

# Learning to Live with the Trickster: Resilience Theory and Environmental Law in the Anthropocene

**Robin Kundis Craig**

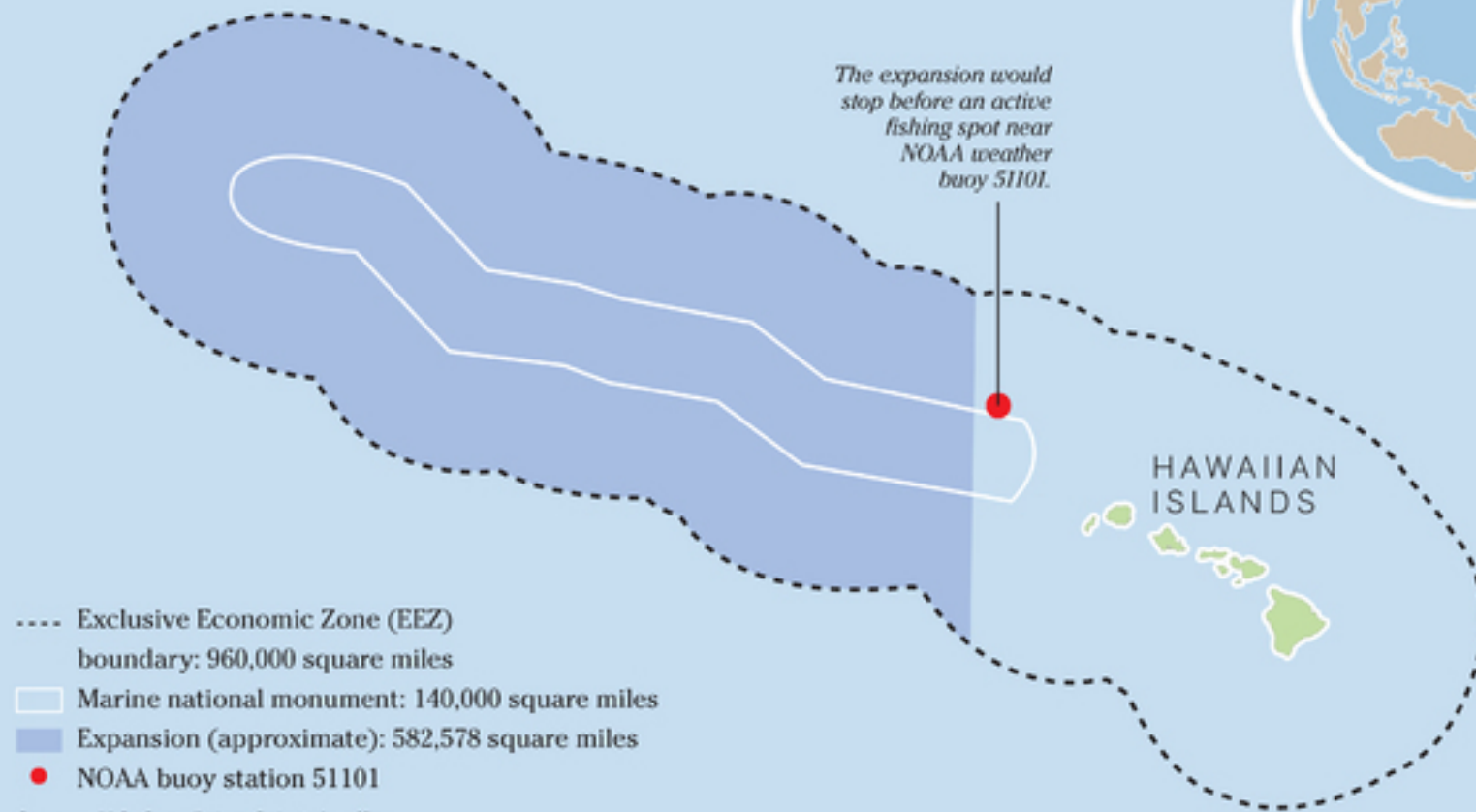
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University of Utah S.J. Quinney College of Law

**Thomas C. Sorensen Policy Seminar Series**  
**University of Nebraska ● April 13, 2017**

# Friday, August 26, 2016

## EXPANSION OF MARINE PROTECTED AREAS

President Barack Obama is expanding the Papahānaumokuākea Marine National Monument from 50 to 200 nautical miles would further restrict commercial fishing in the area.



Source: U.S. Sen. Brian Schatz's office

STAR-ADVERTISER

# Beginning Caveat #1

- The “End of Sustainability” project is most directly a response to continued dependence on ecological stationarity in U.S. natural resources law despite climate change.
- Most U.S. federal natural resources & environmental statutes came into existence in the 1970s and incorporated the steady-state “Balance of Nature” view prominent in biology at the time.

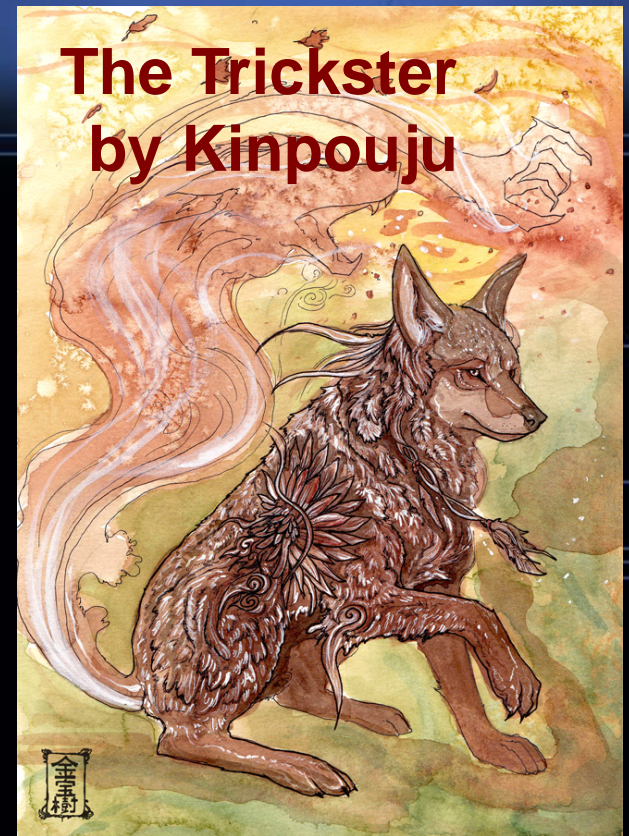
# Beginning Caveats #2 and #3

- We are not using “resilience” in a general sense but rather are focusing on the specific concept of ecological resilience within the specific discipline of resilience theory.
- Part of how you react to the presentation will depend on how much change you believe climate change will bring, but we are convinced that humans are already encountering the limits of continued growth and consumption and that things will get worse.



# The Basic Issue

**Are “sustainability” and “sustainable development” the correct cultural narratives and legal frameworks for natural resources management in a world of increasing, continual, complex, unprecedented, and unpredictable changes to those resources—changes that are likely to limit human choices into the future?**



The background is a dark blue gradient with a white grid of lines and several white circles of varying sizes, some partially cut off by the edges of the frame.

# THE EXAMPLE OF FISHERIES MANAGEMENT

# Magnuson-Stevens Fishery Conservation & Management Act

- Section 301(a)(1): “Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the **optimum yield** from each fishery for the United States fishing industry.”
- Section 3(33): (33) “The term ‘optimum’, with respect to the yield from a fishery, means the amount of fish which—
  - “(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
  - “(B) **is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor**; and
  - “(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.”
- Section 3(34): “The terms ‘overfishing’ and ‘overfished’ mean a rate or level of fishing mortality that **jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis**.”

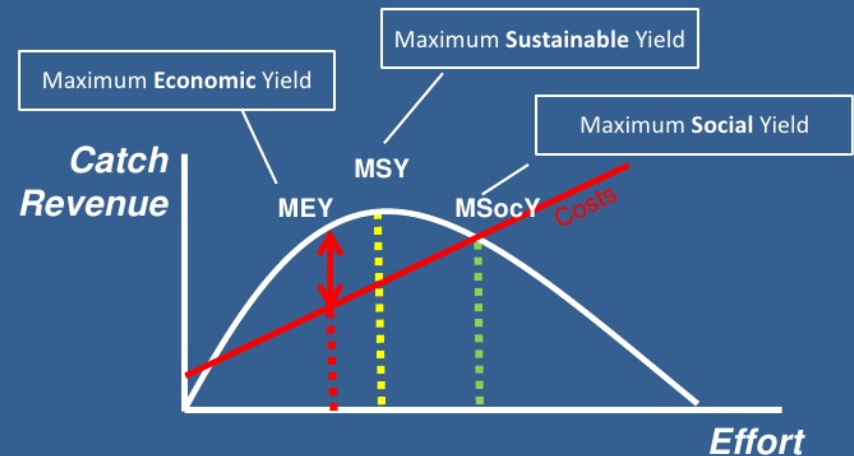
**What does all that  
mean in the  
Anthropocene?**



# Two Big Problems with MSY-Based Fisheries Management

- Assumes fish not needed for reproducing the replacement stock are “surplus”—although those fish are in fact probably doing something important in food webs and ecosystems.
- **Assumes that long-term ecological conditions in the ocean are stable—and they're NOT.**

