



Oluwakemi Izomo

Mitigation and Adaptation Studies



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Class 24: Developing Options: Avoiding Adaptation

Contents

- Sustainability and Policy Making
- Adaptation to Sea Level Rise
- Accounting for Extremes
- Accounting for Slow Changes



System State



Time

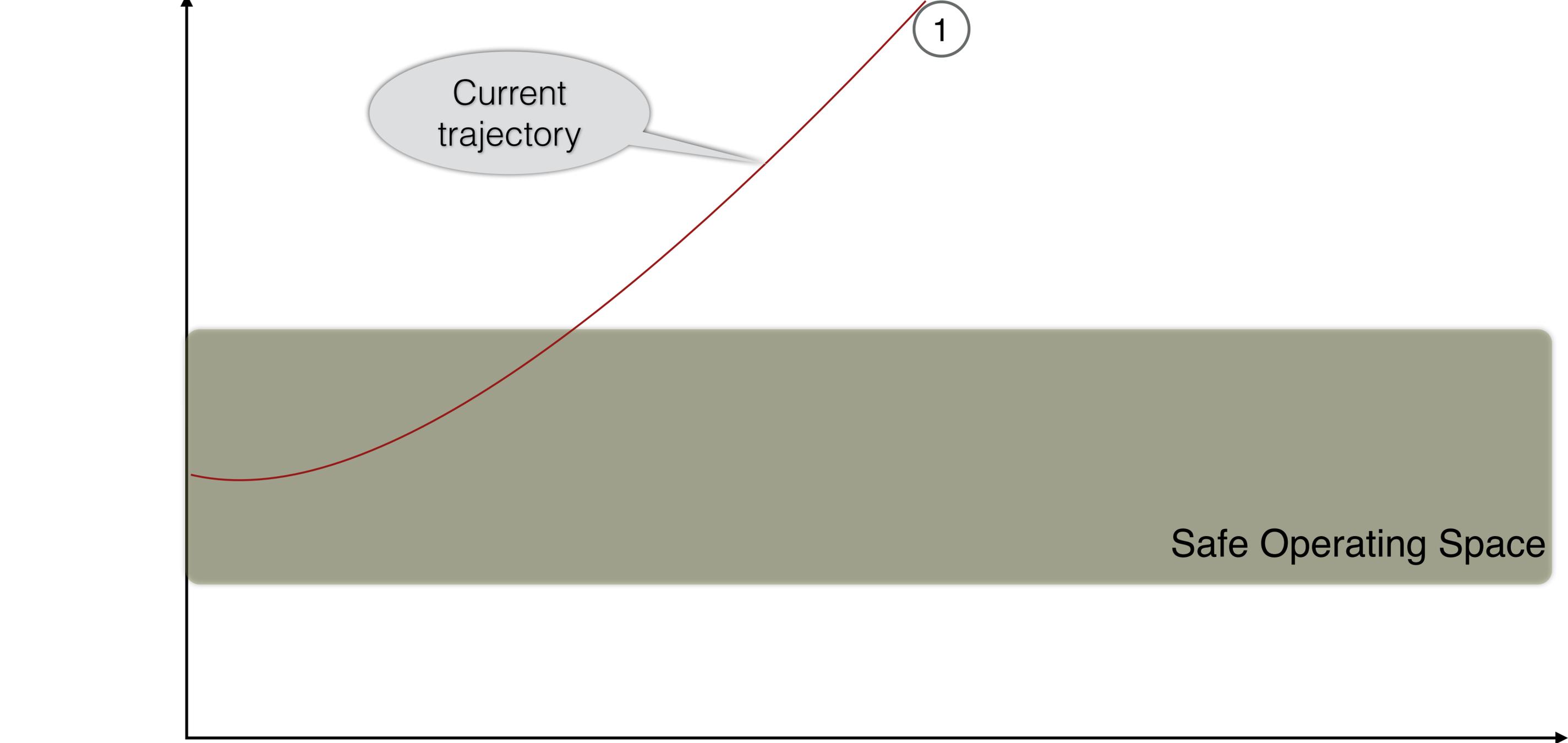
System State



Safe Operating Space

Time

System State



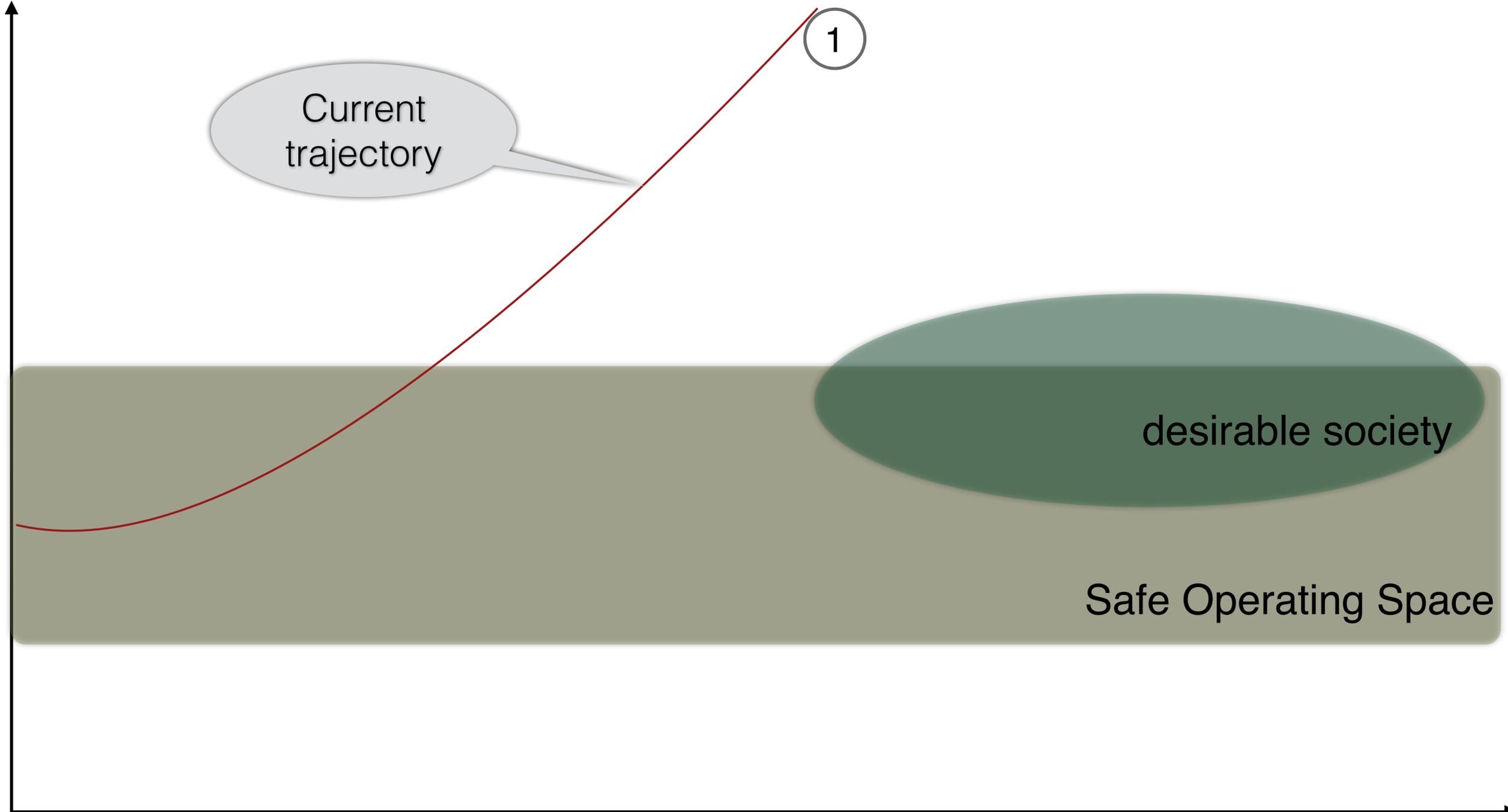
Current trajectory

1

Safe Operating Space

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System State



Current trajectory

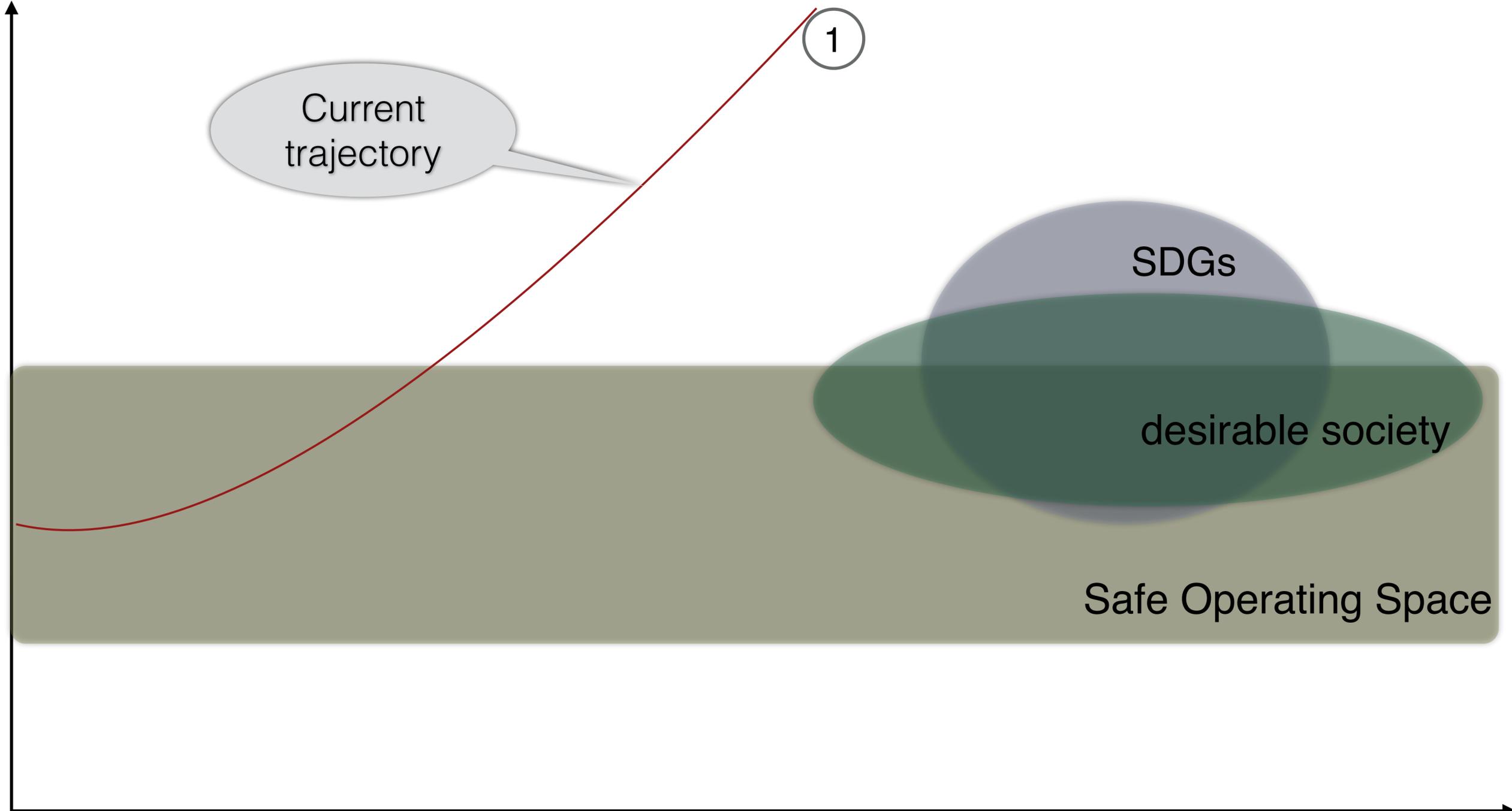
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desirable society

Safe Operating Space

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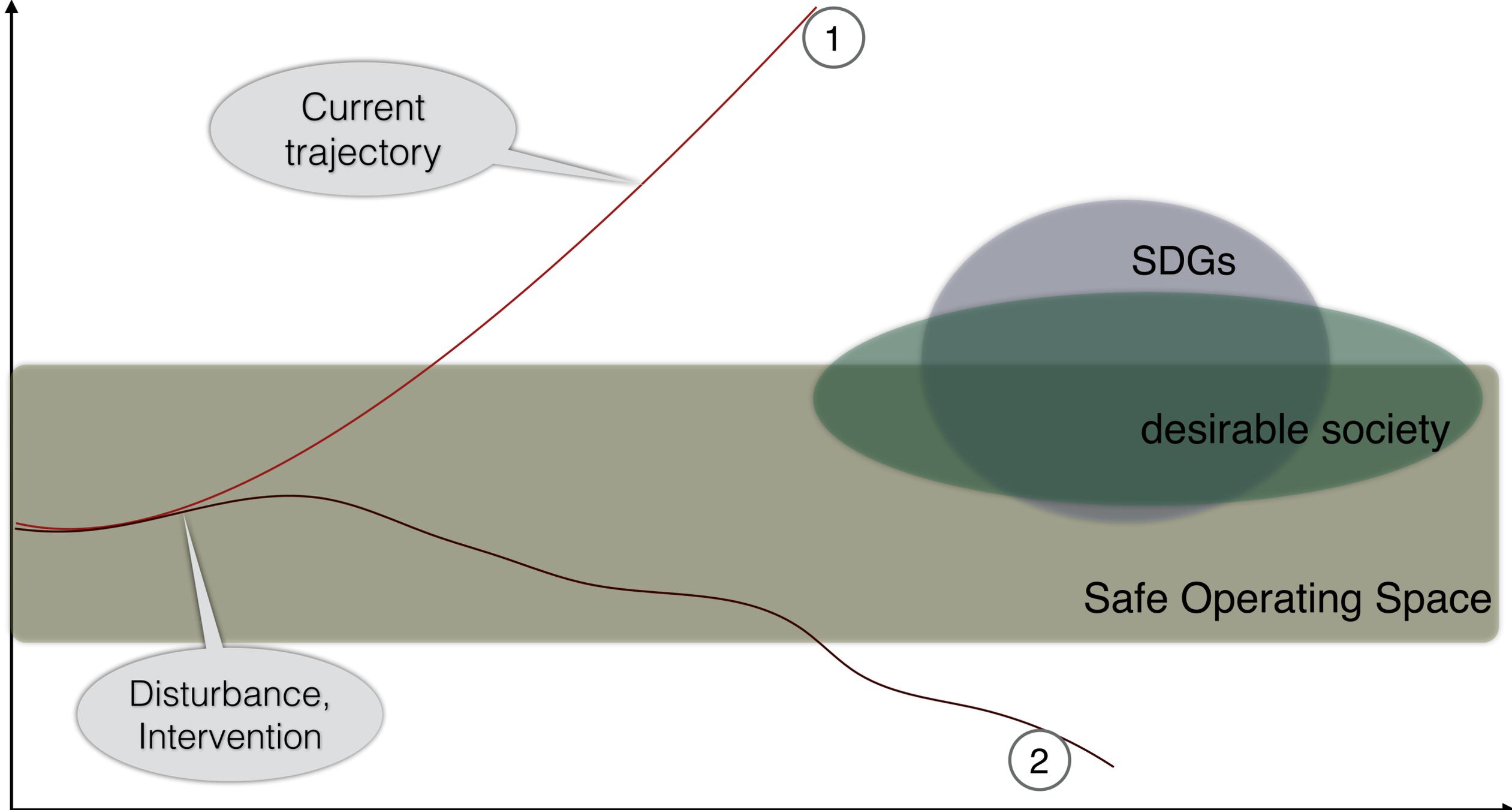
SDGs

desirable society

Safe Operating Space

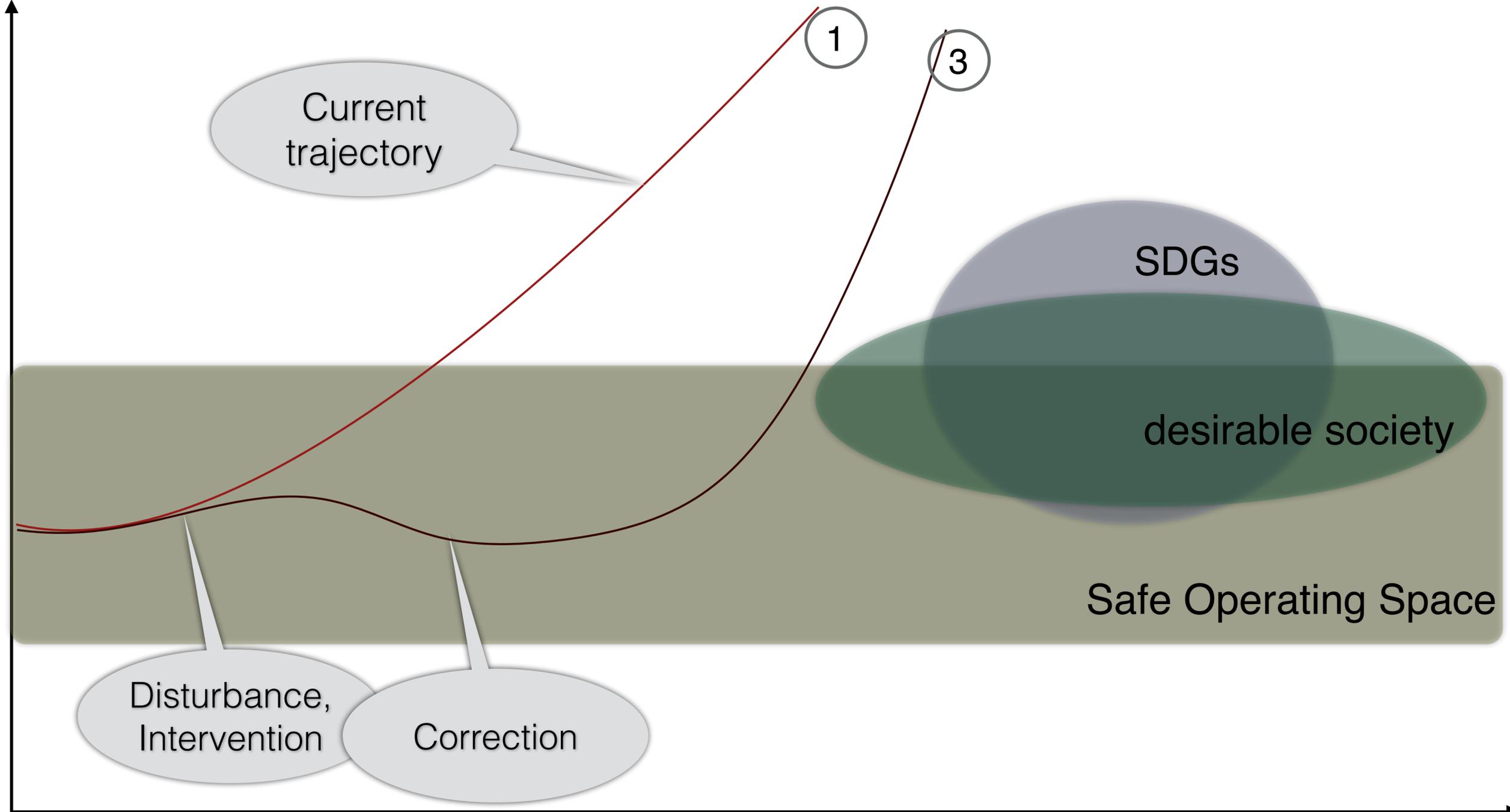
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System State



