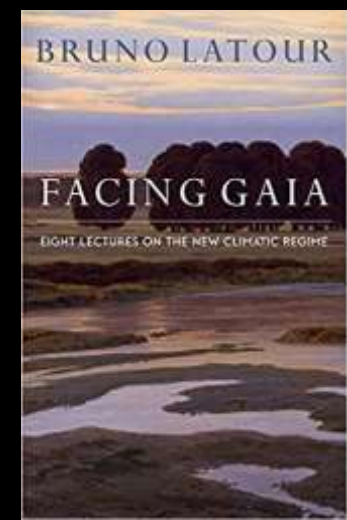
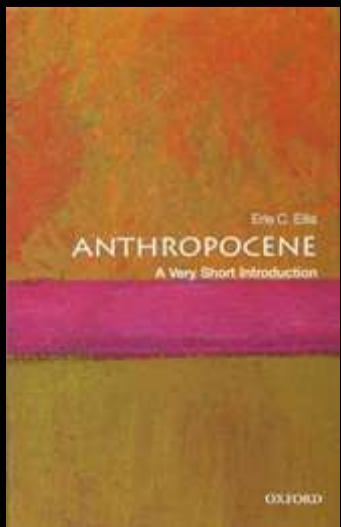
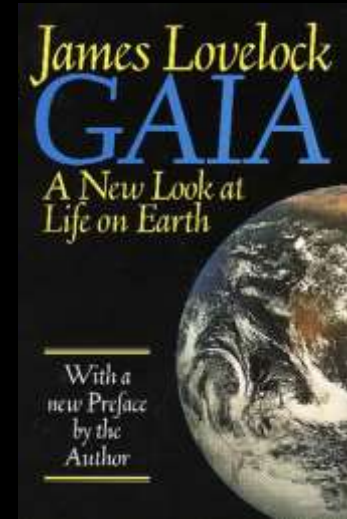
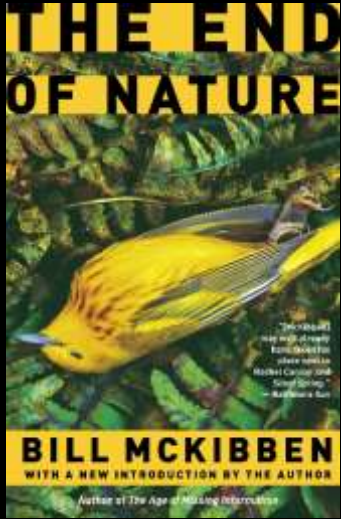




The End of Nature: Prospective Ecology, Gaia and the Anthropocene

Kevin M. Anderson, Ph.D.
Austin Water – Center for Environmental Research

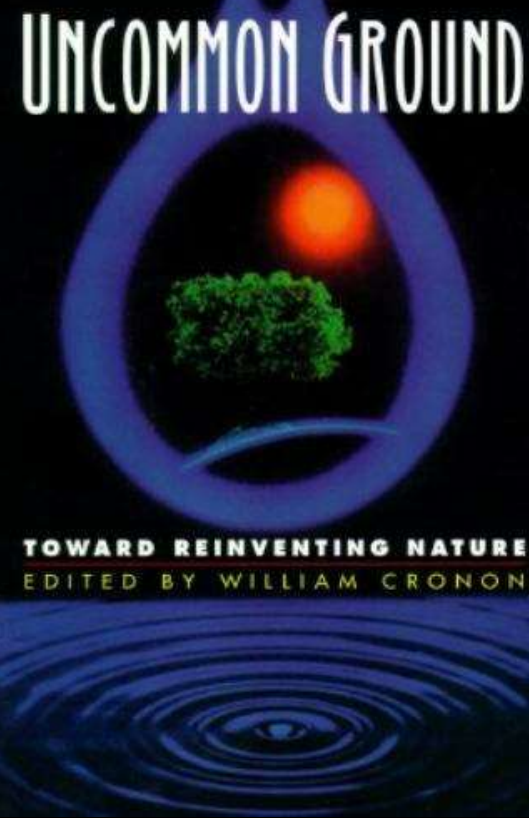


The Full Continuum of a Natural Landscape

“We need to embrace the full continuum of a natural landscape that is also cultural, in which *the city, the suburb, the pastoral, and the wild each has its proper place*, which we permit ourselves to celebrate **without needlessly denigrating the others.**”

“The Trouble with Wilderness or, Getting Back to the Wrong Nature”
William Cronon

Uncommon Ground: Rethinking the Human Place in Nature
(1995)



The American Concepts of Nature and the Humanized Earth

We perceive nature filtered through a conceptual framework that prejudices its ecological and cultural value.

