Sustainable Development and Climate Extremes

WCRP-ICTP Summer School
21 July – 01 August 2014
ICTP Adriatico Guest House
Trieste, ITALY

Kanayathu C. Koshy
Professor of Sustainability
CGSS@USM
Universiti Sains Malaysia
kanayathu.koshy@gmail.com
http://cgss.usm.my

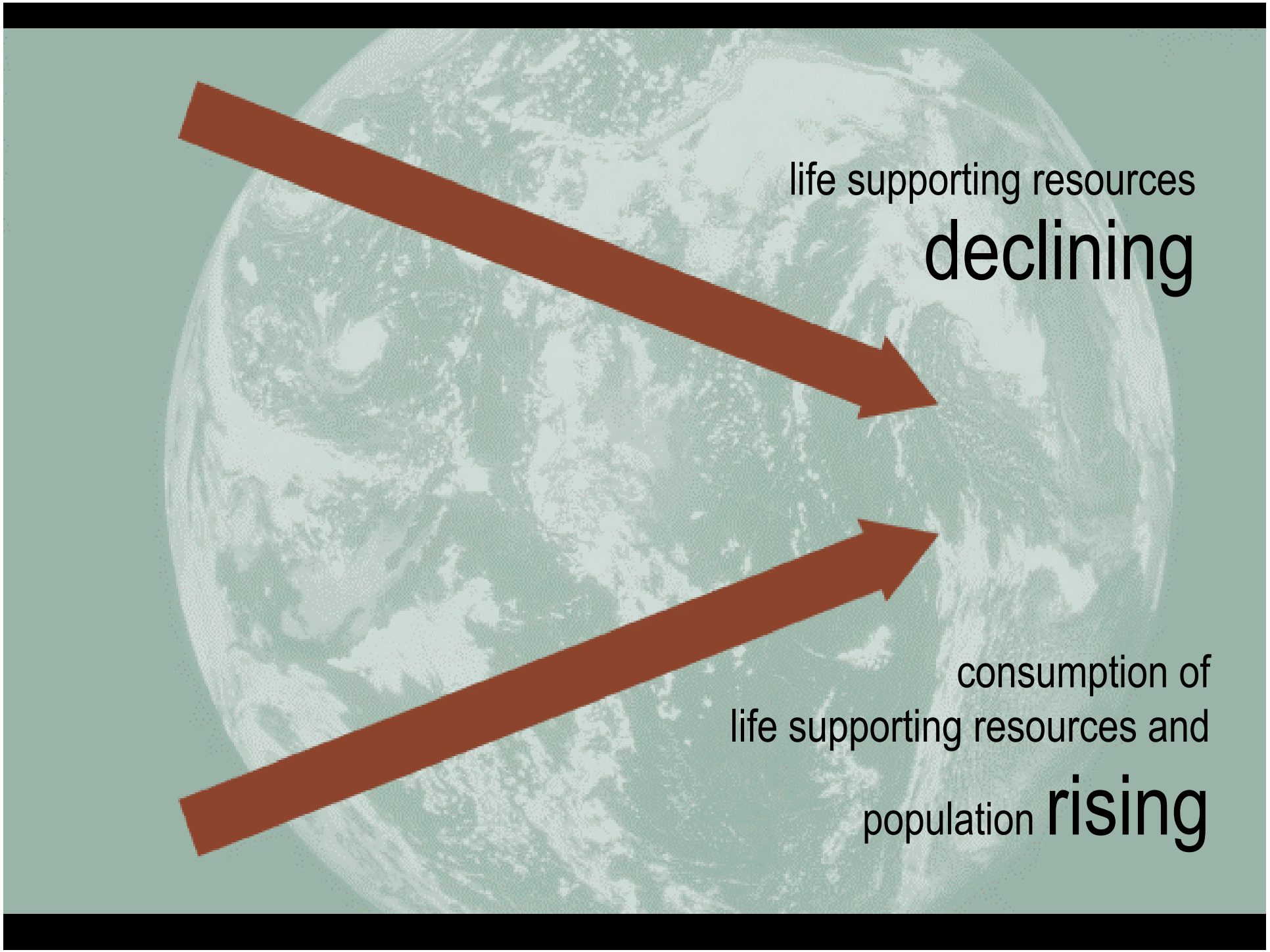
Overview

Sustainable Development

- State
- Response

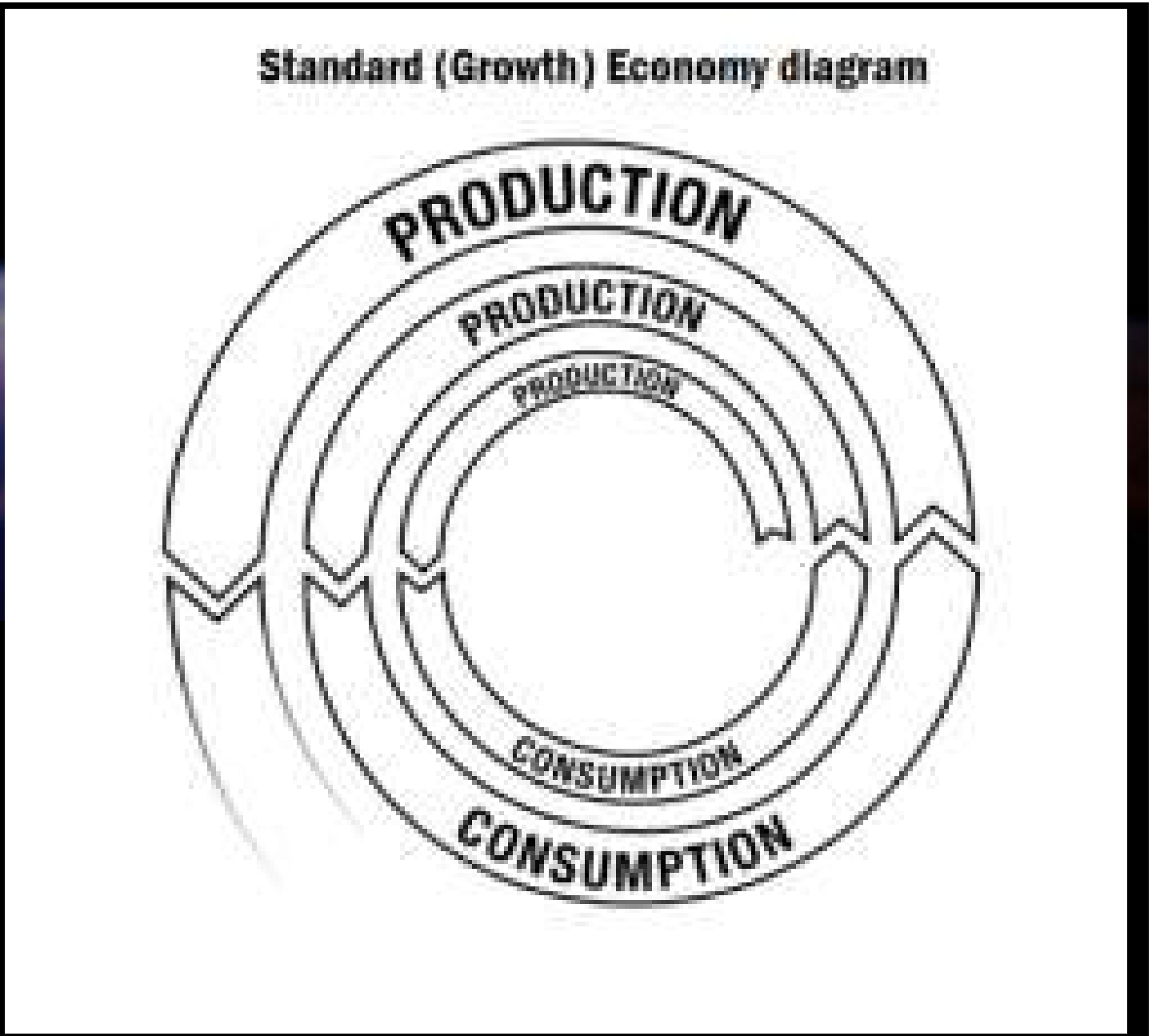
The Climate Concern

- State
- Response


life supporting resources
declining
consumption of
life supporting resources and
population rising

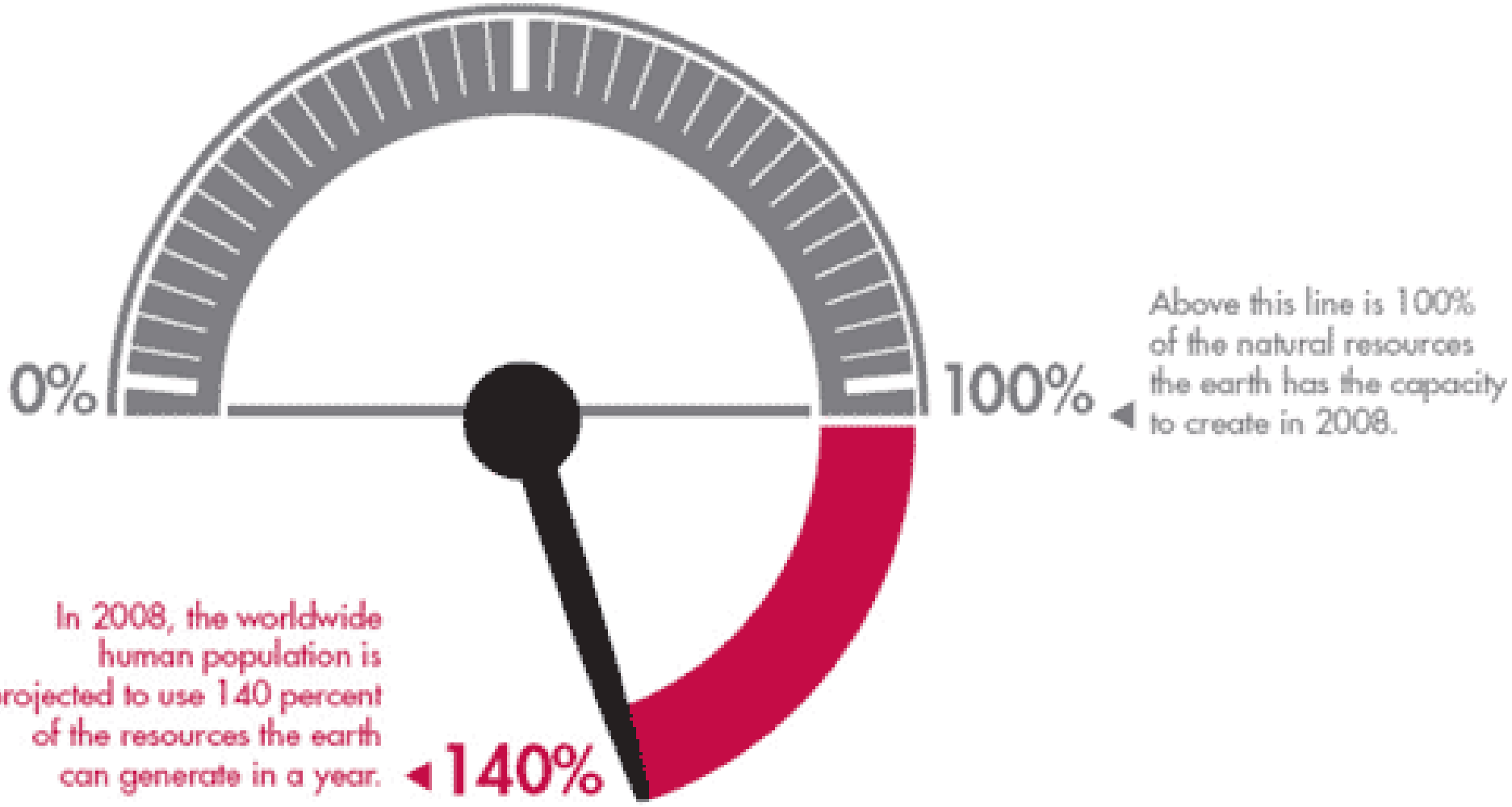
The Consumer Trolley

Perpetual growth myth

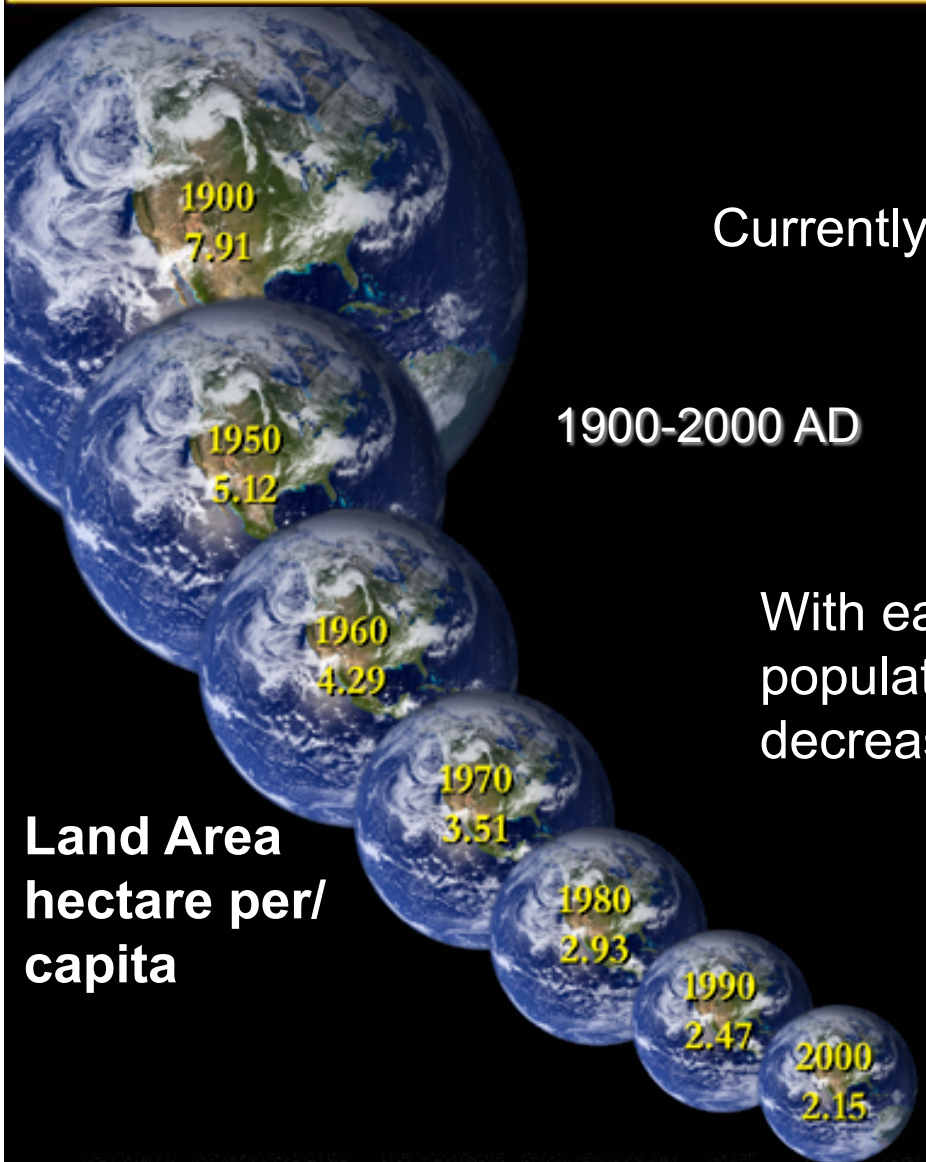


…promotes rapid accumulation of physical, financial and human capital but at the expense of natural capital

