



The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning

# *ON SCARCITY OF NATURAL RESOURCES AND THE VULNERABILITY OF THE PLANET*

**Towards the gardening of the  
planet  
*in the period of the  
anthropocen***

– *the world as a socio-bio-space*

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Formas and

The Stockholm Resilience Center, Sweden

**The EU Conference "The World in 2025"  
24 September 2009, Brussels**

## POINTS TO DISCUSS

- A. THE NATURAL RESOURCE CHALLENGES**
- B. THE ENVIRONMENTAL "SHADOW" OF THE USE**
- C. THE SOCIO- ECONOMIC- ECOLOGICAL INTERVOWENNESS**
- D. THE SYSTEMS ESCALATING UP TO THE PLANETARY LEVEL - BEYOND "ONLY CLIMATE"**
- E. THE ANTHROPOCEN**
- F. GARDENING OF THE PLANET**

POINTS TO DISCUSS

**A.THE NATURAL  
RESOURCE  
CHALLENGES**

## NATURAL RESOURCES

- **ENERGY**
- **WATER**
- **MARINE**
- **LAND USE: FOOD, FEED AND FIBRE**
- **BIODIVERSITY**
- **NON-RENEWABLES**

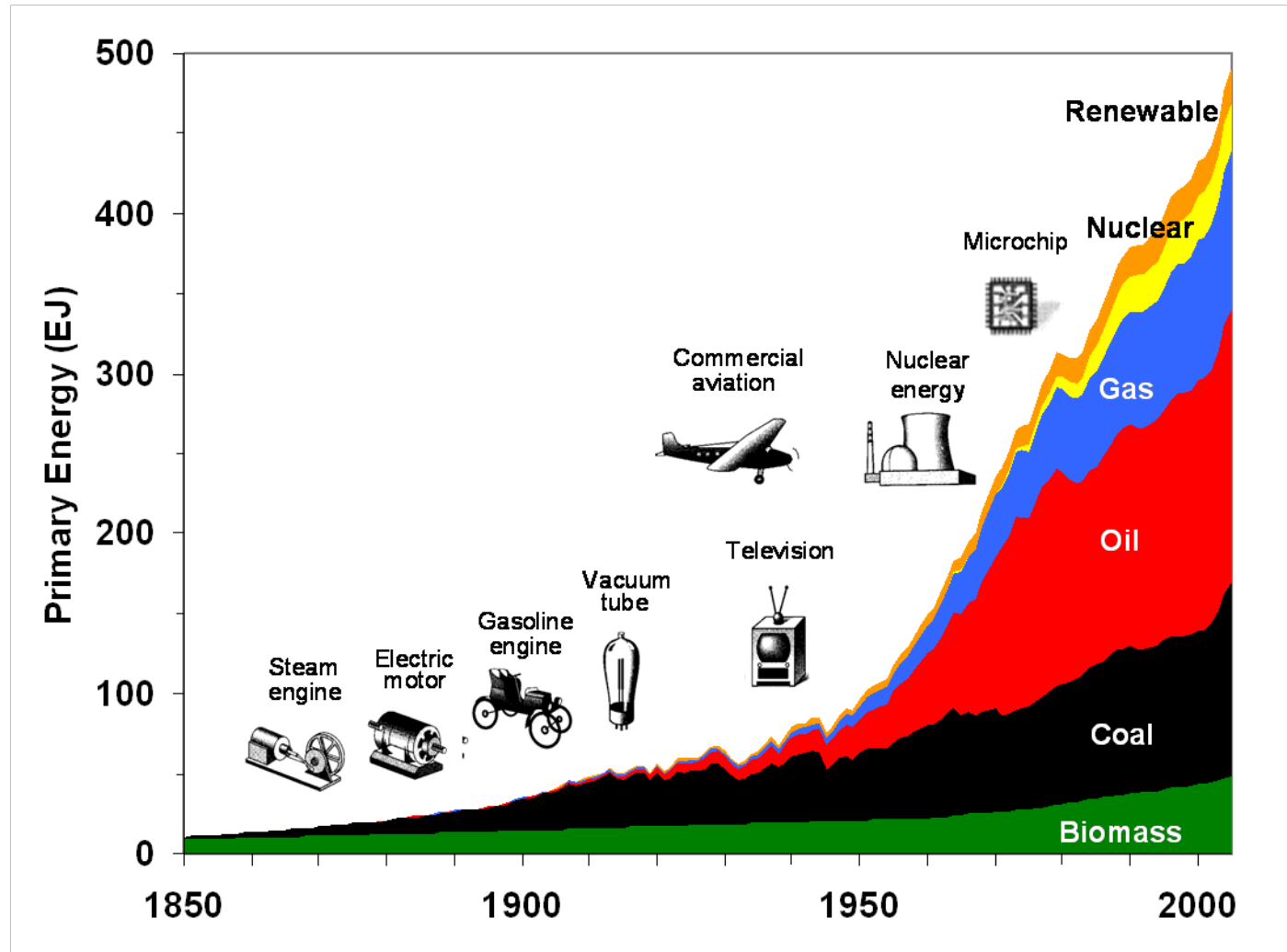
POINTS TO DISCUSS

**B. THE  
ENVIRONMENTAL  
"SHADOW" OF THE USE**

# THE CAUSES - IMPACT MATRIX FOR CLIMATE

	<b>NATURE</b>	<b>SOCIETY</b>
<b>CAUSES</b>	<i>SOLAR INFLUX CHANGE</i>	<i>INDUST- RIAL AC- TIVITY</i>
<b>IMPACTS</b>	<i>FLOODS +ERO- SION</i>	<i>FOOD SHORTA- GE</i>