Wilderness

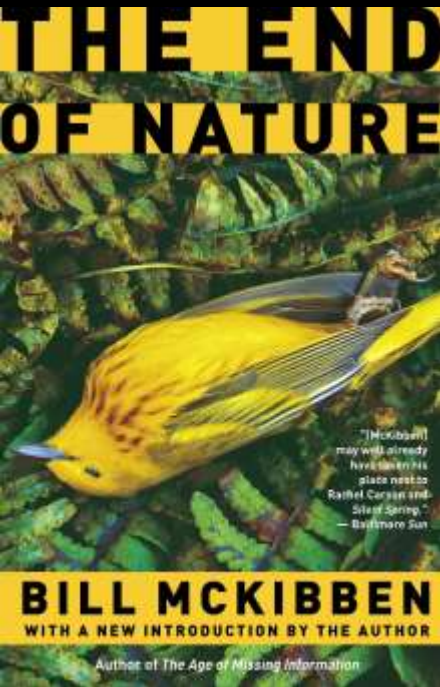


Pastoral Nature



Urban (Suburban) Nature?





The Humanized Earth and the Idea of Nature

The Lament - *The End of Nature* (1989)

"The idea of nature will not survive the new global pollution –

We have changed the atmosphere, and thus we are changing the weather, we make every spot on earth man-made and artificial.

We have deprived nature of its independence, and that is fatal to its meaning."

"There's no such thing as nature anymore—and there is nothing except us alone"

"Having lost its separateness, it loses its special power. Instead of being a category like God – something beyond our control – it is now a category like the defense budget or the minimum wage, a problem we must work out...one of the possible meanings of the end of nature is that God is dead."

Assumptions –

- Nature – Human Dualism – We are not part of nature.
- Permanence not Change is fundamental.



Permanence and Change

Learning *to* Die *in the* Anthropocene

REFLECTIONS ON THE
END OF A CIVILIZATION

Roy Scranton

"Scranton draws on his experiences in Iraq to confront the grim realities of climate change. The result is a fierce and provocative book."

