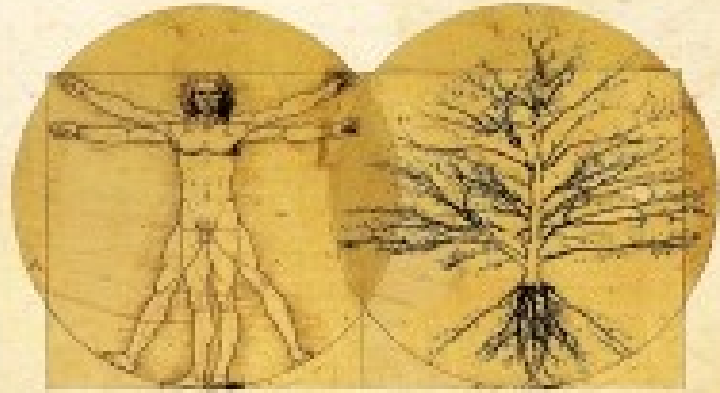


Foundations *for* Sustainability

A Coherent Framework of Life-Environment Relations



Daniel A. Fiscus, Brian D. Fath



Foundations *for* Sustainability

Brian D. Fath, Ph.D.

Fulbright Distinguished Chair, Masaryk University, Brno, Czech Republic

Professor, Towson University, Maryland, USA

Senior Research Scholar, International Institute for Applied Systems Analysis, Austria

a new paradigm

Environmental concerns have become of paramount importance.

Certain global problems may soon be *irreversible* (e.g., deforestation, extinction, soil loss, climate change).

These are *systemic problems* that cannot be understood in isolation but rather are interconnected and interdependent.

Our actions intended to solve the problem actually makes it worse because *unintended side effects* make the problem worse

Environmental Challenges

Yesterday's solutions become today's problems

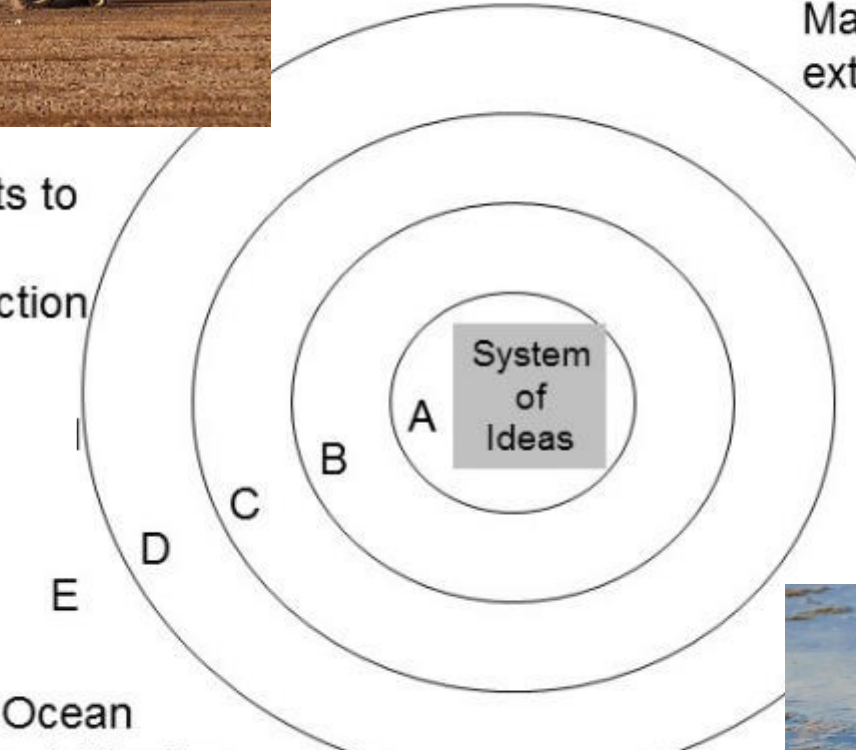


Climate disruption

Mass species extinctions



N cycle disruption



Threats to food production



Ocean acidification

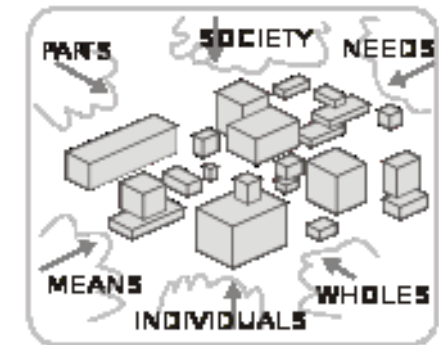


rise of systems thinking – from parts to wholes:

system – integrated whole whose essential properties arise from the **relationships** between its parts

systems thinking – the understanding of a phenomenon within the **context** of a larger whole

systems thinking is **complementary** to analytical thinking



Sustainability

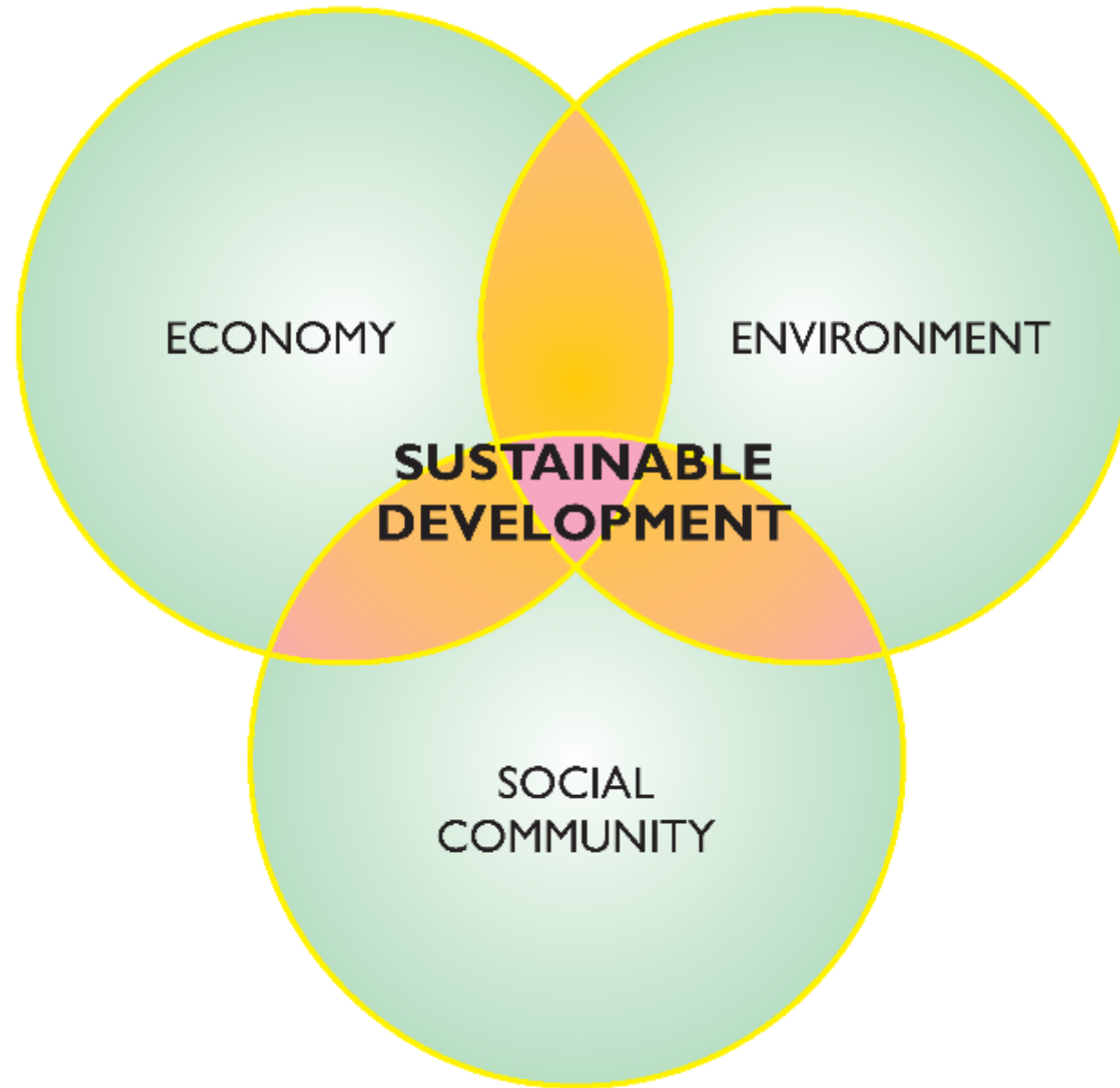
- What does it mean for a system to be sustainable?
- What makes a system sustainable?