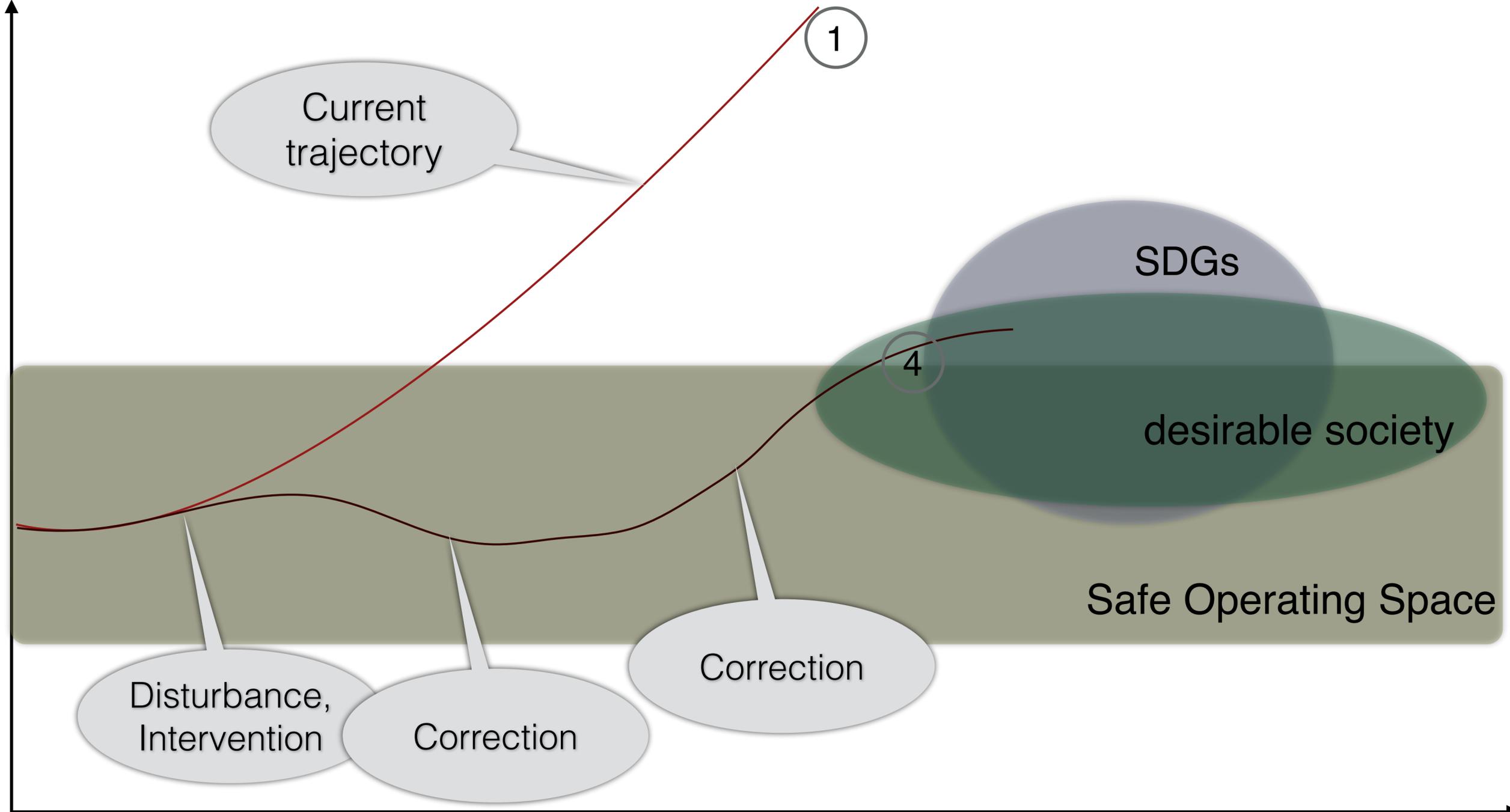
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System State



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Time

Foreseeability and Foresight:

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- What might happen?

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- Possible threads and hazards

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System knowledge
Current state and trends

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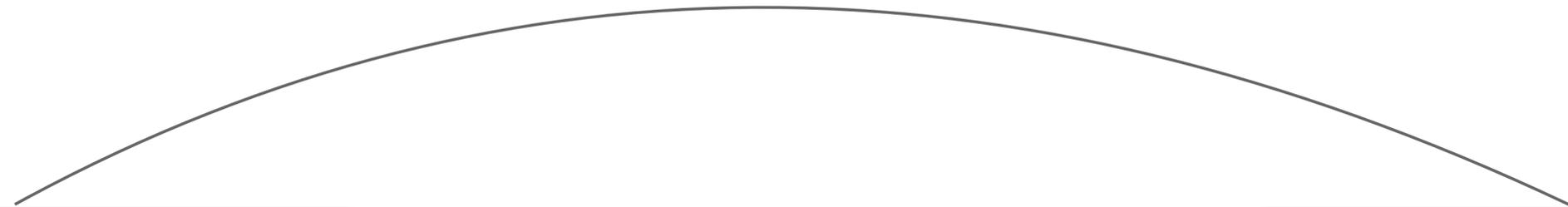
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System knowledge
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Goal knowledge
desirable future



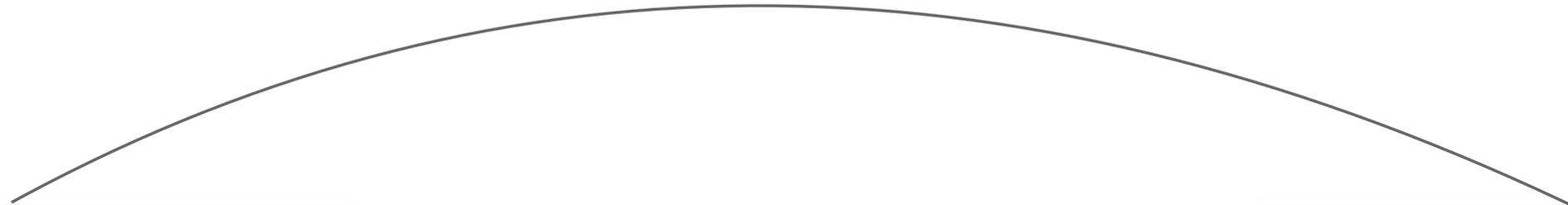
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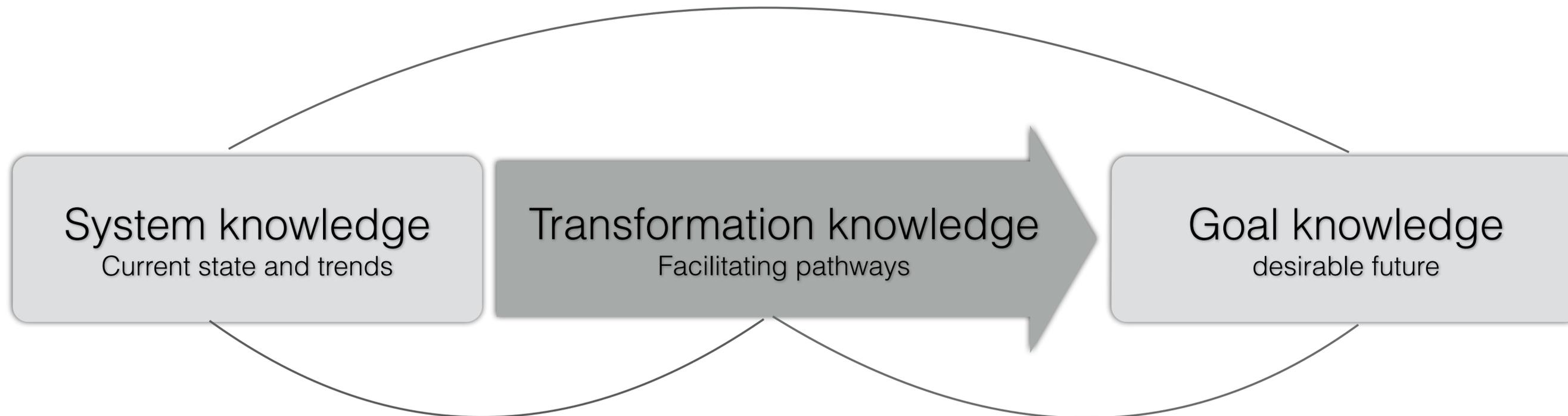
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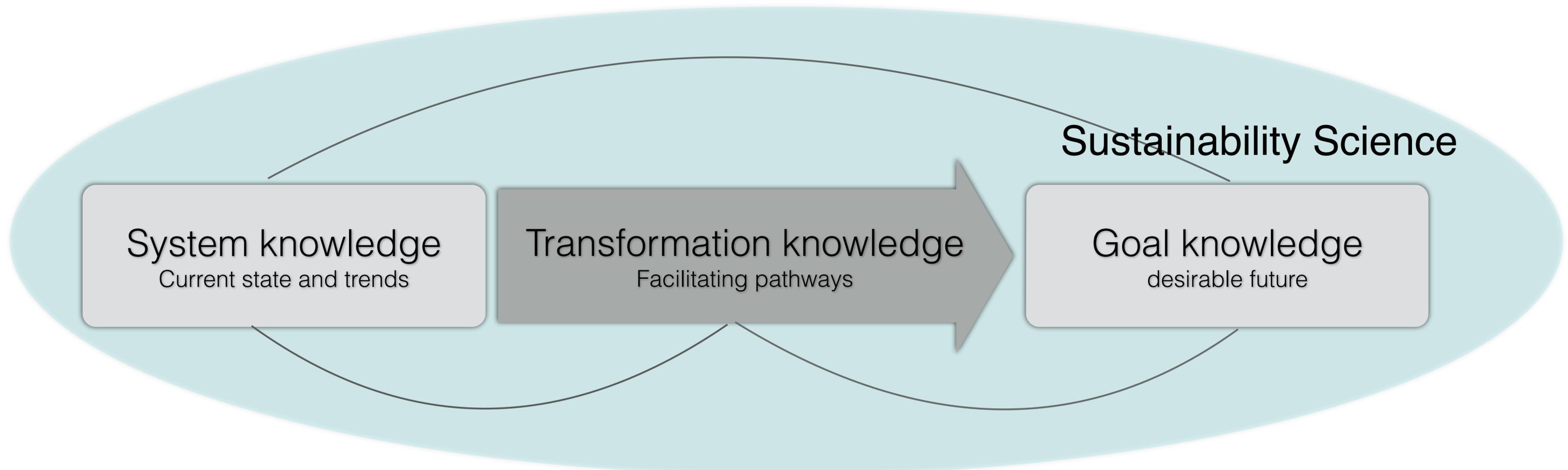
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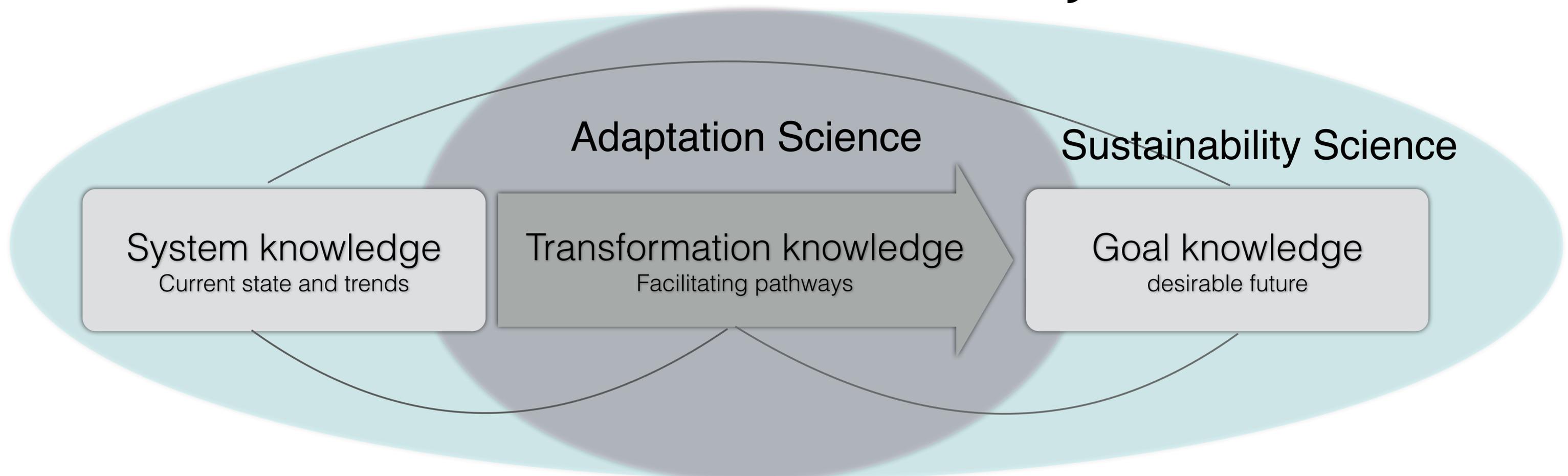
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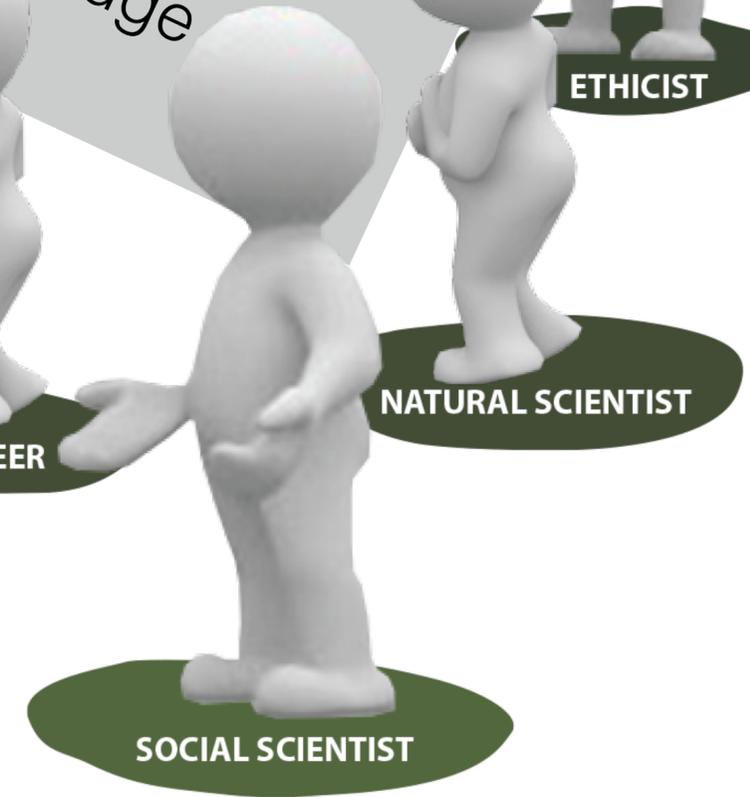
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“Wizard Clairvoyant”
*Exploring the Future
with Simulations*