—Elizabeth Kolbert, author
of *The Sixth Extinction*

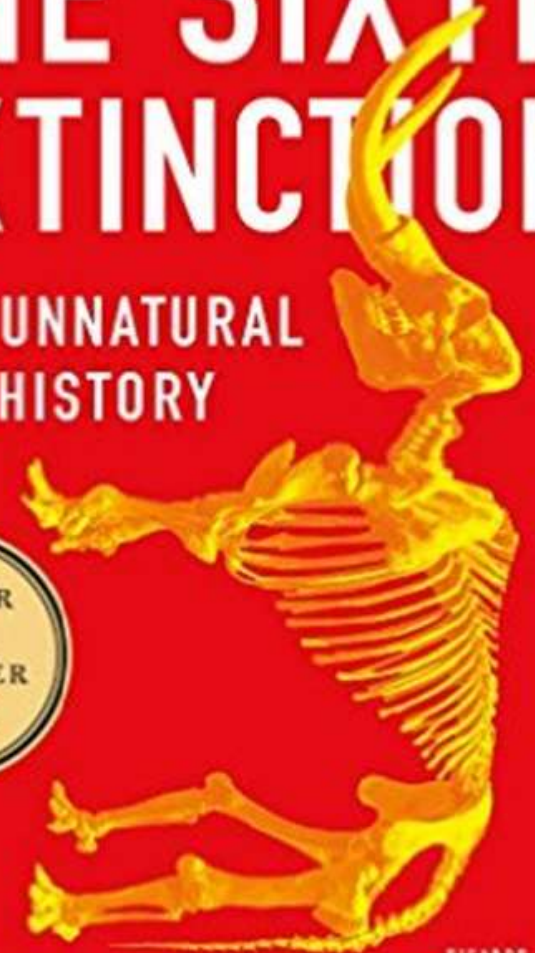


NEW YORK TIMES BESTSELLER

THE SIXTH EXTINCTION

AN UNNATURAL
HISTORY

WINNER
of the
PULITZER
PRIZE



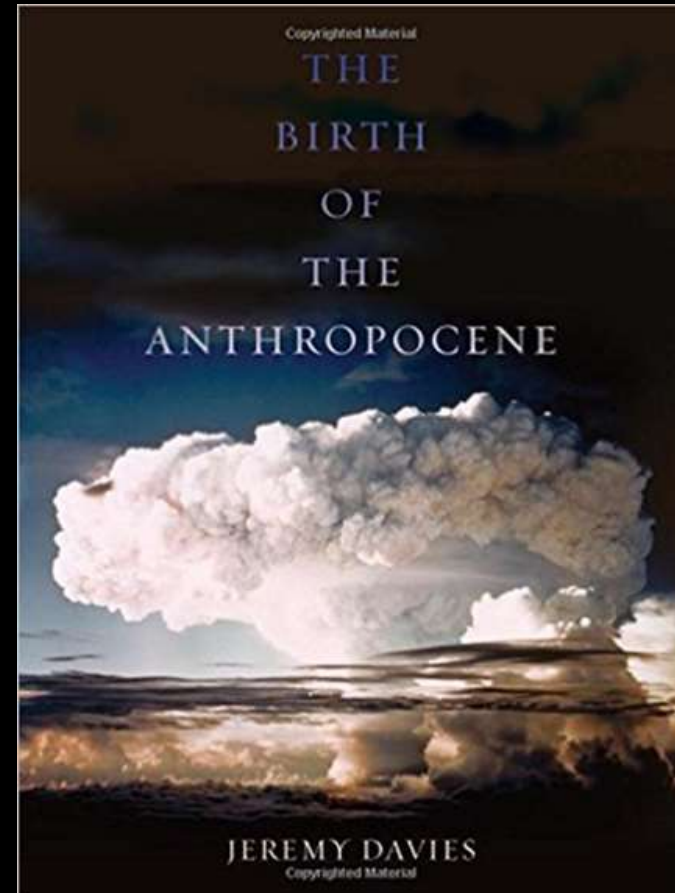
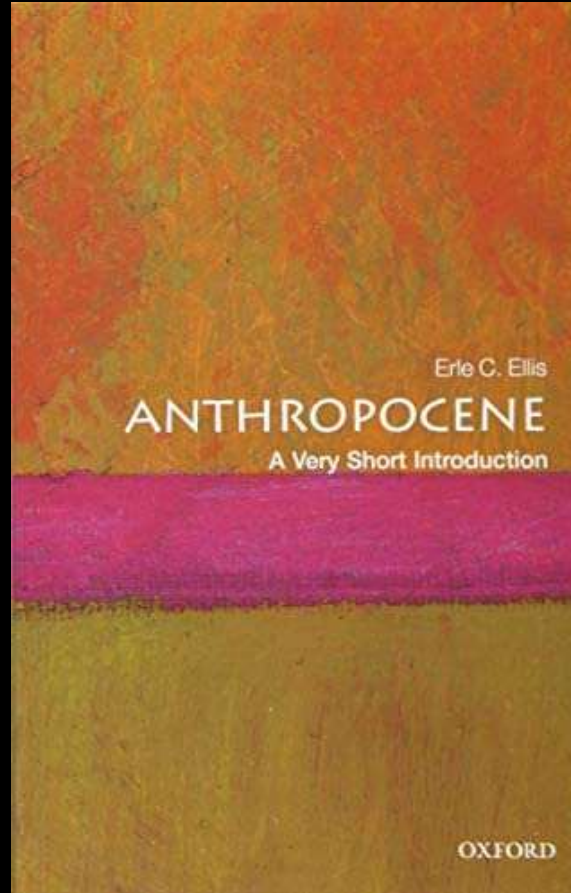
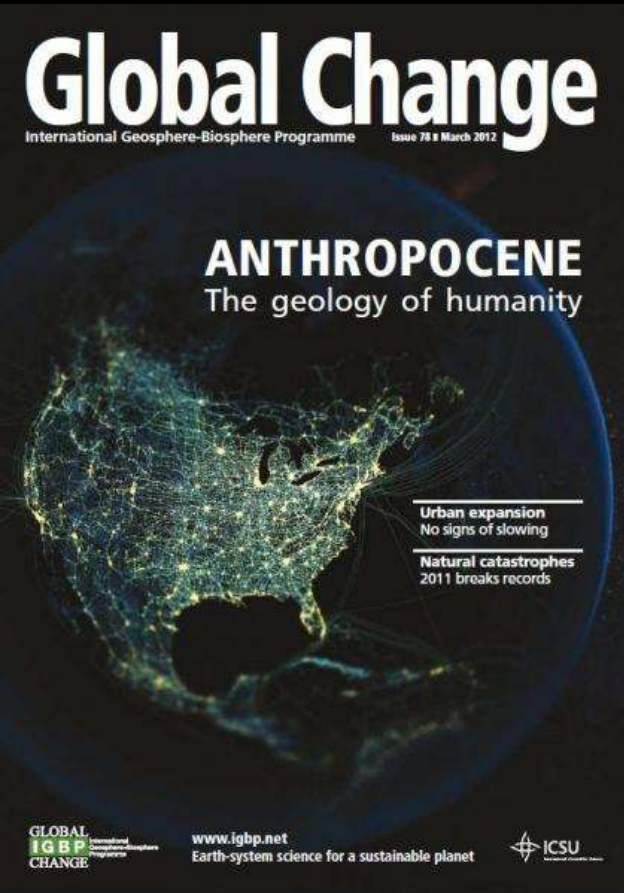
PICADOR