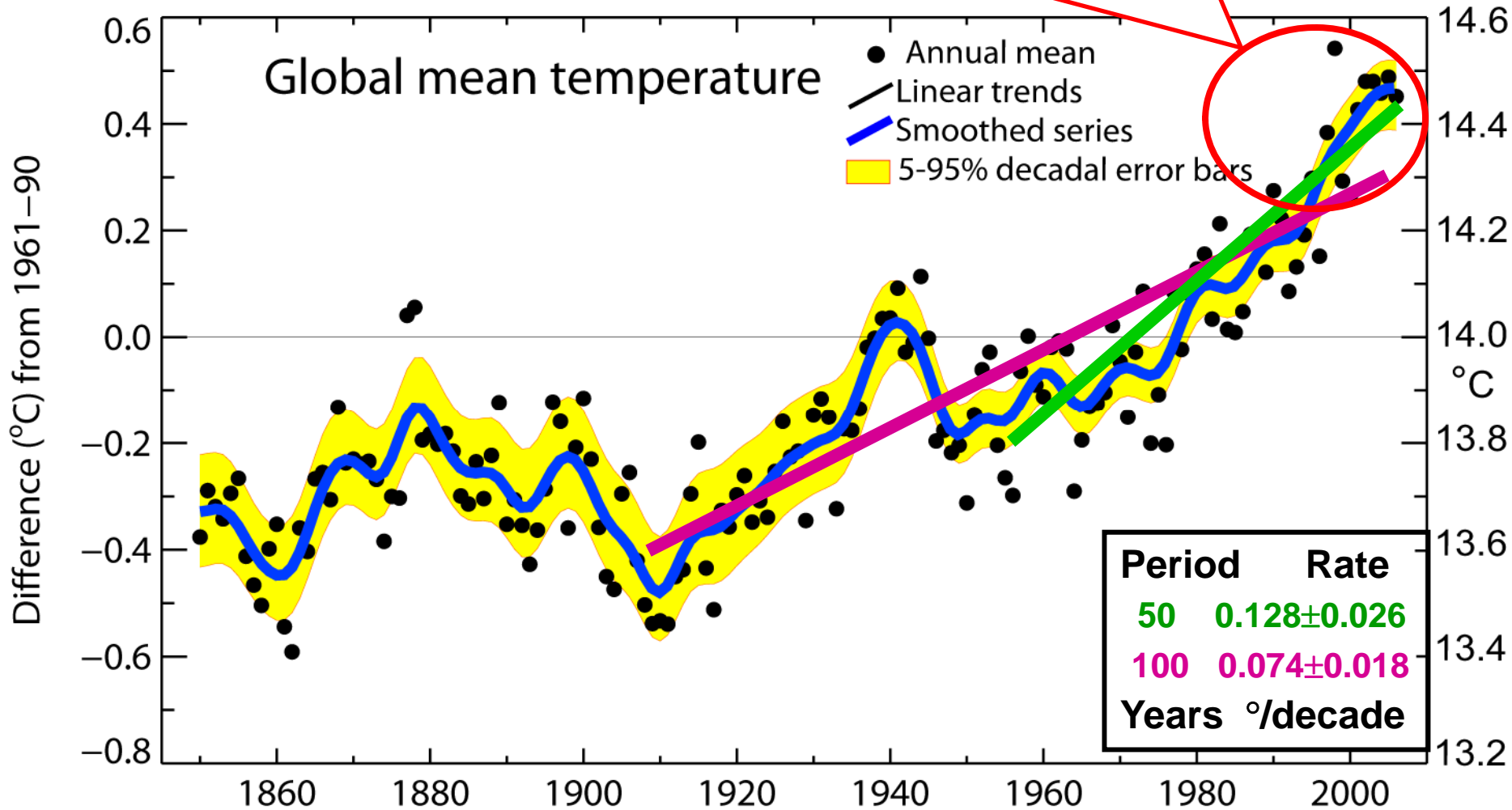
# World Primary Energy



# Global Mean

**Warmest 12 years:**  
1998, 2005, 2003, 2002, 2004, 2006,  
2001, 1997, 1995, 1999, 1990, 2000

# ing





# MUIR GLACIER, SE ALASKA

AUG 1941

PHOTO WILLIAM FIELD

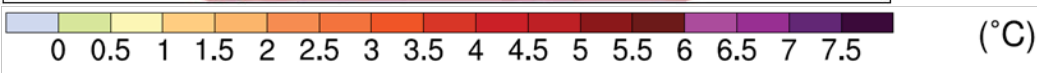
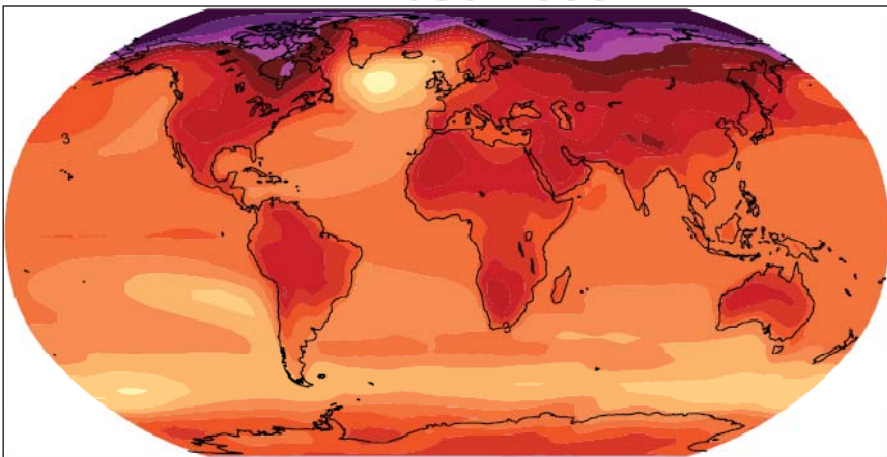