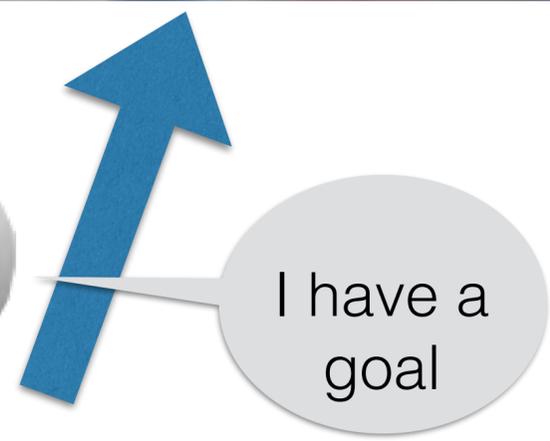
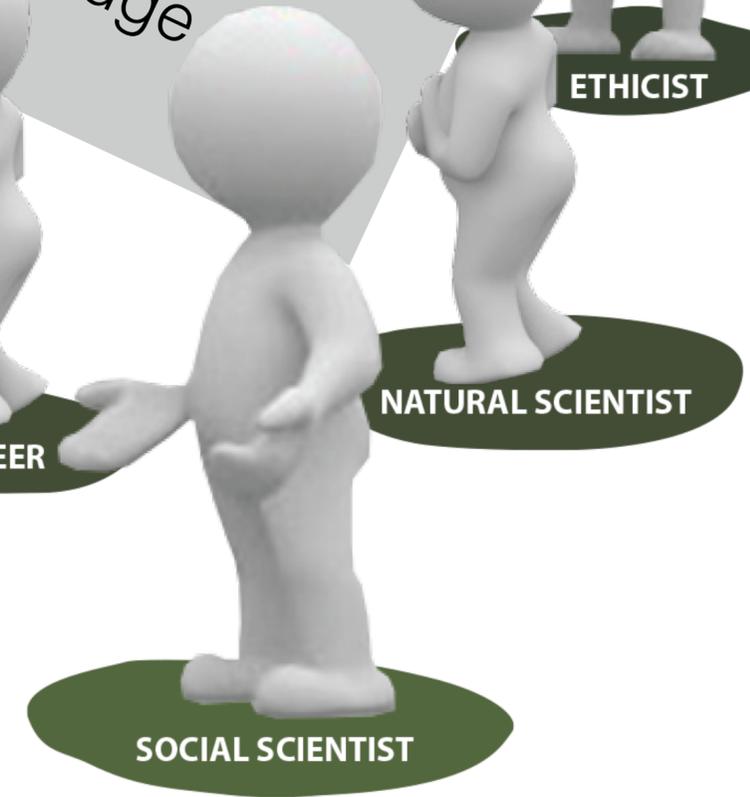
Scientific knowledge





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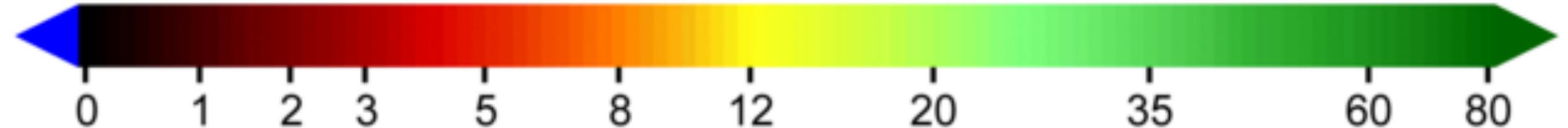
I have a goal



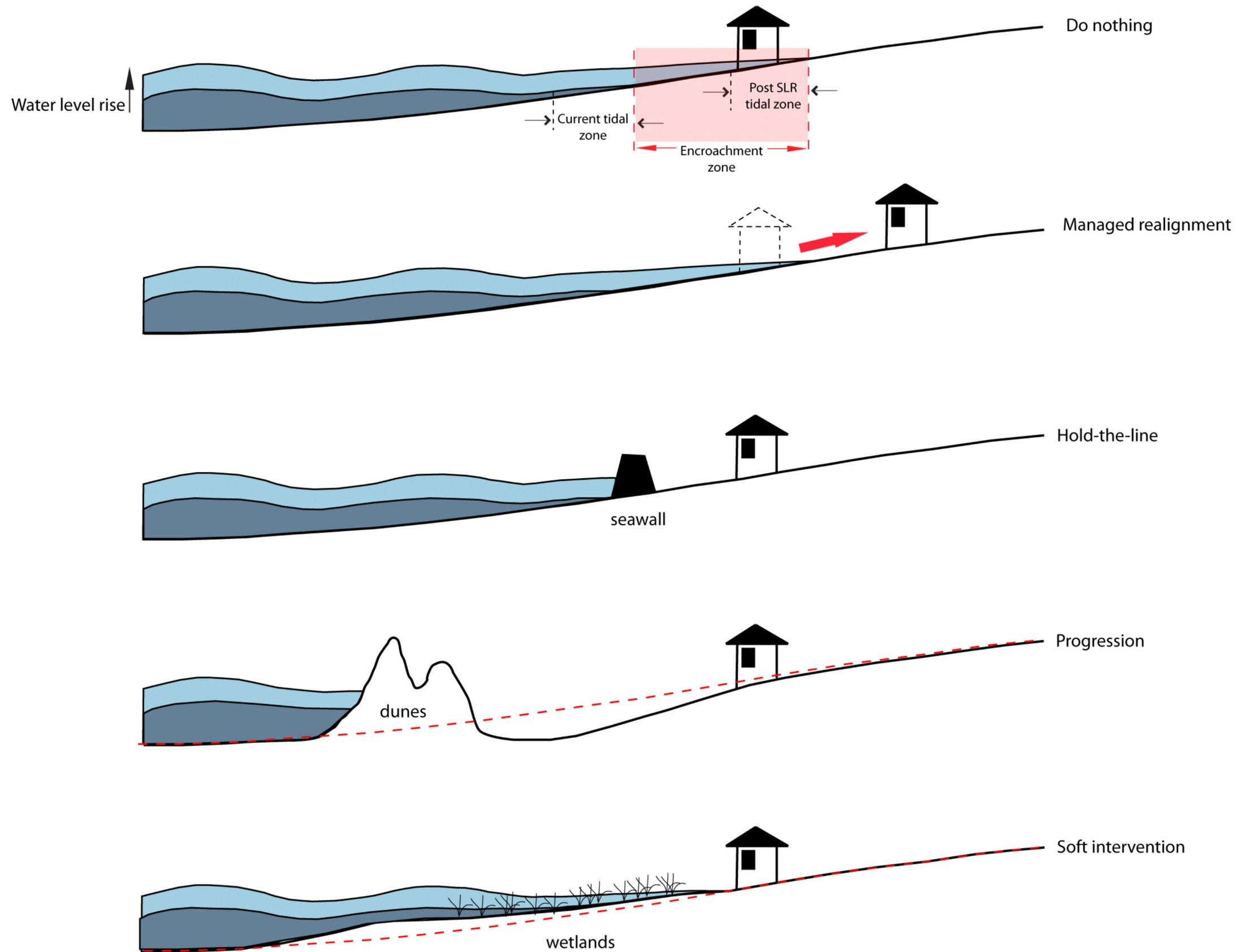
Regions Vulnerable to Sea Level Rise



Height Above
Sea Level (m)



Adaptation to Sea Level Rise



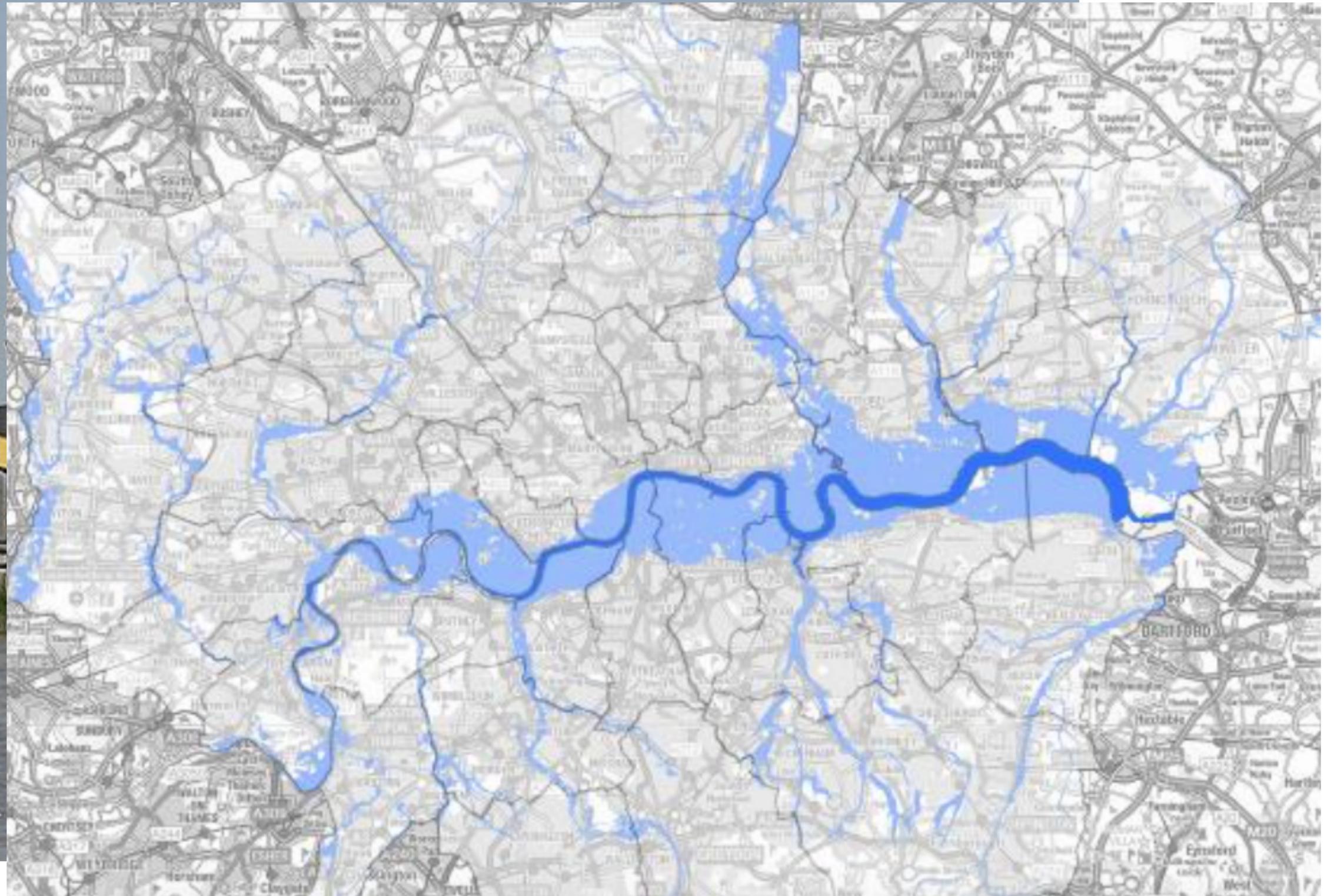
Adaptation to Sea Level Rise



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Adaptation to Sea Level Rise



Adaptation to Sea Level Rise

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Winter storms in December 2013-January 2014 almost reached the top of the barrier.

Adaptation to Sea Level Rise



Adaptation to Sea Level Rise

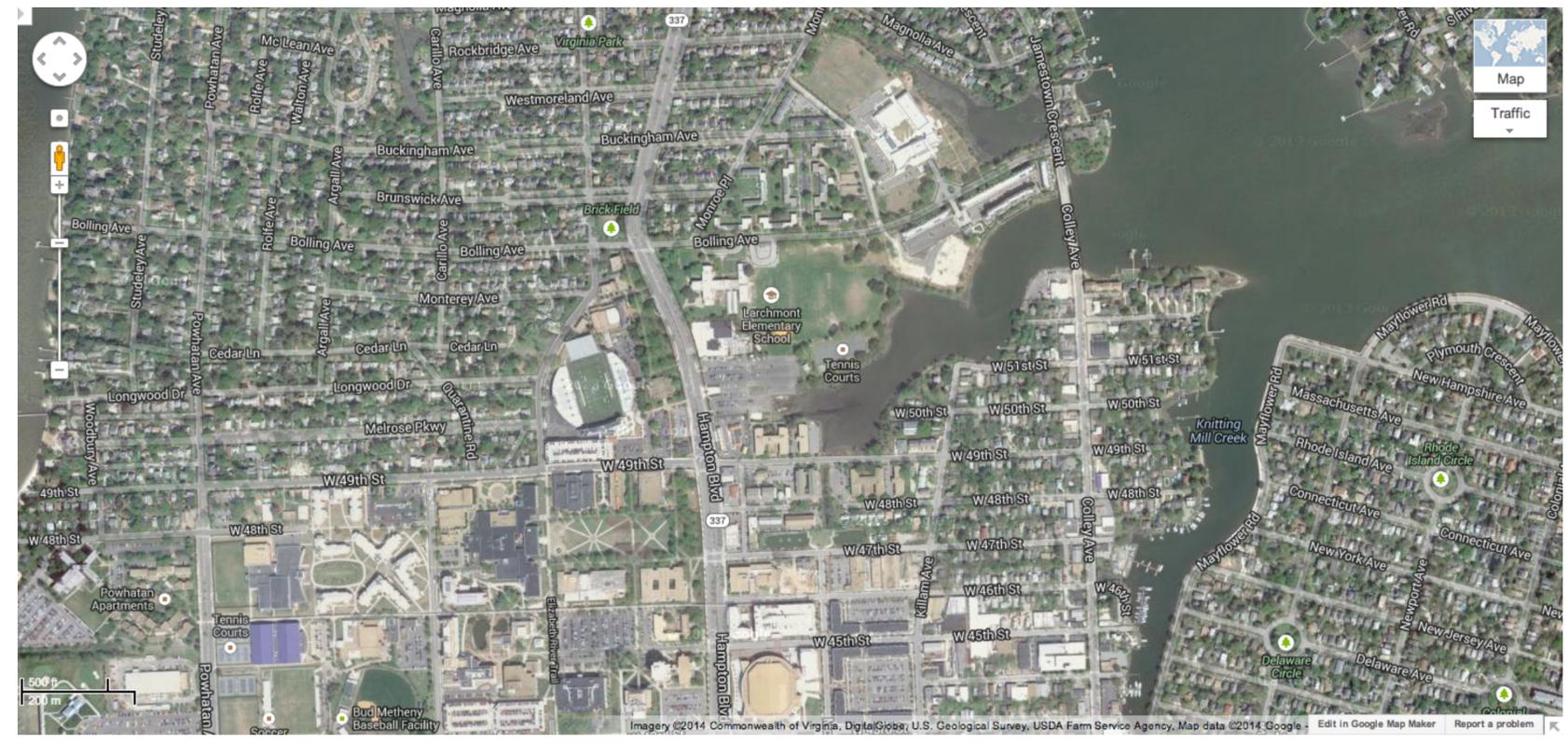


Adaptation to Sea Level Rise

- The Netherland:
- 60 % of the country below sea level
 - protected by massive infrastructure



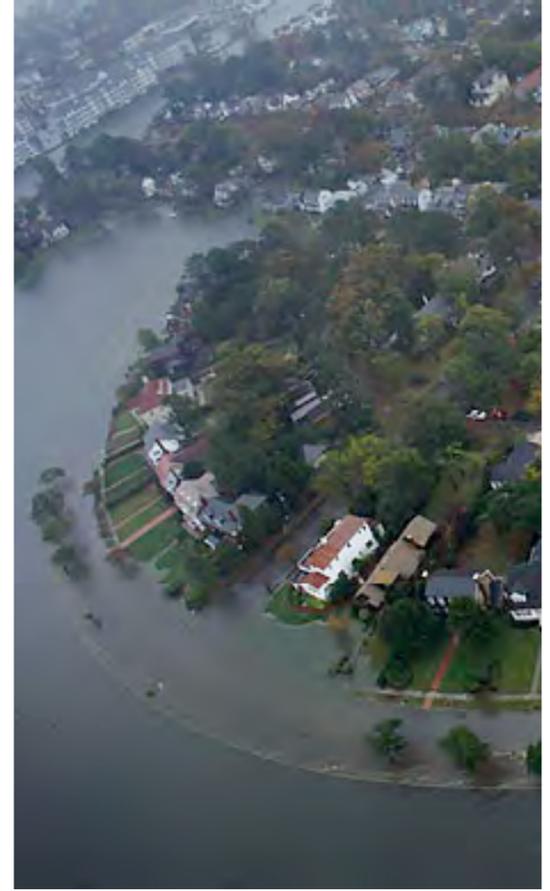
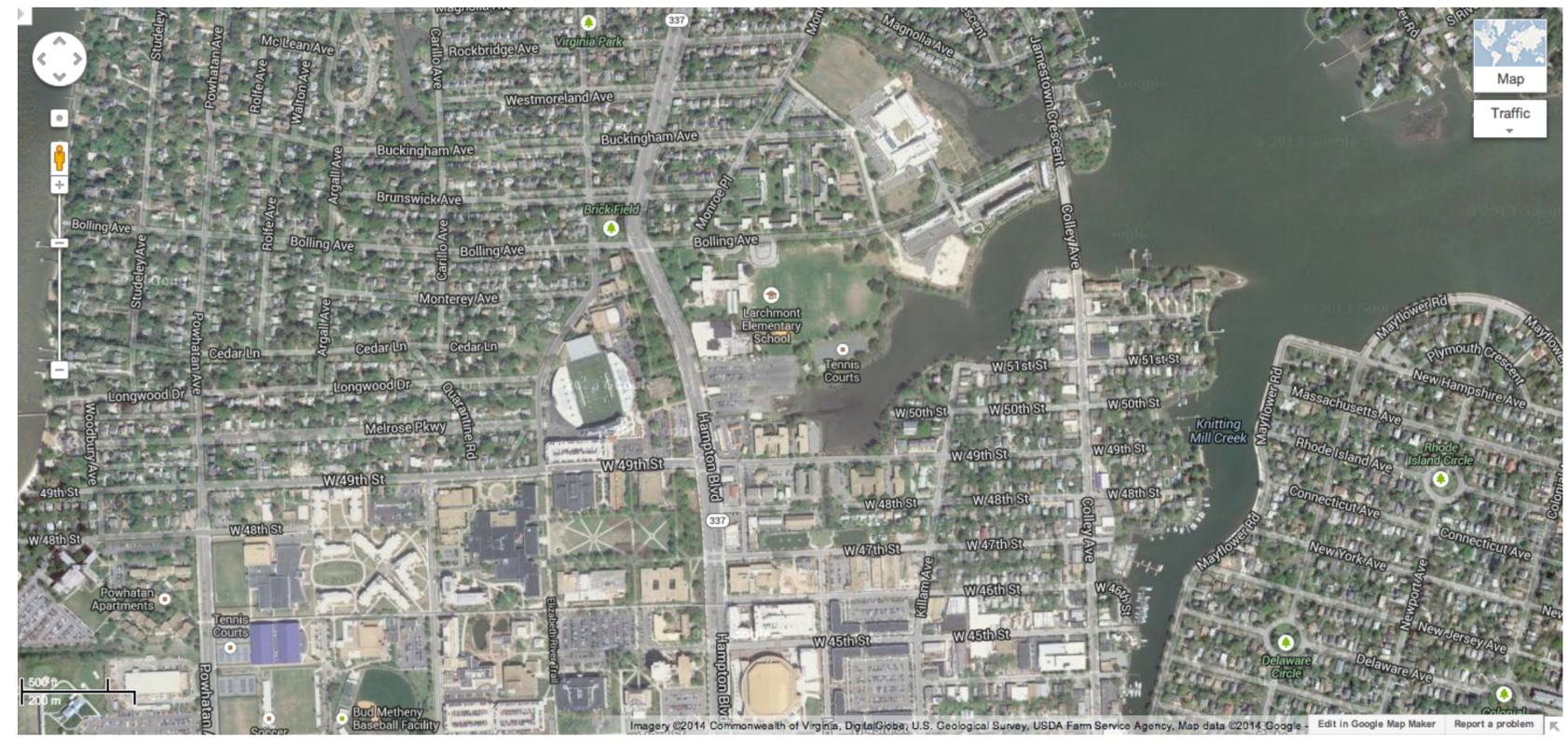
- US:
- many low-laying areas fully exposed
 - frequent flooding increasingly an issue