ELIZABETH KOLBERT

Author of *FIELD NOTES
FROM A CATASTROPHE*

Anthropocene – The Age of Humans

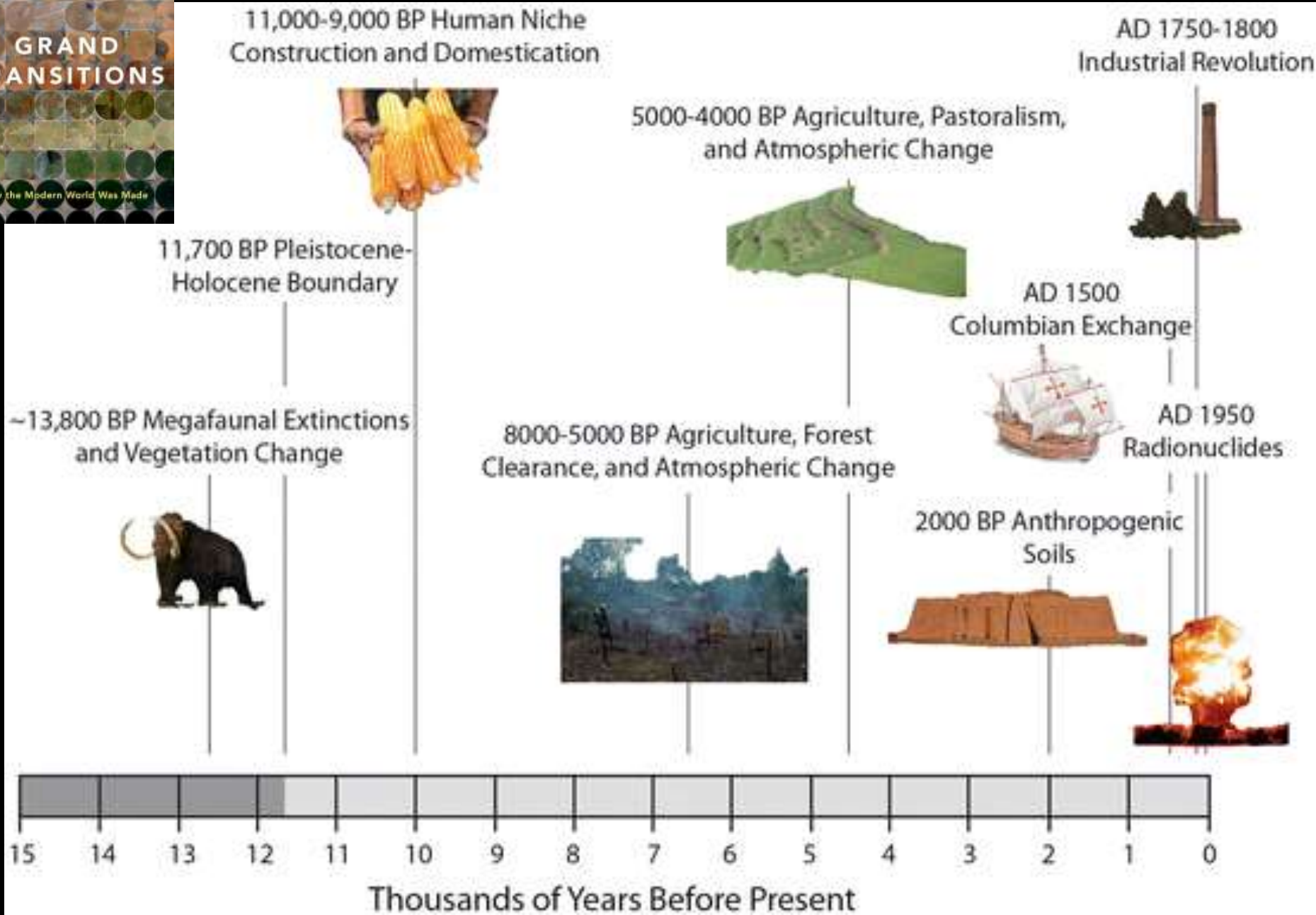
The Anthropocene is an unofficial unit of geologic time, used to describe the most recent period in Earth's history when human activity started to have a significant impact on the planet's climate and ecosystems.



When did the Anthropocene Begin?