Ecological Overshoot:
the Development Dilemma



Earth's Shrinking Biosphere



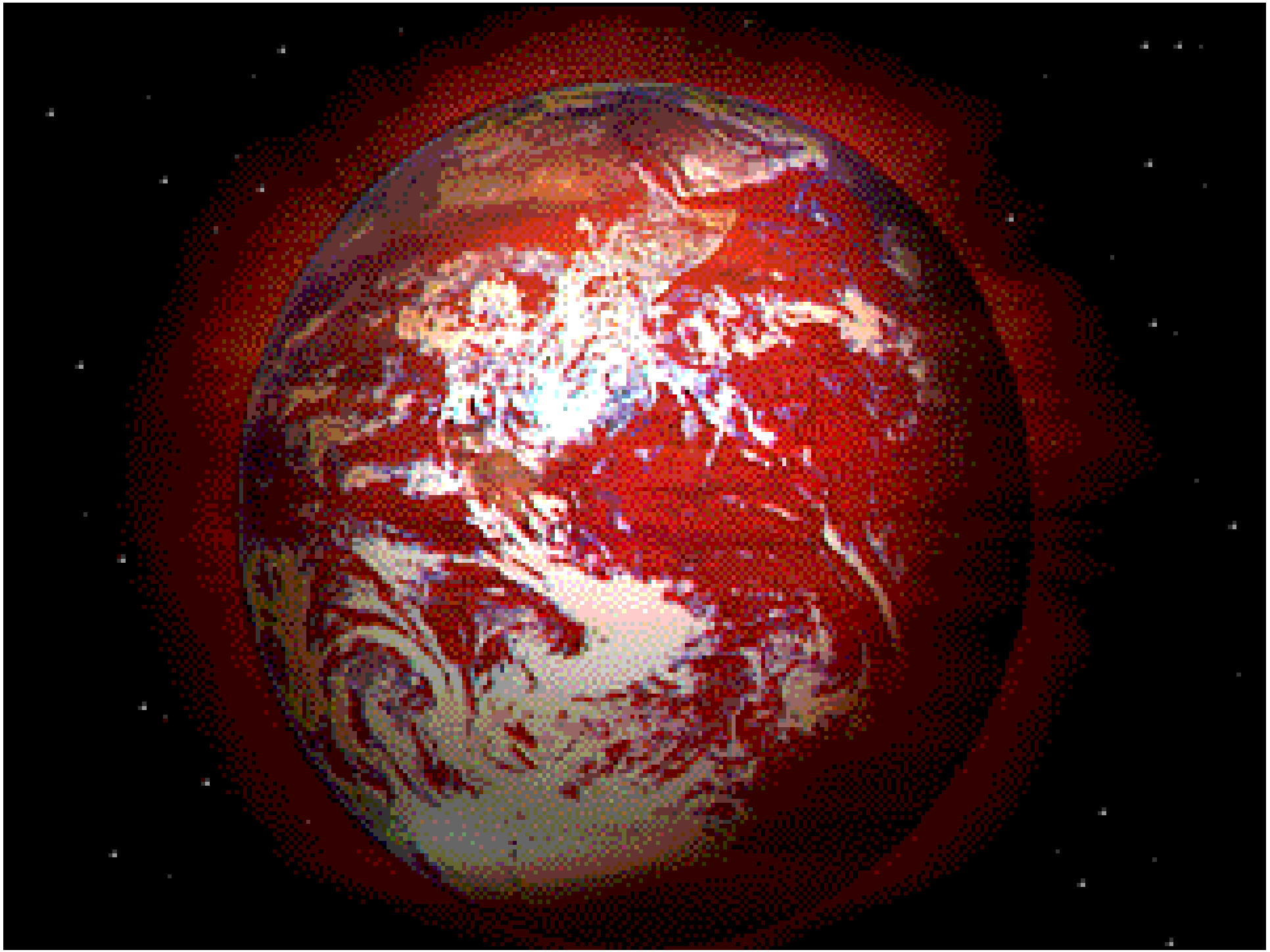
Currently, the Earth is the only home we have

1900-2000 AD

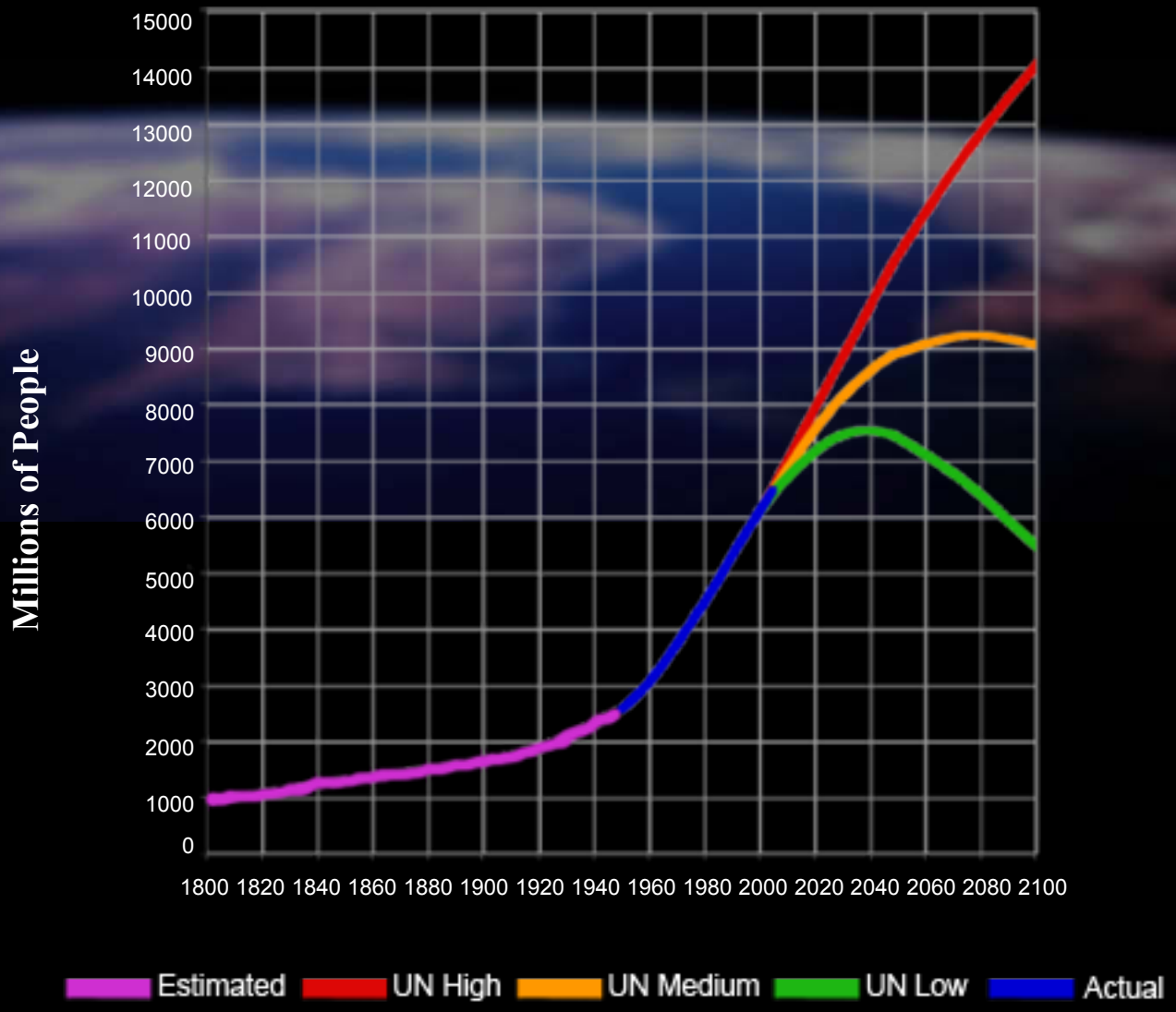
With each new person added to our growing population, the amount of our living space decreases