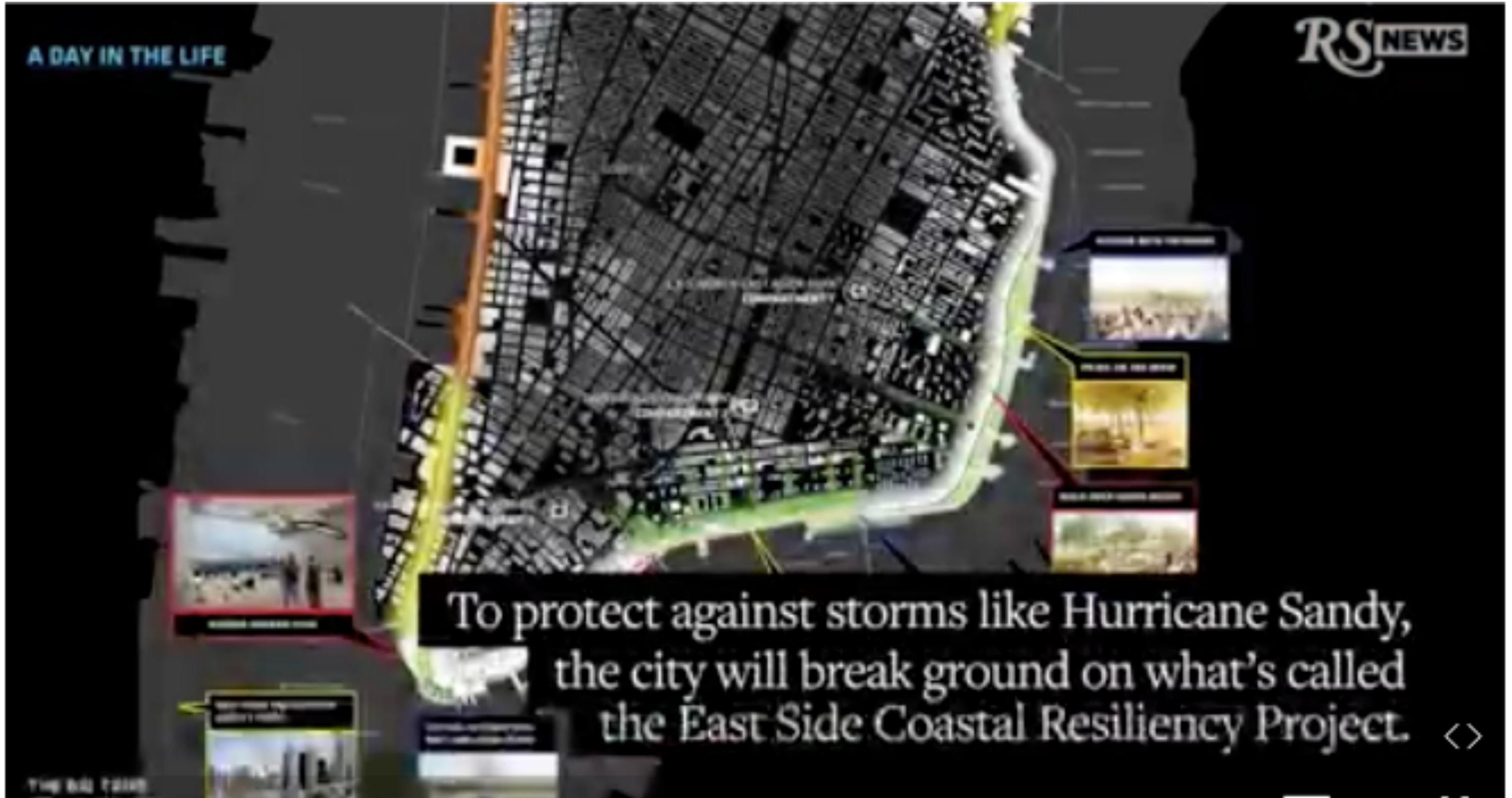
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John Blackford

RS NEWS

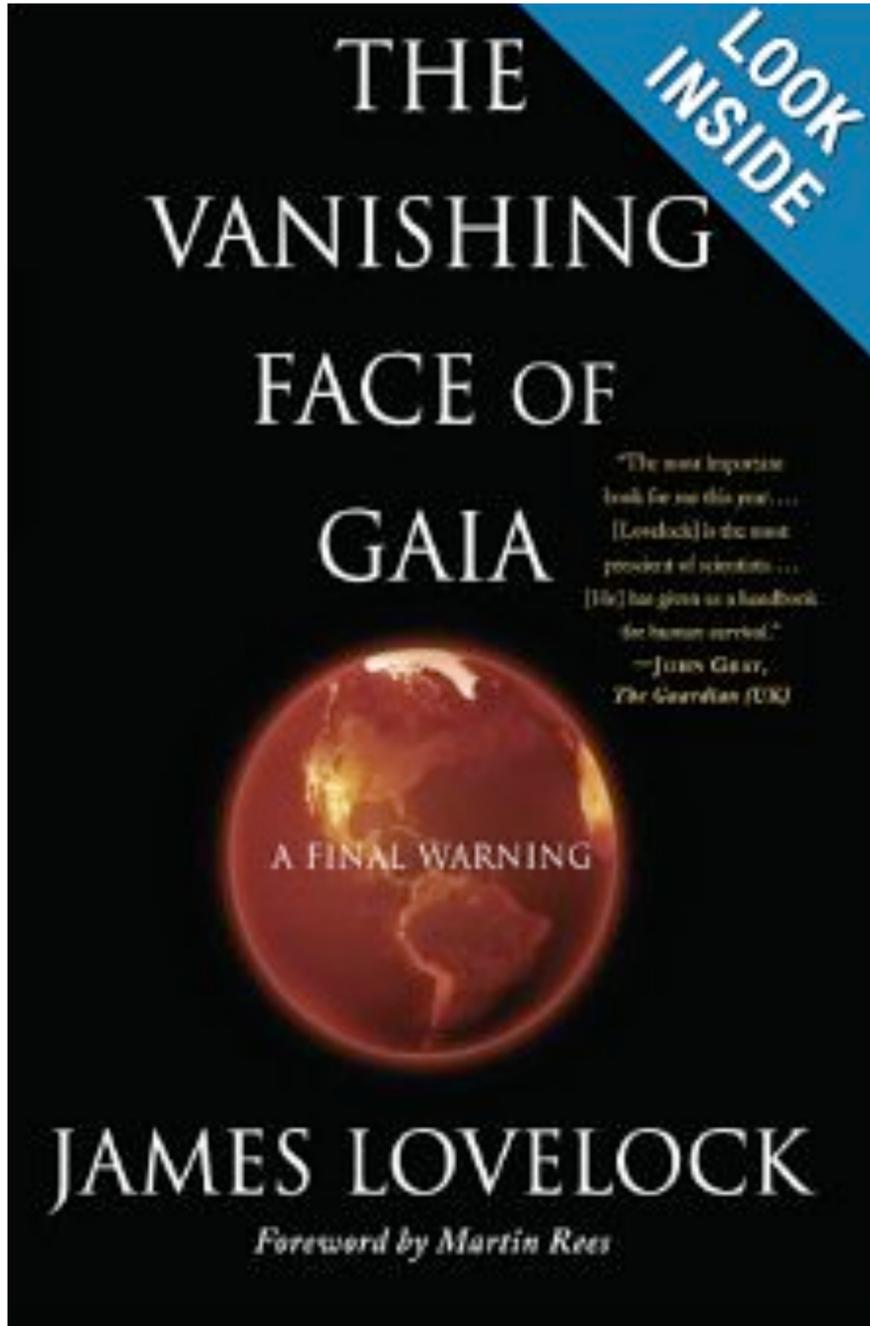
“

“But there will come a moment when no matter what you do, even a rich city like New York won't be able to protect itself.”

– *Guy Nordenson, professor of structural engineering and architecture at Princeton University*