The theory is (relatively) simple



## Ecosystem Overfishing

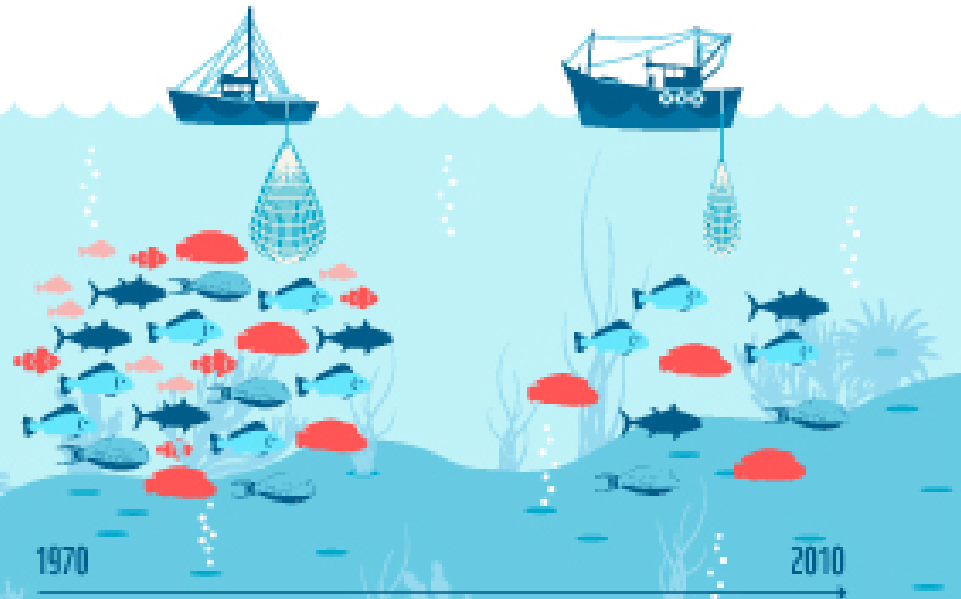


FISHING



BYCATCH

FISH POPULATIONS  
ESSENTIAL FOR  
FOOD AND  
JOBS HAVE  
**CRASHED BY 50%**  
IN THE LAST  
**4 DECADES**



Graphic courtesy of the World Wildlife Foundation

ALTERED ECOSYSTEM STRUCTURE AND FUNCTION

# Pre-Existing Impacts: Habitat Destruction

UNTRAWLED



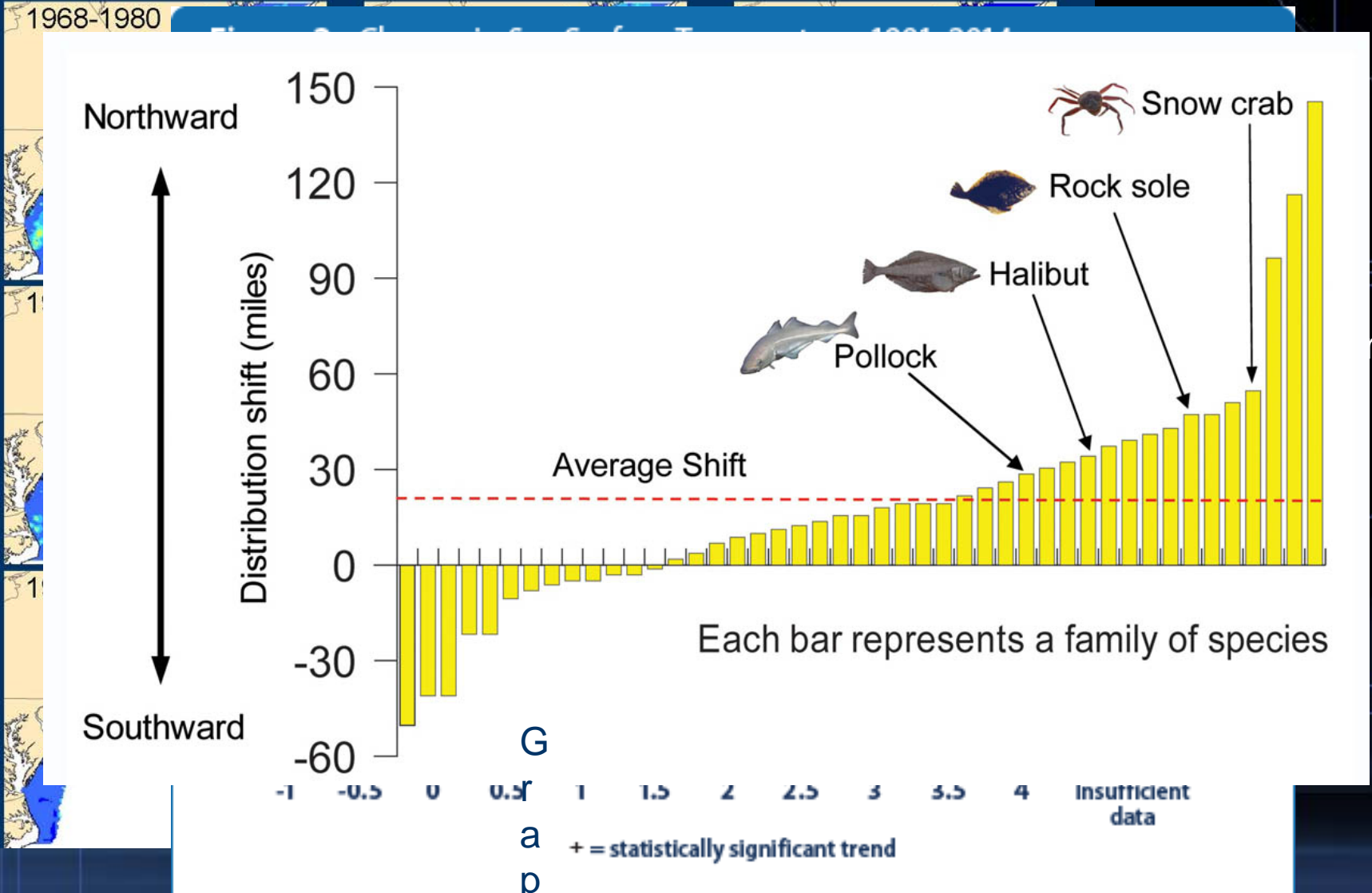
©NOAA/Oceana

TRAWLED



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# Climate Change and Fisheries: Increasing Temperatures