AUG 2004

PHOTO BRUCE MOLNIA



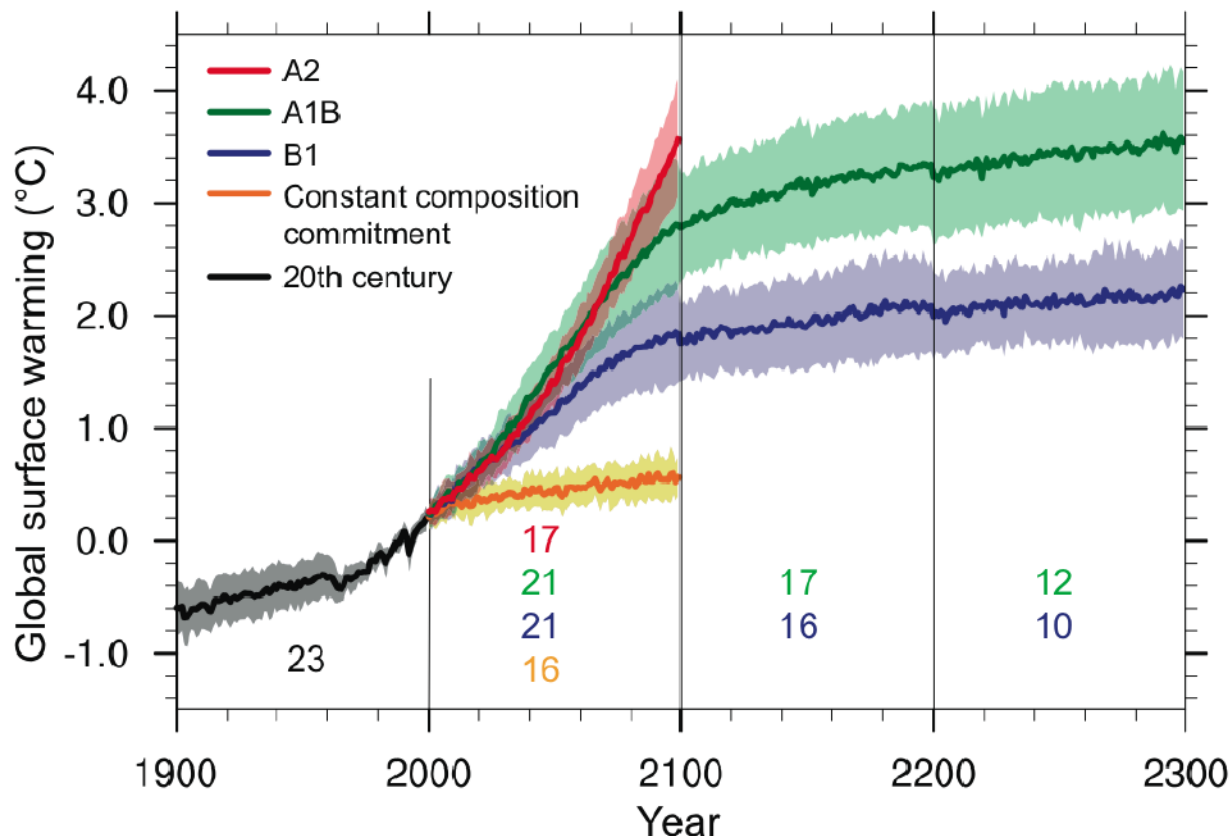
A2: 2080-2099



# Projections of future global warming

© ipcc (2007) WGI, ch 10

- CO<sub>2</sub> in 2100
  - ~ 850 ppm
  - ~ 700 ppm
  - ~ 550 ppm
- CO<sub>2</sub> constant
  - ~ 370 ppm