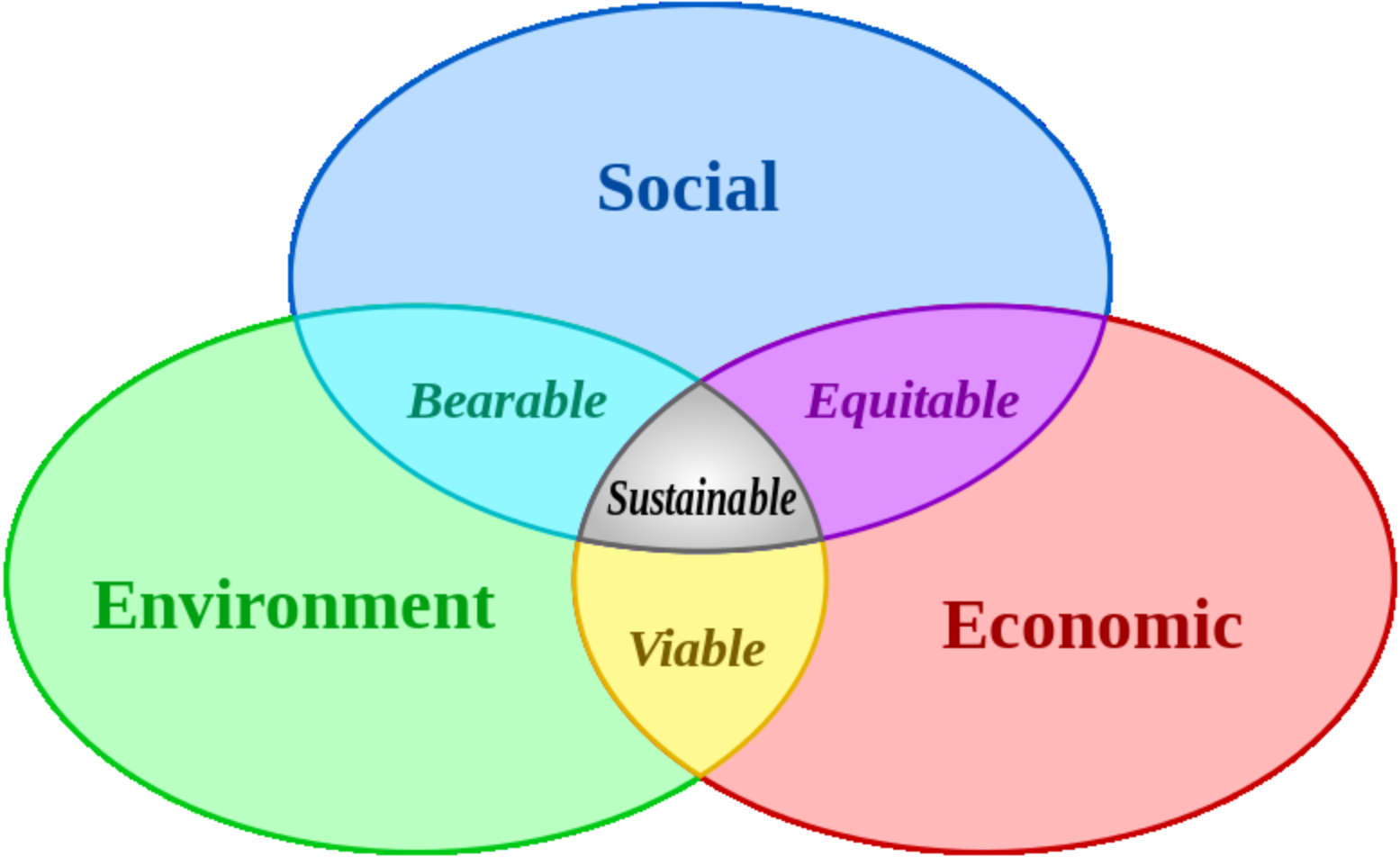
- What role do humans play in sustainability?
- Can we be sustainable given our current population and resource use level?