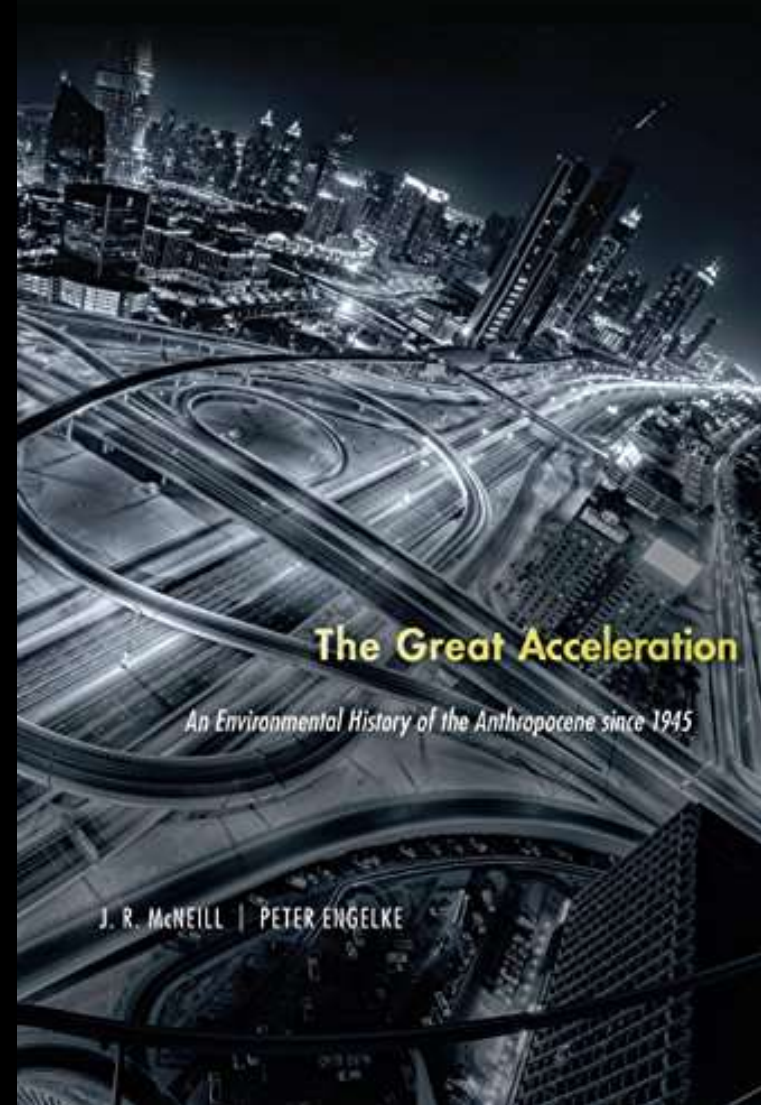
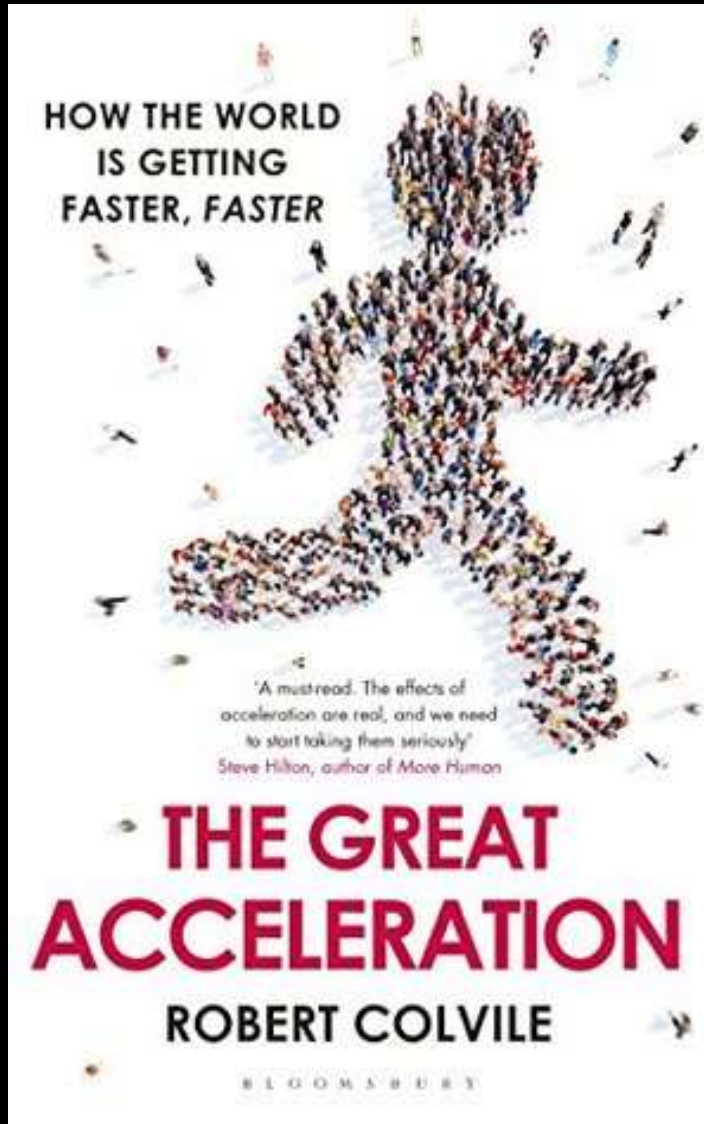
GRAND TRANSITIONS