# FOOD PRODUCTION

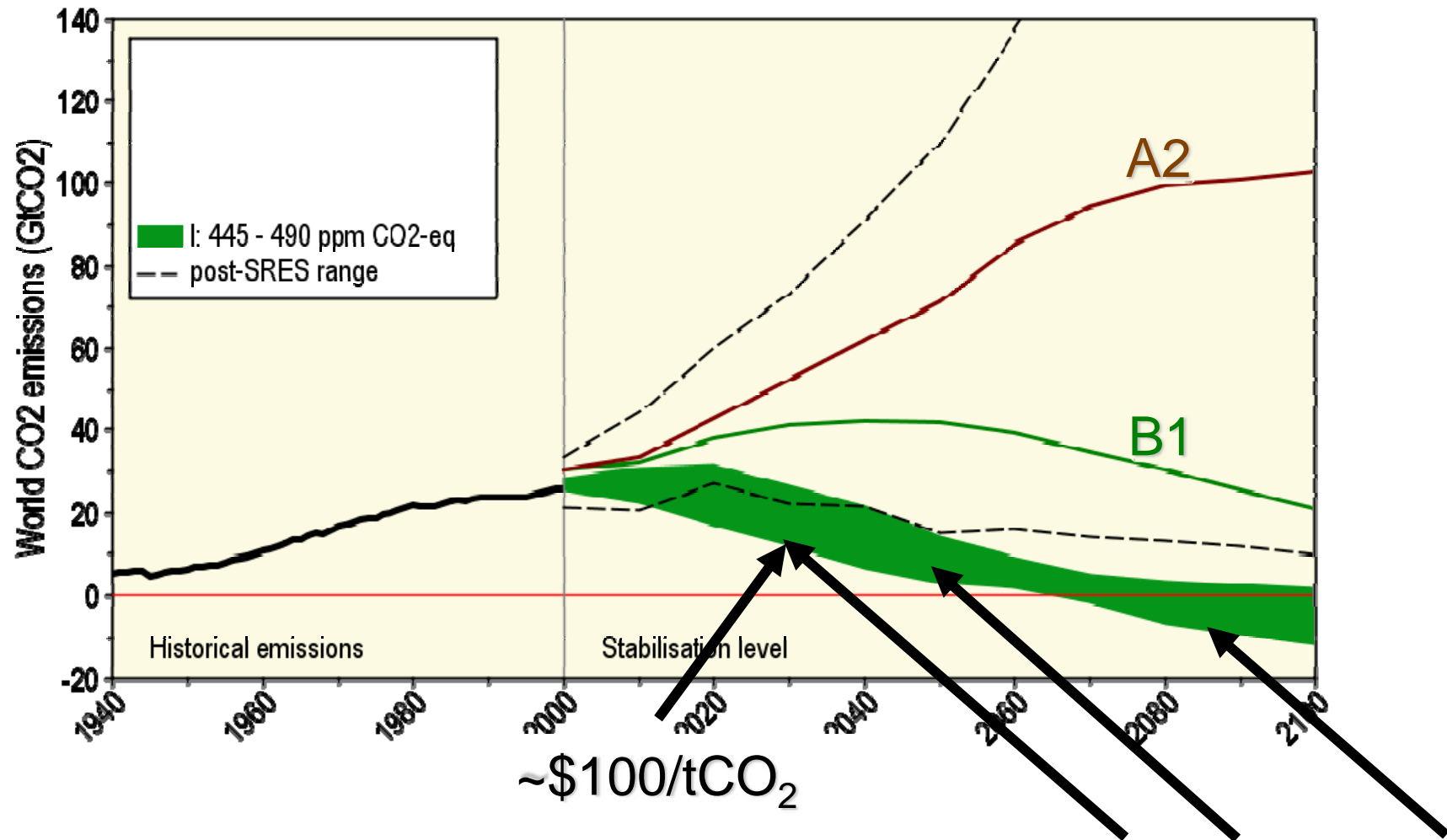


from Wolfgang CRAMER, PIK



# Long-Term Stabilization Profiles

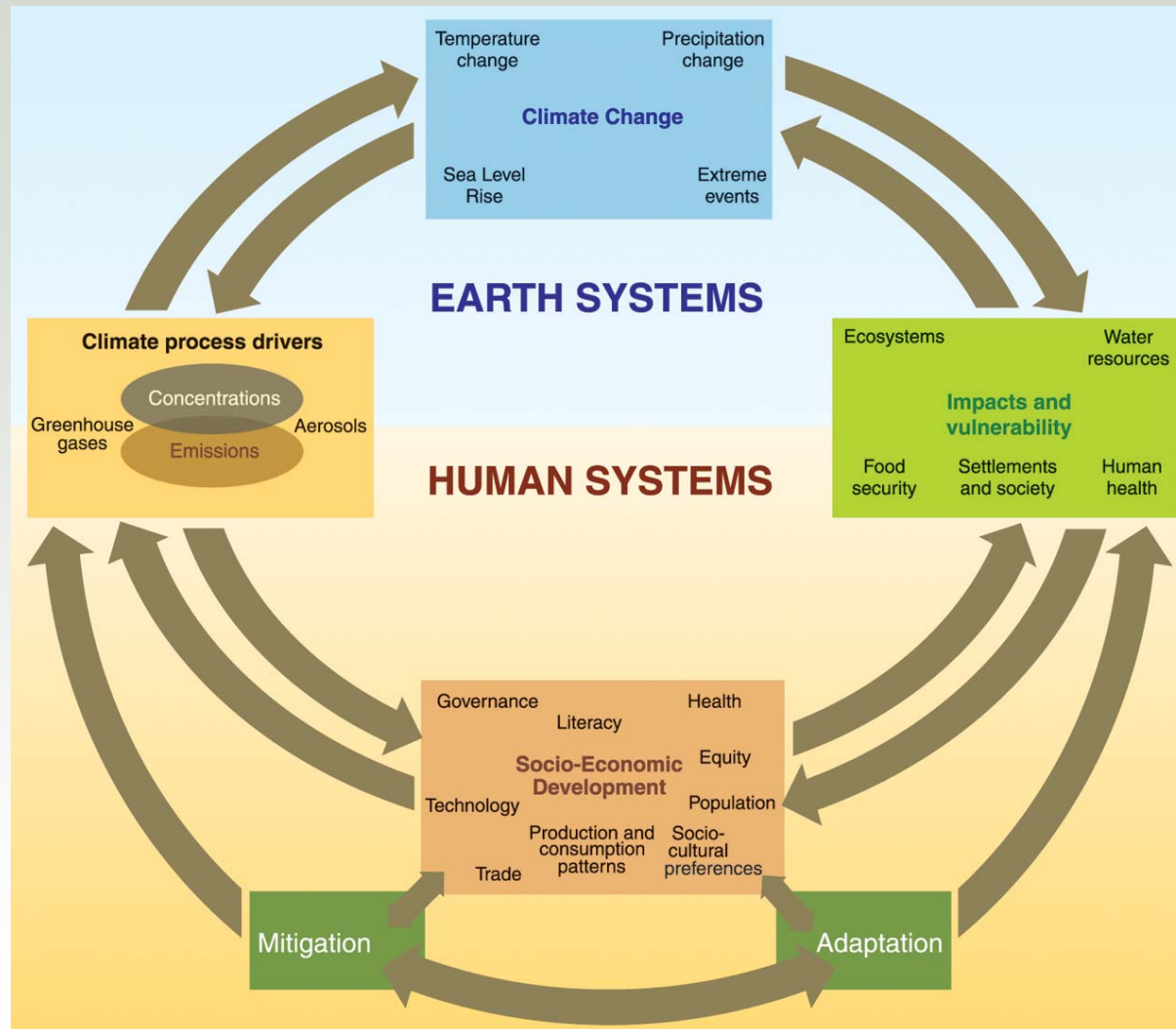
IPCC and UNEP



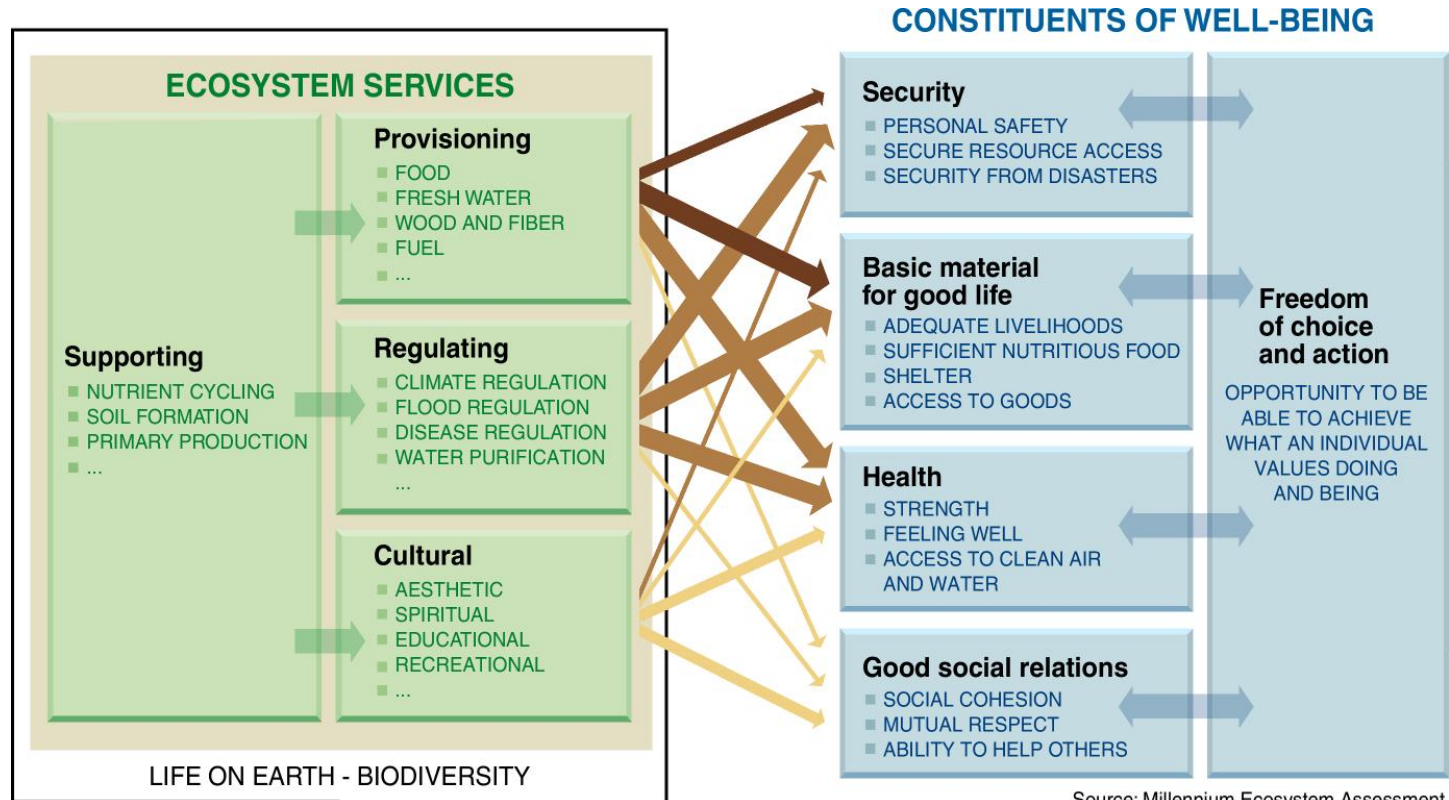
POINTS TO DISCUSS

**C. THE SOCIO-ECONOMIC-  
ECOLOGICAL  
INTERVOWENNESS**

# The Overall IPCC Picture



# Consequences of Ecosystem Change for Human Well-being



Source: Millennium Ecosystem Assessment

**ARROW'S COLOR**  
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

**ARROW'S WIDTH**  
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong



# The bottom line

We are spending Earth's natural capital, putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted.

At the same time, the assessment shows that the future really is in our hands. We can reverse the degradation of many ecosystem services over the next 50 years, but the changes in policy and practice required are substantial and not currently underway.

Source: Millennium Ecosystem Assessment 2005

POINTS TO DISCUSS

**D. THE SYSTEMS ESCALATING  
UP TO THE  
PLANETARY LEVEL –**