Sustainable Development

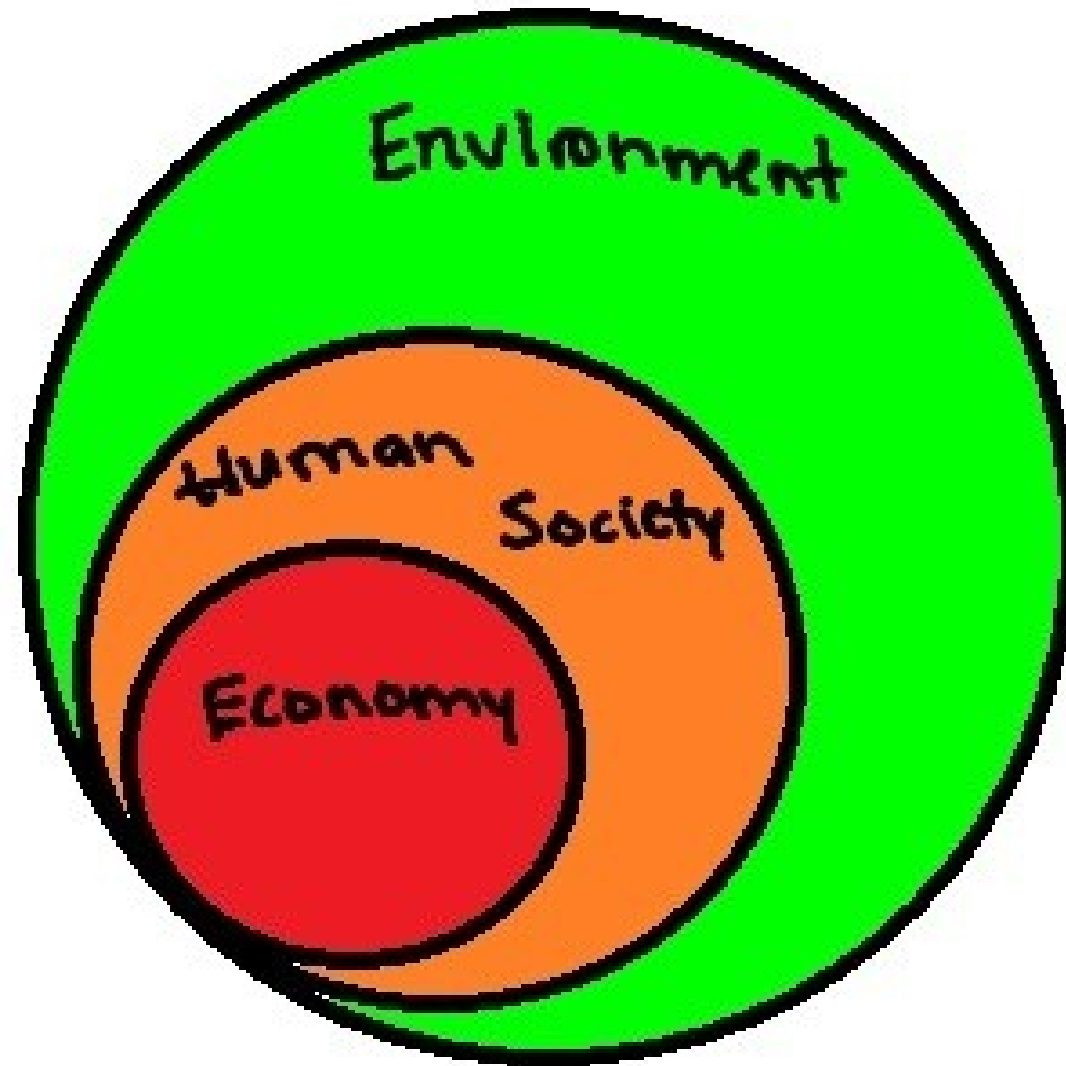
- Sustainable Development: “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs” – *Our Common Future/ Brundtland Report*, 1987

Three pillars of Sustainable Development





Environment is foundation for all aspects of sustainability,
others are subsets



SUSTAINABLE DEVELOPMENT GOALS



Adopted September 2015 – also called Agenda 2030



Sustainable Development vs Sustainability

- Sustainable Development: “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs” – *Our Common Future/ Brundtland Report*, 1987

What are “our needs”?

- Sustainability: “the capacity to endure; how systems remain diverse and productive over time” – wikipedia



Hurricane



Photo by Brad Goddard

Tornado



Ecosystem



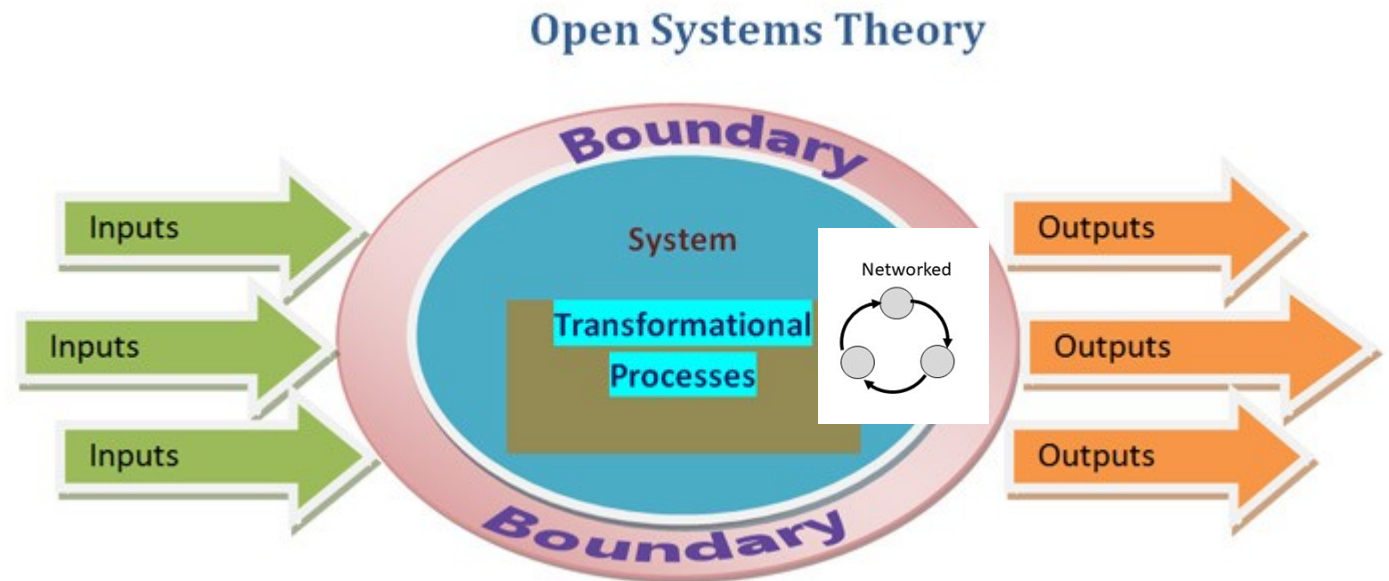
City



Campus

All are open systems with energy driving and maintaining the processes

All import, reuse, and export resources (water, wood, waste, minerals, metals, materials, etc.)



What is life?



A single cell possesses all the necessary aspects to be alive

What is life?