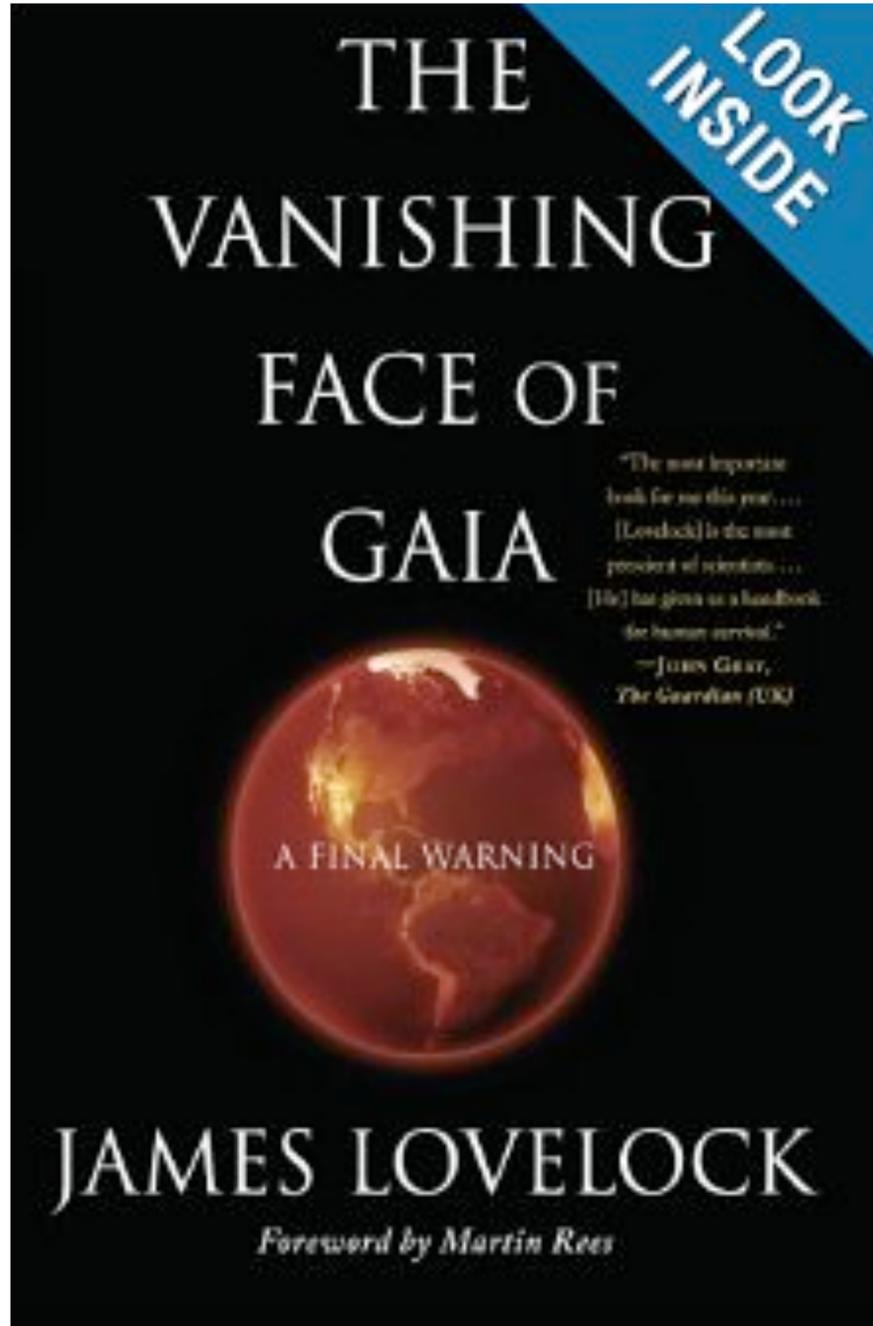






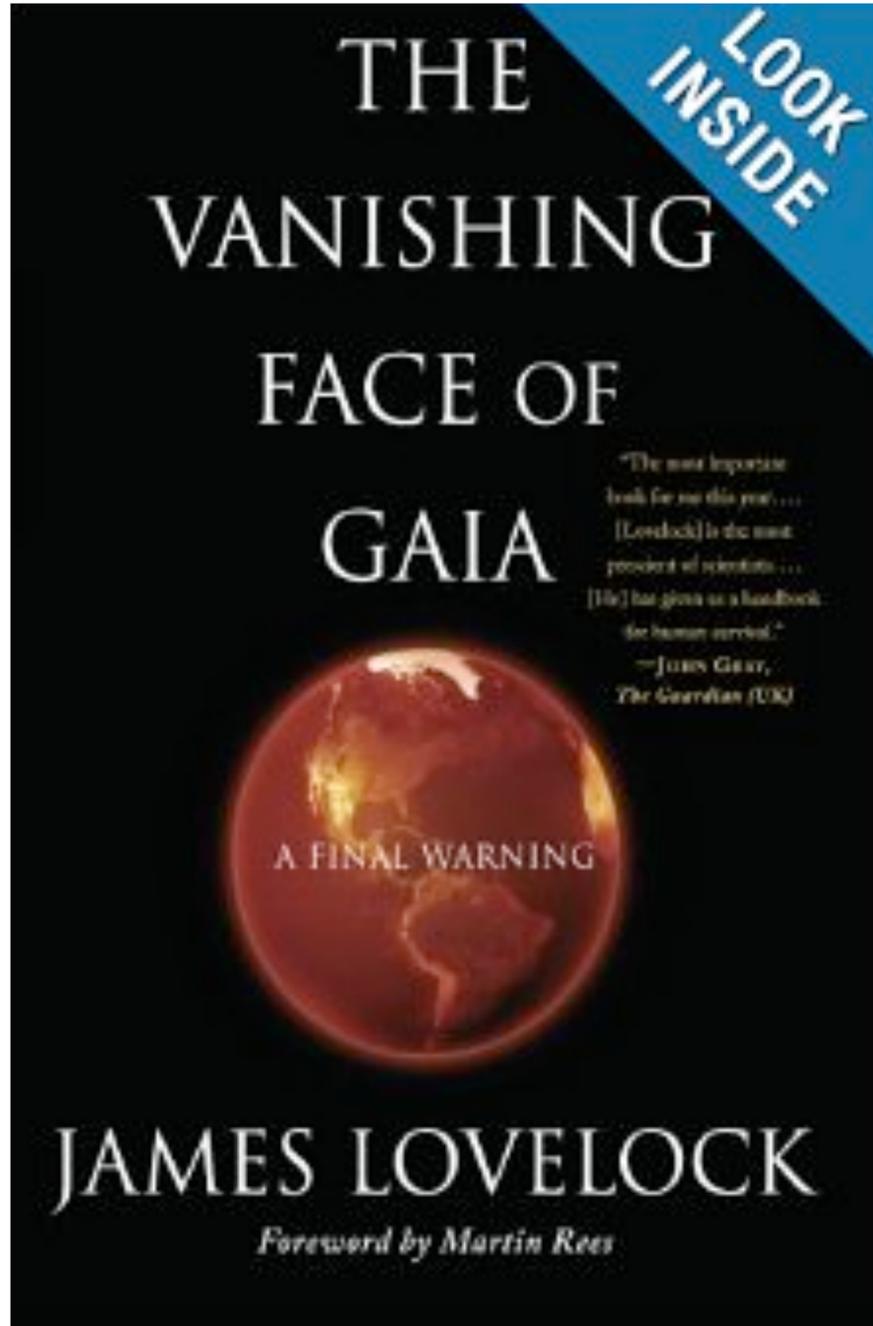
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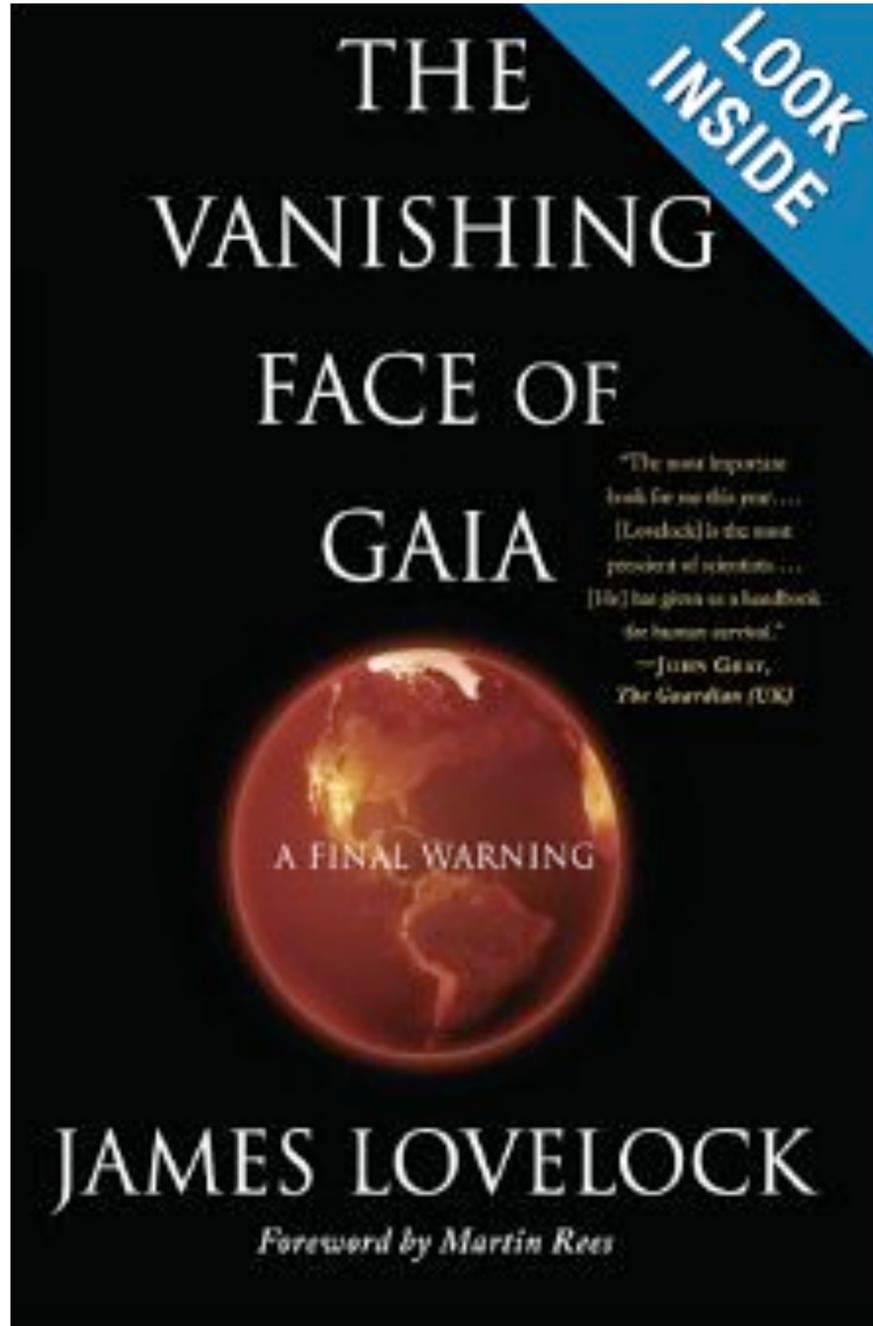
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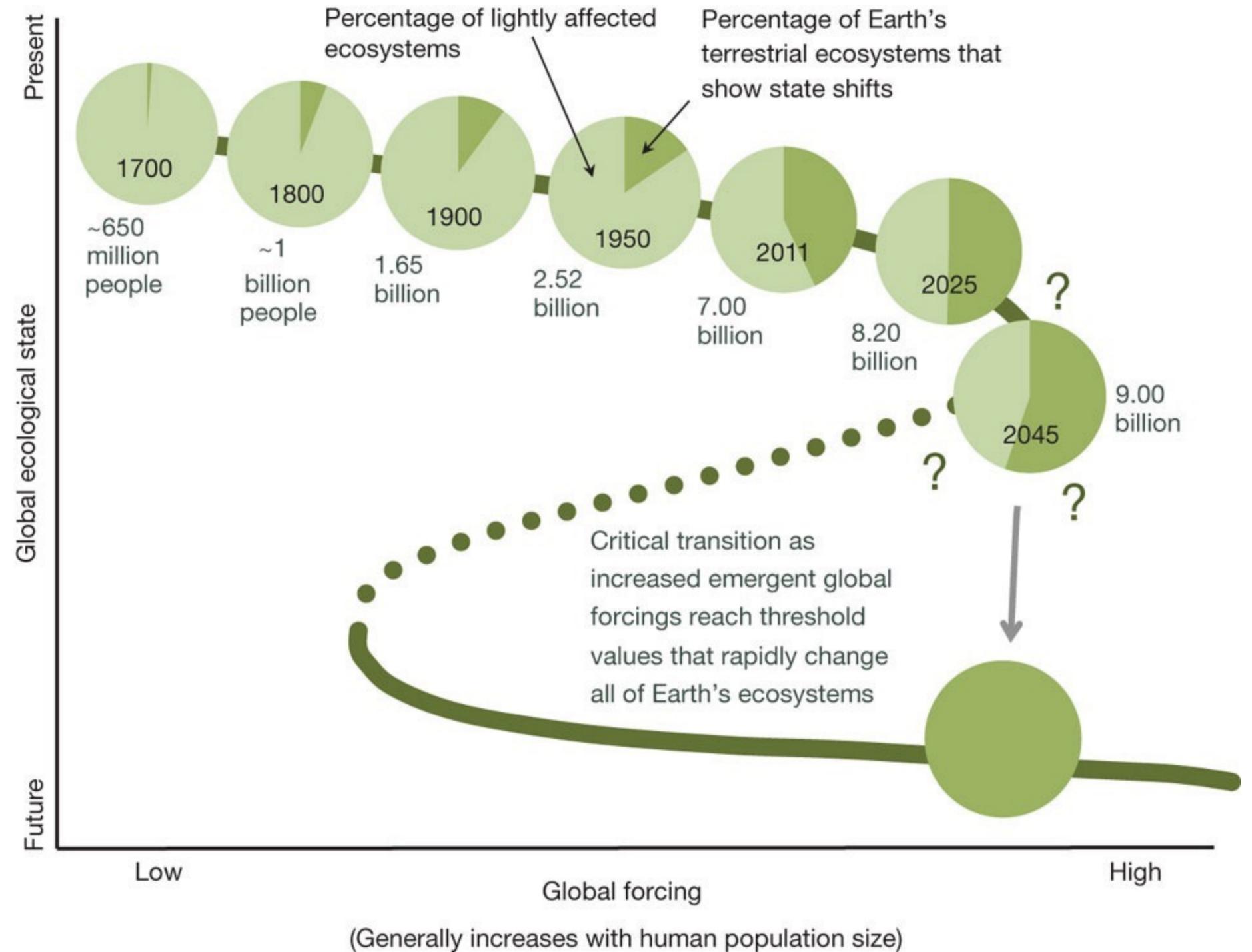


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- Type II errors (false negatives) are critical in times of unsustainability and rapid changes

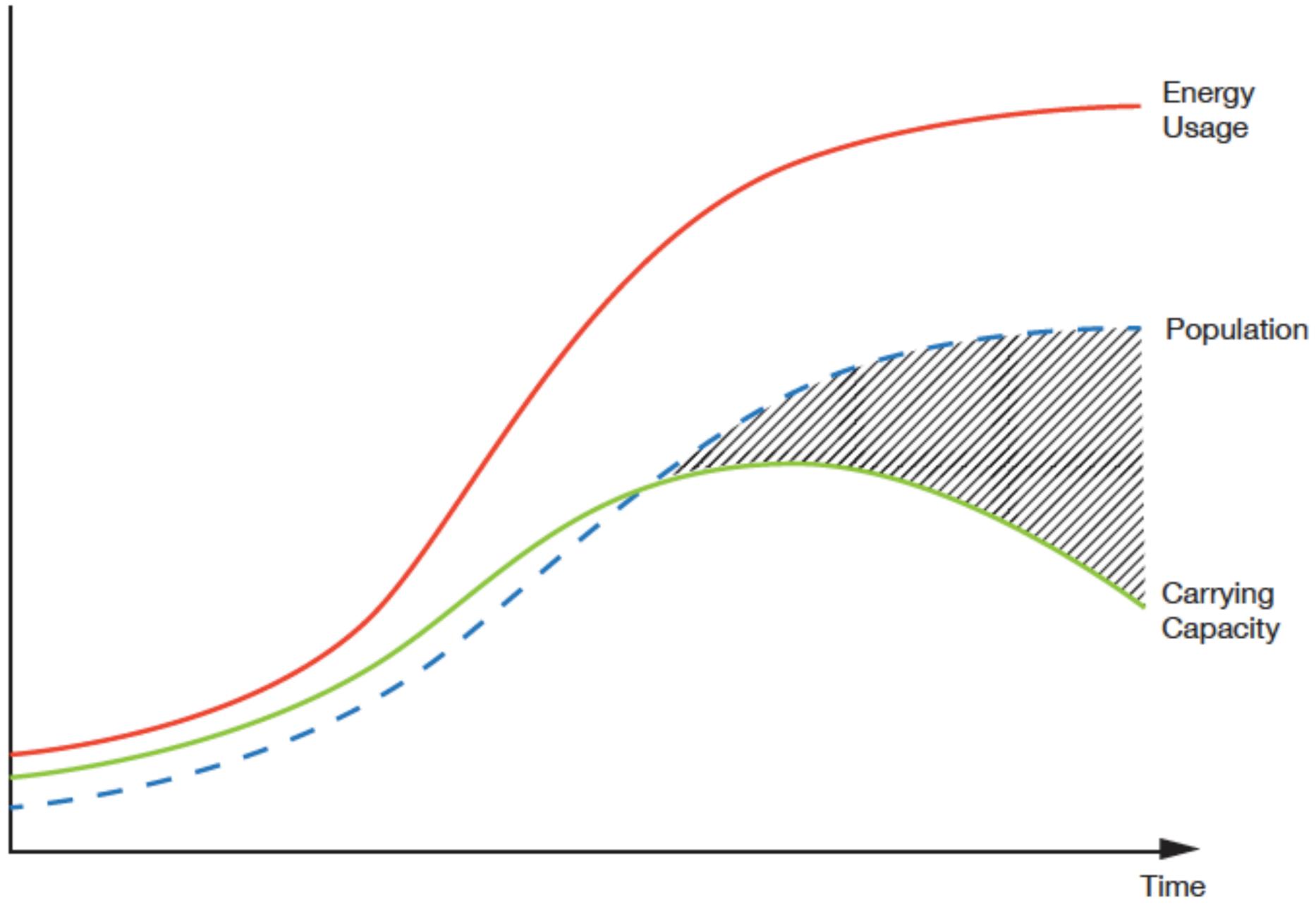
Crossing thresholds could lead to systemic changes ...

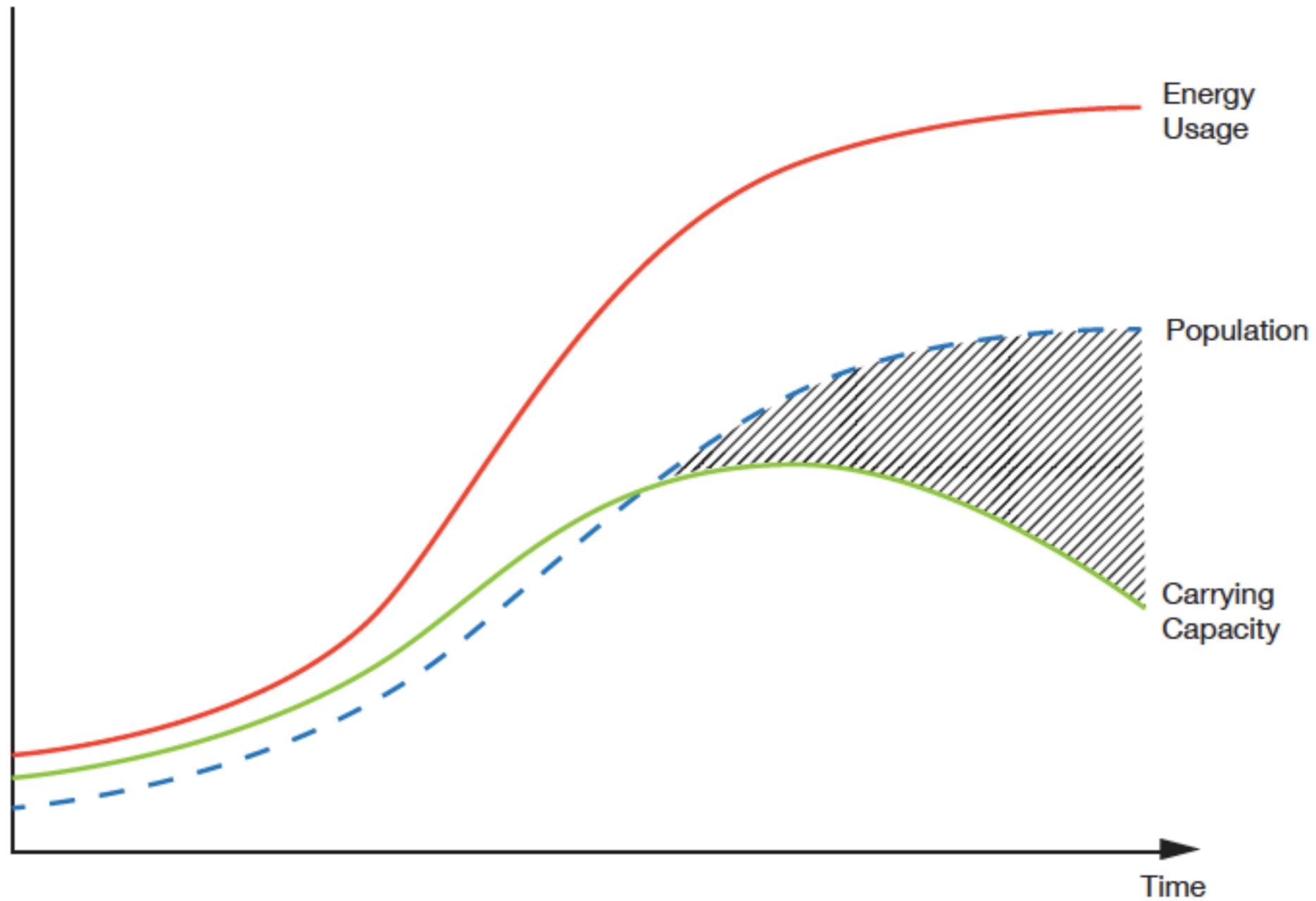
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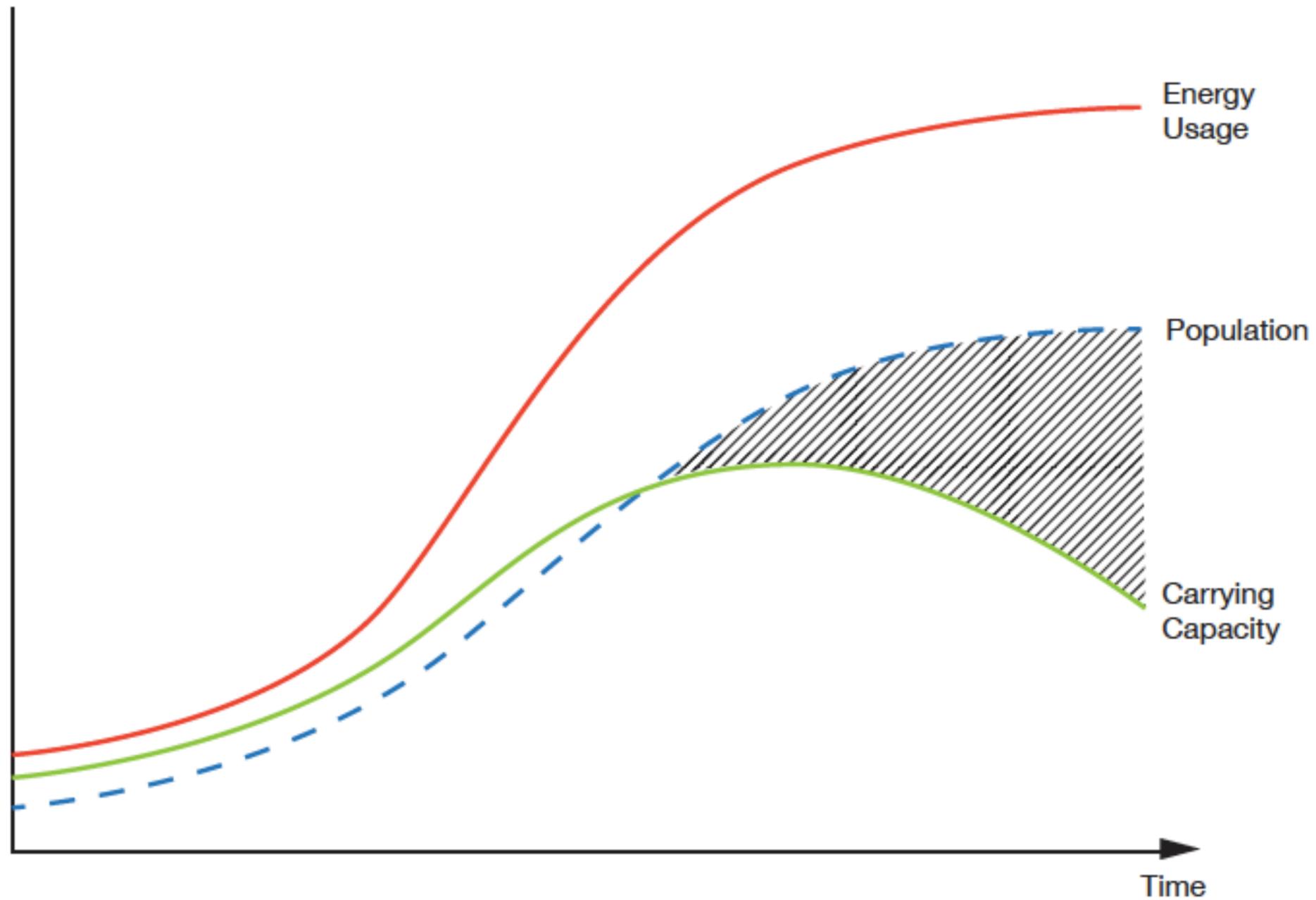
Adaptation to Global Change





Carrying Capacity = function of: Arable Land, Nitrogen, Phosphorous, Climate, Water, Biodiversity, Land Use, Energy, Degradation, Technology, ...