**AND BEYOND "ONLY CLIMATE"**



## ASPECTS

- **COMPLEXITY - INTERPLAY**
- **SCALING – MICRO TO MACRO**
- **TIMING: TIME WINDOWS AND PATH DEPENDENCIES**
- **BIO IMPORTANCE EMERGING**

# BIOPHYSICAL THRESHOLDS

The scientists first identified the Earth System processes and potential biophysical thresholds, which, if crossed, could generate unacceptable environmental change for humanity.

They then proposed the boundaries that should be respected in order to reduce the risk of crossing these thresholds.

# NINE BOUNDARIES

- 1. climate change,**
- 2. stratospheric ozone,**
- 3. land use change,**
- 4. freshwater use,**
- 5. biological diversity,**
- 6. ocean acidification,**
- 7. nitrogen and phosphorus inputs to the biosphere and oceans,**
- 8. aerosol loading and**
- 9. chemical pollution.**

# THREE MAYBE TRANSGRESSED ALREADY

- climate change,
- biological diversity and
- nitrogen input to the biosphere

The boundaries are strongly  
connected –

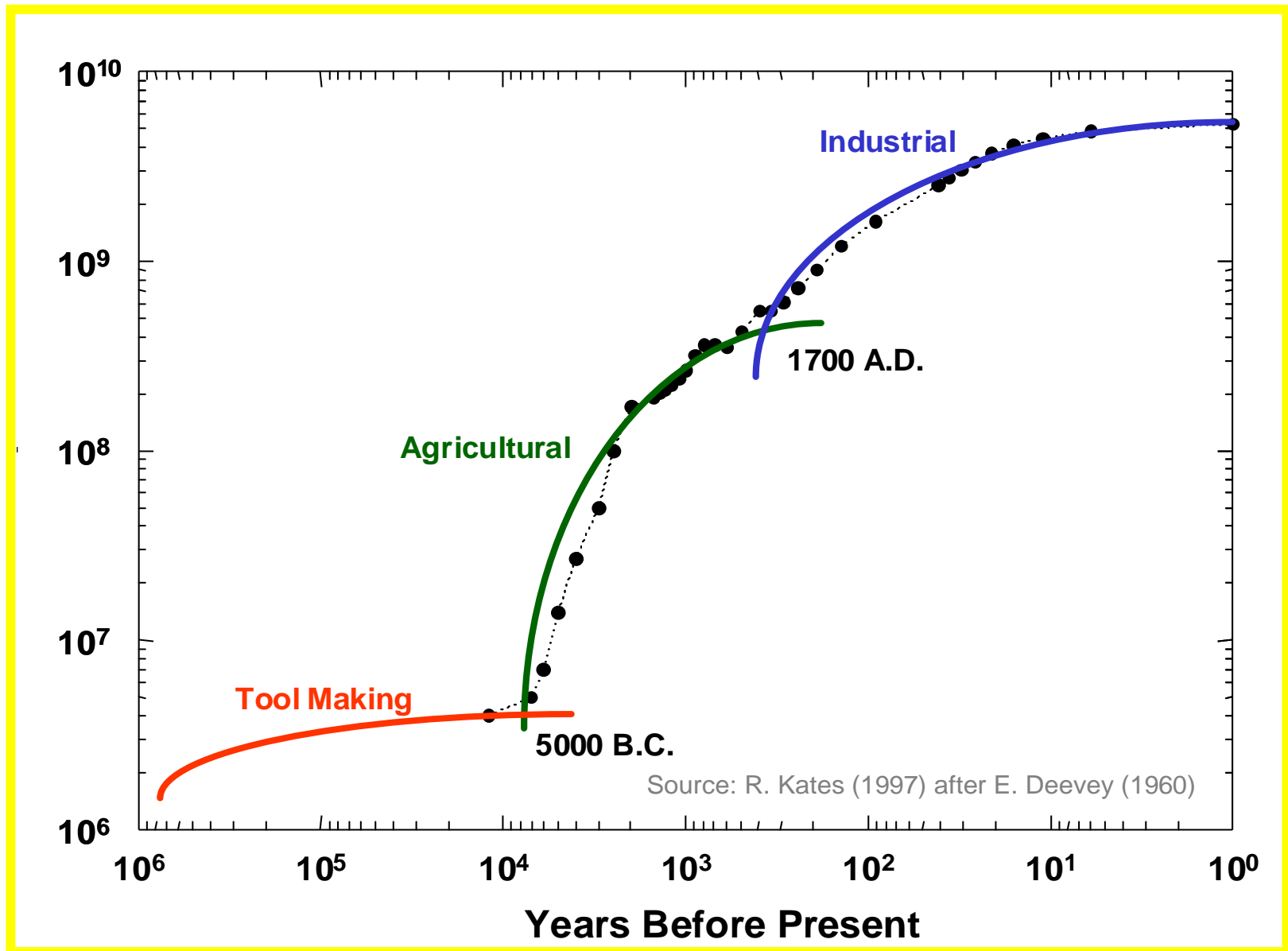
crossing one boundary may  
seriously threaten the ability to  
stay within safe levels of the  
others