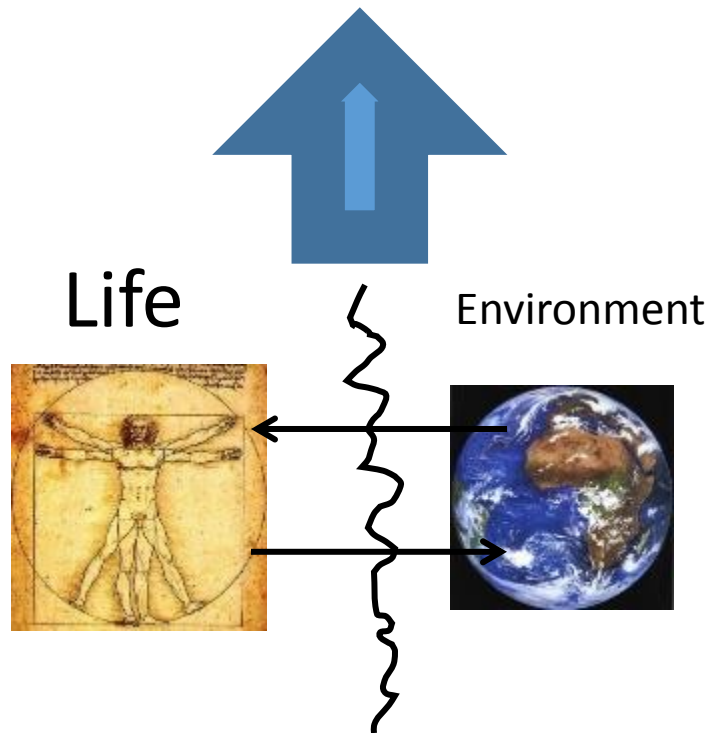


A single organism possesses all the necessary aspects to be alive

Mental models and outcomes

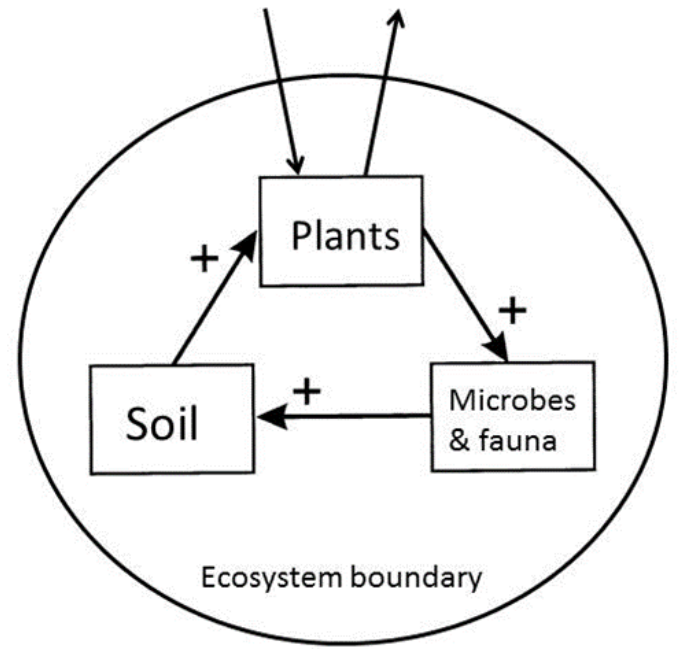
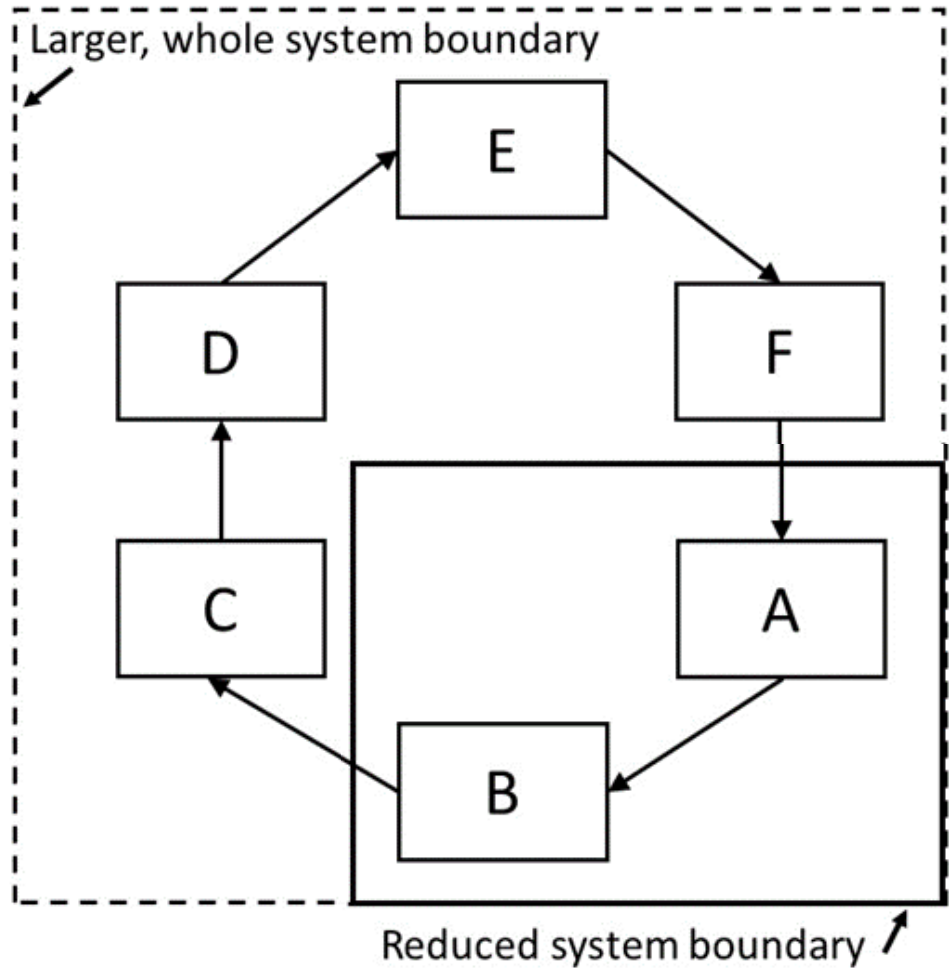
Real impacts of choice of system boundaries

Tragedy of the Commons
Humans win, environment degrades



Figures by Dan Fiscus

- Inherent in this paradigm, life is separate from environment in mind and action
- Once fragmented, it is possible and likely that the value of environment is seen and treated as less than the value of life
- Environment is consumed and degraded as manifest in many symptoms of ecological crisis



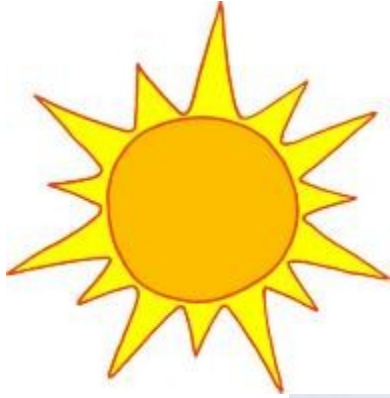


Ecosystem is full of
Interconnections
and
Interdependencies

Art work of Jan Heath, entitled "food chain"

A bottom up re-visioning is vital: A new holistic paradigm for life

- Contrary to the dominant mainstream view, the basis of all current biology and life science education, it now is becoming clear that ***life is not only or even primarily an organismal property.***
- In the view actively emerging, life is not centered on organisms, nor is it primarily a localized, objectified or material phenomenon.
- ***Life is inherently relational, distributed, and non-localized***