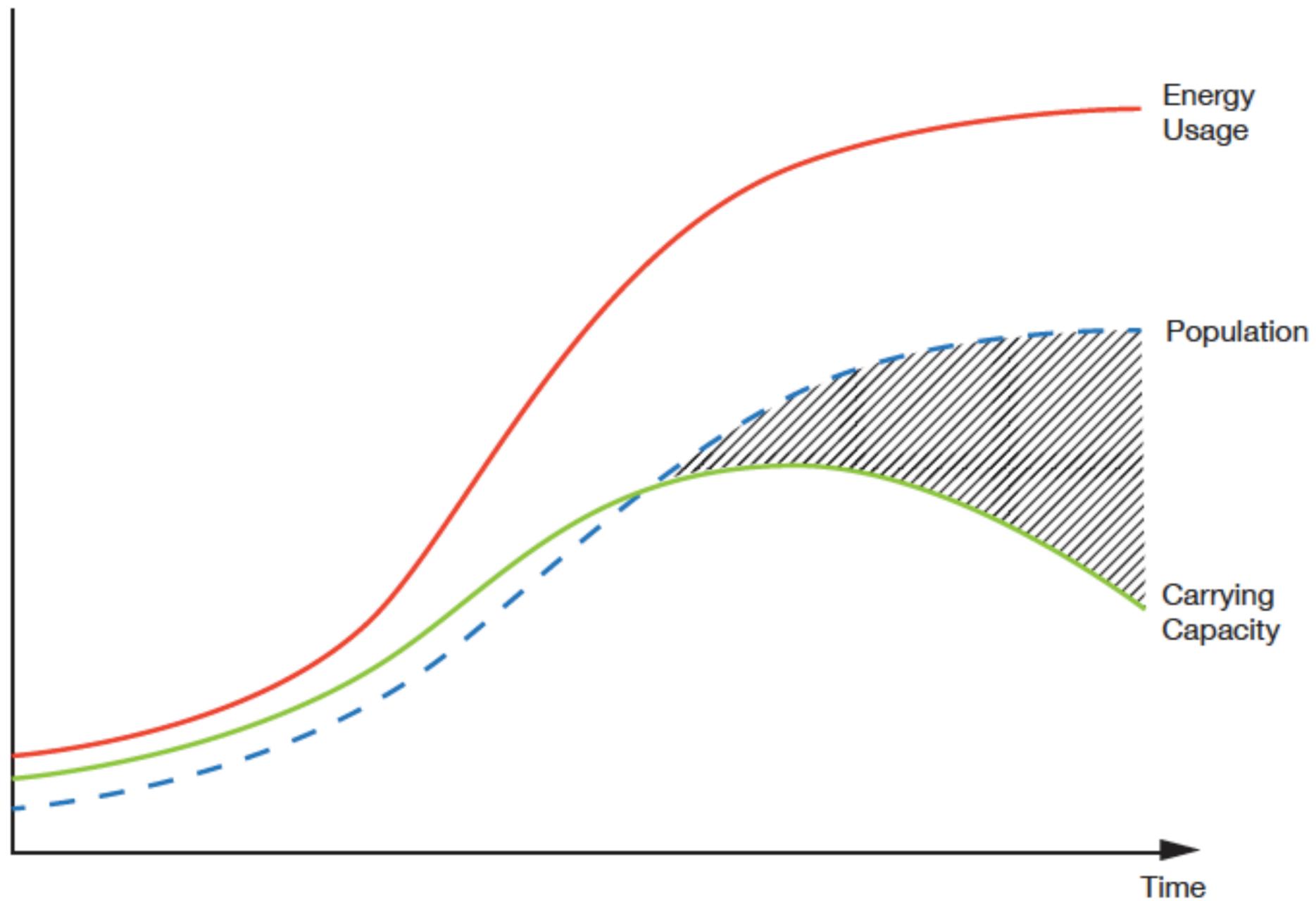
$$CC = f(A, N, P, C, W, B, L, E, D, T, \dots)$$



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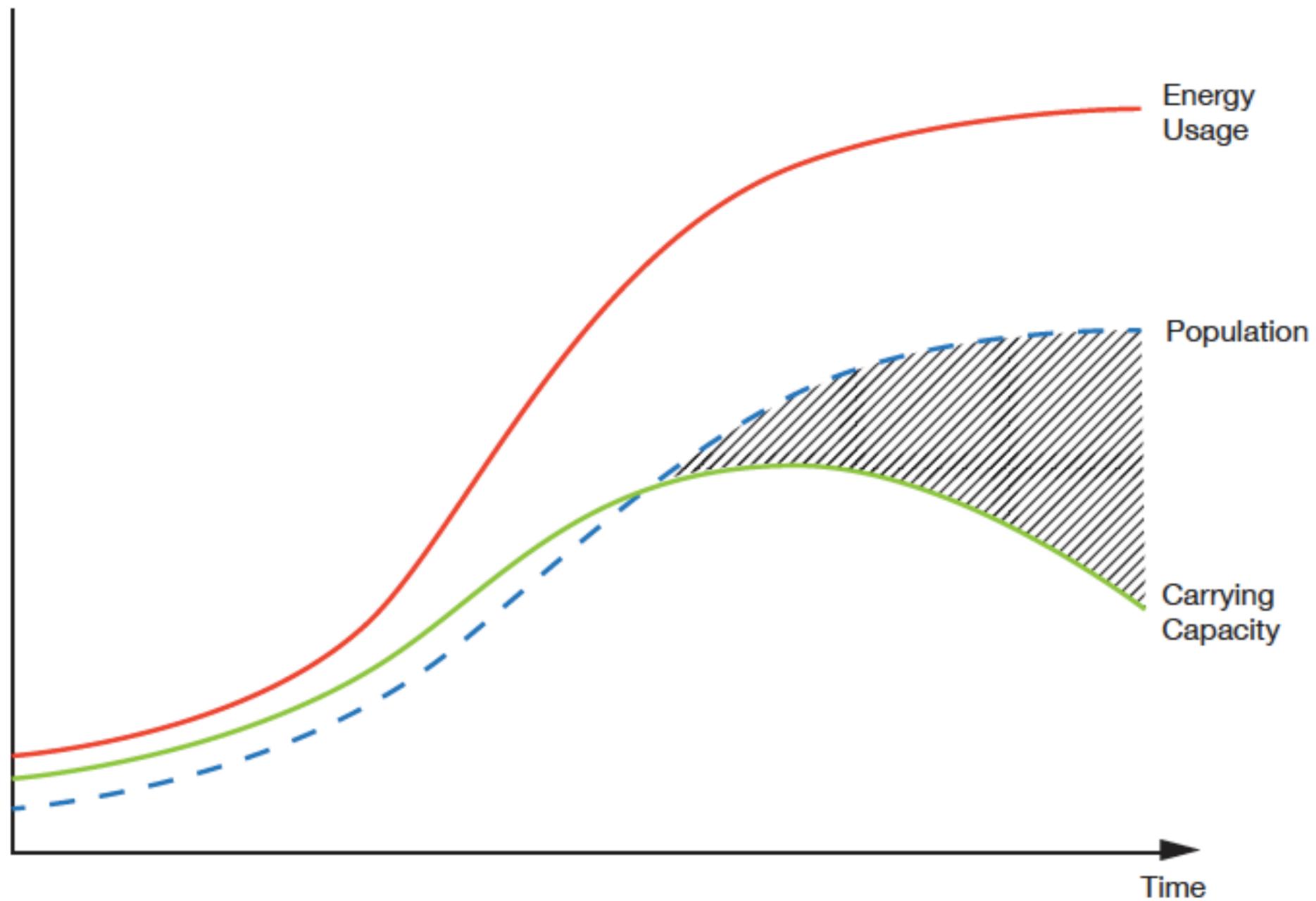


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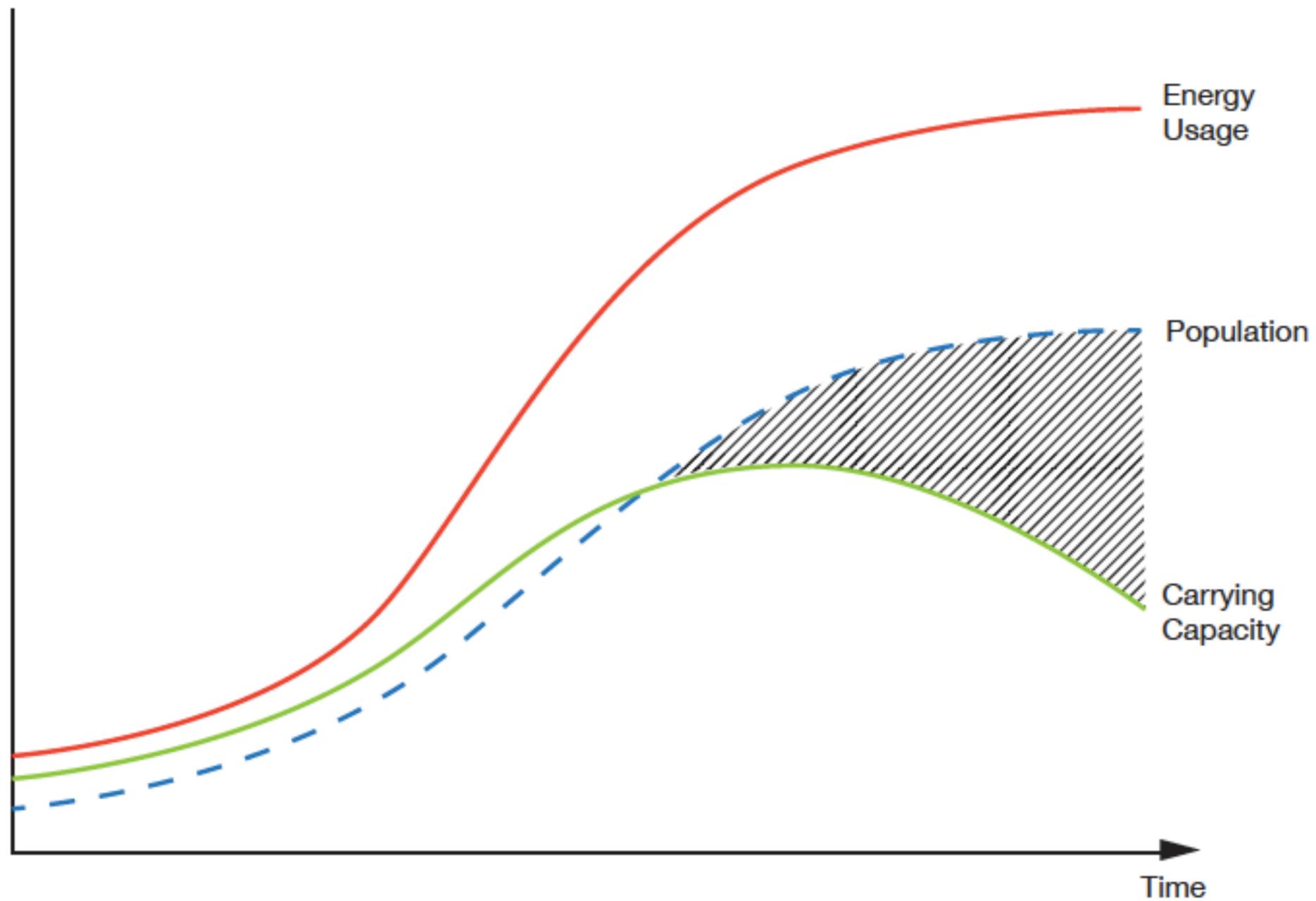
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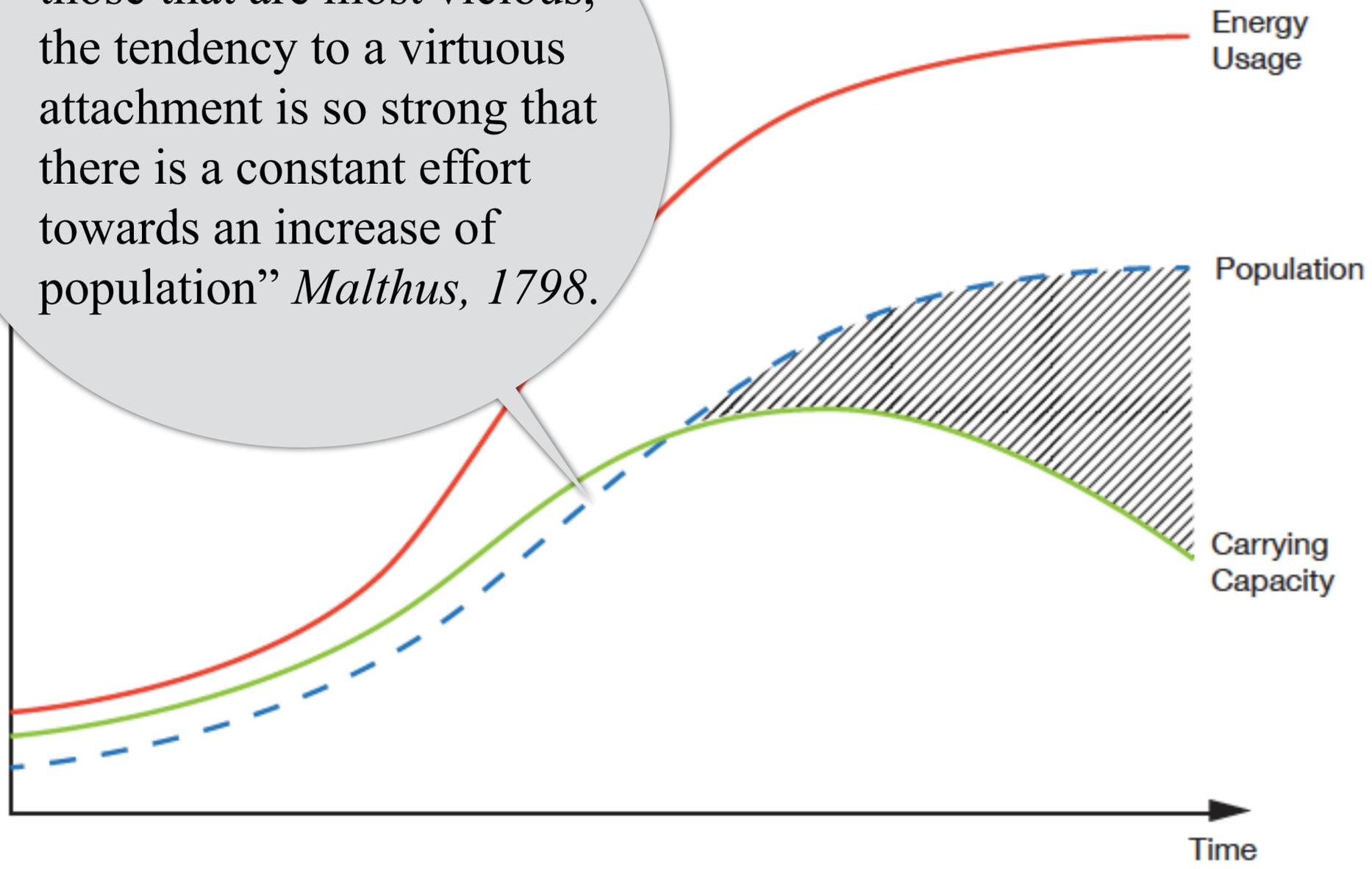
$$W = f(C, L, E, D, \dots)$$

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$$B = f(C, W, L, D, \dots)$$

Adaptation to Global Change

"Yet in all societies, even those that are most vicious, the tendency to a virtuous attachment is so strong that there is a constant effort towards an increase of population" *Malthus, 1798.*