How the Modern World Was Made



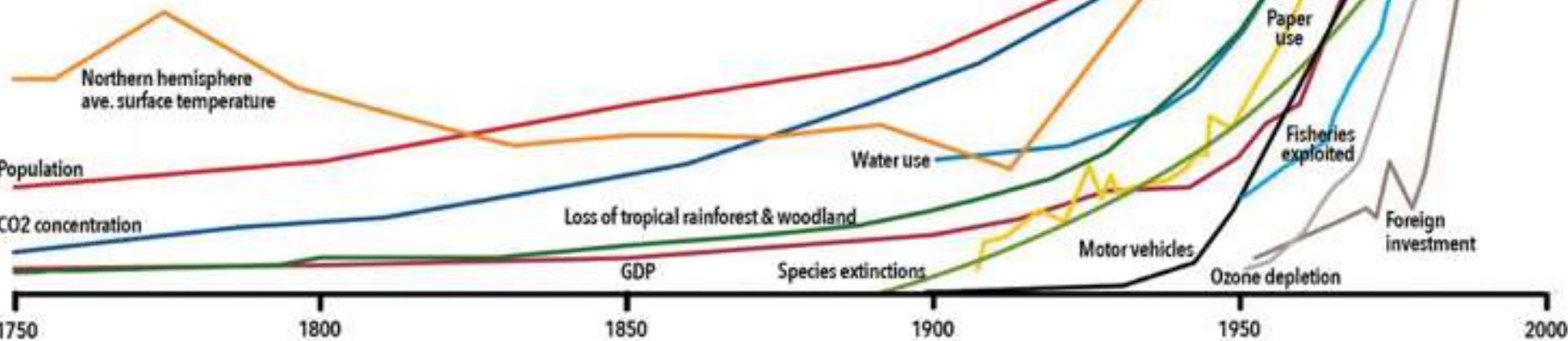
The Great Acceleration

The dramatic, continuous and roughly simultaneous surge in growth rate across a large range of measures of human activity, first recorded in the mid-20th century and continuing to this day.



Great Acceleration

- Population
- Real GDP
- Foreign direct investment
- Water use
- Paper production
- Fertilizer consumption
- Motor vehicles
- Primary energy use
- Telephones
- Tourism
- River dams
- McDonald's restaurants
- Atmosphere: CO2
- Atmosphere: N2O
- Atmosphere: CH4
- Atmosphere: ozone depletion
- N hemisphere surface temperature
- Loss of tropical rainforest & woodland
- Domesticated land
- Great floods
- Fisheries fully exploited
- Flood frequency
- Coastal nitrogen
- Species extinction