ONE PLANET MANY PEOPLE Atlas of Our Changing Environment

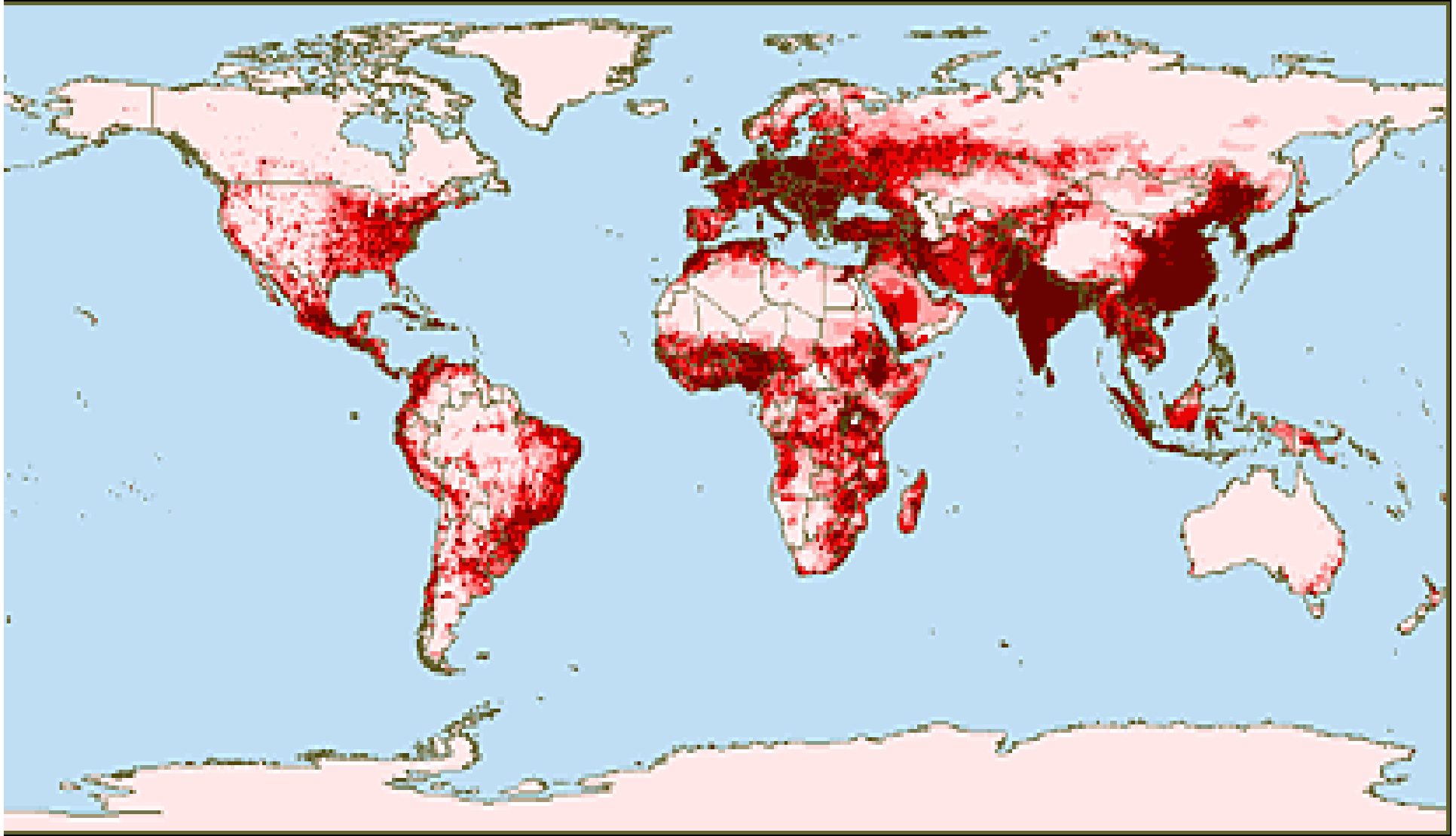
UNEP



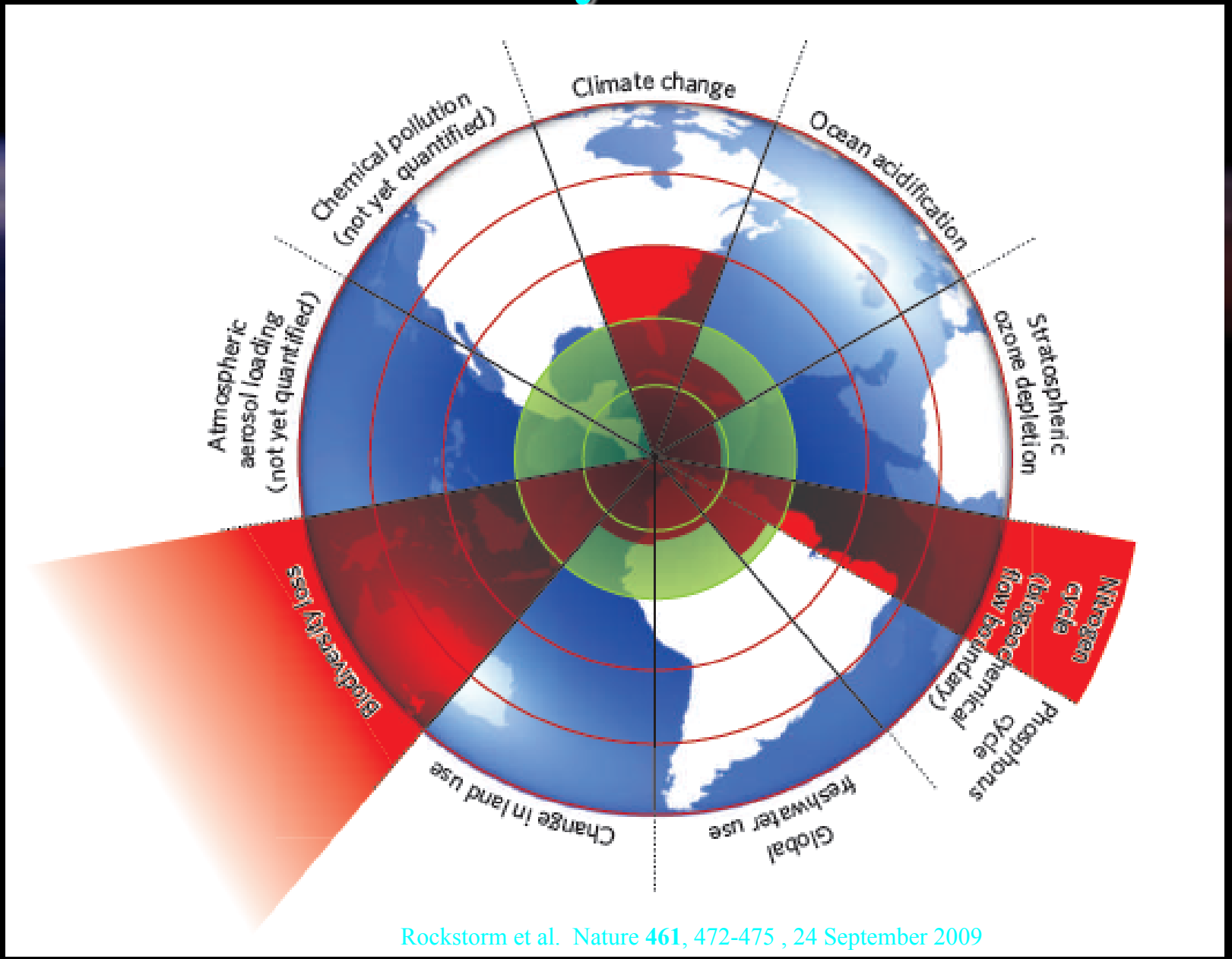
Global Population Profile



The Population Dilemma



Planetary Boundaries



Rockstorm et al. Nature **461**, 472-475 , 24 September 2009

Little Progress…?


NO STOPP
ANYTIM


Kofi ANNAN 1997-2006

The Rio Process:

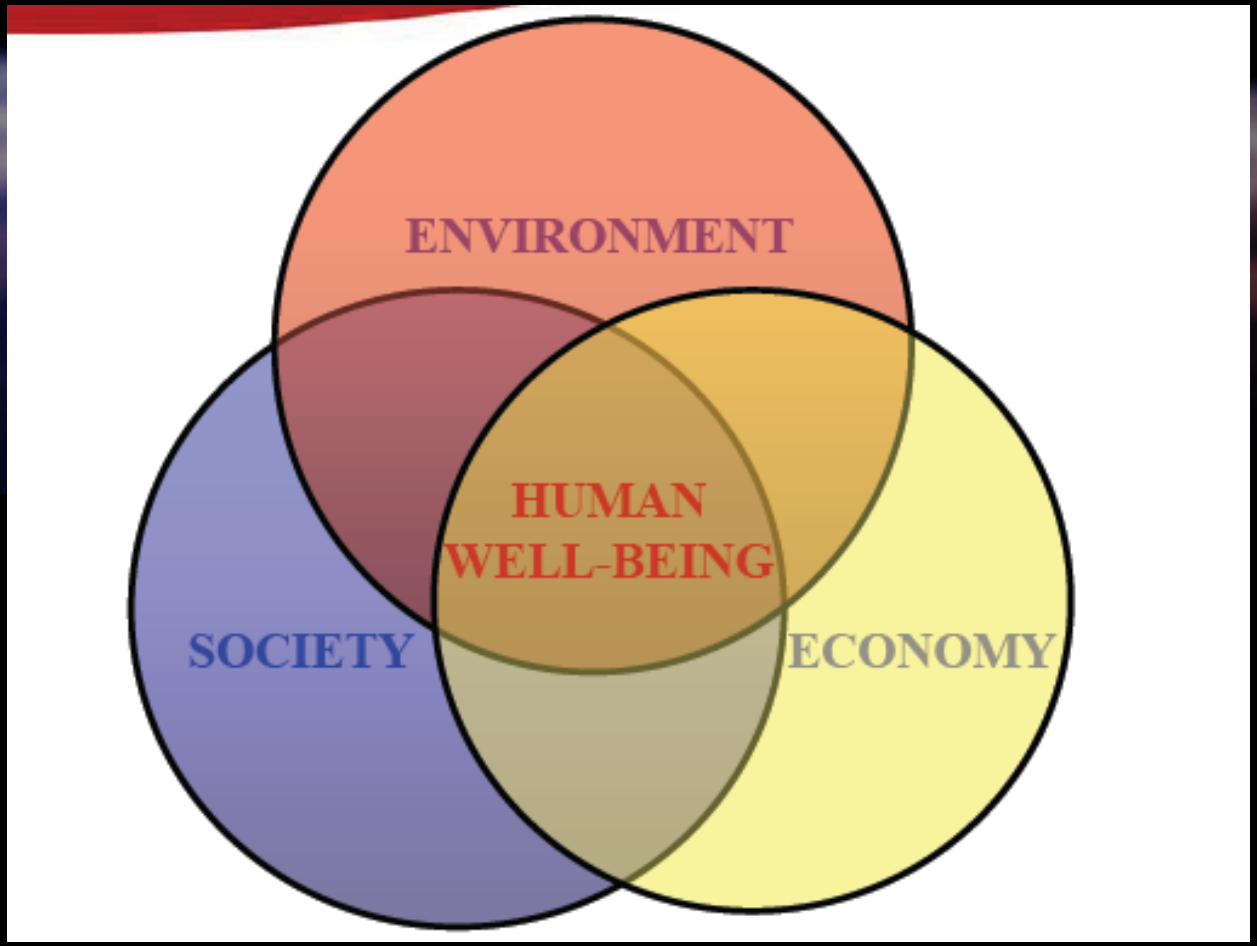
1992: UNCED –Earth Summit
2002: Rio+10 – WSSD
2012: Rio+20 - UNCSD

Sustainability Defined…

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

- Brundtland Commission, "Our Common Future"

The Triple Bottom Line of SD



Sustainable Development

What needs to be sustained?

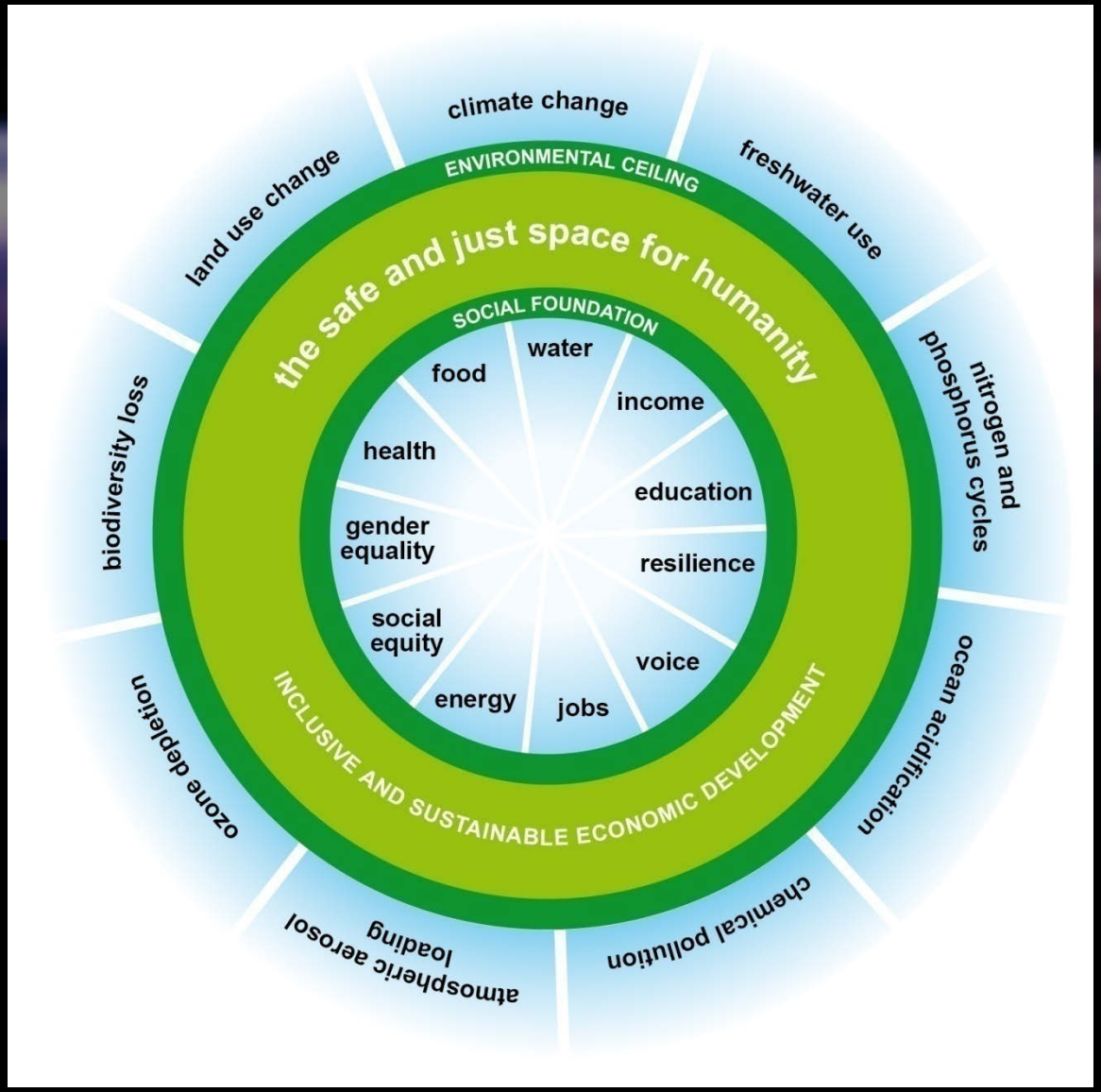
- **Nature:** (earth, biodiversity, ecosystem)
- **Life support systems:** (ecosystem services, resources, environment)
- **Community:** (cultures, IKS, places)

Sustainable Development

What needs to be developed ?

- **People:** (health, education, equity, human capital)
- **Economy:** (wealth, products, services)
- **Society:** (institutions, social capital, states)