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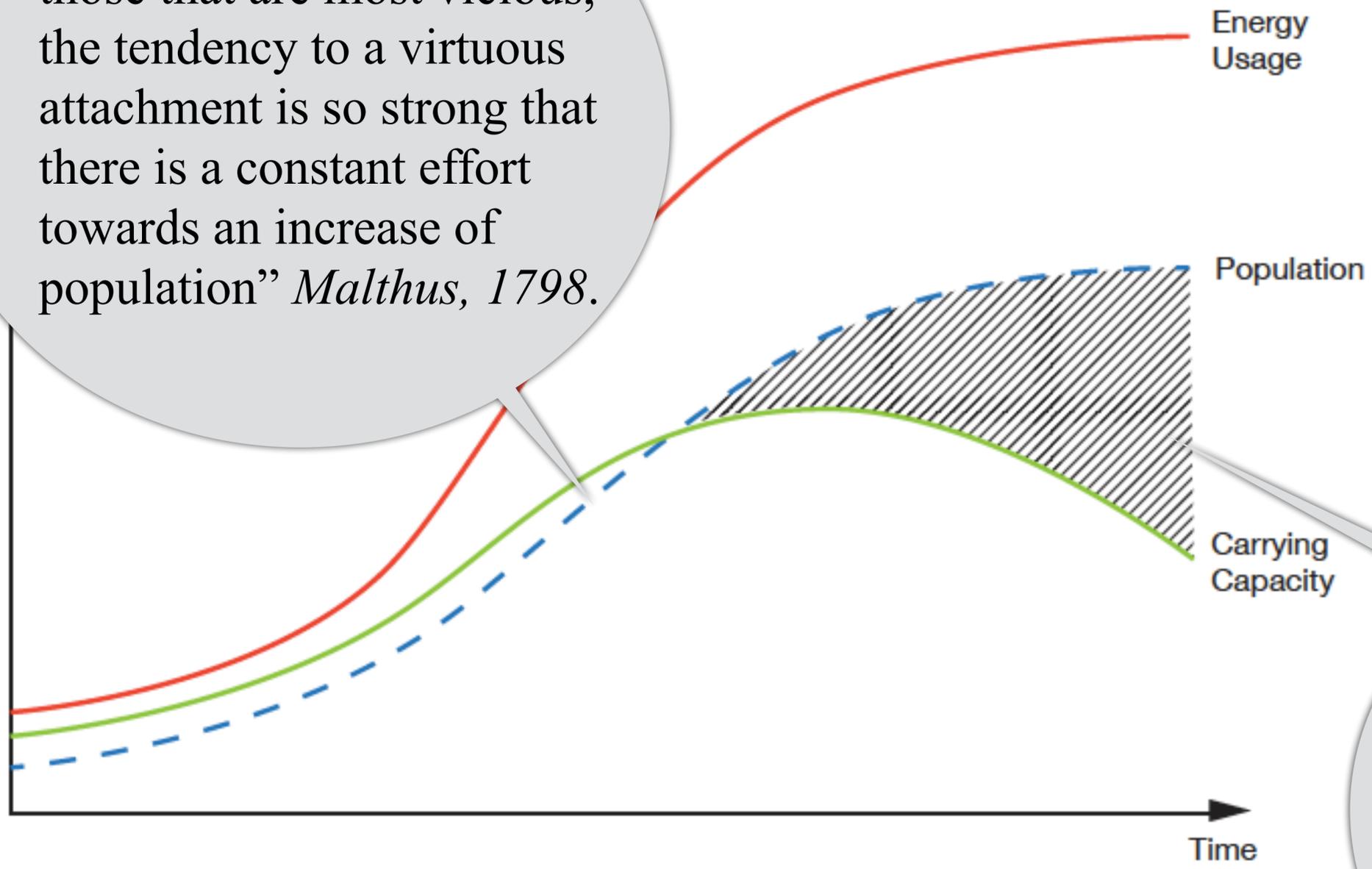
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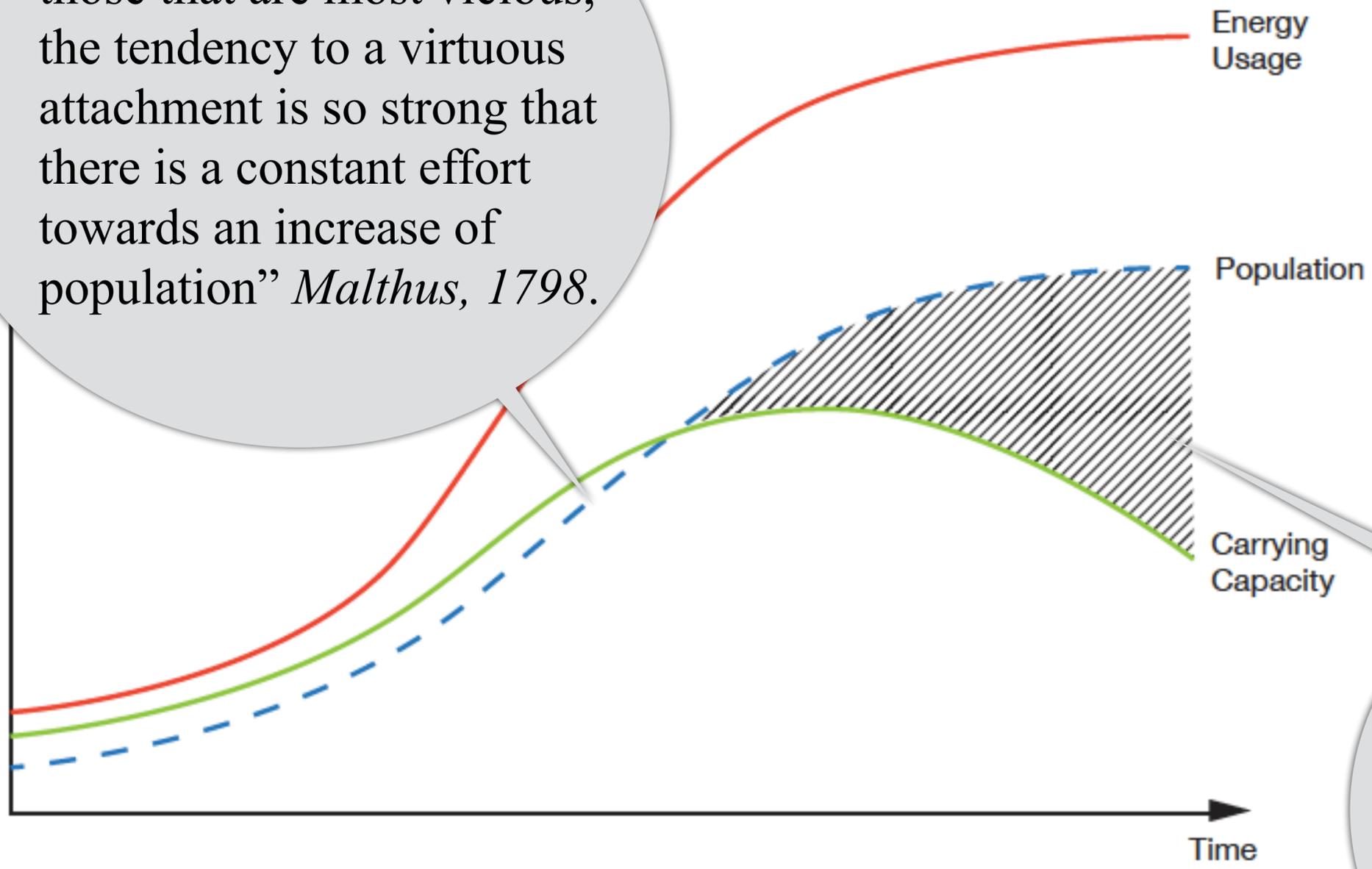
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"That the increase of population is necessarily limited by the means of subsistence, That population does invariably increase when the means of subsistence increase, and, That the superior power of population is repressed, and the actual population kept equal to the means of subsistence, **by misery and vice.**"

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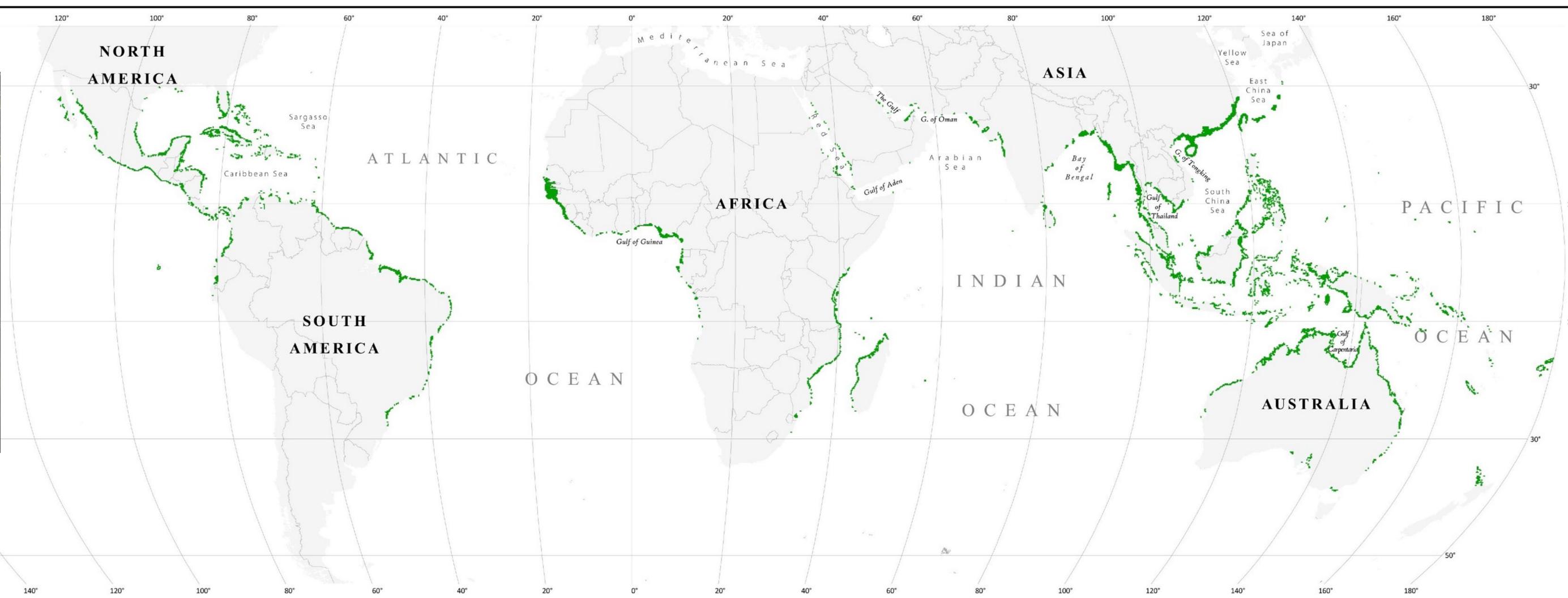
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Lovelock: Carrying Capacity will be down to 1 Billion in 2050

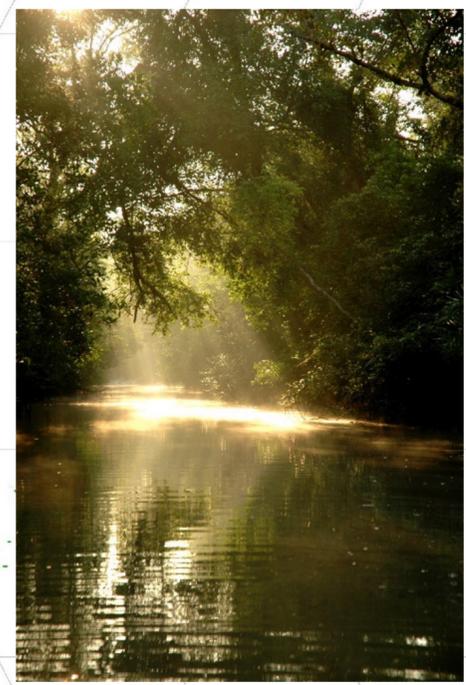
Adaptation to Global Change

Mangroves



Adaptation to Global Change

Mangroves



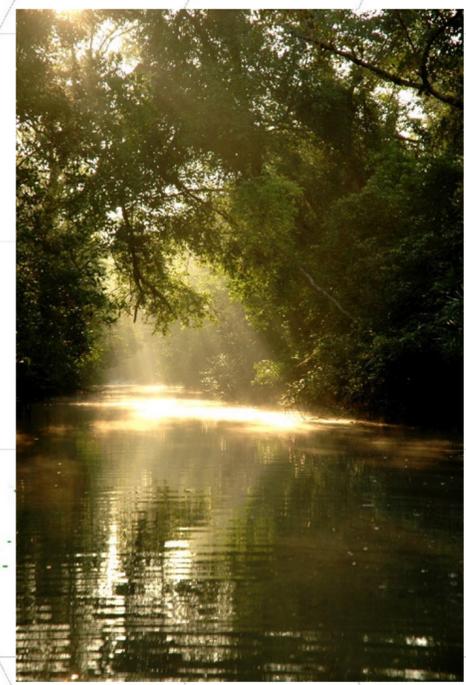
About half of mangrove loss has occurred in the last 50 years, mostly in the last two decades, due to:

- shrimp farming
- tourism
- urbanization
- agriculture expansion
- roadways
- marinas, and
- other intrusive developments.



Adaptation to Global Change

Mangroves



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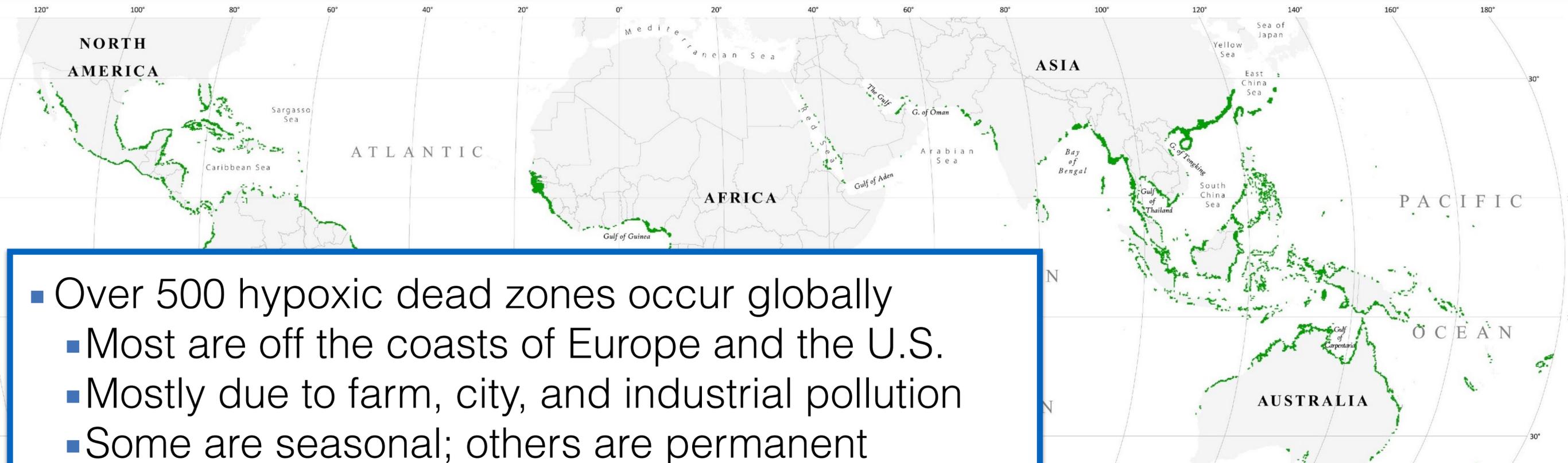
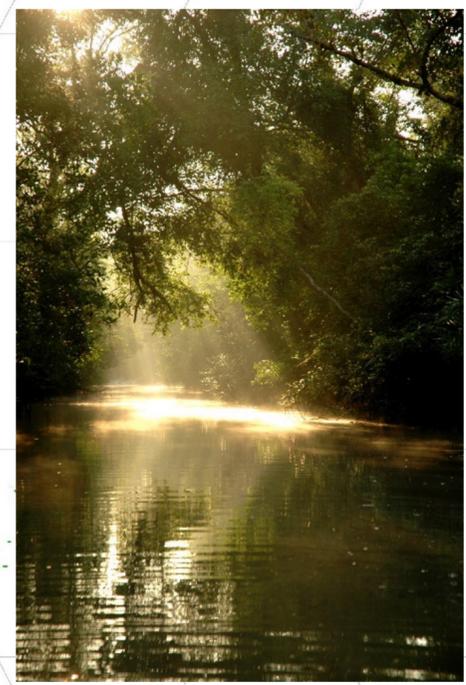
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A Tragedy for our Oceans
Continuing heavy loss of mangrove forests represents a real tragedy for our oceans and the extensive life-support systems mangroves engender.



Adaptation to Global Change

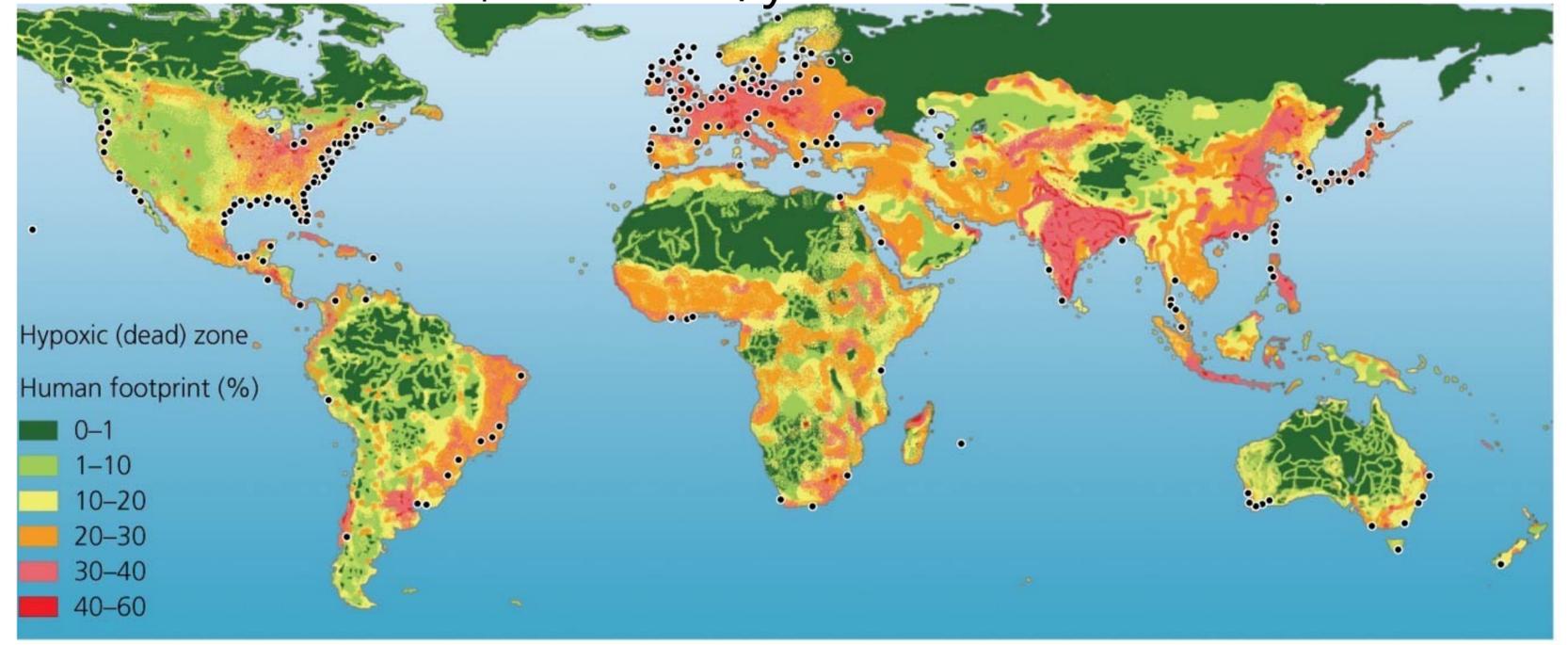
Mangroves



- Over 500 hypoxic dead zones occur globally
 - Most are off the coasts of Europe and the U.S.
 - Mostly due to farm, city, and industrial pollution
 - Some are seasonal; others are permanent
- Fisheries and ecosystems are devastated
 - Causes over \$2 billion/year in lost harvests