Environment and ecological interactions



A single organism possesses all the necessary aspects to be alive

Interacting ecological community and its environment is an ecosystem



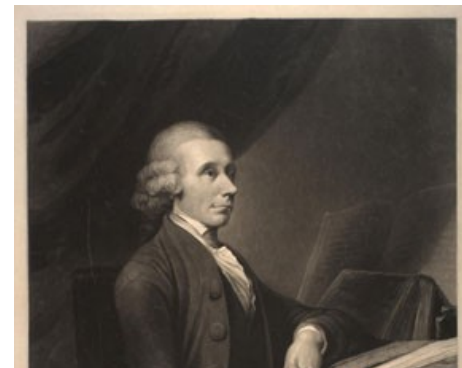
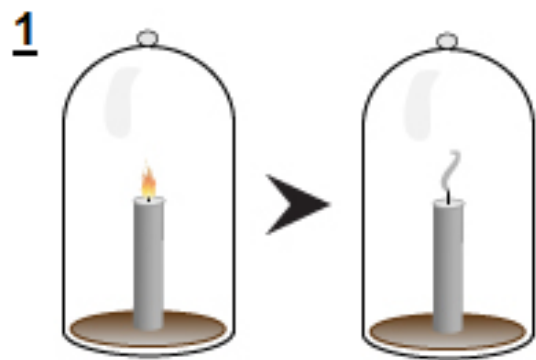
An ecosystem possesses all the necessary aspects to sustain life

Life and environment are best understood and modeled as unified as a single “life–environment” system.

Bounty of the Commons
Humans win, environment improves



Joseph Priestley discovered oxygen in 1774



Rene Descartes *Discourse on the Method* (1637).



I think,
therefore,
I am

Founder of the “Cartesian” worldview

“To Descartes the material universe was a machine and nothing but a machine... This mechanical picture of nature became the dominant paradigm of science in the period following Descartes.

The Cartesian view of the universe as a mechanical system provided a “scientific” sanction for the manipulation and exploitation of nature that became typical of modern civilization.

The Cartesian approach has been very successful, especially in biology, but it has also limited the directions of scientific research. The problem has been that many scientists, encouraged by their success in treating living organisms as machines, tended to believe that they are *nothing but* machines.” (p. 25-26)

Capra and Luisi (2015). *Systems View of Life*



One major barrier is the dominant idea in mainstream science now – to treat the fundamental working unit of Nature as a “mechanism” – we have turned the world into the machine we have pictured it to be.

The suite of systemic problems listed above – showing a world and natural life support ecosystems literally “running out of gas” and “breaking down” in myriad ways – is not typical behavior of natural living systems.



On the contrary, natural living systems normally self-organize continually and self-repair after disturbance. They grow, develop and improve in environmental quality over time (O_2 atmosphere, O_3 layer, soils, water purification, etc.)

These demonstrate the normal behavior of healthy Life systems is a win-win where life and environment both improve over time.

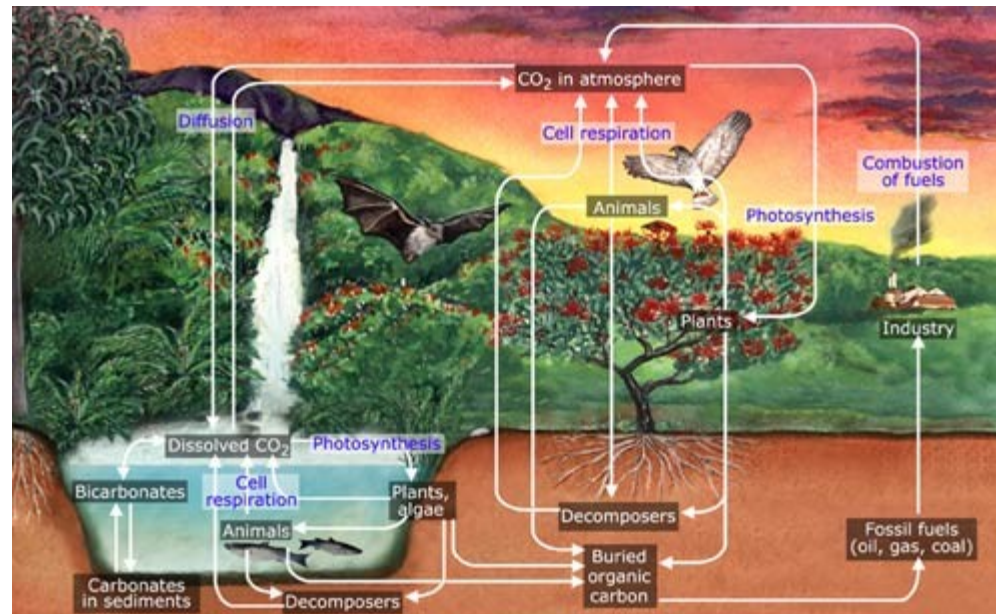


What can we learn from Nature?

There are no trash cans in nature

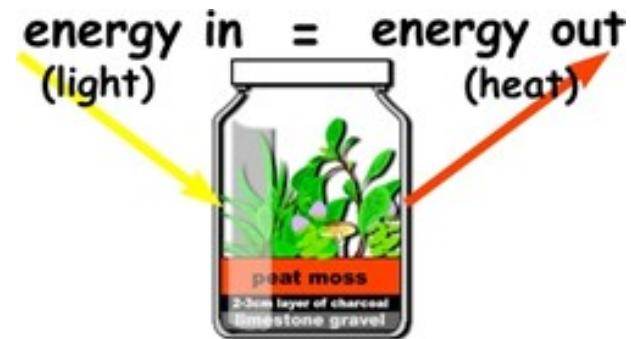


Material is reused again and again through functional couplings



An ecosystem uses surplus energy to move further from thermodynamic equilibrium (physically driven biological aspect).

Another way of expressing that ecosystems can grow



Newton's Apple

He didn't answer the corollary question:

How did the apple get above the ground in the first place?



An ecosystem co-evolves by adapting to and modifying its environment (biologically driven biological aspect).



We live in a world full of life.

Nothing on Earth is entirely abiotic

Rather it is

With Life –
conbiotic



Rene Descartes *Discourse on the Method* (1637).



Founder of the “Cartesian” worldview

“I think, therefore I exist.

That is, I think now, therefore I exist now. But I think *only as long as* I have a steady input of oxygen, water, and food to sustain my thinking via my life. And, after I am done thinking with aid of these vital materials, they are transformed and expelled not so much as waste but as food for the plants and other living beings that in turn create and supply my material needs.”