# Plus, Ocean Acidification

## OCEAN ACIDIFICATION

Less acidic  More acidic

Atmospheric carbon dioxide



Graphic courtesy of the U.K. Ocean Acidification Programme

Dissolved carbon dioxide



Water



Carbonic acid



Hydrogen ions



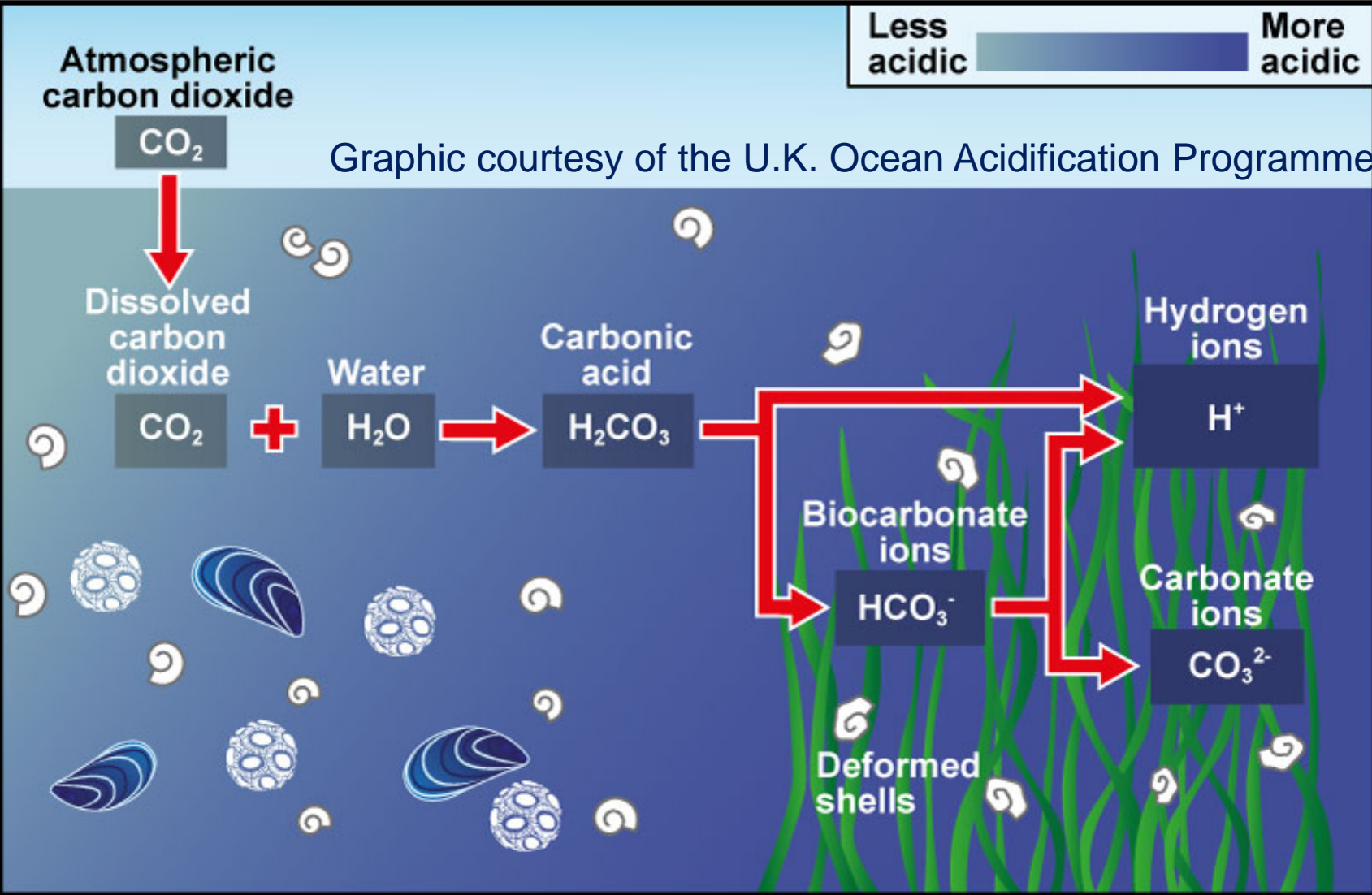
Bicarbonate ions



Carbonate ions



Deformed shells





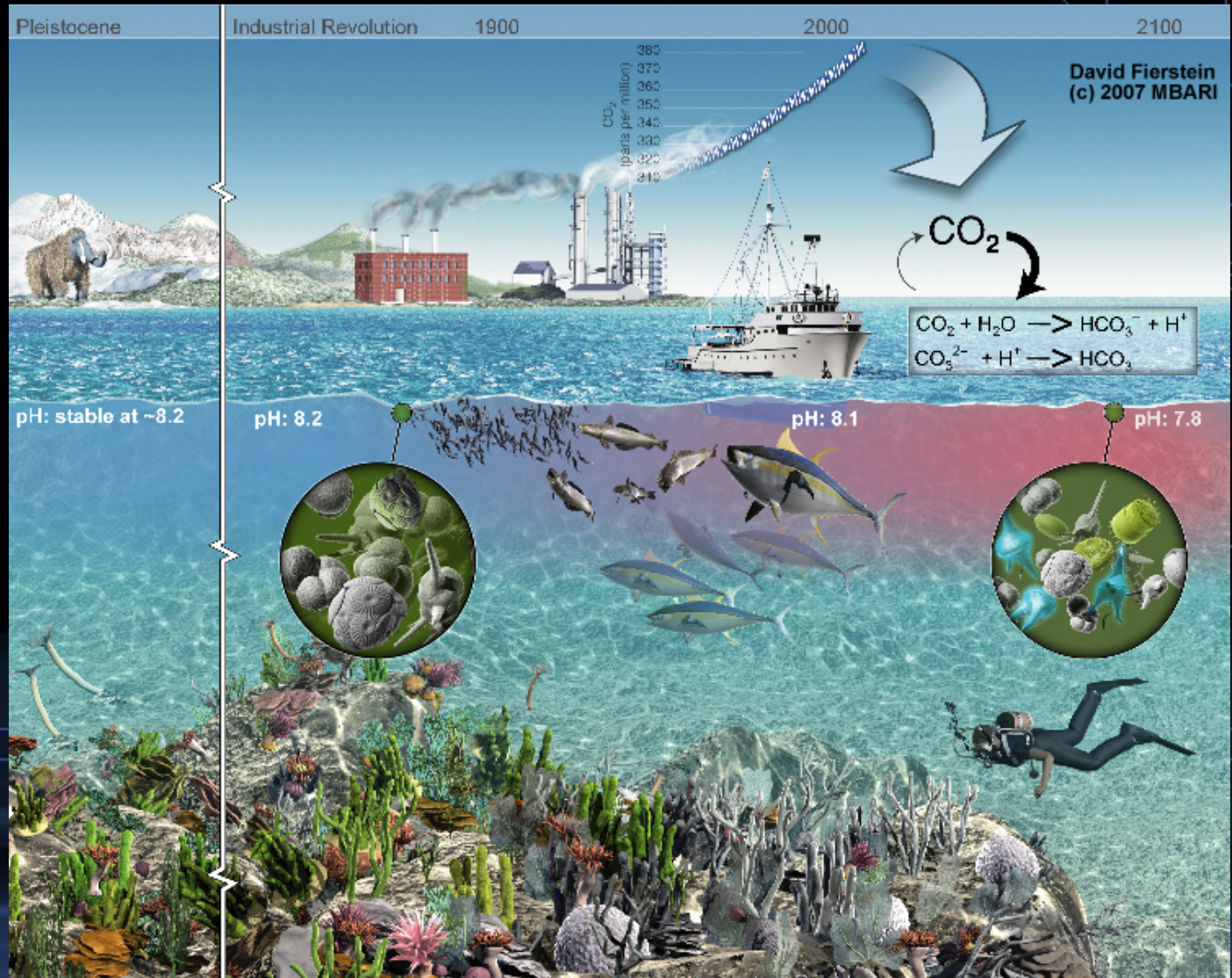
# Ocean Acidification Effects: Pteropods (Sea Butterflies)



Graphic  
courtesy of  
David  
Littschwager,  
National  
Geographic  
Society

# What Ocean Acidification Does Over Time

Graphic courtesy of the Monterey Bay Aquarium Research Institute





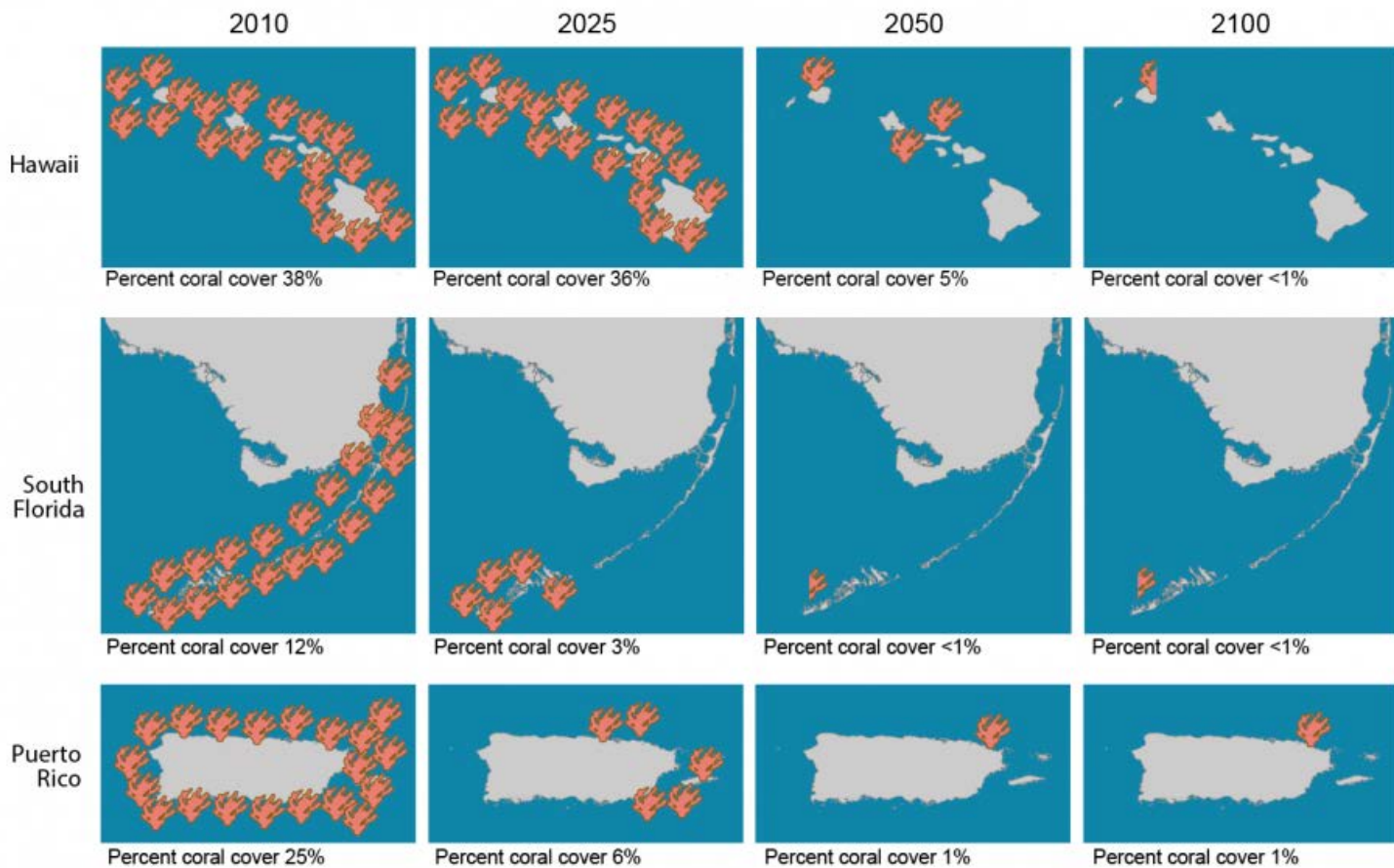
# Florida Keys

# Reefs on the B al Reefs

# Jamaica



U.S. Coral Reef Losses under Unmitigated Climate  
Graphic courtesy of the U.S. EPA



375 ppm  
+1°C

450 ppm  
+2°C

650 ppm  
>+3°C



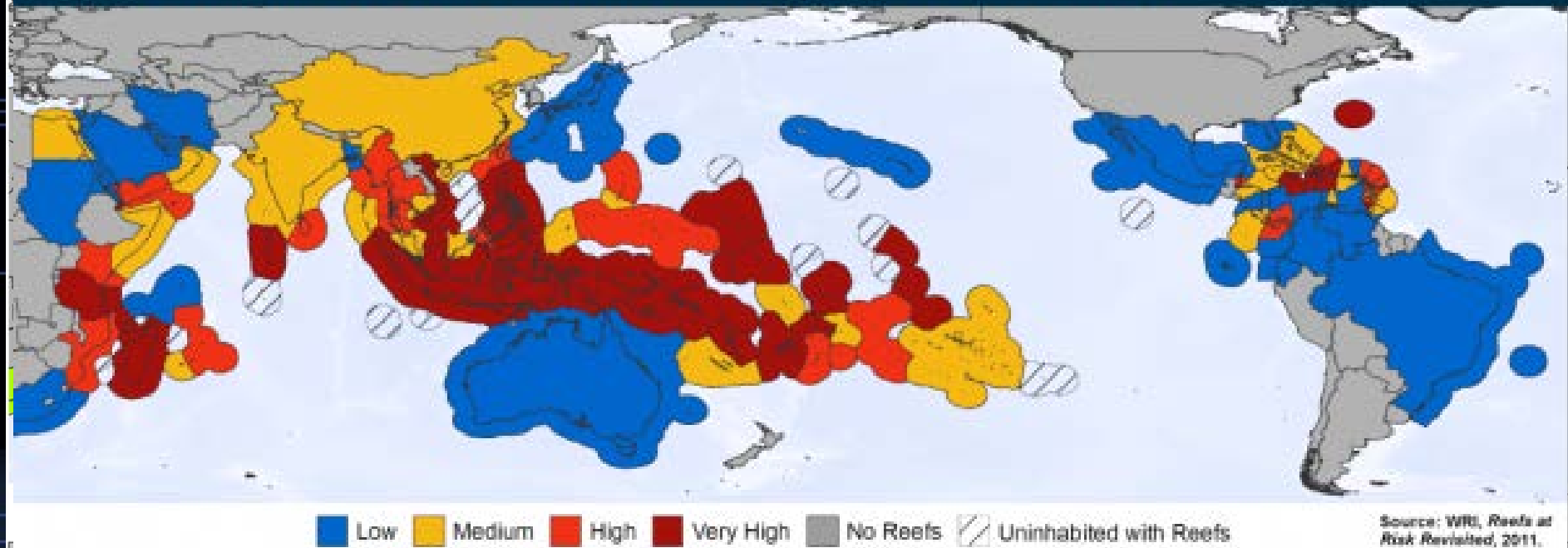
2010



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# Implications for Sustainable Development: Coral Reefs