A Safe & Just Space for Humanity

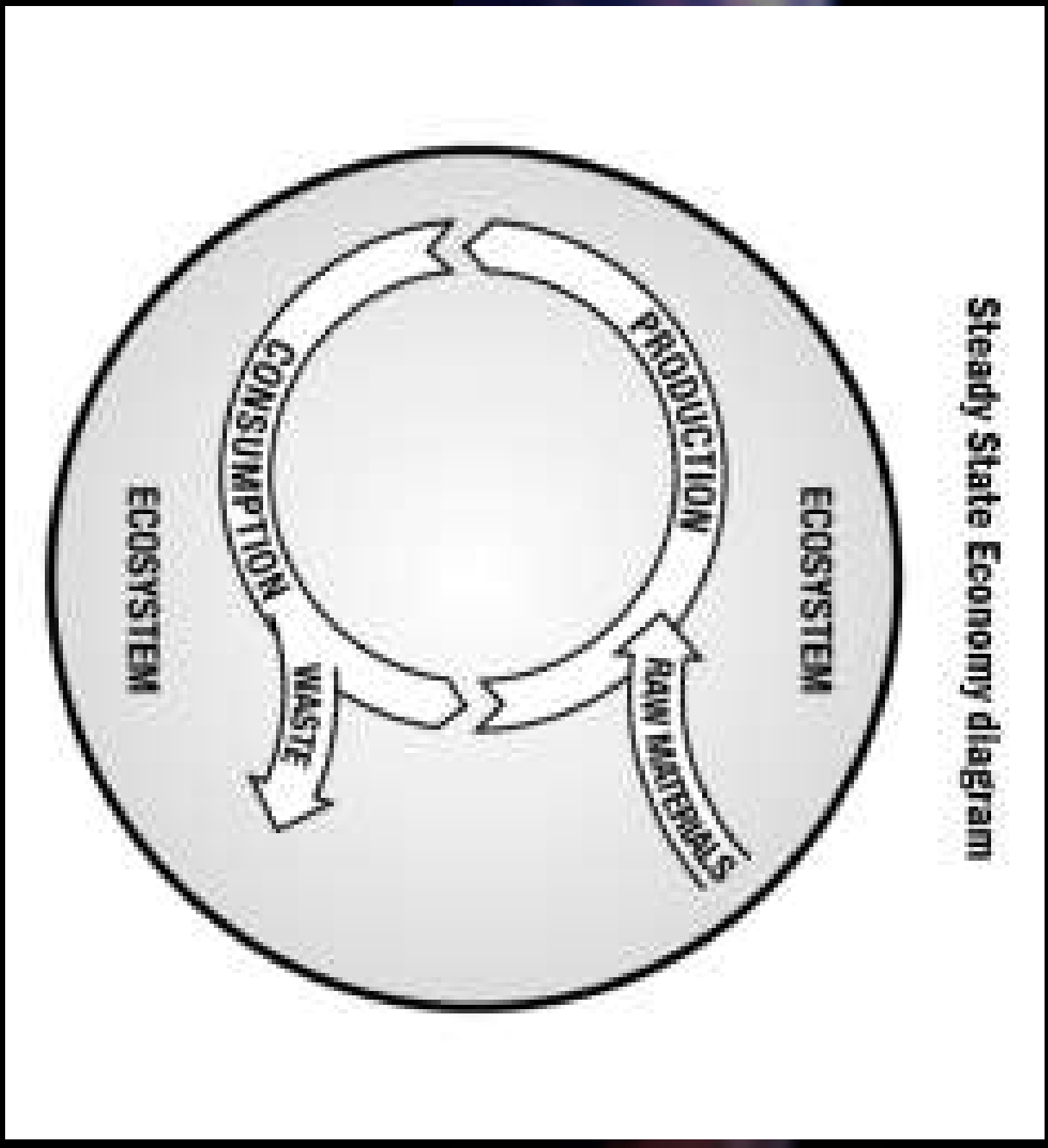


Kate Raworth: http://blogs.oxfam.org/en/blog/12-02-13

A Safe and Just Space: Indicators

Kate Raworth: http://blogs.oxfam.org/en/blog/12-02-13

Sustainable production – consumption

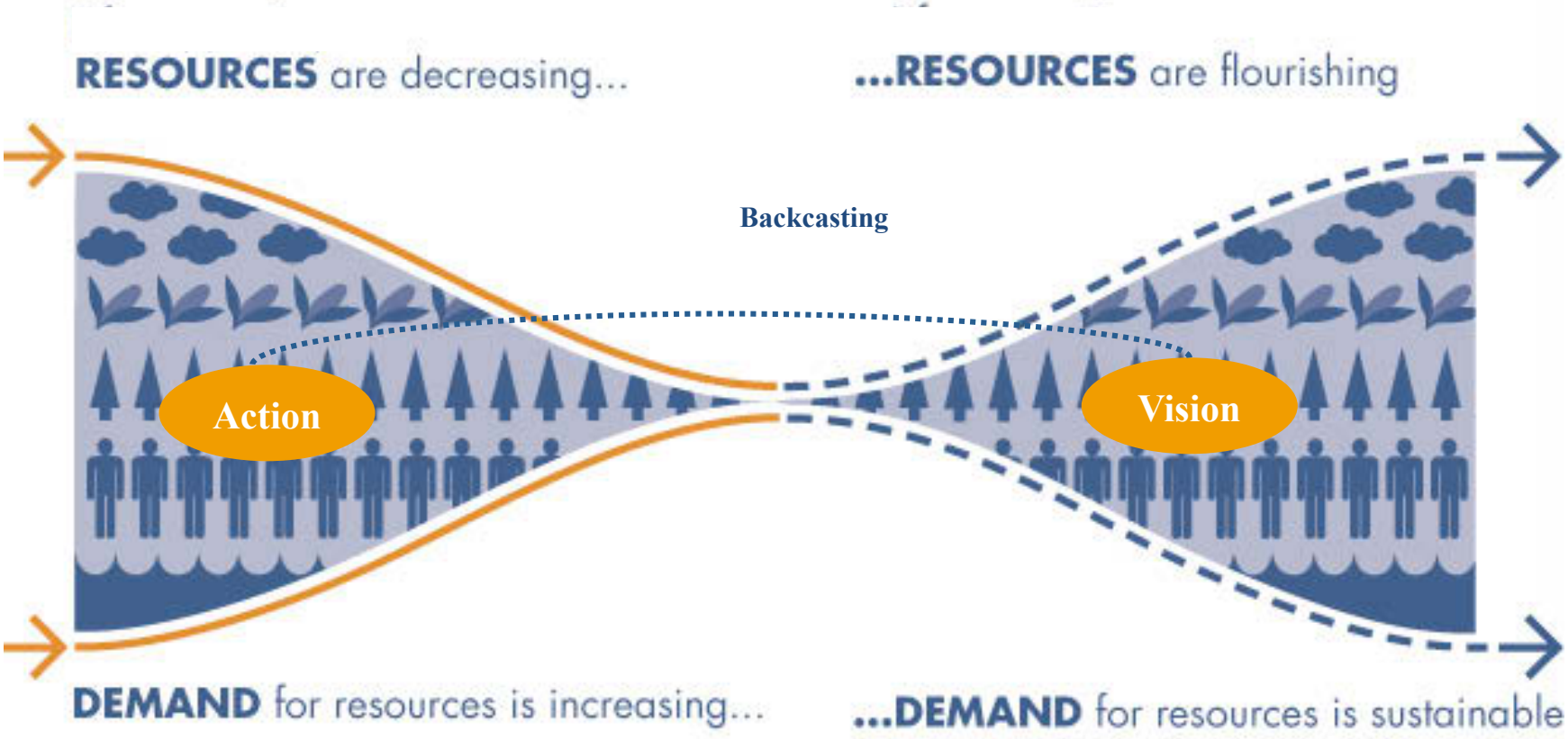


Sustainability

…the ability to sustain stability

Process Overview:

Precautionary Approach & Implications



SD and the Climate Connection

Changing climate

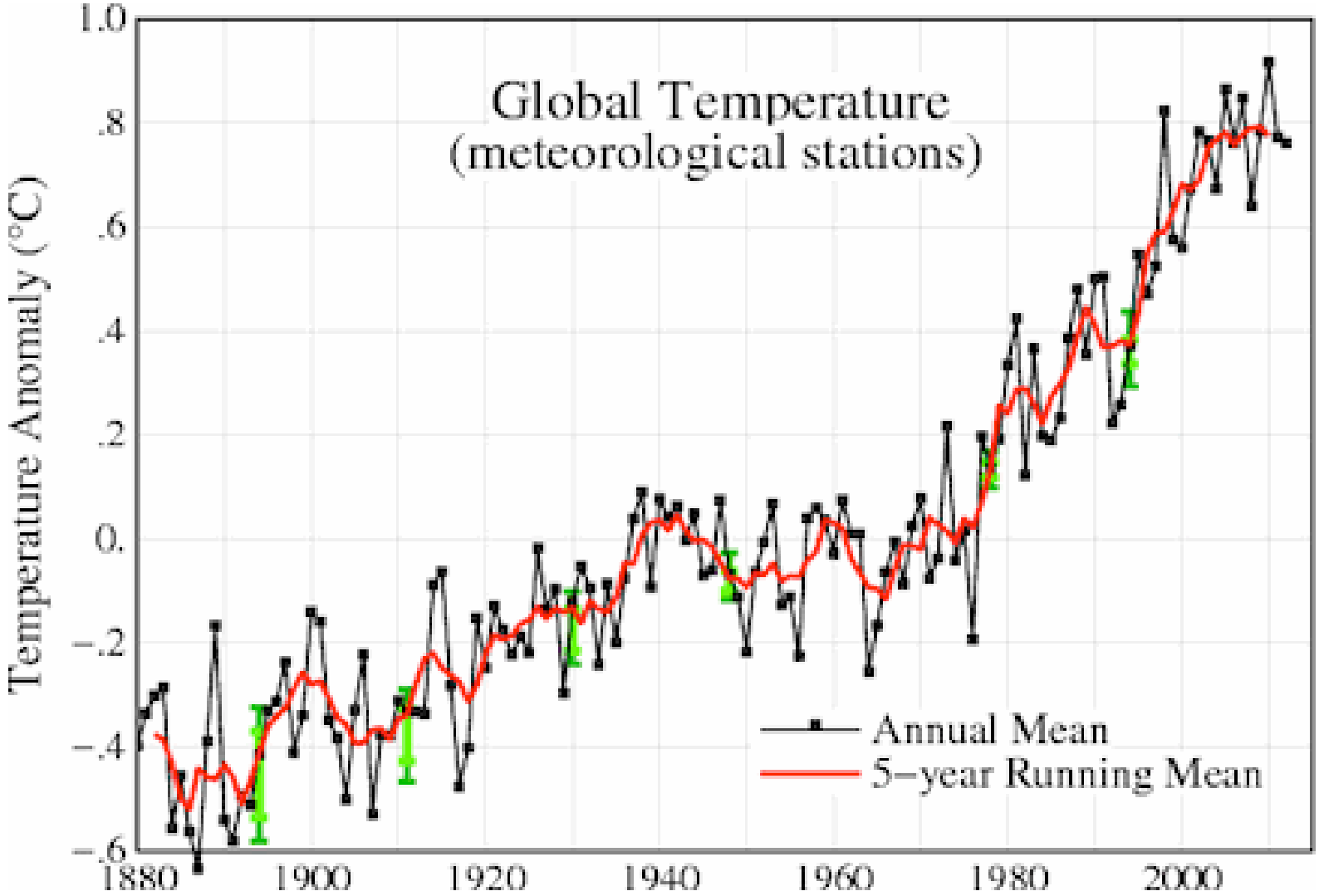
- State

Increasing Risk

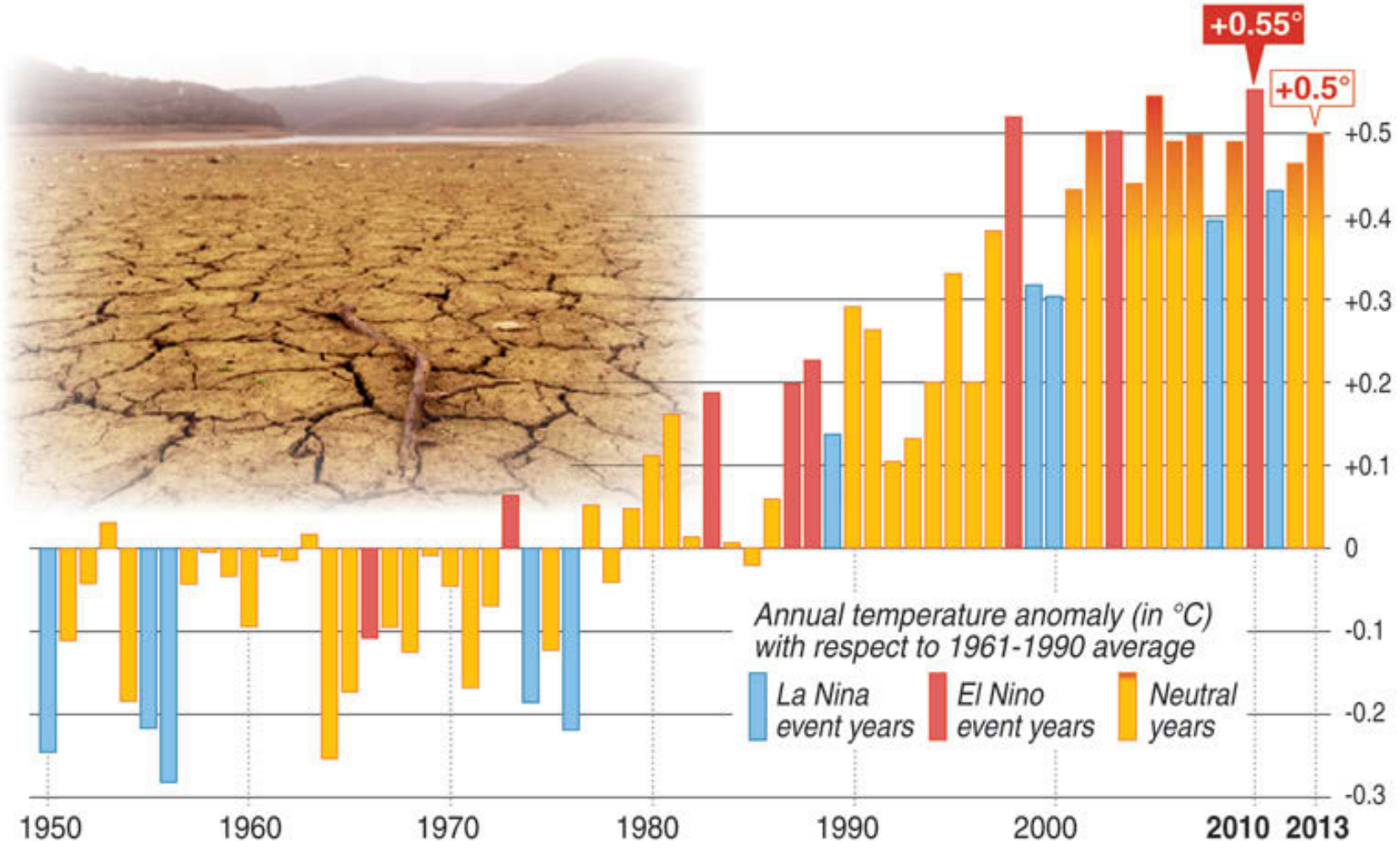
- Trend

- Response

IPCC AR5, September 2013



The 21st century has had 13 of the 14 hottest years recorded since 1850

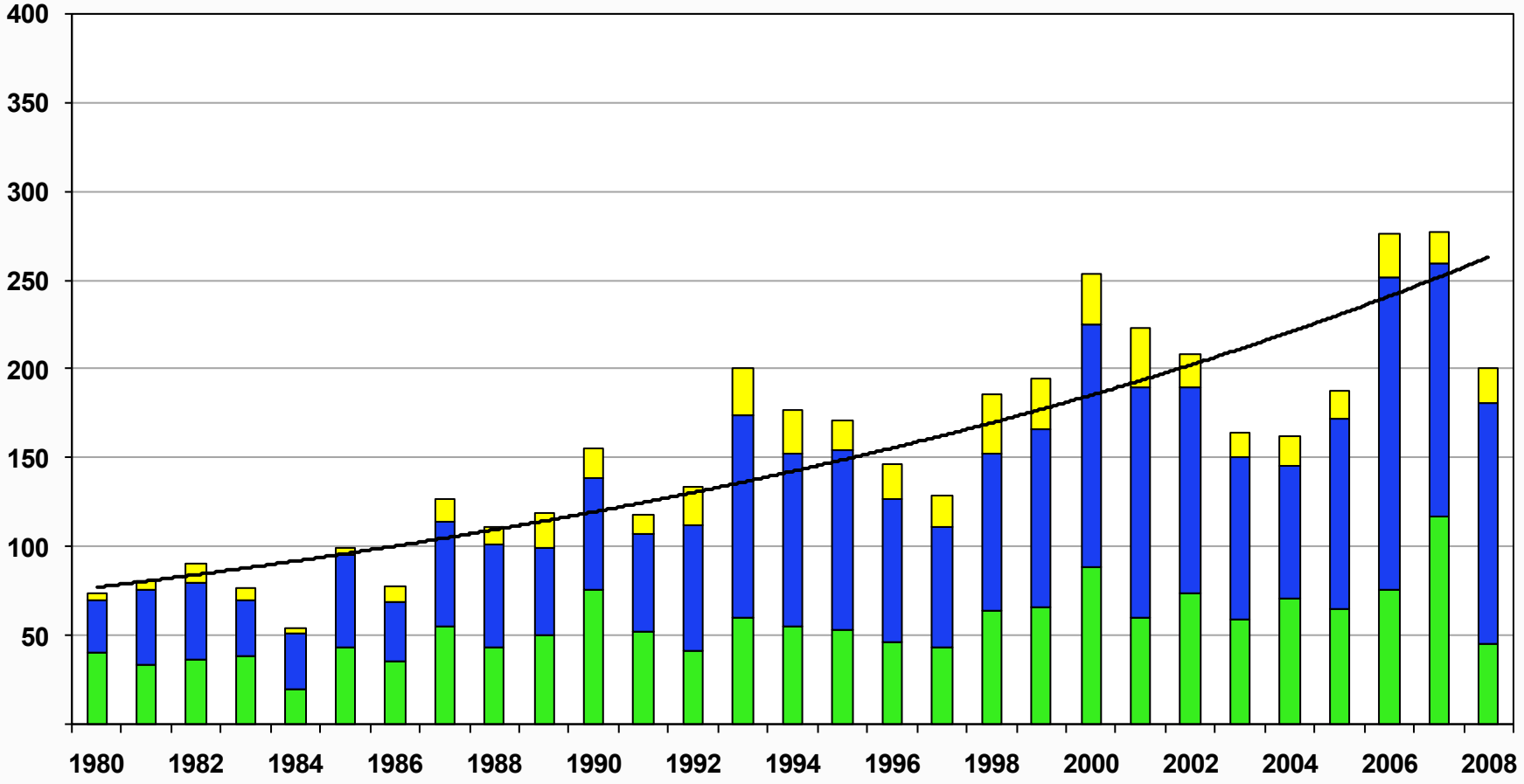


Source: World Meteorological Organization

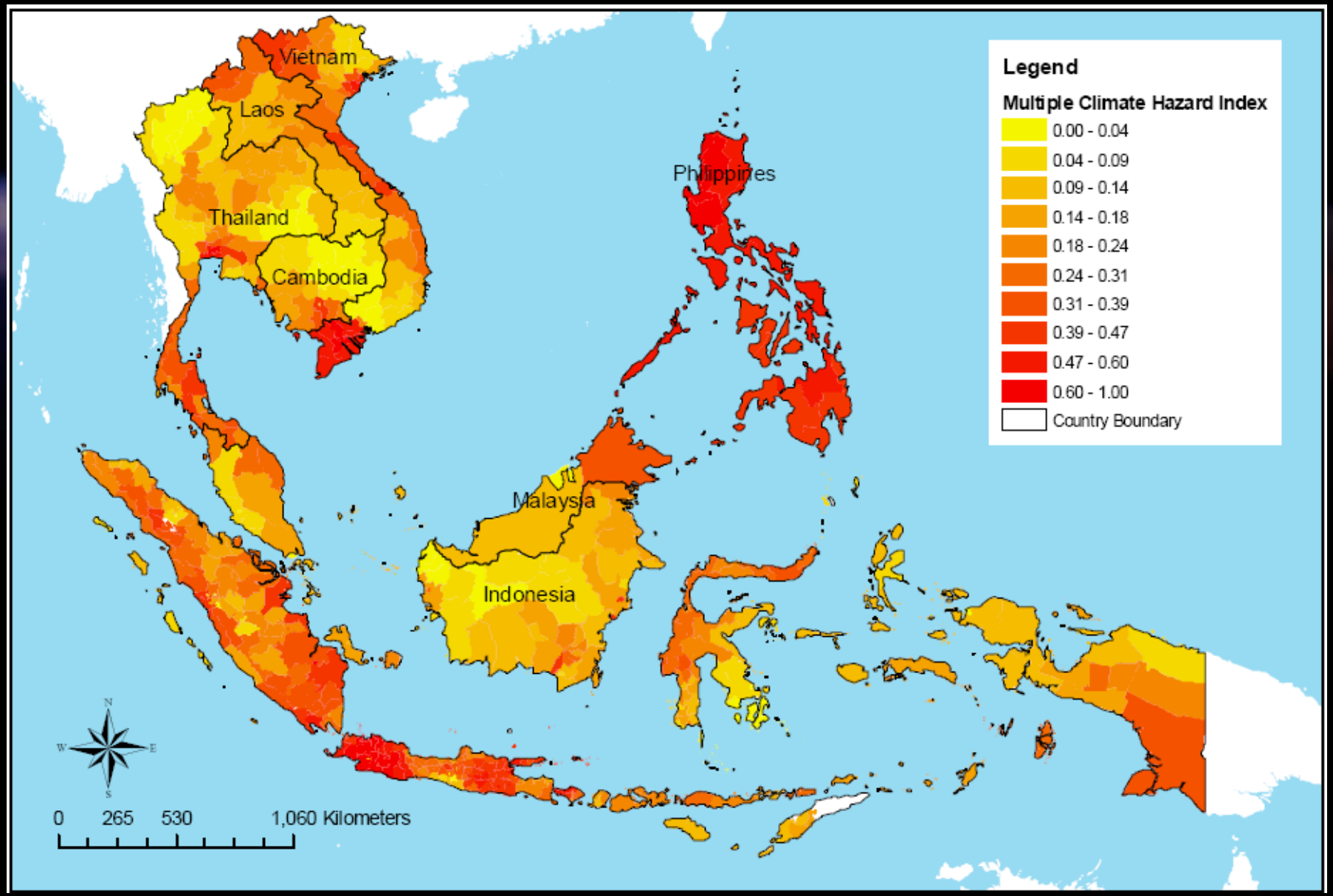
AFP

Weather catastrophes in Asia 1980 – 2008
Number of events

Munich RE

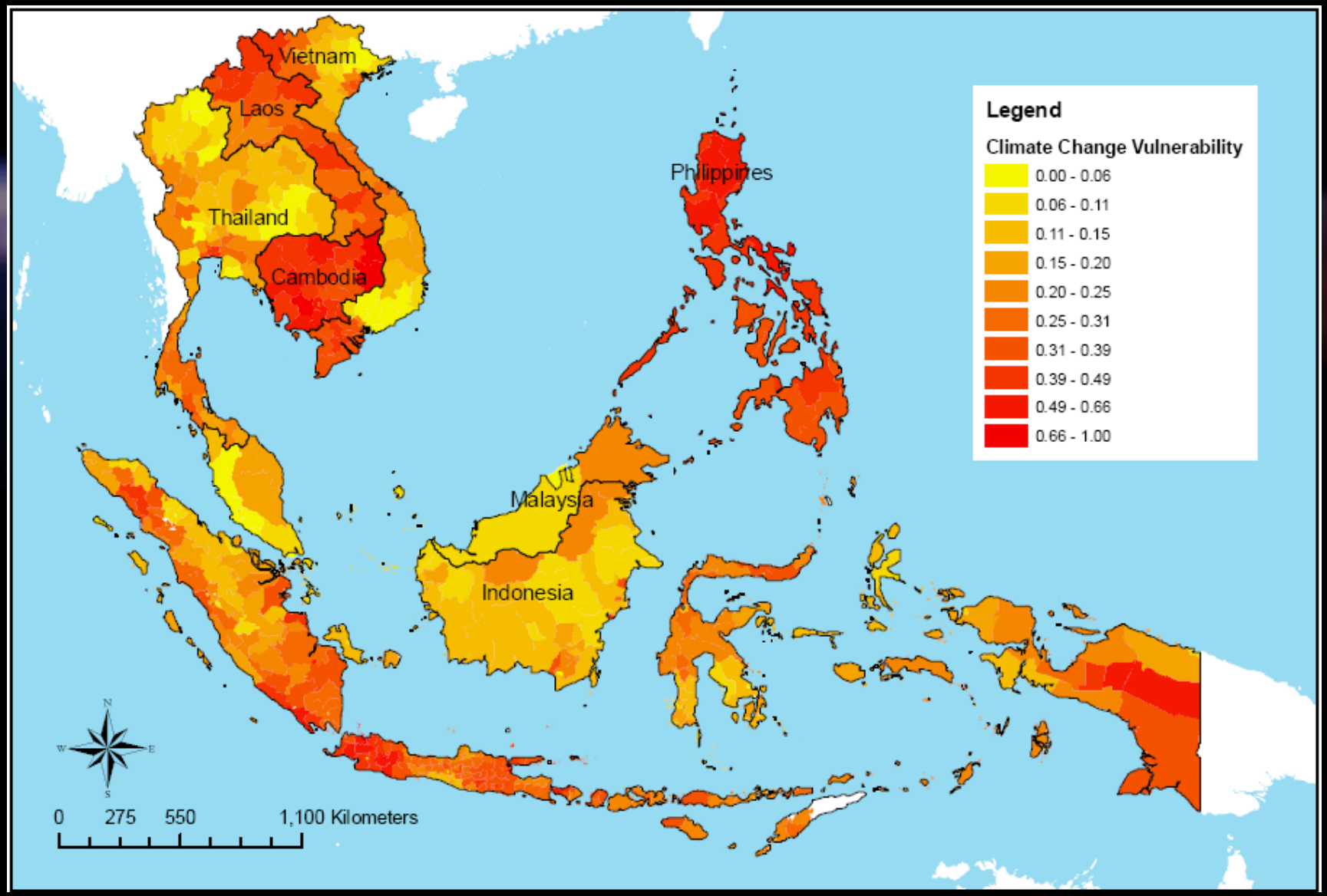


Multiple climate hazard map of Southeast Asia



Source: Arief Anshory Yusuf & Herminia A. Francisco, UNEP 2009

Climate change vulnerability map of Southeast Asia



Source: Arief Anshory Yusuf & Herminia A. Francisco, UNEP 2009

Risk Management 1/3

UNEP Risk Equation:

Hazard + Vulnerability = Risk

Realized Risk is Disaster

Risk Management 2/3

ISDR Risk Equation:

$$\frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}} = \text{Risk}$$

Realized Risk is Disaster

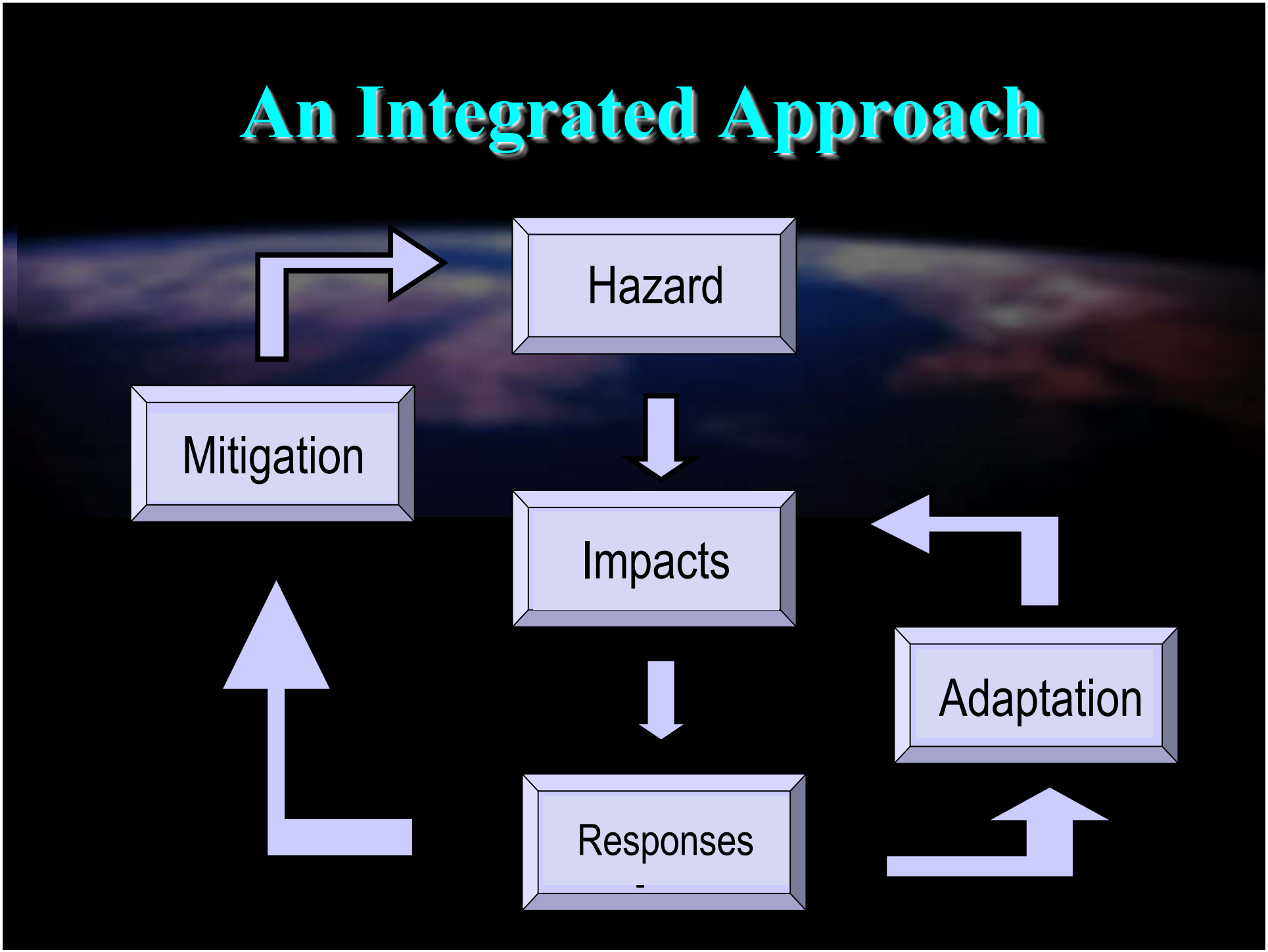
Risk Management 3/3

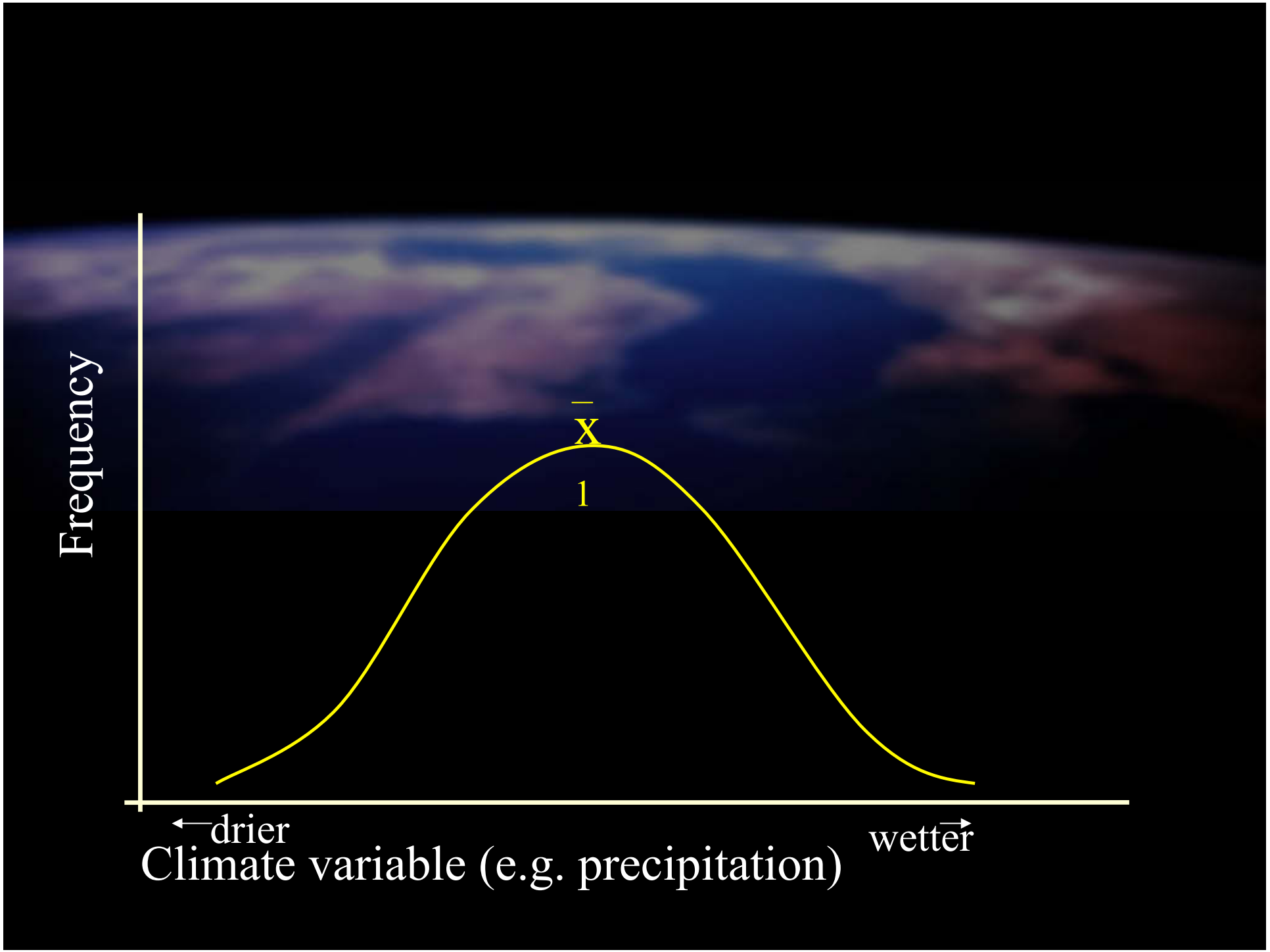
Hazard + Vulnerability = Risk

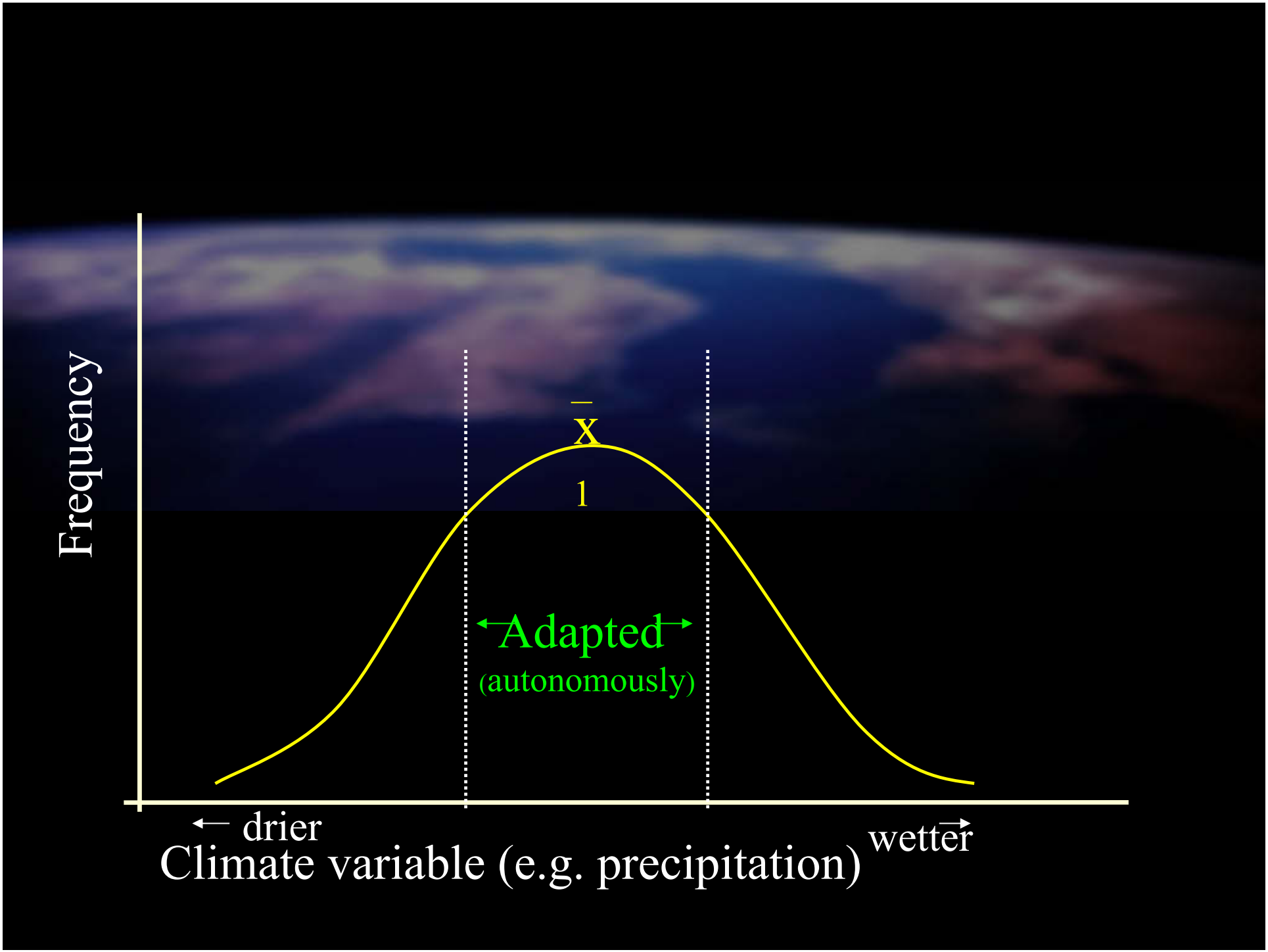
Hazard – Mitigation = Vulnerability
Impact - Adaptation = Vulnerability
(Hazard + Impact) – Capacity = Vbty