“I think, therefore, I am...
we are... an ecosystem”

Fiscus & Fath 2019

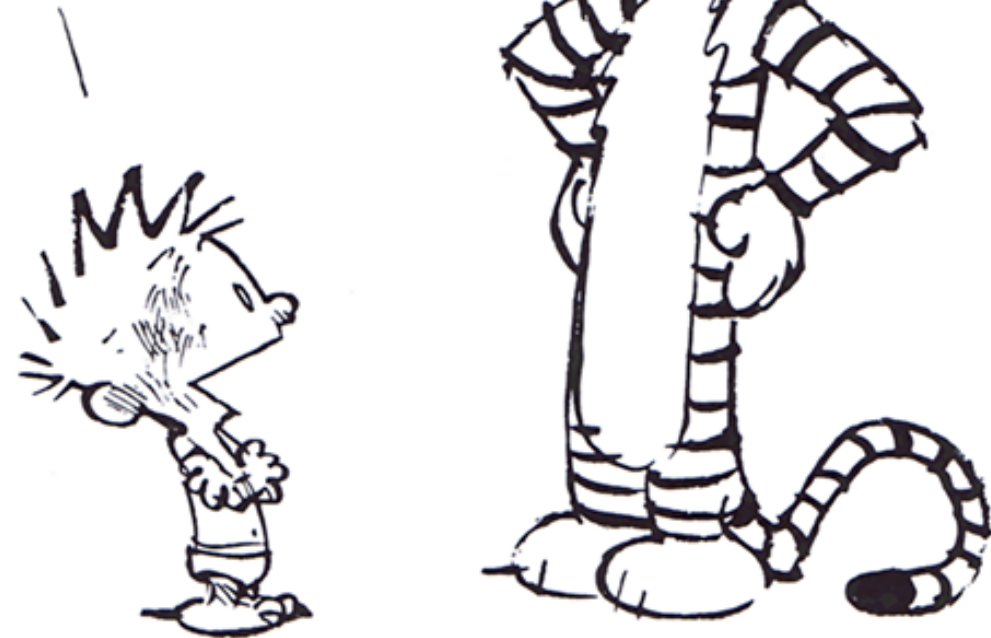
Sustained Thought



Foundations for Sustainability - principles of Holistic Life Science:

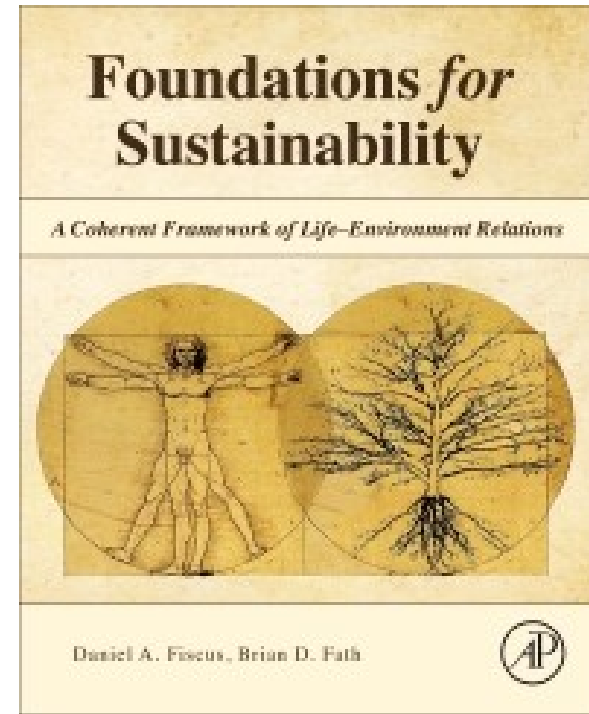
- 1) Founded on Life as the basis of value, where Life is the Life–environment system as a unified whole
- 2) Anticipatory and accelerates scientific change toward the ultimate goal of a sustainable human environment relation and Life–environment relation
- 3) Balances holism with reductionism and synthesis with :
- 4) Equally emphasizes internalist and self–referential as w
- 5) Is complex itself (employs impredicative logic, comple
guide complex human–natural systems
- 6) Is radically empirical, continually questioning, challeng
structures, especially when these distract from topics of

If you need something to worship,
then worship life — all life,
every last crawling bit of it!
We're all in this beauty together!



Conclusions

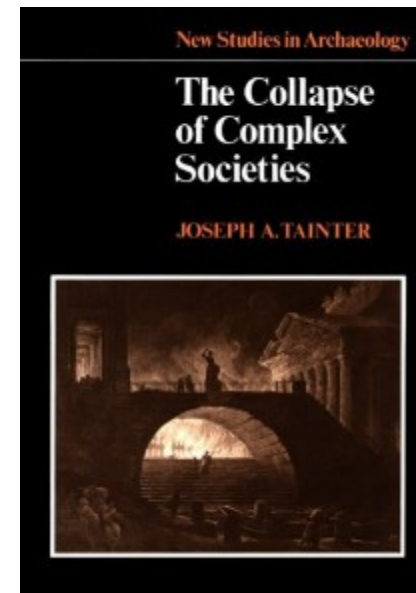
- ❑ Change our dominant paradigm
- ❑ Use systems thinking and ecosystem thinking
- ❑ Find solutions that address the root causes of environmental problems
 - Ask yourself where does stuff come from: Food, clothes, electronics, water, energy
 - Where does it go when I flush it or throw it “away”?
- ❑ See connections, make connections
- ❑ Care about yourself, care about place
- ❑ Enlist a cadre of excited, eager, and enthusiastic colleagues to explore, discuss, improve, spread, and implement these ideas!



THANK YOU FOR YOUR ATTENTION
bfath@towson.edu

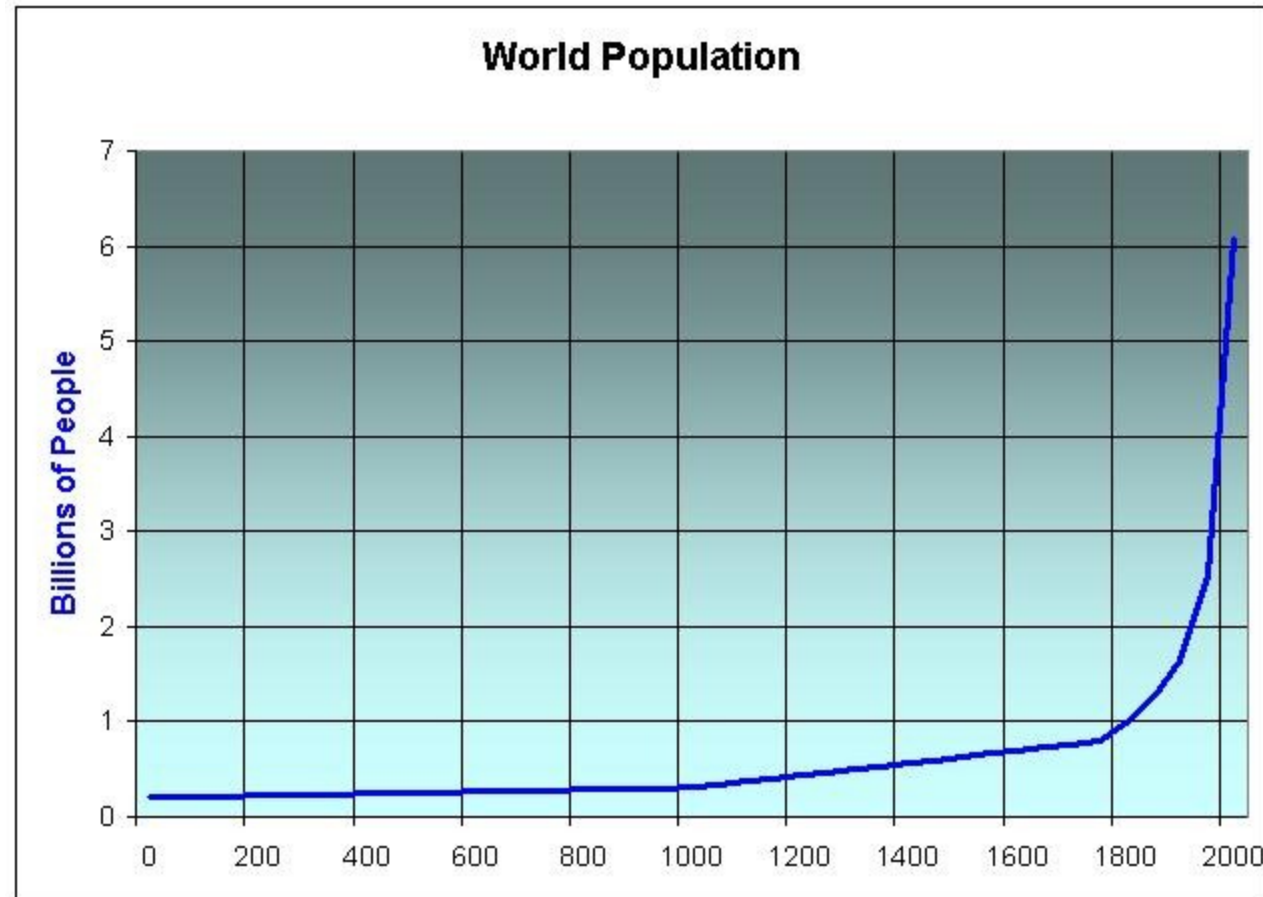
Is sustainability still possible?