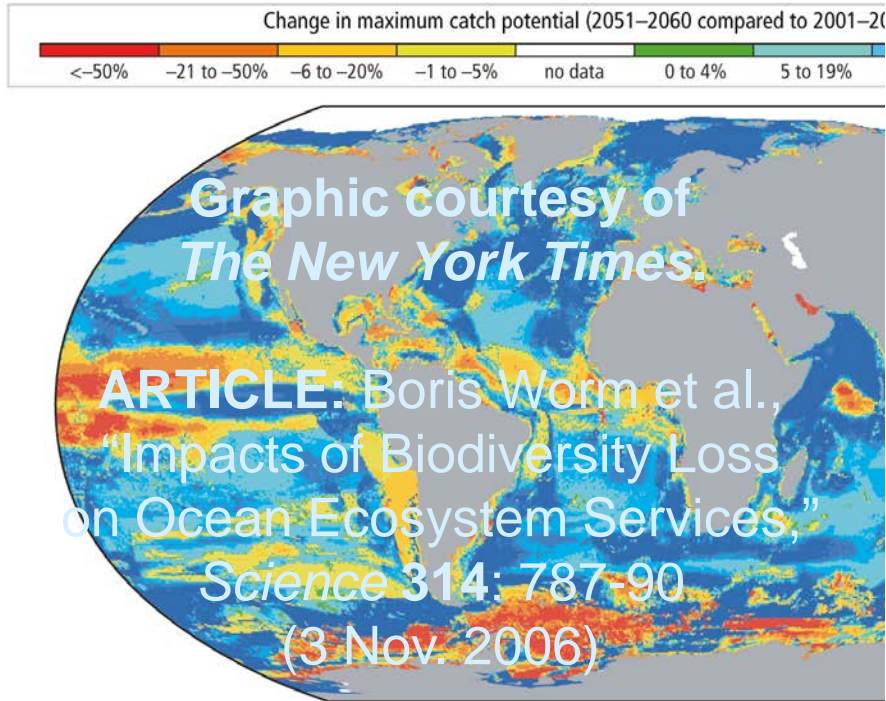
## SOCIAL AND ECONOMIC VULNERABILITY OF COUNTRIES AND TERRITORIES TO REEF LOSS



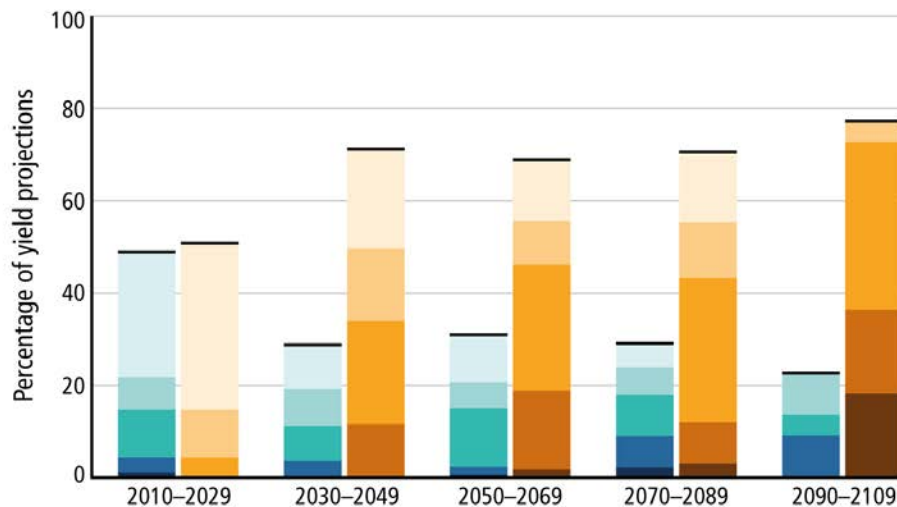
**Notes:** Adaptive capacity is based on economic resources, education, health, governance, access to markets, and agricultural resources. Eighty-one countries, 21 island territories, and six subnational regions (Florida, Hawaii, Hong Kong SAR, Peninsular Malaysia, Sabah, and Sarawak) were assessed, and are categorized according to quartiles.

## Climate change poses risks for food production

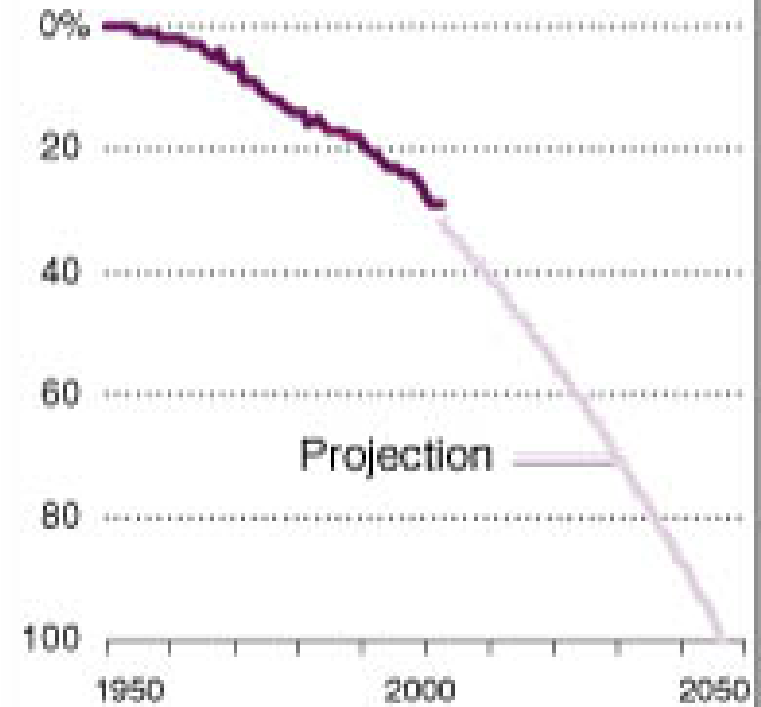
(a)



(b)



## Percentage of species collapsed (defined as less than 10% left)



Source: SeaWeb

The New York Times

A major study in the journal *Science* predicts global collapse of the world's major fisheries by 2053





# CURRENT NARRATIVES OF OUR RELATIONSHIP TO ECOSYSTEMS

# “Humans As Controlling Engineers”: WWII & After



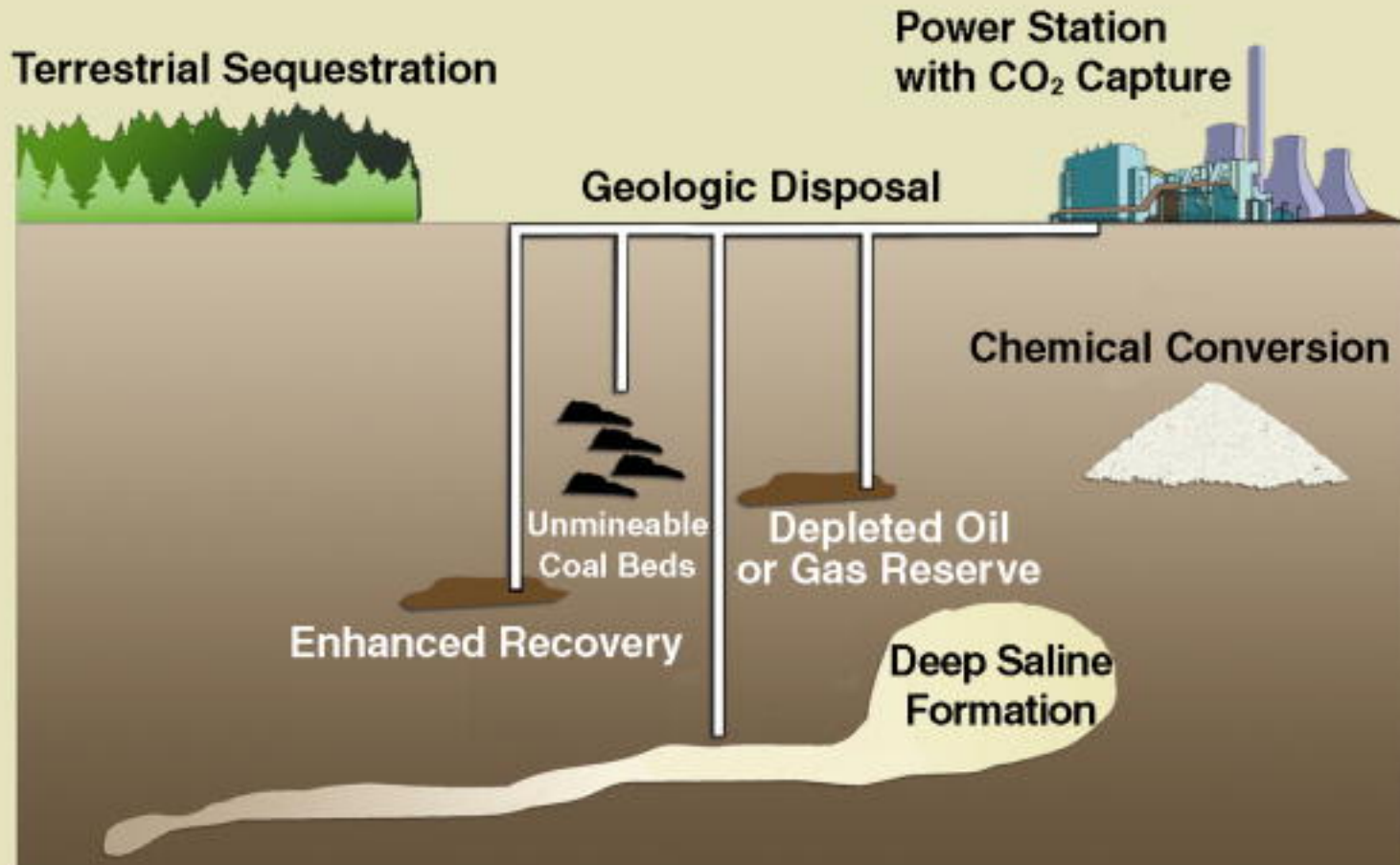


**Newtown Creek Wastewater Treatment Facility**  
Photograph courtesy of the City of New York

**Orange County, CA Wastewater Treatment & Reclamation Facility**



# Carbon Sequestration Options



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100 miles

Source: U.S.