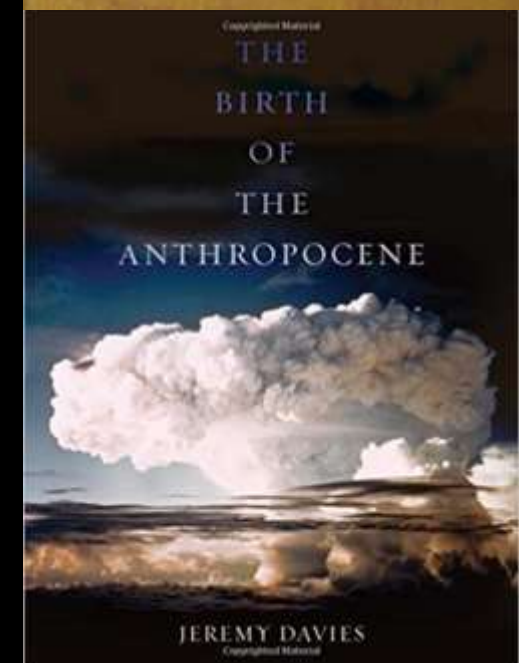
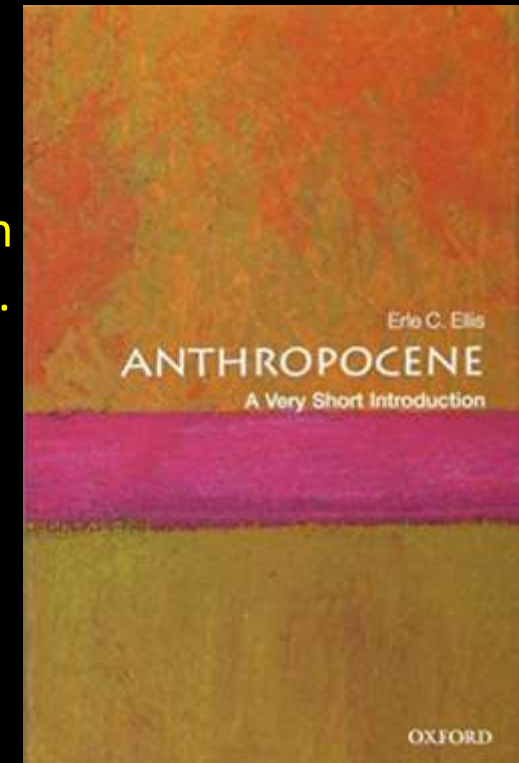
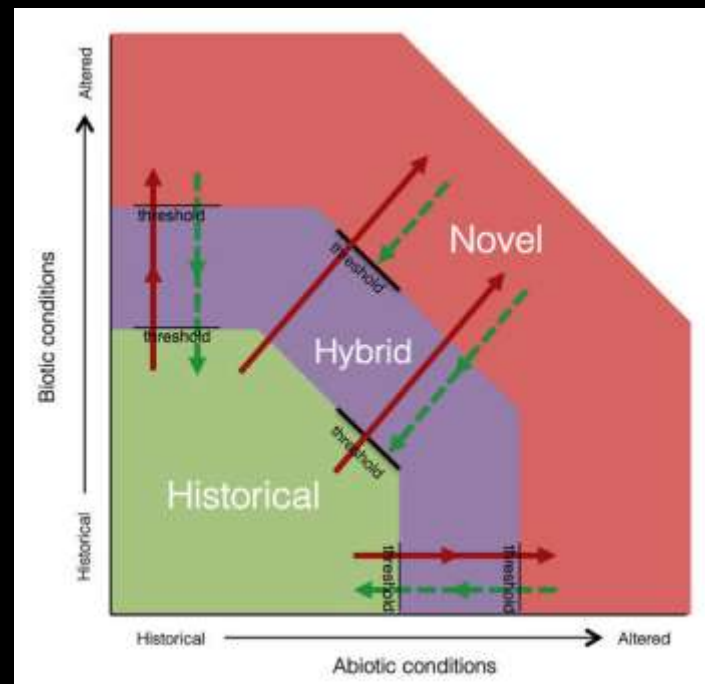
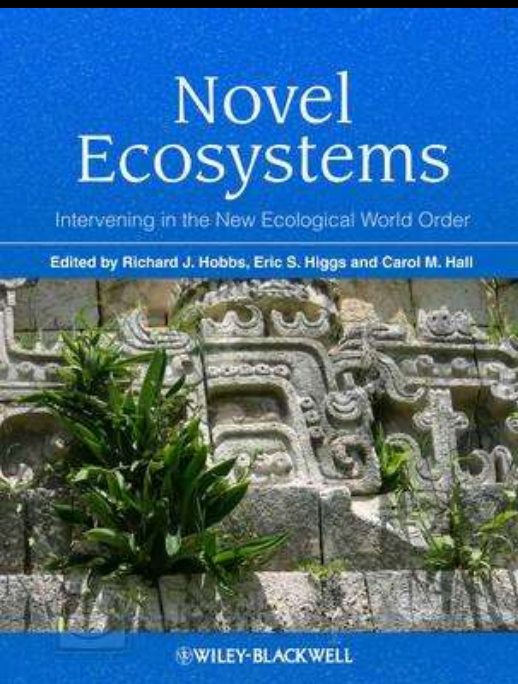
Global Change and the Biosphere

Anthropocene – the Age of Humans

Nearly all humans live in anthropogenic landscapes, especially in urban, suburban and densely populated rural village landscapes.