- “Growing human populations are eating more meat, using more carbon-based energy, shouldering aside more natural resources, and tapping into more renewable and nonrenewable commodities than ever before.”
- “If humanity fails to achieve sustainability, when, and how, will unsustainable trends end?”

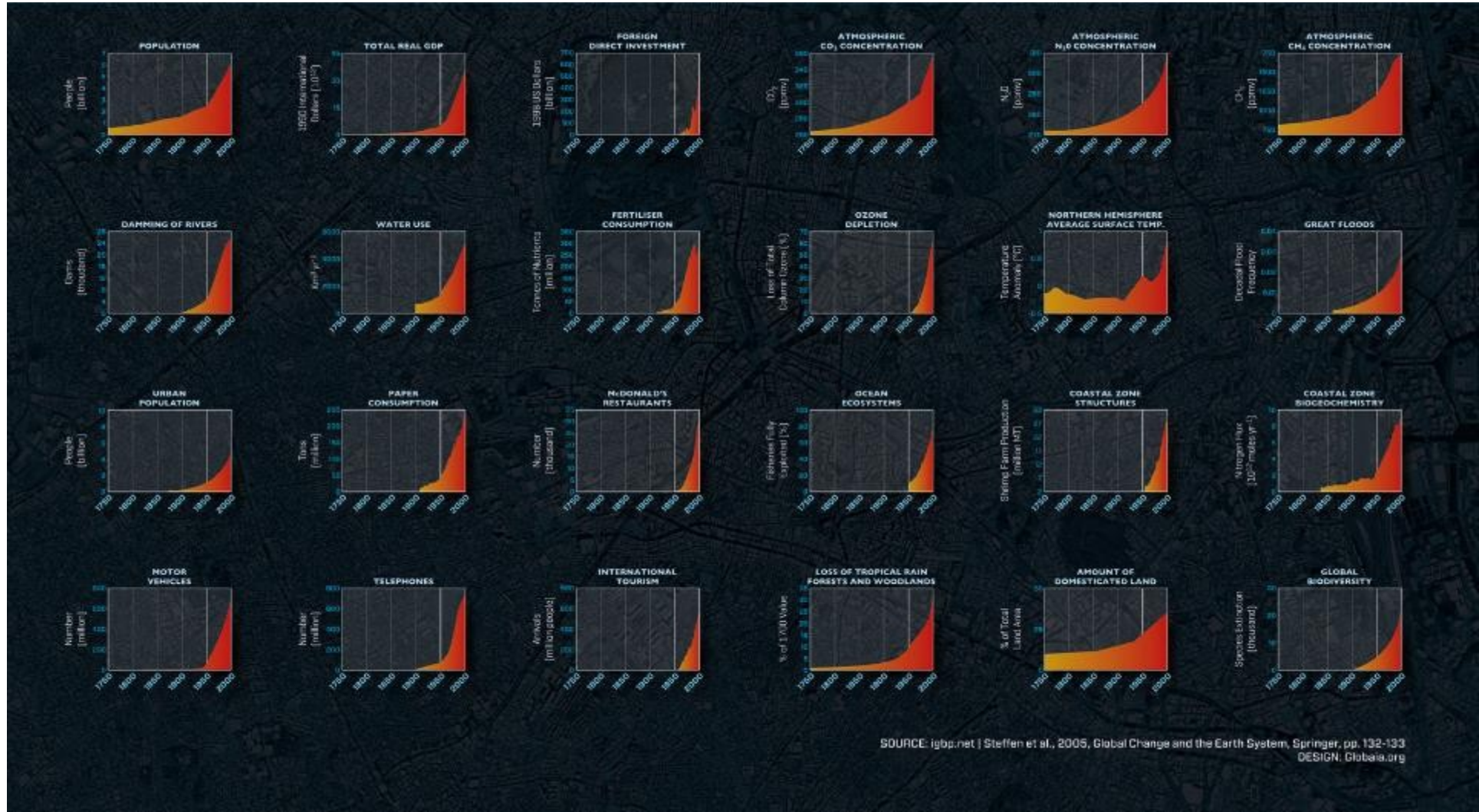


Human Population

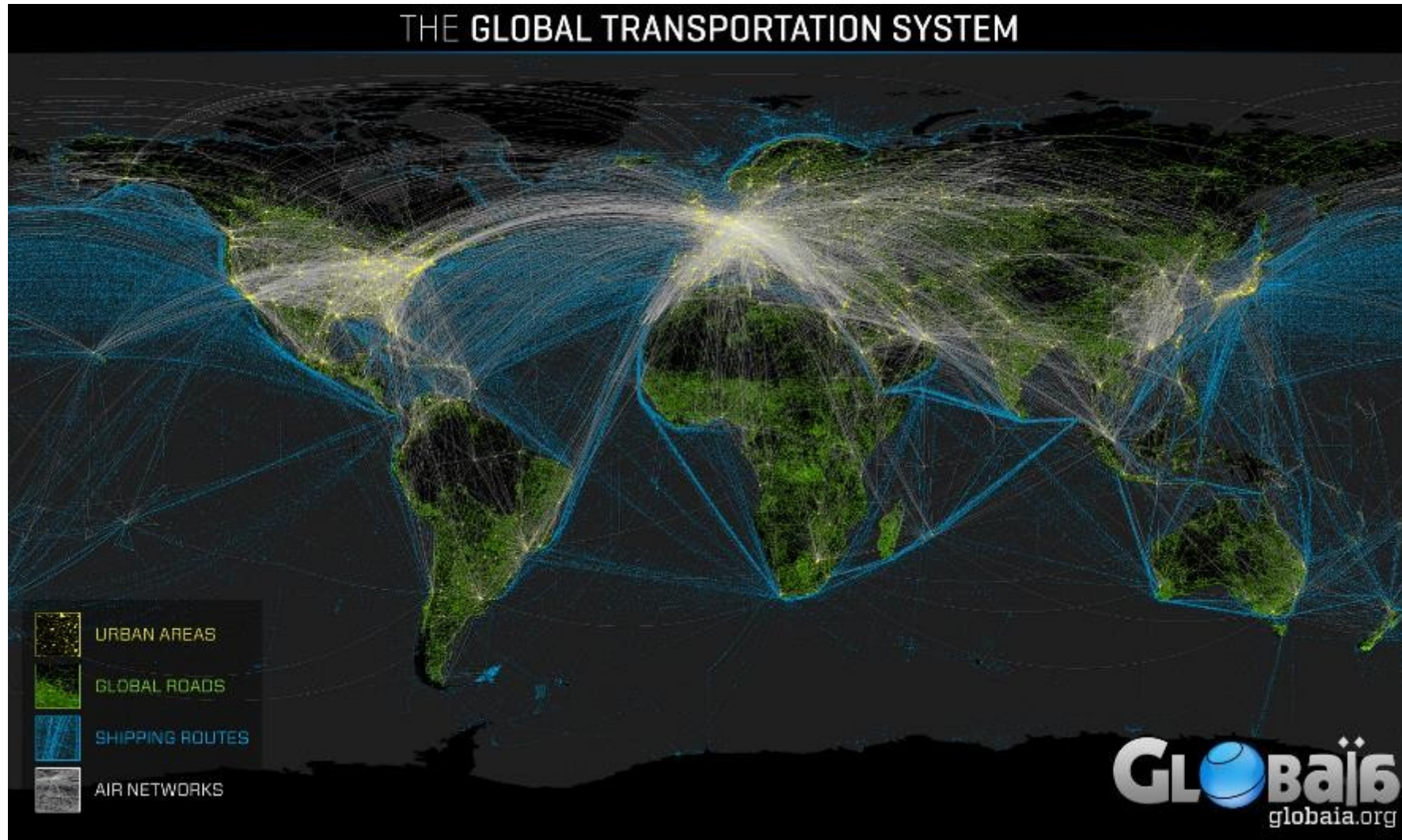
- [World 7,732,909,210](#)



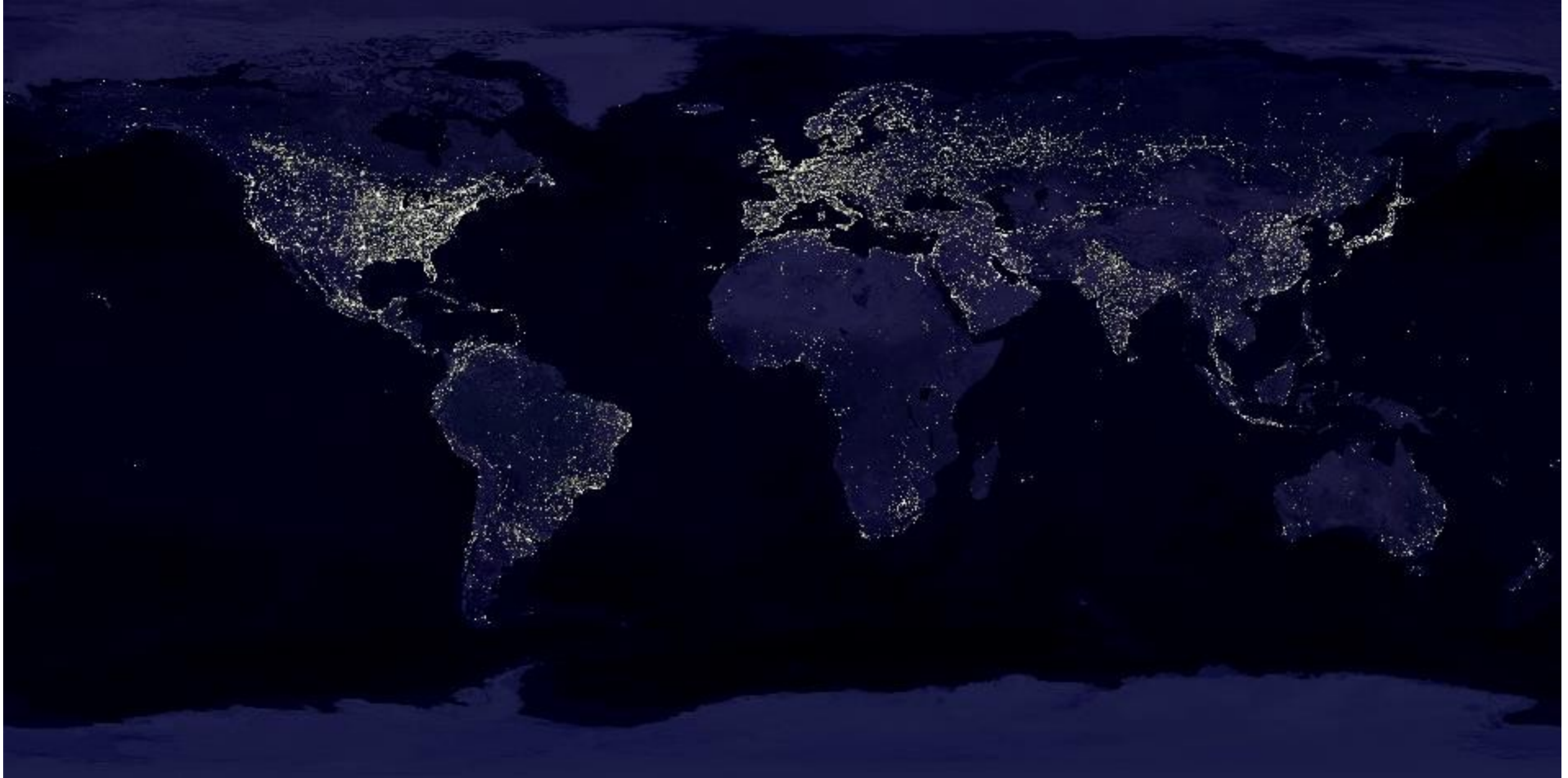
Great Acceleration



Anthropocene - term to denote the present time interval, in which human activities profoundly impact geology and ecosystems.



Anthropocene – urban perspective



Is sustainability still possible?

- Why has it proved so hard to conform human behavior to the needs of a life-supporting future?
- Our political and economic institutions evolved before anyone imagined the need to restrain human behavior out of concern for the future.