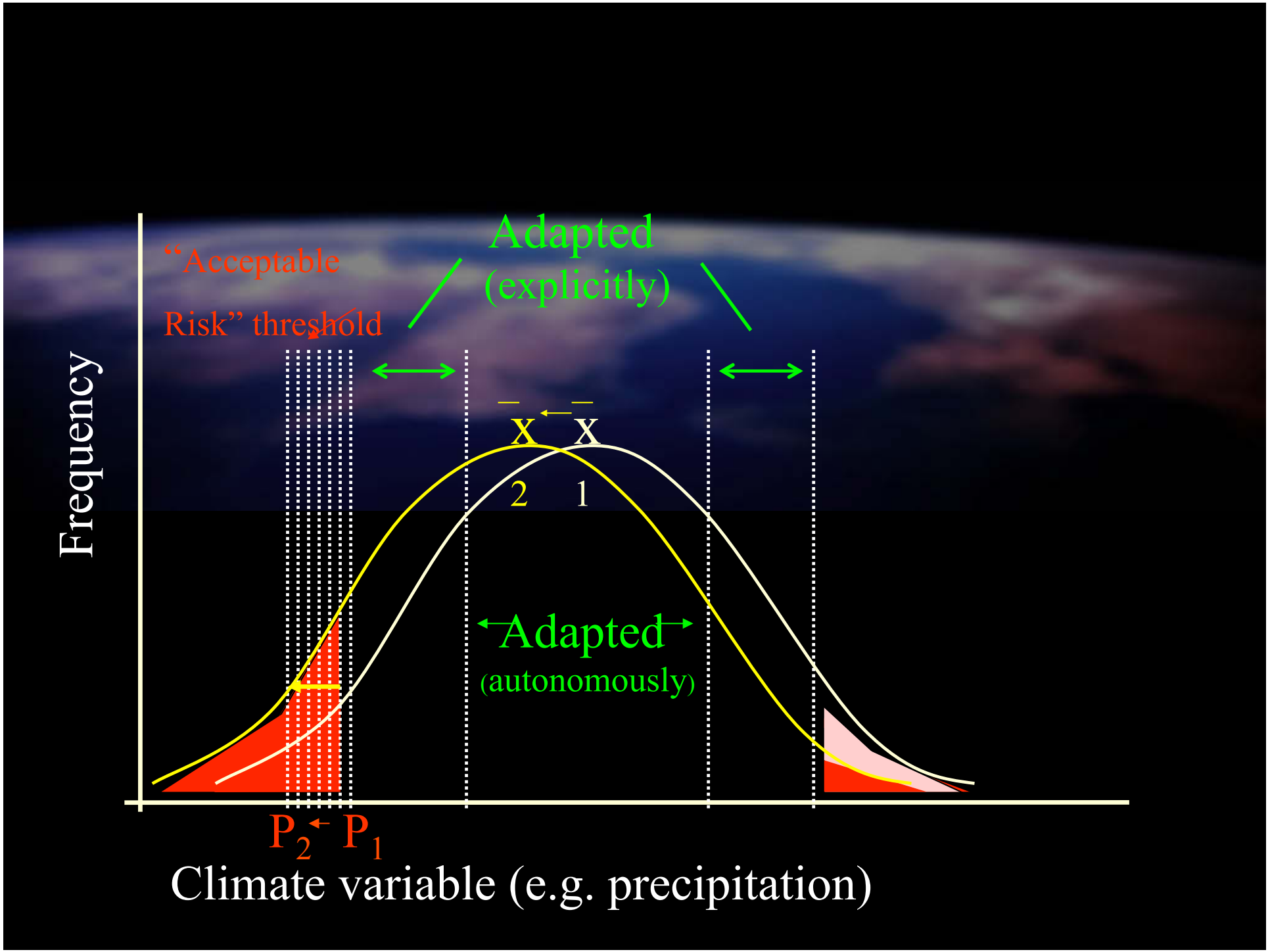
Realized Risk is Disaster

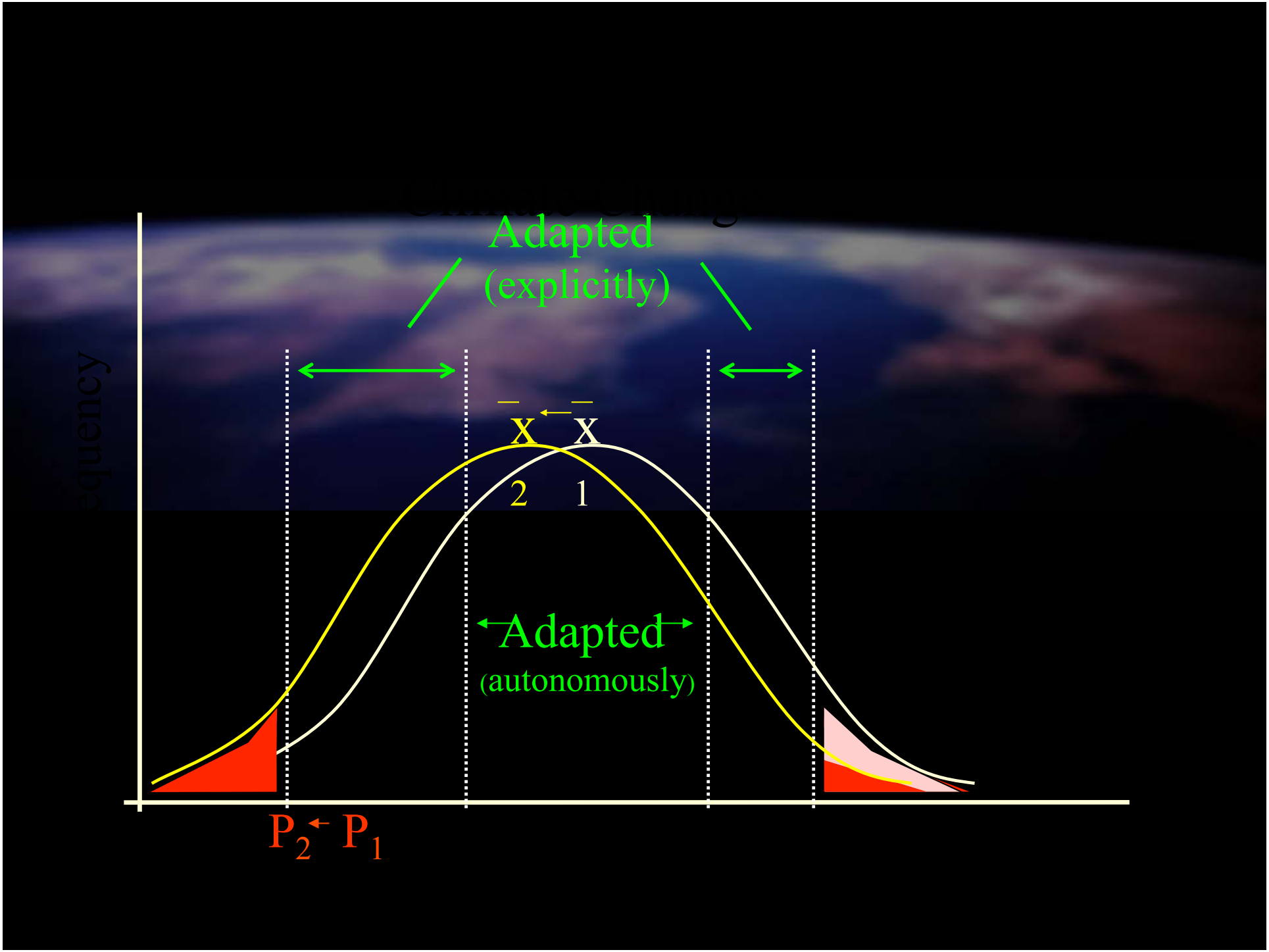
An Integrated Approach



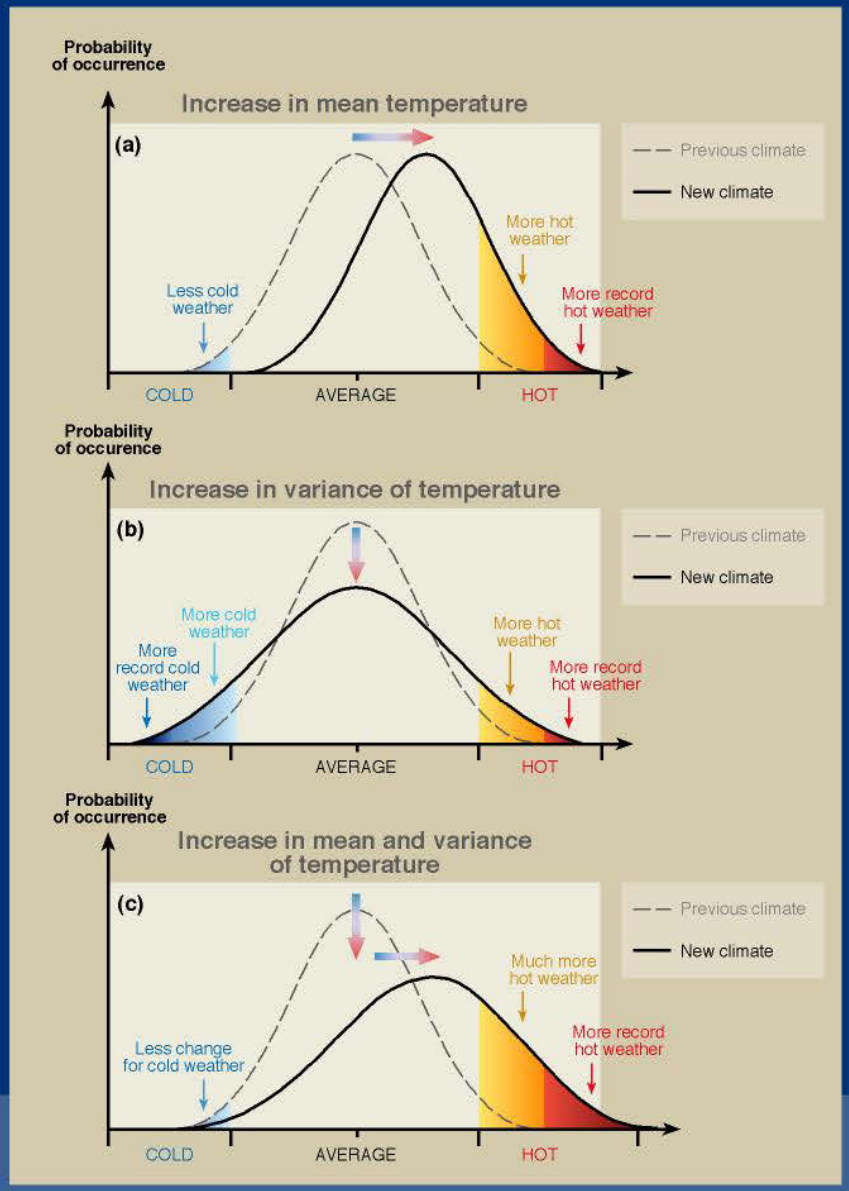

Frequency
$\bar{x}$
1
drier
wetter
Climate variable (e.g. precipitation)


Frequency
$\bar{x}$
1
Adapted
(autonomously)
drier
wetter
Climate variable (e.g. precipitation)


"Acceptable
Risk" threshold
Adapted
(explicitly)
Frequency
$\bar{X}_2$ $\bar{X}_1$
Adapted
(autonomously)
P_2 P_1
Climate variable (e.g. precipitation)

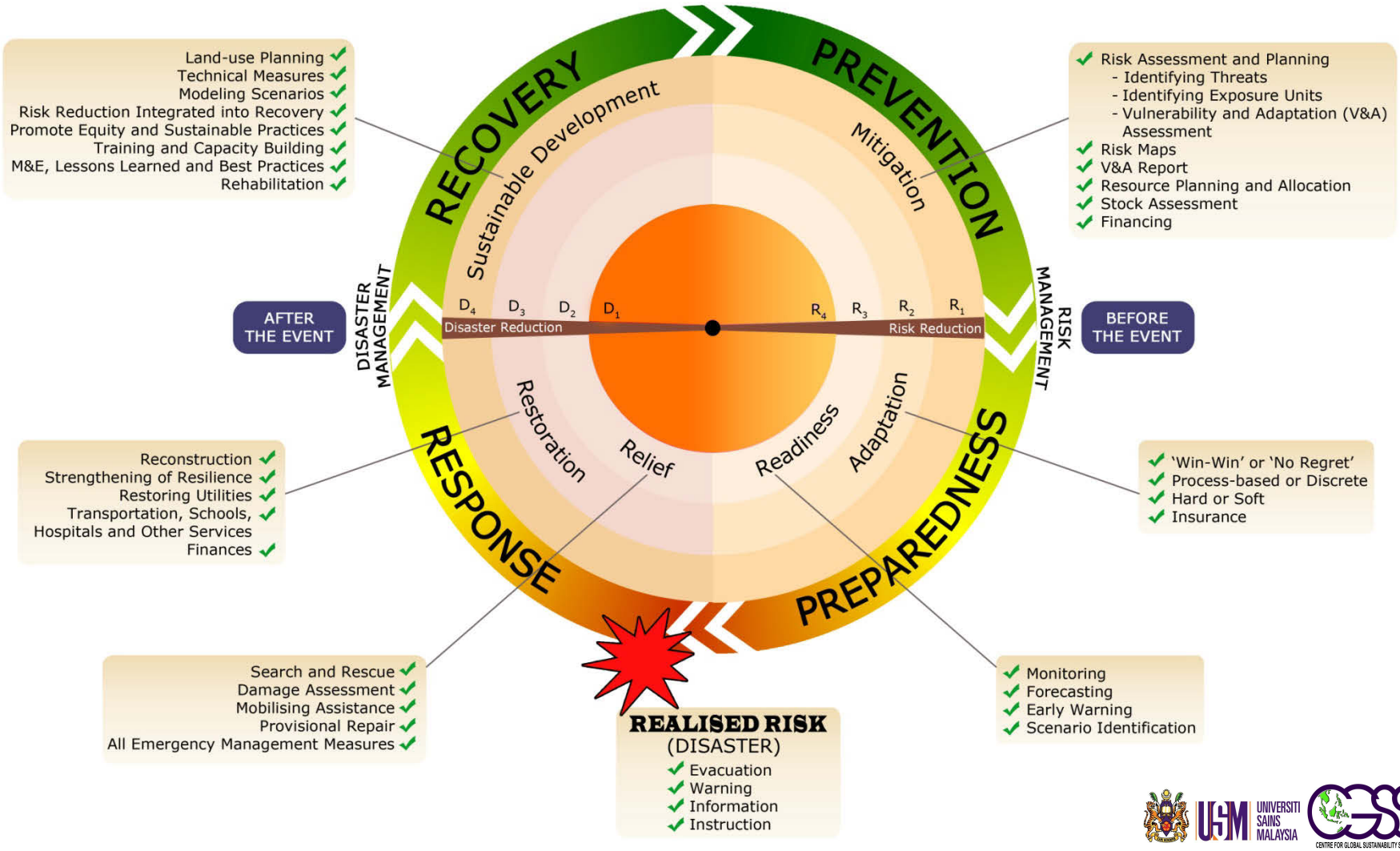

Adapted
(explicitly)
Frequency
$\bar{x}_2 \leftarrow \bar{x}_1$
Adapted
(autonomously)
$P_2 \leftarrow P_1$

Effects on extreme temperatures



SYR - FIGURE 4-1

Disaster Risk Management for Sustainable Development



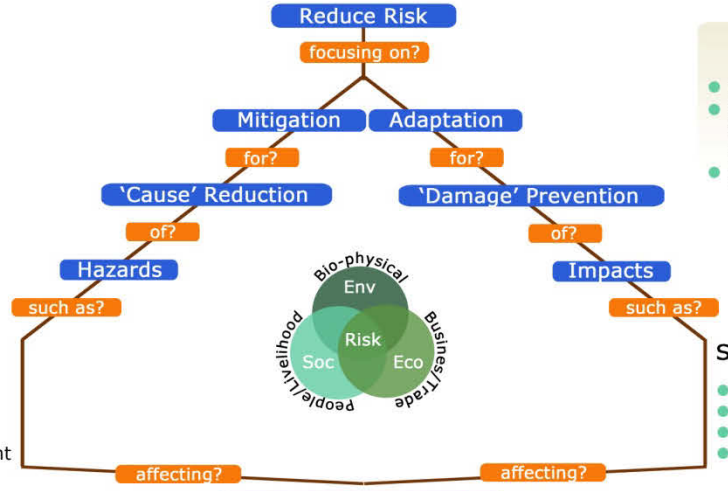
RISK ASSESSMENT METHODOLOGY (R.A.M)

The R.A.M Logic

- The assessment is based on the risk equations - See PX
- Essentially in risk management, the effort is to 'reduce the cause' of the hazard and to 'prevent potential damage' of the impacts
- Once the impacts of the hazard on critical exposure units spanning the three pillars of SD are assessed, a risk rating is carried out
- Based on this prioritization, risk management approaches such as 'prevention and preparedness', before the event, and 'response and recovery', after the events are implemented

How to follow this chart?

- Start from the top
- Each ▬ has an instruction or suggestion to be carried out as an act or a process, while each ▬ contains a clarifying question/query
- Read reflectively as you traverse down to the bottom-most line



Extreme/Unusual:

- Physical event
- Phenomenon
- Human activity
- Technological accident

Severe/Destructive:

- Flood, drought, tsunami
- Climate change, poverty, species loss
- War, inequity
- Oil spill, pollution

How the Risk Rating works?

1 Given that disasters result in 'loss', the goal is to minimize loss as much as possible.

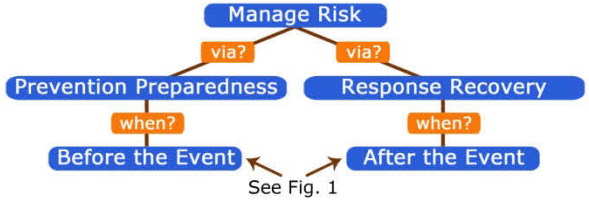
2 Using any semi-quantitative assessment approach, assign H (High), M (Medium) and L (Low) symbols to the four atributes, shown in columns 4-7, of the impact under consideration.