POINTS TO DISCUSS

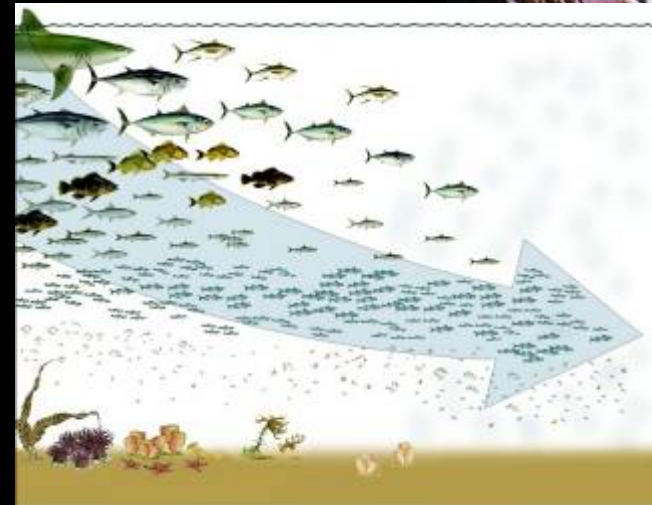
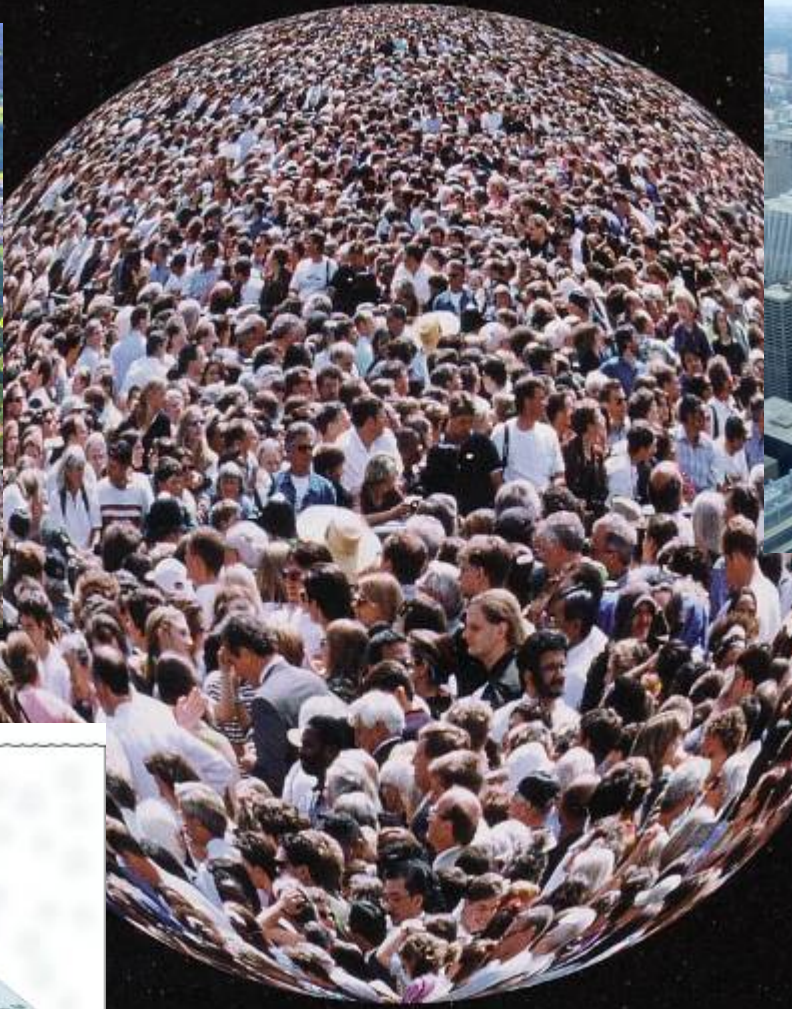
**E. THE ANTHROPOCEN**