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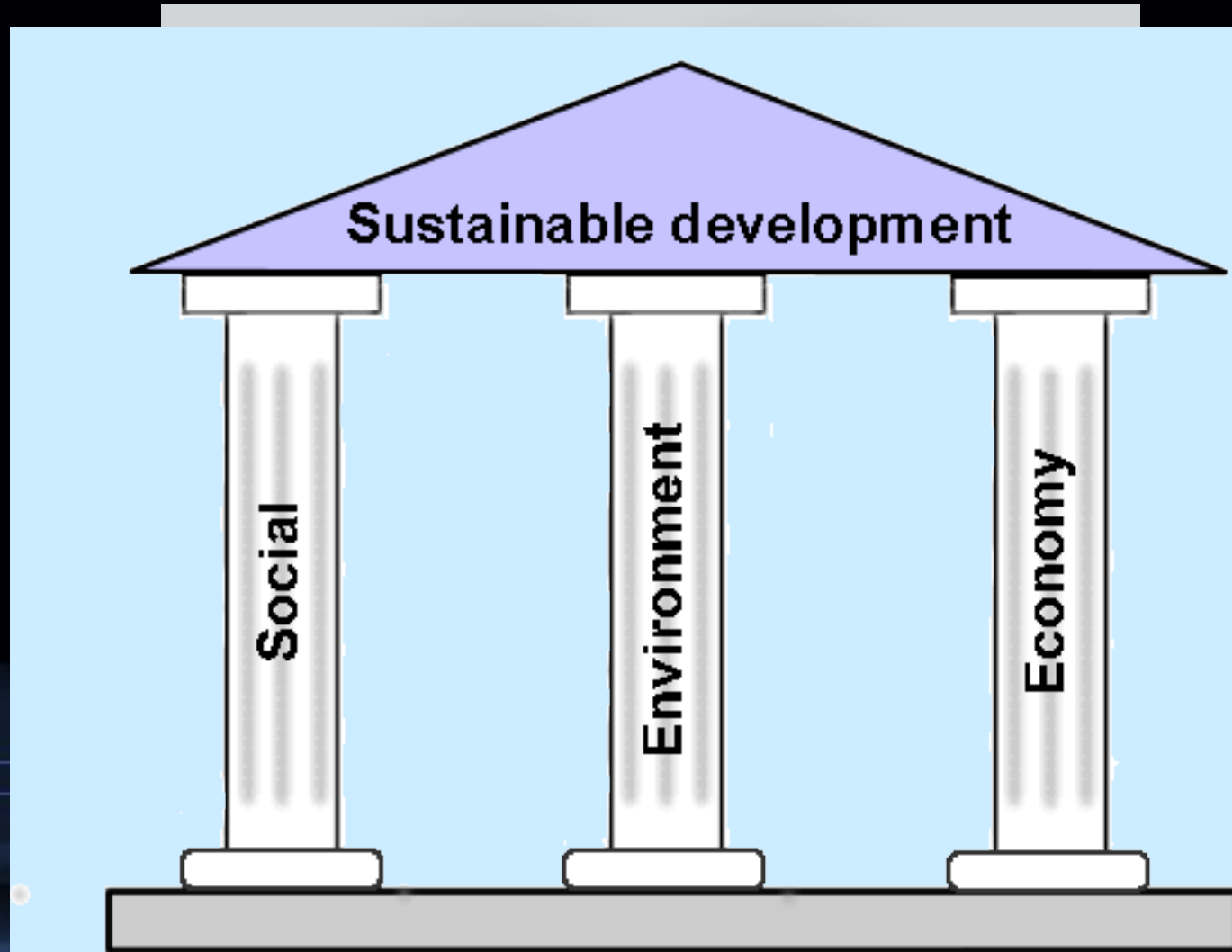
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© 2011 MCT

# Sustainable Development and Its Current U.S. Narratives





**And the narratives  
that the U.S. has  
developed so far for  
climate change  
aren't helping . . .**

# NARRATIVE #1: Climate Change Isn't Real



# NARRATIVE #1: It isn't us.

# 51%

OF CNBC CLIMATE COVERAGE DENIES THAT CLIMATE CHANGE IS CAUSED BY MAN-MADE POLLUTION.

\*SOURCE: MEDIA MATTERS



Reality Denial

while

# 9%

OF CLIMATE AGREEMENT/CHANGE IS CAUSED BY MAN



TAMBERG

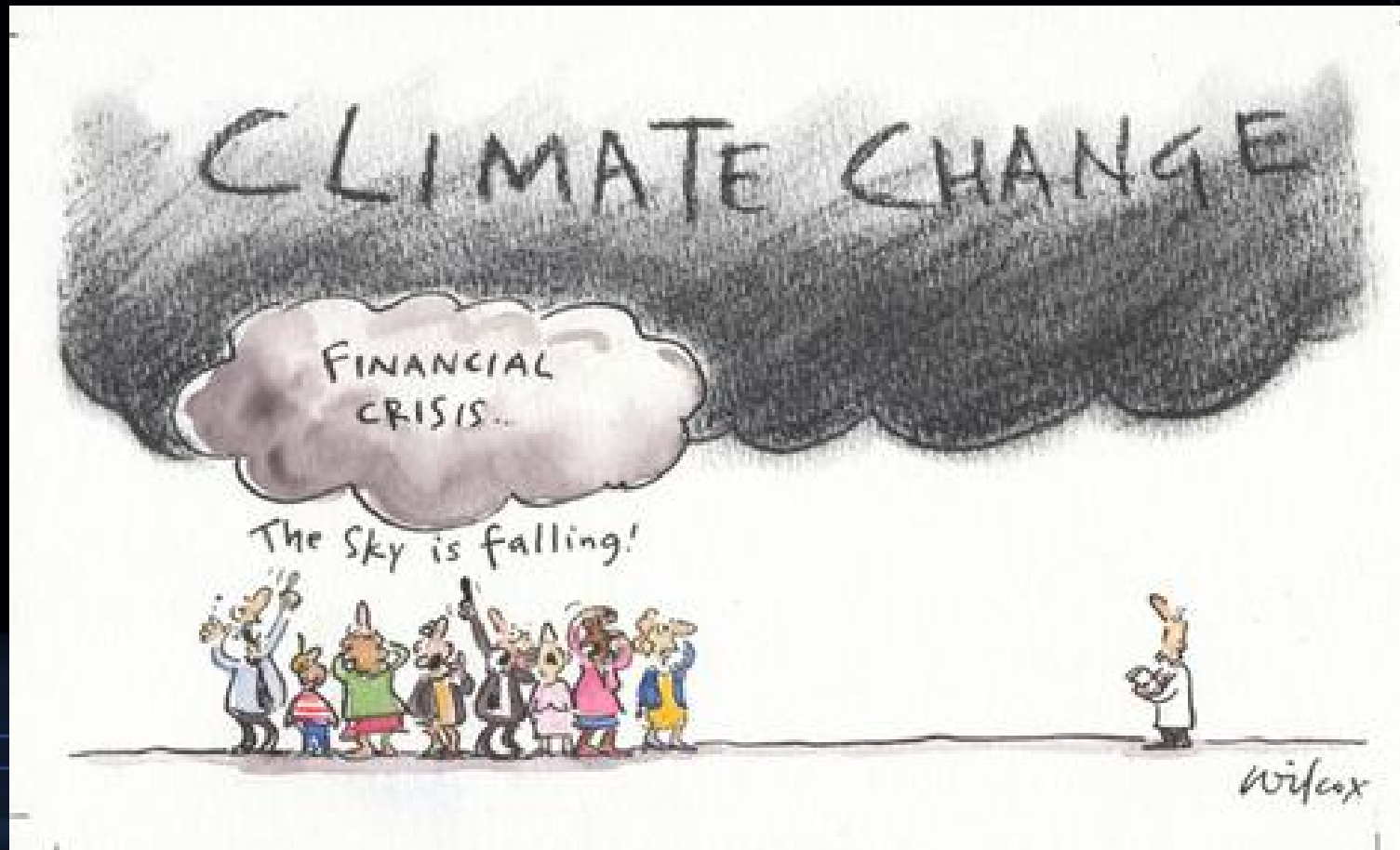




# NARRATIVE #3: Technology Will Save Us



# NARRATIVE #4: It's the End of the World as We Know It





# Blending Narrative #4 with Apoc

## THE LAST MYTH

WHAT THE RISE OF  
APOCALYPTIC THINKING  
TELLS US ABOUT AMERICA

MATHEW BARRETT GROSS  
MEL GILLES

# THE D TOM



# #4 Variation: *Carpe Diem!* Party Like It's 1999

A satellite image of Antarctica with a color-coded map overlay showing ice melt. The map uses a color scale from blue (low melt) to red (high melt), with the highest melt rates concentrated in the interior and along the coastlines. The word "Forbes" is superimposed in large, bold, black letters on a white rectangular background.

**Forbes**

**“If Antarctic Melting Has Passed  
The Point Of No Return We Should  
Do Less About Climate Change, Not More”**

Image courtesy of NASA



BETTER CULTURAL AND  
LEGAL NARRATIVES FOR  
THE ANTHROPOCENE




# #1: The Trickster








# U.S. Selected Significant Climate Anomalies and Events for 2015





 For AK, 2015 tied 2002 as the 2<sup>nd</sup> warmest year on record. Only 2014 was warmer in AK.


 MT, OR, and WA had their warmest year on record. Limited winter snowpack contributed to summer drought and a record-breaking wildfire season.


 The CONUS had the 2<sup>nd</sup> warmest and 3<sup>rd</sup> wettest year on record. Every state was warmer than average.


 Late winter/early spring was record cold for parts of the Northeast and Midwest. Boston, MA had its snowiest season with 110.6" of snow.


 Drought plagued CA. Lack of winter precipitation and near-record warmth contributed to low reservoirs, wildfires, and agricultural losses.


 Late-December tornadoes, severe storms, and record flooding caused over 50 fatalities across the South, the deadliest weather event of 2015.


 Moisture associated with Hurricane Joaquin interacted with an upper level low to bring record rainfall to the Carolinas in early October.

 Record summer/autumn precipitation in HI, accompanied by record warmth, ended a multi-year drought.