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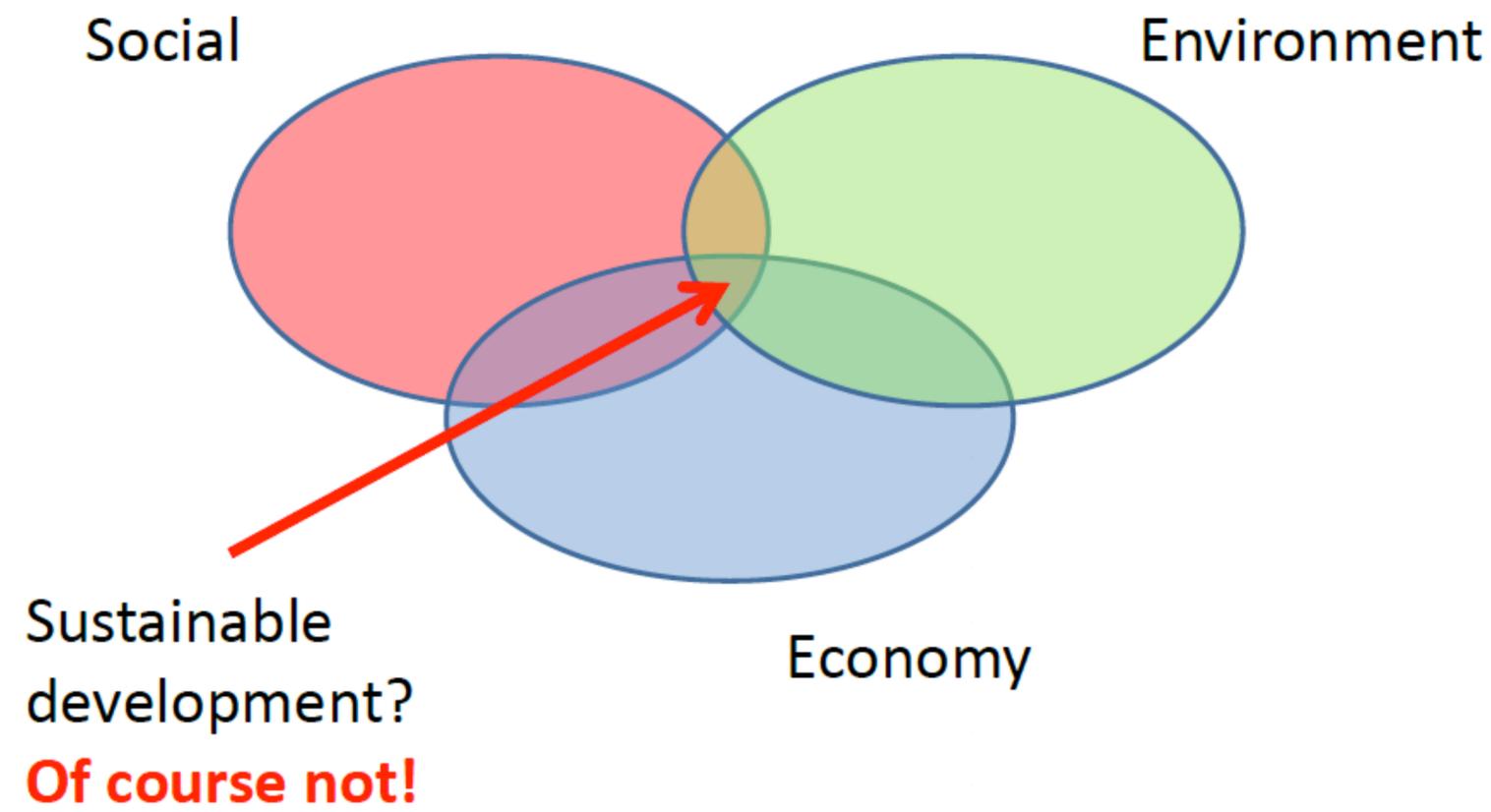
Loss of mangrove forests is a tragedy for our oceans and port systems. Mangroves



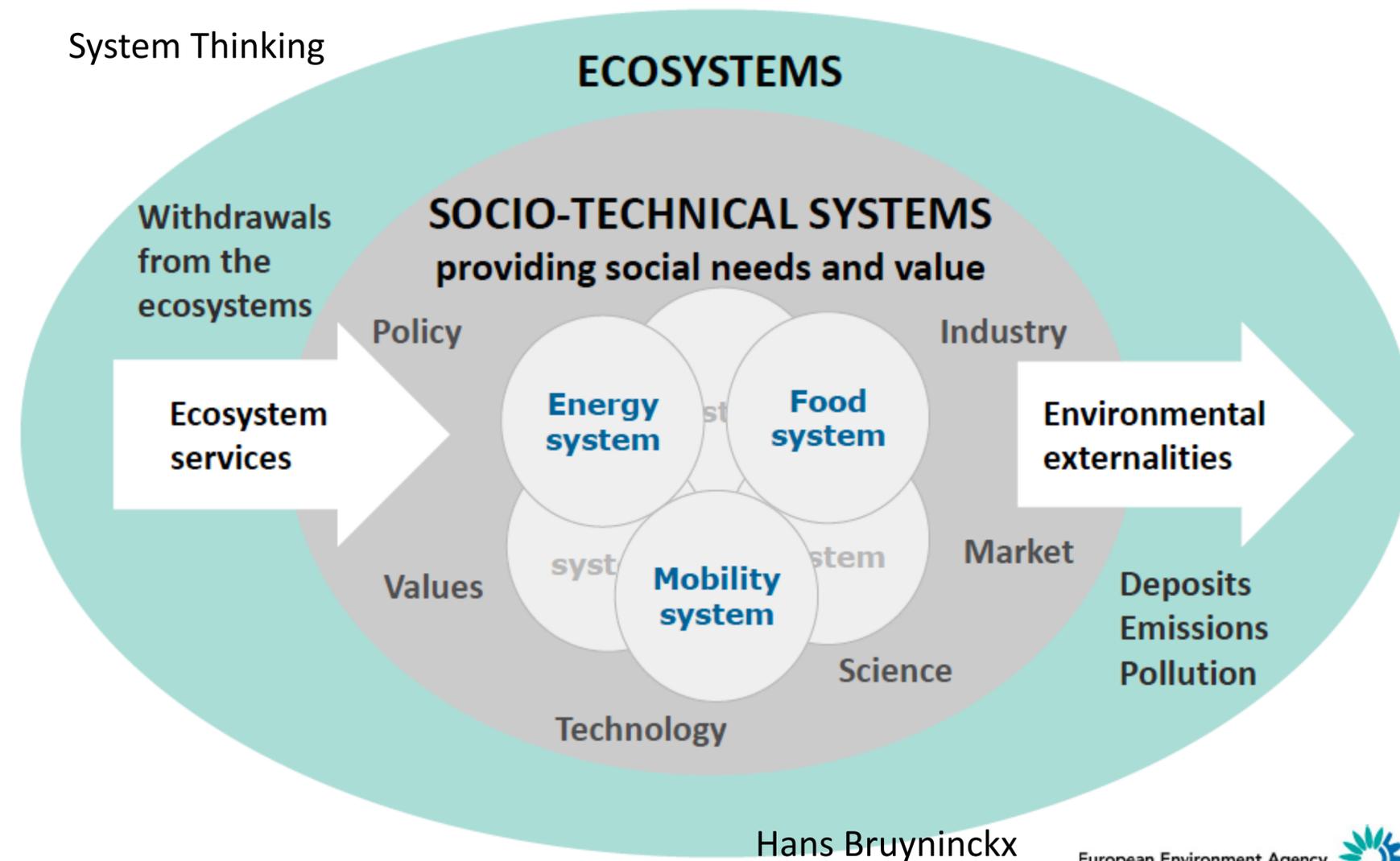
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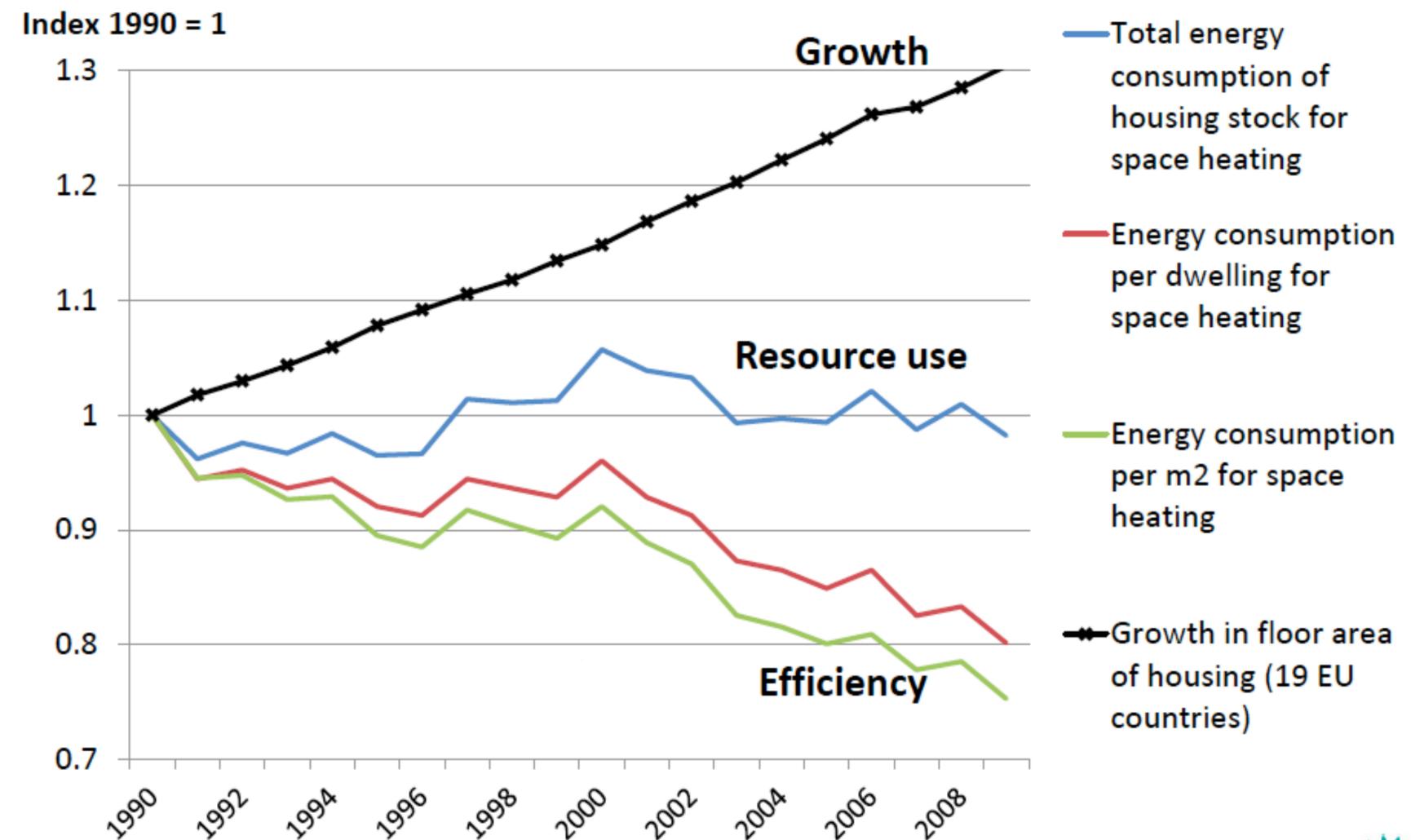
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Homes (EU) are now more energy efficient, but also much larger, increasing pressures on land, water and materials

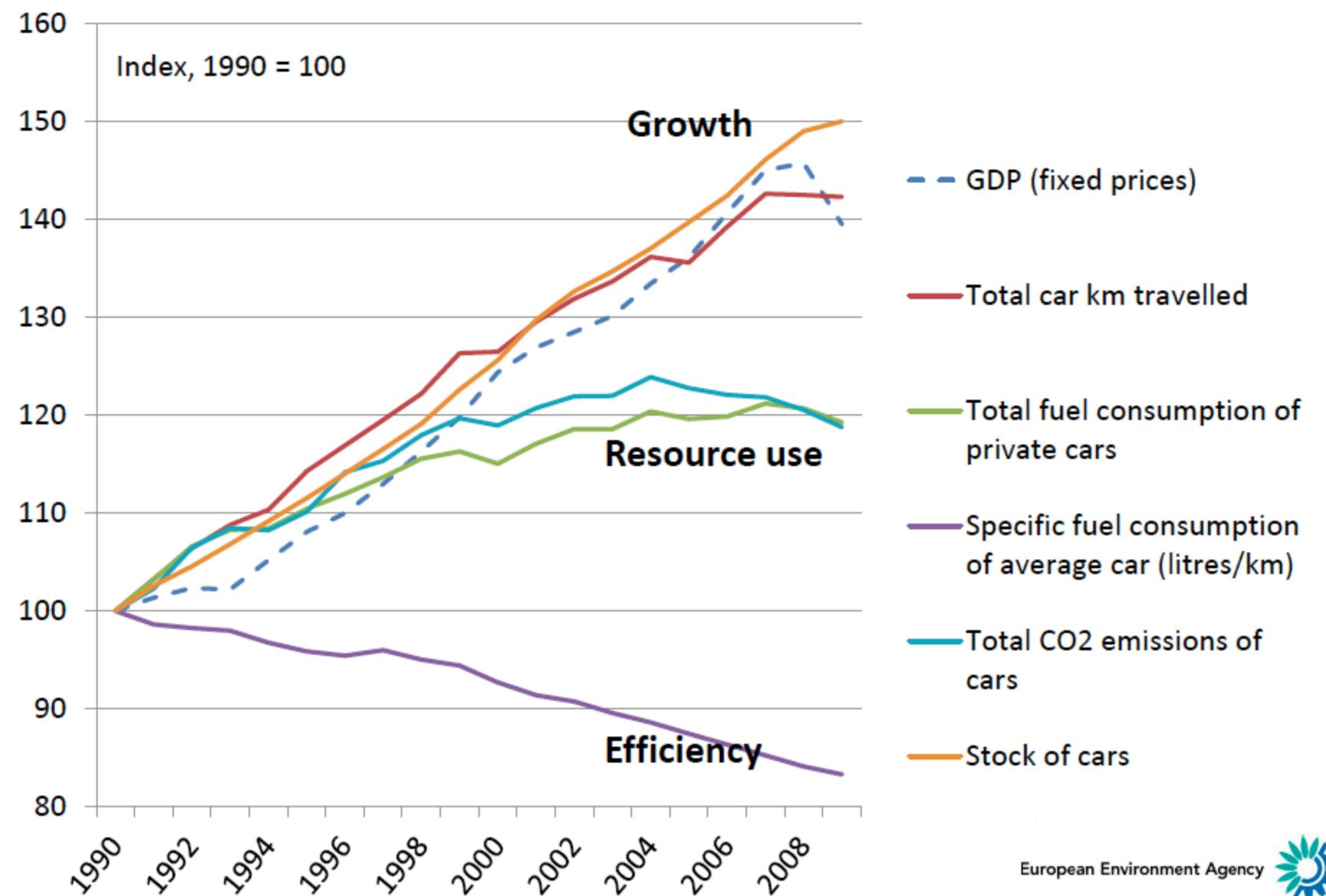


Source: SCP023 indicator (draft)

Sustainable Development:
 Brundtland et al., 1987: “Development that meets the needs of the present without compromising the ability of future generations to meet their needs’



Cars (EU) are more efficient but contribute to a range of negative impacts on people’s quality of life in cities



Sustainable Development:
Brundtland et al., 1987: “Development that meets the needs of the present without compromising the ability of future generations to meet their needs’



To reach ambitious environmental visions

Not just incremental efficiency gains ...

nor new technologies only ...



Adaptation to Global Change

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... but also a different systemic (re-) thinking.



Adaptation to Global Change

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Griggs et al., 2013: “Development that meets the needs of the present while safeguarding Earth’s life-support system, on which the welfare of current and future generation depends”



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Griggs et al., 2013



Plag et al., 2013

Economy is the link between humanity and Earth’s life support system

Assumption: We know the extreme end of the hazard spectrum

Planning is impacted by social construct of risk and vulnerability:

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Planning is impacted by social construct of risk and vulnerability:

North Sea countries:

- general perception (based on 2,000 years of cultural heritage): vulnerability to, and risk associated with storm surges is very high and a national/regional problem;
- approach to extreme events:
there is a 1% chance that the 1 in 10,000 years flood happens in this century.
- Approach to SLR: What is the maximum SLR in the 21st century that cannot be excluded?

Assumption: We know the extreme end of the hazard spectrum

Planning is impacted by social construct of risk and vulnerability:

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United States:

- general perception: vulnerability to, and risk associated with storm surges is more a local problem and can be addressed ad hoc by (horizontal) evacuation;
- approach to extreme events: there is a 1% chance that the 1 in 100 years flood happens in this year.
- Approach to SLR: What curve should we choose? Definitely not the maximum SLR in the 21st century that cannot be excluded!

Knowing the “worst case:” worst case scenarios almost always fall short of reality

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Paradigm shifts:

- identifying the vulnerabilities and comprehensively assessing the risks
- understanding the worst cases (food, water, heat waves, droughts, storms, sicknesses, social unrest, wars, ...)
- increasing preparedness and general resilience
- having early warning (for extreme events and rapid impacts)

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Preparing for surprises

Accounting for Extremes

Preparing for Surprises: Extreme flood in Gauteng, South Africa, November 10-11, 2016