# New Worlds: Grand Transformations

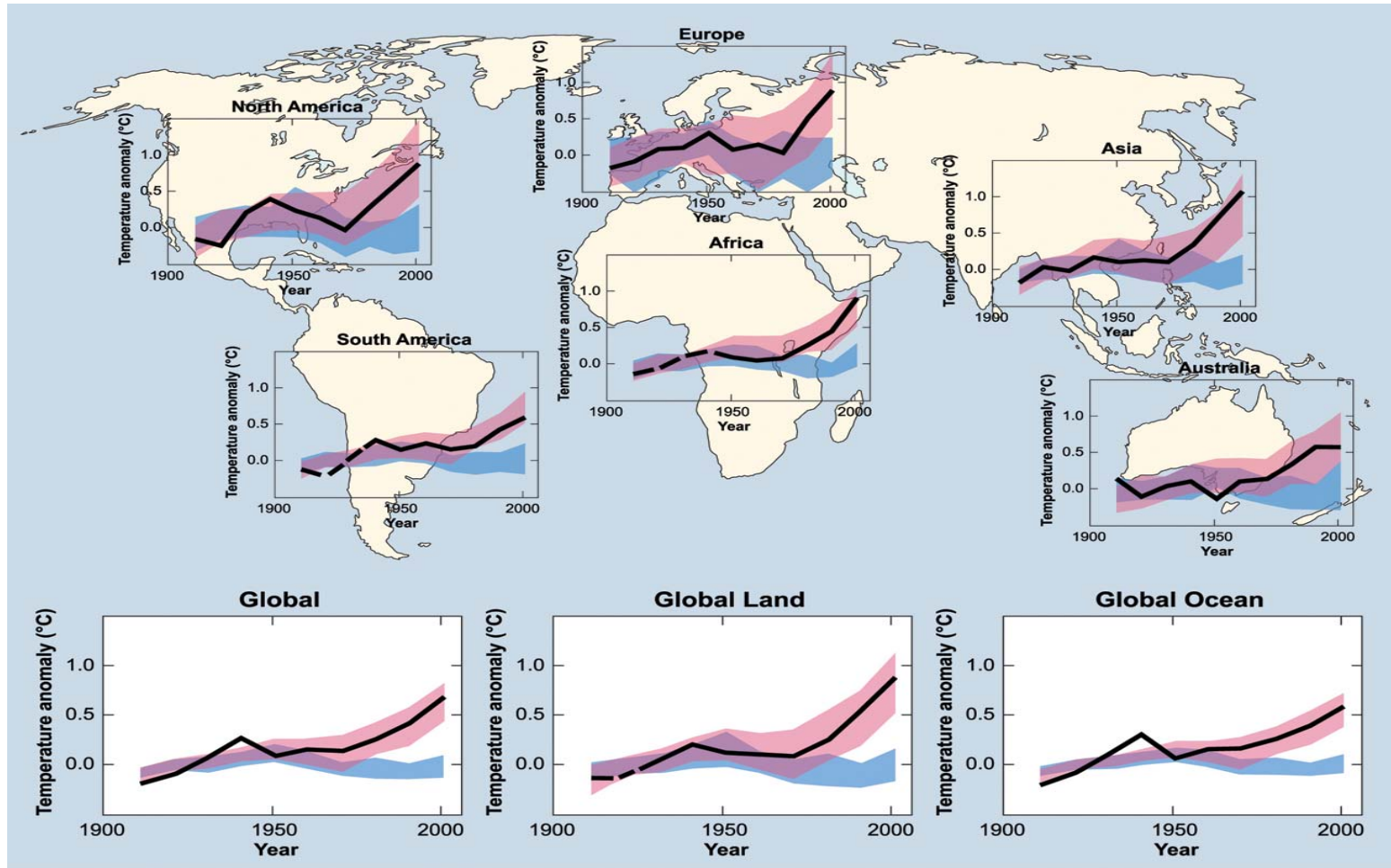


Source: Kates & Deevey ref by Nakicenovic

# A biosphere shaped by humanity



# THE IPCC ANALYSIS OF NATURAL-HUMAN INFLUENCES



models using only natural forcings  
models using both natural and anthropogenic forcings

observations

- **THE GLOBAL-PLANETARY SCOPE**
- **THE SYSTEMIC CONNECTIONS**
- **THE HUMAN DEGREE OF PRESENCE**

POINTS TO DISCUSS

**F. TOWARDS  
GARDENING OF THE  
PLANET**

## ELEMENTS FOR THE FUTURE (1)

- **FORMATION OF A NEW  
CONNECTEDNESS OF SOCIO-  
BIO-SPACE**

## ELEMENTS FOR THE FUTURE (2)

- **ANTHROPOCEN AS THE PERIOD AHEAD CALLING FOR A PLANETARY MANAGEMENT BY HUMANKIND**
- **MATCHING KNOWLEDGE**
- **RESPONSIBILITY AND ETHICS**
- **IMPLEMENTATION CAPACITY AND DRIVE**





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## ELEMENTS FOR THE FUTURE (3)

# WHAT COULD A GARDENING OF THE PLANET MEAN ?

# THREE SCENARIOS

ABOUT THE OUTCOME OF THE  
ACTIVITIES THAT THE CURRENT  
AND NEXT GENERATION (I.E. 50  
YEARS) MAY INDUCE THROUGH  
THE ACTIONS THAT TRANSFORMS  
THE RELATIONS BETWEEN  
HUMANS AND NATURE