 OK and TX had their wettest year on record, ending a multi-year drought. The remnants of East Pacific tropical cyclones caused widespread flooding.

 FL had its warmest year on record with a temperature 3.3°F above average.

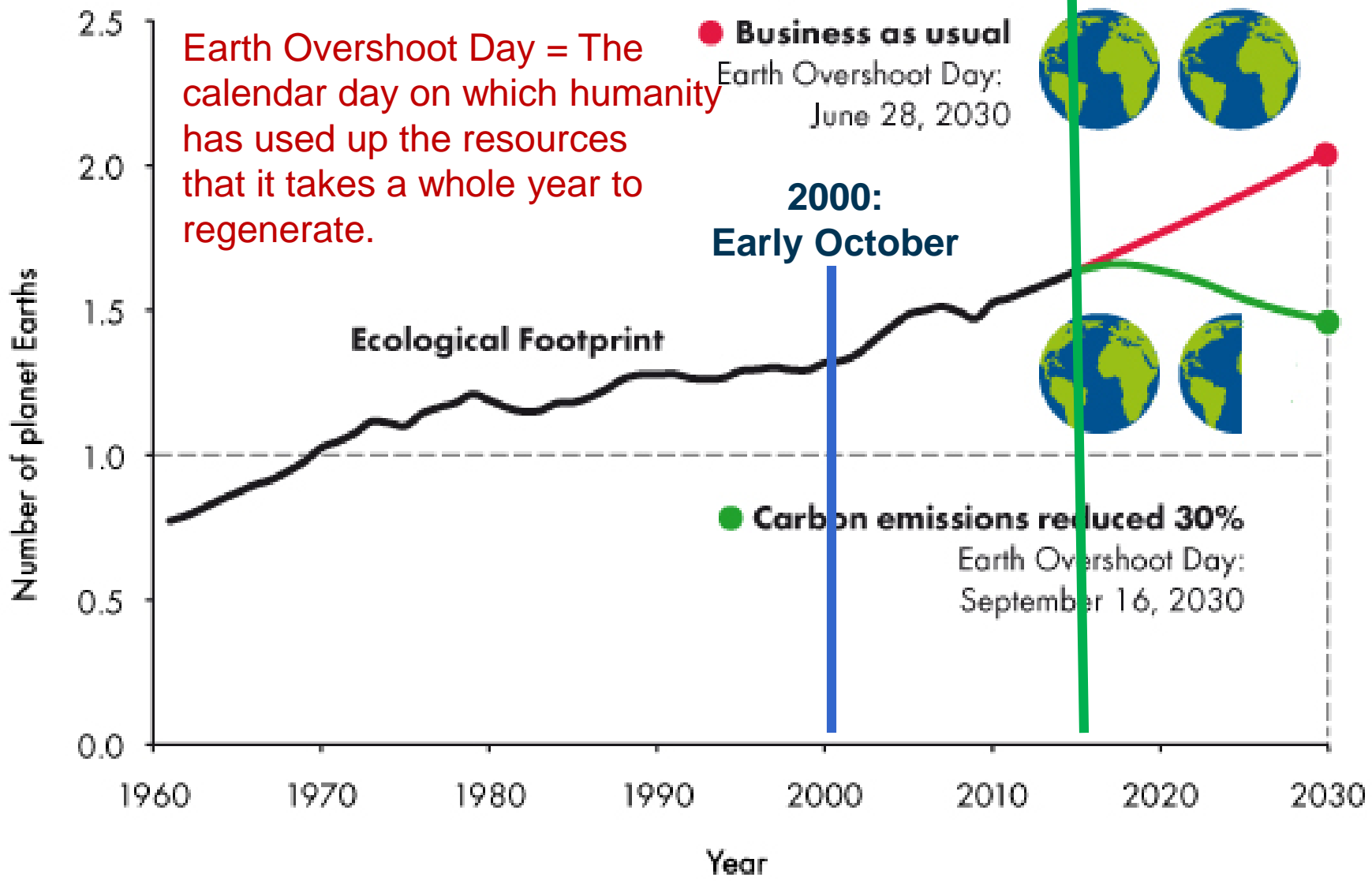
 At the beginning of 2015, 28.7% of the CONUS was in drought. The drought footprint peaked in April at 36.9% of the CONUS, but shrank to 18.7% by the end of the year.

 The North Atlantic had 11 named storms, 4 hurricanes, and 2 major hurricanes—a slightly below average season.

# How many Earths does it take to support humanity?

Image courtesy of Global Footprint Network

2015: August 13



# #3: The Boundaries

## Planetary Boundaries

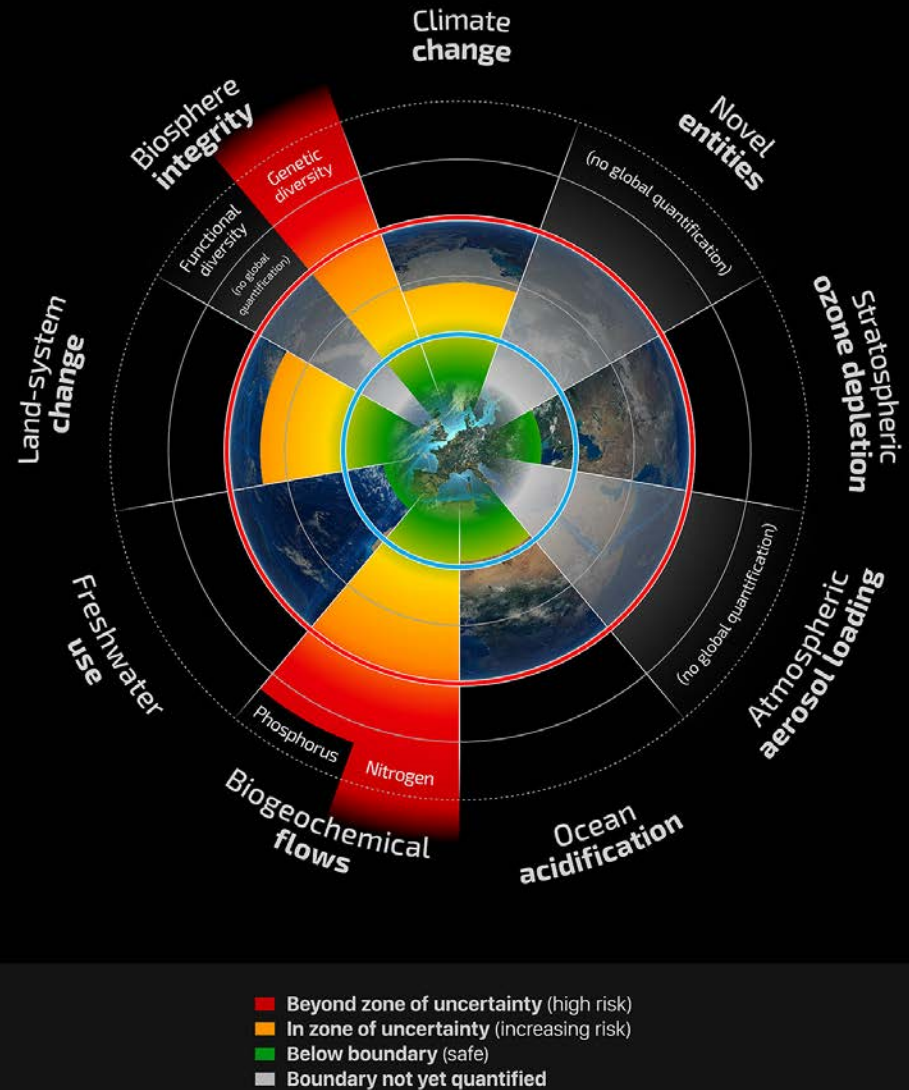
A safe operating space for humanity

Image Credit:

2015 F. Pharo, J. Descheres, J. Globalia

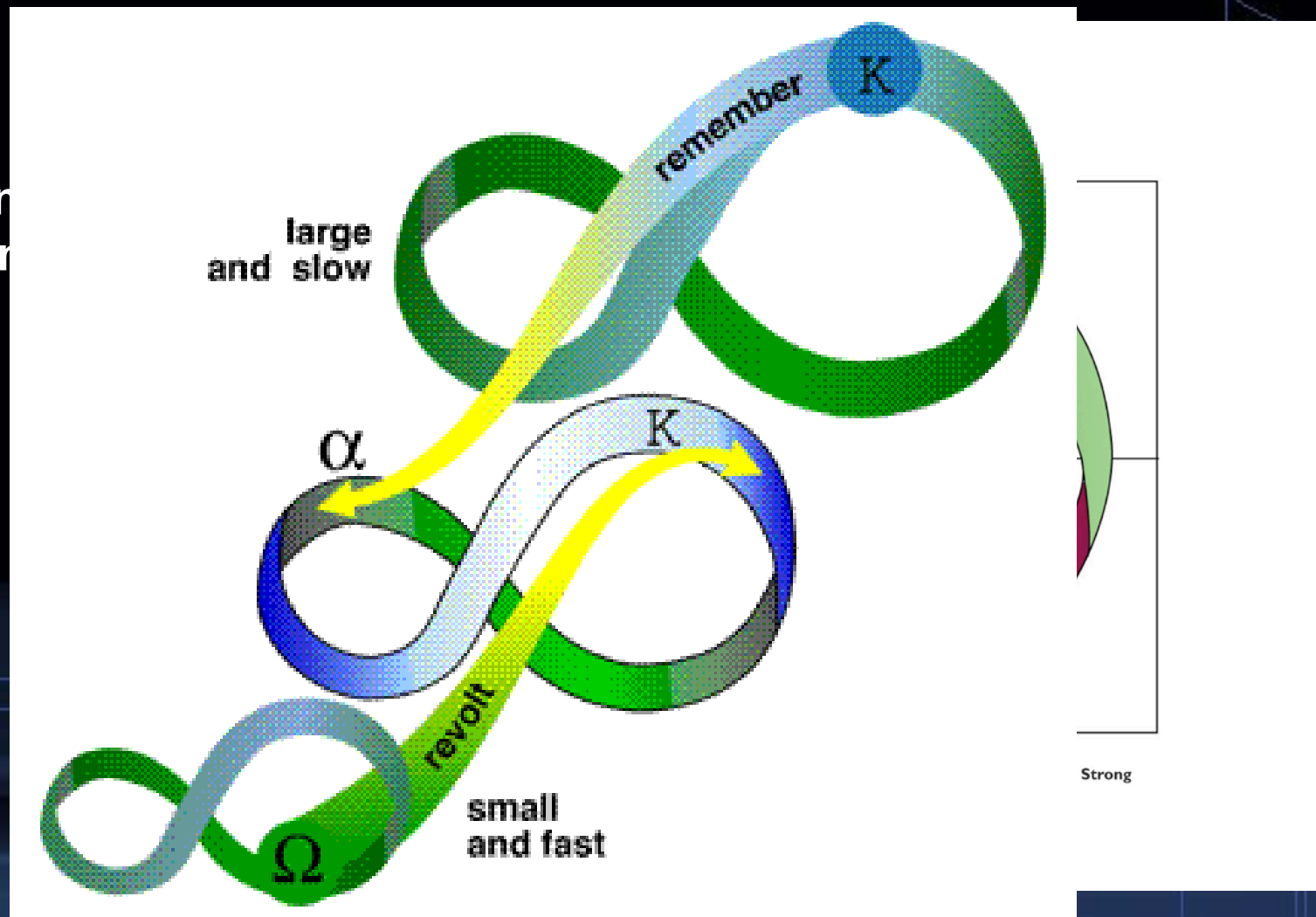
Article: Will Steffen et al. Planetary boundaries. Guiding human development on a changing planet, Science 347: 736 (13 Feb. 2015)

