic, and environmental challenges (climate change, weather extremes, migration, social and economic collapse, wars, …)