3 Then use the table on the right to assign an average 'Risk Rating' symbol in column 8 (see 4 & 5).

contd. →

Worksheet

1 Sphere	2 Resource / Sector	3 Impact	4 Magnitude / Coverage H, M, L (How Big)	5 Intensity / Severity H, M, L (How Strong)	6 Probability / Certainty / Timing H, M, L (How Often)	7 Importance / Capacity / H, M, L (How Resilient)	8 Risk Rating H, M, L (Average)
Social	People	Of Hazard/ Extreme Event e.g. flood, drought, tsunami	M	M	L	H	
	Livelihood		M	M	L	H	
Economic	Business		M	M	L	H	H
	Trade		M	M	L	H	
Environmental	Ecosystem		M	M	L	H	
	Physical		M	M	L	H	



See Fig. 1

→ contd.

Risk Rating Table

High H (>50%) 51-100%	Medium M (≤50%) 25-50%	Low L (≤25%) 0-25%
4H	4M	4L
3H, M	3M, L	
3H, L	3L, H	
3M, H	3M, L	
2H, M, L	2L, M, H	
2M, L, H		

4 The above table has been generated assigning the upper level value (H-100%), (M-50%) and (L-25%) to average the letter representations' in the left table. The entries in column 8 is also a measure of the vulnerability of the exposure units.

5 E.g. 2M, L, H $= 2M+L+H$

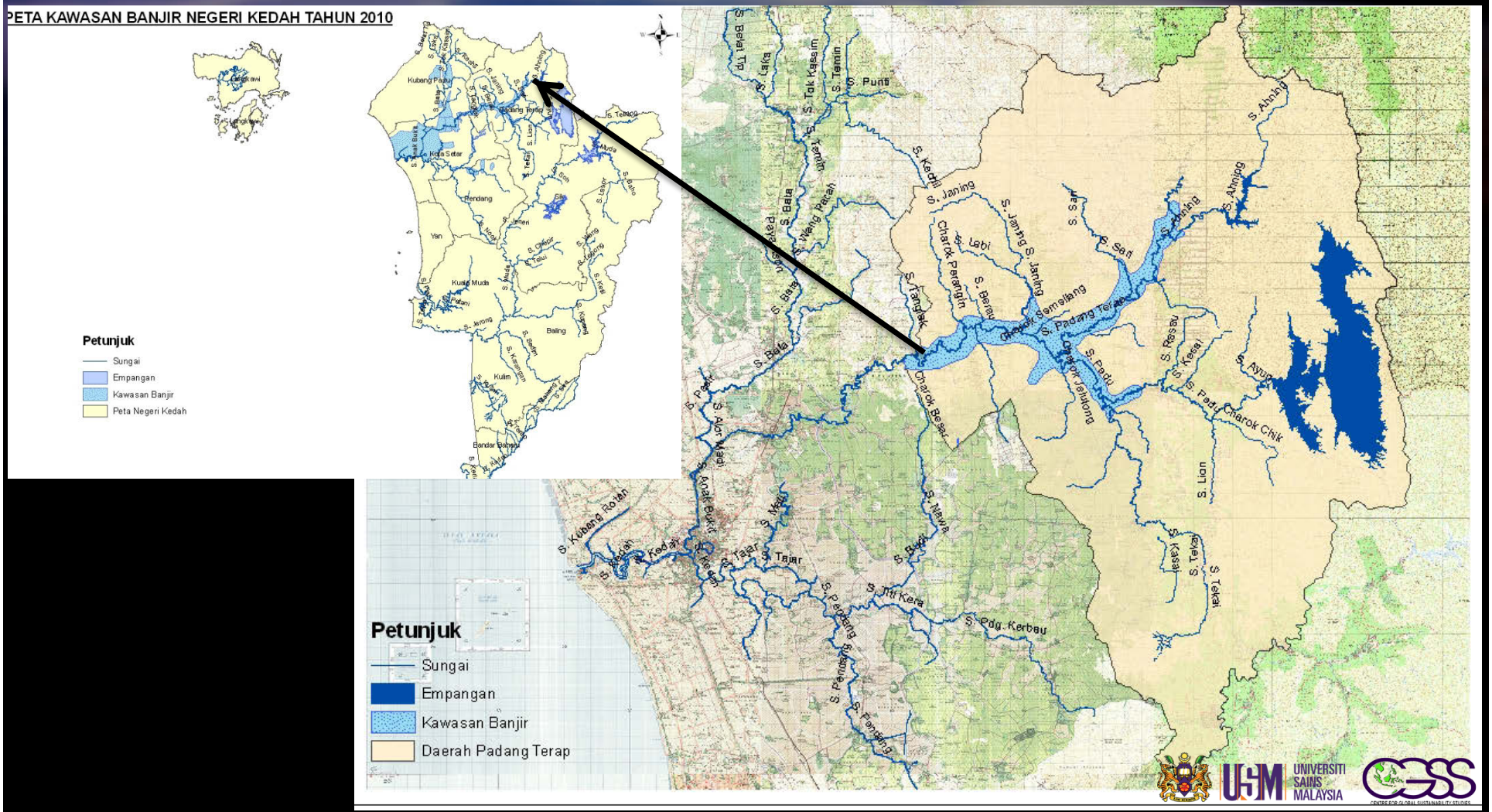
$$= \frac{2x50+25+100}{4}$$

$$\approx 56 = H$$

Disaster Risk Management for Sustainable Development

USM Universiti Sains Malaysia — CGSS Centre for Global Sustainability Studies

Flood prone Area
(Padang Terap District, Kedah)



Stakeholder Workshop - FGD

Adaptation 1

Adaptation 2


USP/AusAID Site in Fiji

Adaptation Implementation

Buretu


Adaptation Implementation
Buretu

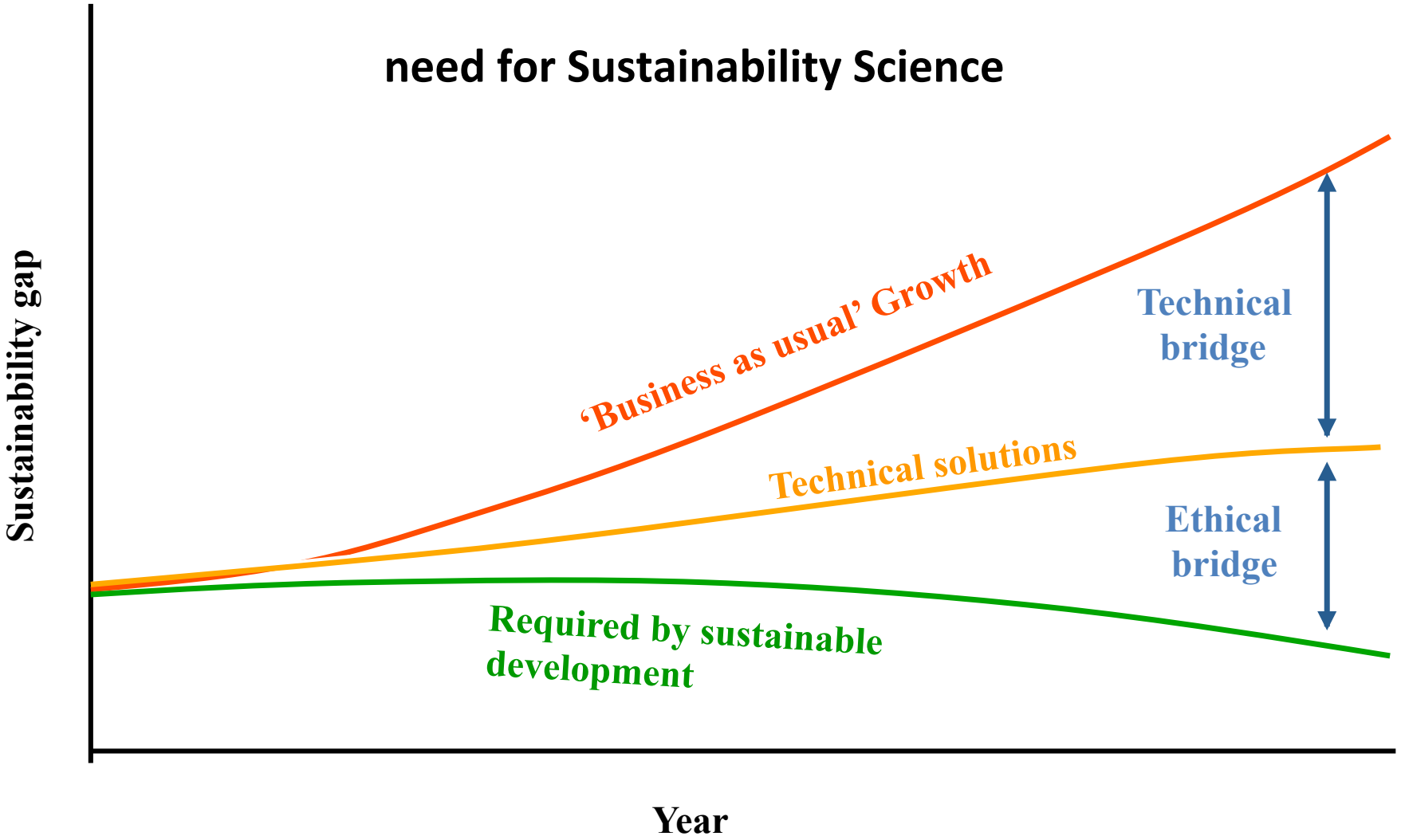

Adaptation Implementation
Navukailagi

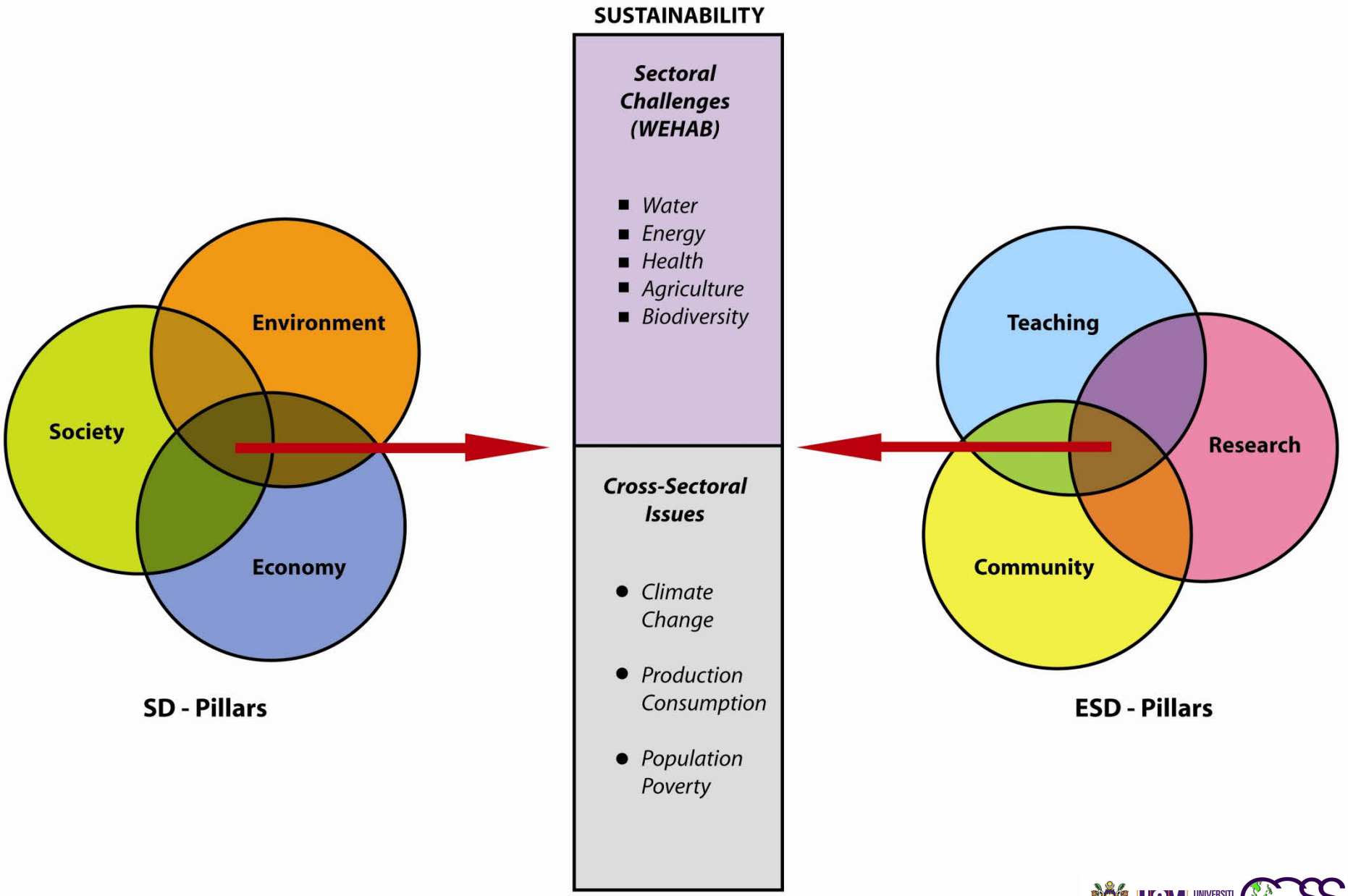
Sustained Response

- **Knowledge –** refined understanding
- **Skills –** technical ability
- **Perspectives –** inter-relationship
- **Value systems –** world-view
- **Issues –** problems/challenges

Two bridges are needed to close the Sustainability gap -

need for Sustainability Science




SUSTAINABILITY
Sectoral Challenges (WEHAB)
Water
Energy
Health
Agriculture
Biodiversity
Cross-Sectoral Issues
Climate Change
Production Consumption
Population Poverty
Environment
Society
Economy
SD - Pillars
Teaching
Research
Community
ESD - Pillars


Thank
you
…the sunrise …