Guiding human development on a changing planet, Science 347: 736 (13 Feb. 2015)



# #4: A Better Framework for Law: RESILIENCE THEORY

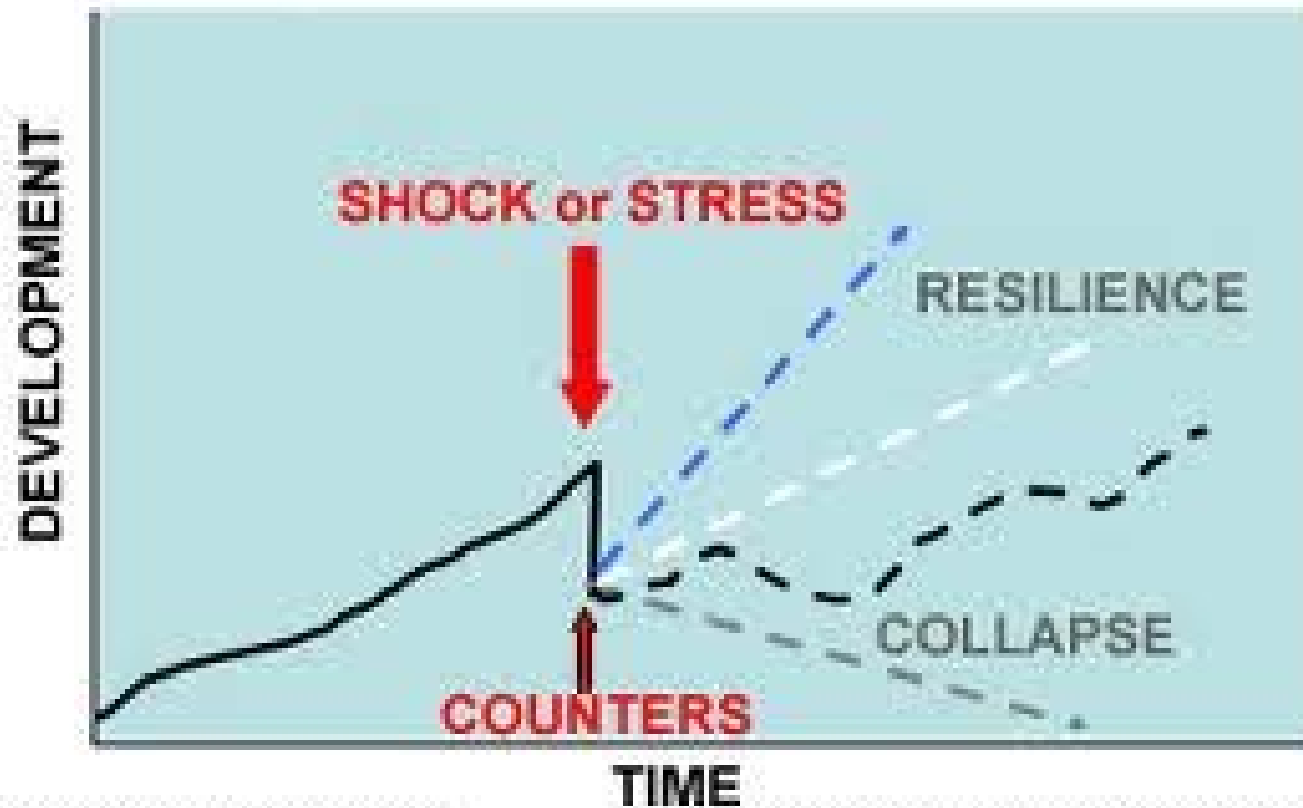
Resilient  
Thinking





# Acknowledging Different Outcomes from Changes

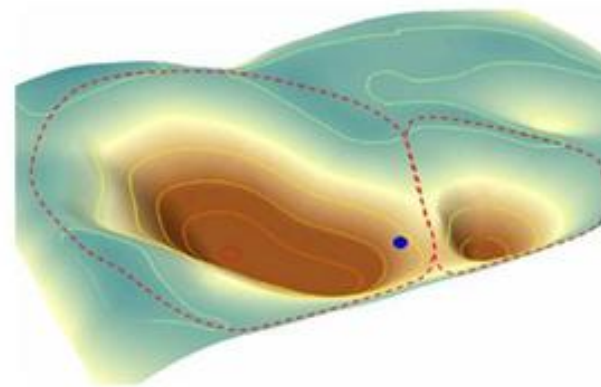
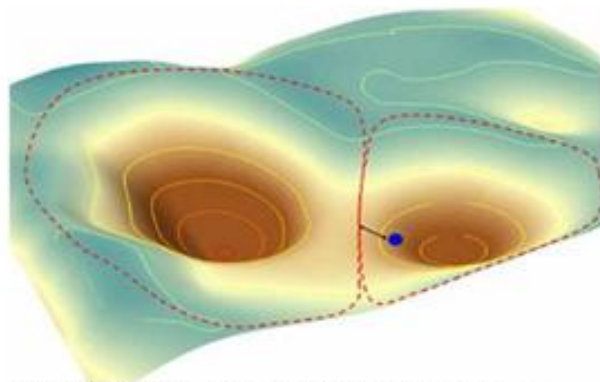
Figure 1 - Concept of resilience



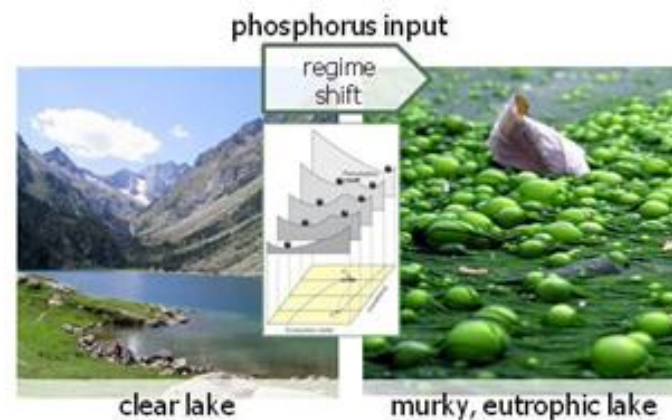
# Acknowledging that Transformations are Possible

system dynamics, never at rest:

the ball in the basin, the 'stability landscape'



- the ball = the current state of the system
- a basin = set of states with same functions and feedback (regime); acts as a basin of attraction: the system (= ball) moves to bottom (= equilibrium state, = attractor) but also moves elsewhere because of inner dynamics; multiple regimes
- shape of basin is constantly changing due to changing (external) conditions; therefore also position of ball changes: the system is **never in 'stable-perfect' equilibrium**
- dotted line = a threshold, after crossing this tipping point, the system tends towards a different equilibrium (because of a change in feedbacks that drive the system's dynamics)



# Why We Think Resilience Thinking Is an Improvement

- Like the trickster, resilience thinking acknowledges that sudden and unpredictable change is a reality of life (ecosystems and socio-ecological systems).
- Unlike sustainability and sustainable development goals as legally implemented in the U.S., resilience thinking provides a system that acknowledges that what is possible today in terms of pursuing human goals may not be possible tomorrow.
- **HOWEVER**, resilience itself is a property, not a normative goal. Thus, law and policy still have to supply the normative goals we seek to achieve in a constantly changing world with the constant threat of diminishing resources and ecosystem services.