# SCENARIO A: A COLLAPSED WORLD



# SCENARIO B. POST MODERN BRICOLAGE



Photo: Uno Svedin

# SCENARIO B. POST MODERN BRICOLAGE



# SCENARIO C: THE GARDEN LANDSCAPE



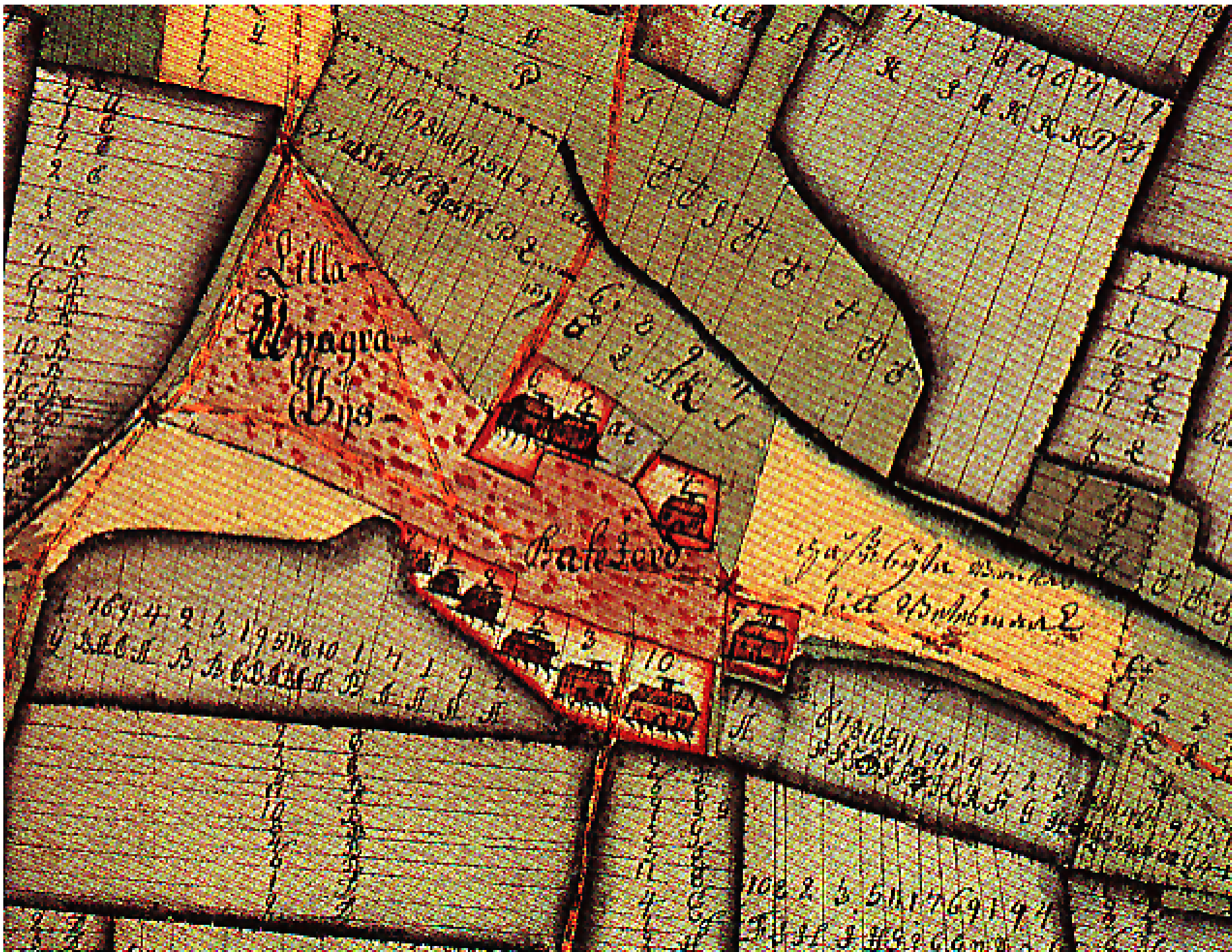
Lilla  
Wnagra  
Bns

Walsoro

1694 2 3 19 5 10 1 17 1 9 2  
4 10 10 10 10 10 10 10 10 10

1694 2 3 19 5 10 1 17 1 9 2  
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100 2 3 5 10 17 69 194  
100 2 3 5 10 17 69 194



# GLOBAL CONNOTATIONS

- **THE GLOBAL FEATURES OF THE GRAND CHALLENGES**
- **GLOBAL ISSUES MEANS GLOBAL COMMON EFFORTS!**
- **INVESTMENT IN STRUCTURES THAT MATCH THE GLOBALNESS**
- **APPROPRIATE TECHNOLOGY PATHS  
(the bottleneck might be time)**





# **THIS IS THE SETTING FOR THE FUTURE !**

- WE OPERATE IN A SOCIO-BIO-SPACE**
- WE ARE LIVING IN THE PERIOD OF  
THE ANTHROPOCEN**
- WE ARE FACED WITH THE  
CHALLENGE OF GARDENING THE  
PLANET**

# BUT WHERE ARE WE ?

- **ARE WE CLOSE TO SOME FLIP FLOPS?**
- **DO WE HAVE THE APPROPRIATE TOOLS IN OUR HANDS TO MATCH THE CHALLENGE (OR THE CAPABILITY TO DEVELOP IT)?**
- **ARE THE HINDRANCES BIG ENOUGH TO PREVENT IT?**

# WE NEED

- **A RIGHT METRIC OF SUCCESS** (identification of the most important topics and means to address them)
- **TO ADDRESS THE BEHAVIORAL CHANGES AND DEVELOP CORRESPONDING KNOWLEDGE**  
(e.g. brain research, social behaviour etc)
- **TO MORE STRONGLY OPEN TO THE NORMATIVE ISSUES THAT ARE IMPLIED**

# THE THINKING

- CHANGES IN THE KNOWLEDGE PRODUCTION SYSTEM
- RIGHT MIND SET
- UNIVERSITY SYSTEM REFORM
- RESOURCES IN THE RIGHT PLACES!
- THE TRUST FACTOR

# THE “DOING”

- BIG NEED FOR IMMEDIATE ACTION
- THE OPPORTUNITIES AND SOLUTIONS NEED TO BE FACILITATED BY PREPARATORY EARLY INVESTMENTS!
- INSTITUTIONAL TRANSFORMATIONS ARE PARTS OF THAT DOING
- EXPERIMENTING (Holling)

# SUMMARY

- THE MAGNITUDE OF THE CHALLENGES CALLS FOR ACTION OF A SIZE NOT EARLIER MOBILISED FOR SUCH PURPOSES**
- MULTIPLE AND INTERCONNECTED CHALLENGES CALL FOR NEW INSTITUTIONAL SOLUTIONS**
- THE KNOWLEDGE PRODUCTION AND INNOVATION SYSTEMS HAVE A KEY ROLE TO PLAY**
- THE MIND SET HAS TO CHANGE**

A FEW IMAGES.....

**WHAT A PRETTY BLUE  
PLANET**





# REFERENCE LINKS

**Feature article in Nature, September 24 issue:** “A safe operating space for humanity”, as well as individual commentaries and reader responses:

<http://www.nature.com/news/specials/planetaryboundaries/index.html>

**Full scientific article:**

“Planetary Boundaries: Exploring the safe operating space for humanity”,

and video interviews, graphics and further background material:

<http://www.stockholmresilience.org/planetary-boundaries>