**The First Normative  
Question for Resilience  
Thinking Fisheries Law:  
The Resilience OF What  
TO What and FOR WHOM?**

**One Answer: The law should promote  
the resilience of changing marine  
ecosystems to climate change  
and ocean acidification for the  
benefit of future generations.**

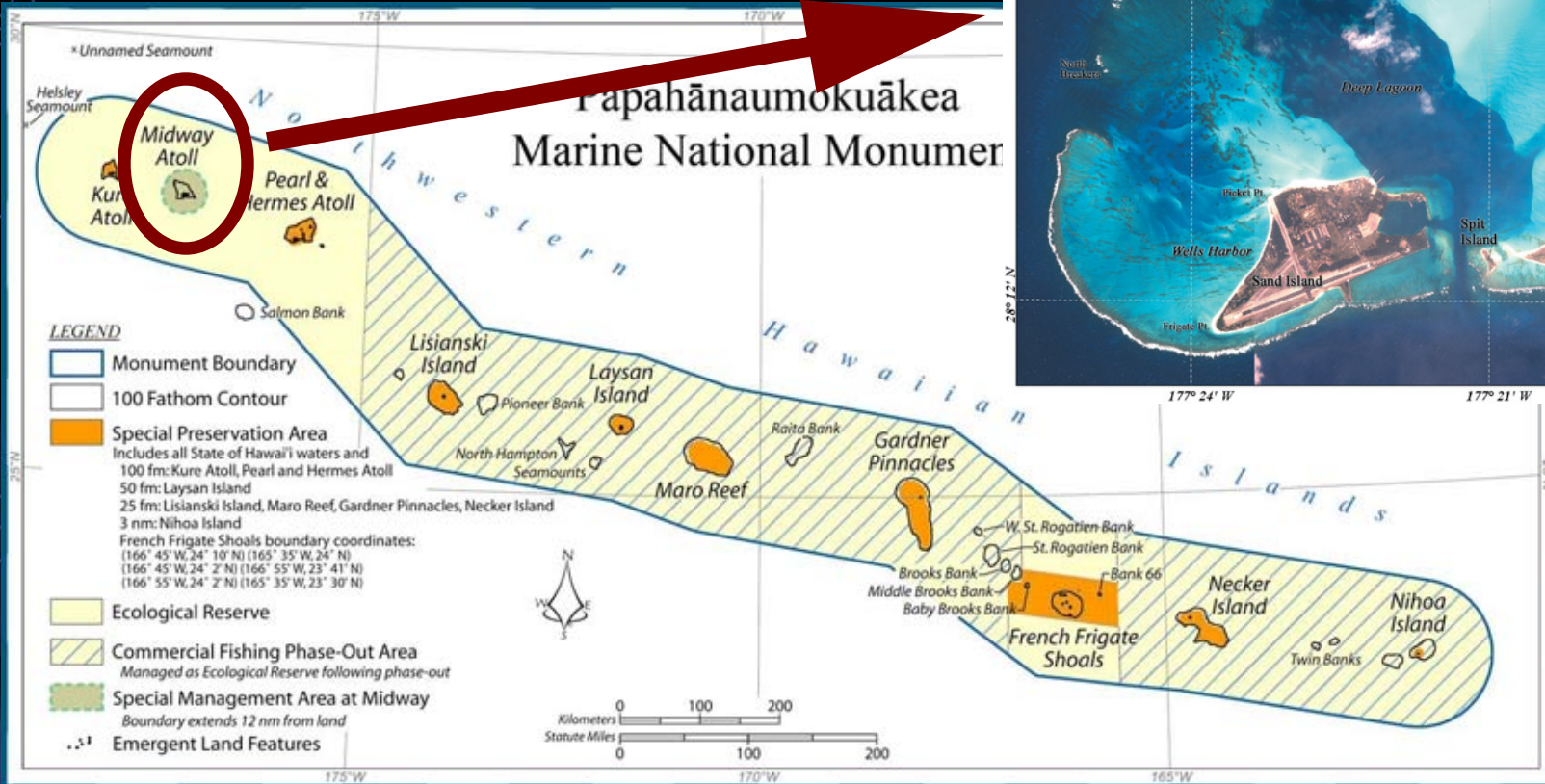


# More Specifically:

- Panarchy counsels that some of the anthropogenic impacts on fish and marine ecosystems are operating at scales beyond effective immediate human intervention, even though control of greenhouse gas emissions is critical:
  - Climate Change: Carbon dioxide concentrations are governed by processes that operate on a century-long scale
  - Ocean Acidification: Operates within planetary carbon cycles on a millennium scale
- Technological and political realities make other stressors equally difficult to address:
  - Ocean plastic pollution
  - Legacy toxic pollution
  - Existing coastal development, with sea-level rise complications
- The two stressors for which regulation for shorter-term improvements is possible:
  - Land-based marine pollution
  - **FISHERIES**

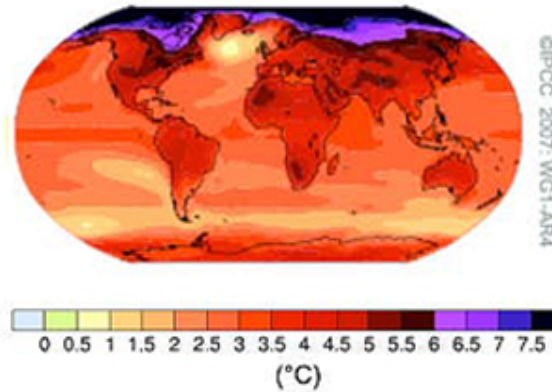
# Protect the Last, Best Places

## The Papahānaumokuākea Marine National Monument

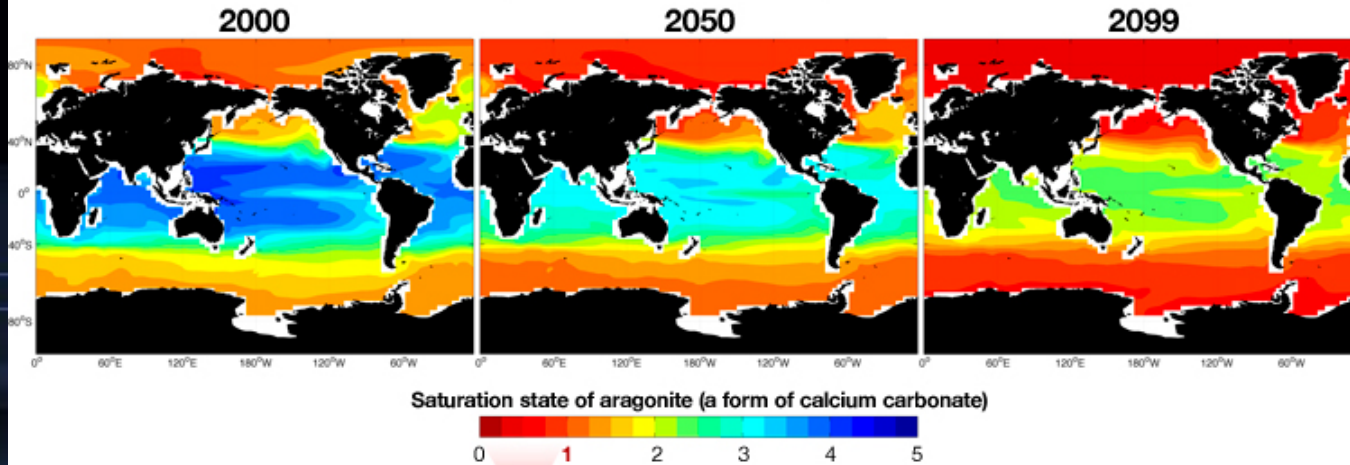


# More Generally, Protect the Emerging Ocean "Sweet Spots"

Temperature change by 2099



Carbonate levels predicted to drop as ocean acidifies



Exposed shells and skeletons likely to dissolve



# Seriously Consider Phasing Out Industrial Marine Fisheries

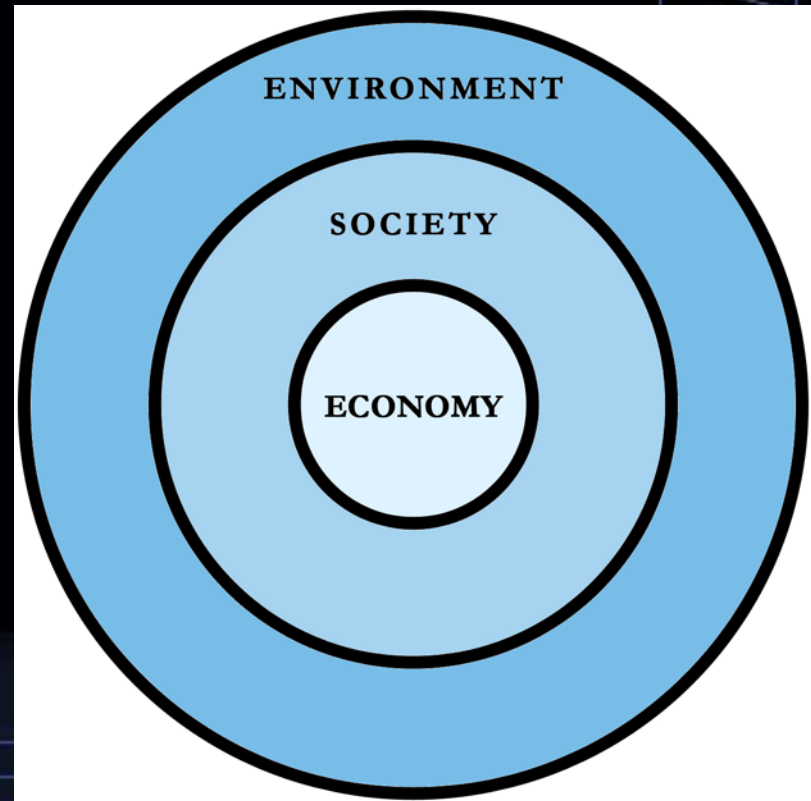


- As with the Paphanamokuakea Marine National Monument, the choice is often framed as fisheries vs. ecosystems.
- In contrast, a resilience theory view of the trickster Anthropocene suggests that we should be viewing our choice in terms of the uncertainty of the ocean's future, where fishing as usual poses a substantial risk of collapsing marine ecosystems for the future (and hence eliminating or severely reducing fishing regardless).
- We can empower ourselves to give changing marine ecosystems their best chance for the future by phasing out commercial ocean fisheries now and transitioning to the more benign forms of marine aquaculture.



# Implications for Sustainable Development

- The “sustainable” development narrative also has to come to grips with a changing planet and ecological limits.
- The planetary boundaries concept could re-frame sustainable development into a viable Anthropocene narrative.
- However, the environment must become the hard limit of development, not an asset that can be traded for economic growth or social improvement.



# The Empowerment



- **Resilience theory warns us that undesirable transformations are possible, and in some cases, maybe, inevitable.**
- **HOWEVER, resilience theory also teaches us that we can work to avoid the social-ecological transformations we REALLY don't want.**
- **MOVEOVER, resilience theory also counsels that we can work to guide the transformations we cannot avoid to end up with productive—if different—ecosystems and SESs.**
- **In other words, we can, in fact, cope with the trickster.**

# And One Last Point . . .

**Resilience theory also counsels us that if we don't get serious about mitigation, the climate change trickster will play a bigger and bigger role in our lives, in ways that will make us increasingly uncomfortable.**



**Trickster Print by Bill Lewis**

THANK  
YOU!

# THE END OF SUSTAINABILITY

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**RESILIENCE  
AND THE  
FUTURE OF  
ENVIRONMENTAL  
GOVERNANCE  
IN THE  
ANTHROPOCENE**

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**Melinda Harm Benson & Robin Kundis Craig**