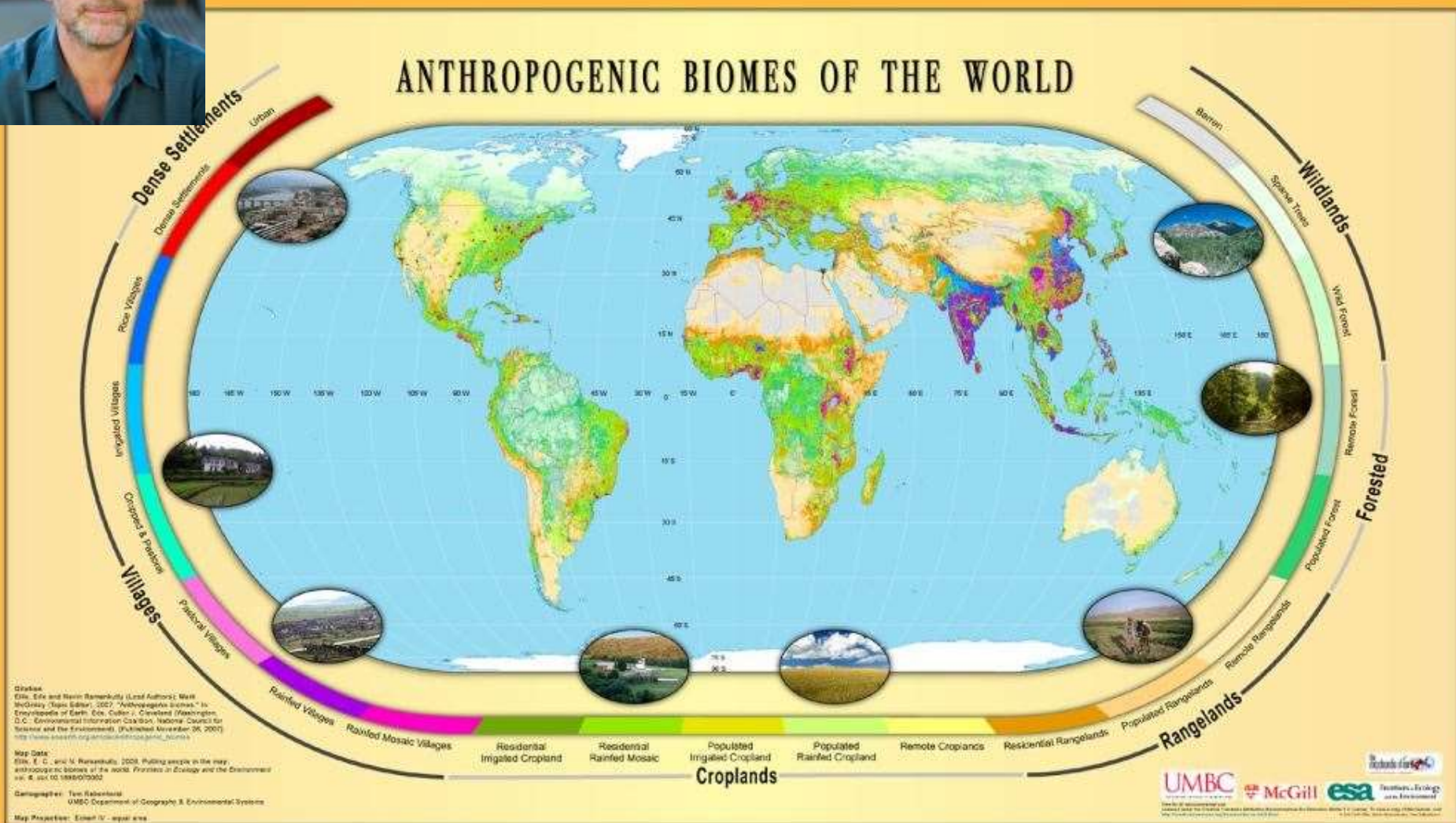
Anthropogenic landscape transformation (land-use change) is one of the primary drivers of global changes in climate, biodiversity and biogeochemistry.

Ecological processes in anthropogenic landscapes differ profoundly from those of pristine ecosystems.



Anthropogenic Biomes "Anthromes"

Erle Ellis, Director, Anthroecology Lab, Geography & Environmental Systems,
University of Maryland, Baltimore County



Anthropocene

A Completely Different Story

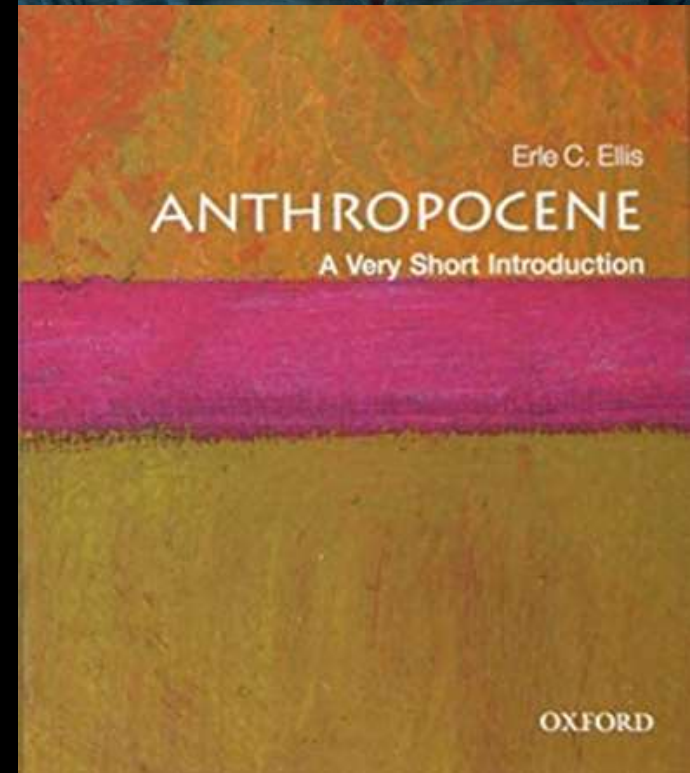
“Anthropogenic biomes point to a necessary turnaround in ecological science and education, especially for North Americans.

Beginning with the first mention of ecology in school, the biosphere has long been depicted as being composed of natural biomes, perpetuating an outdated view of the world as ‘natural ecosystems with humans disturbing them’.

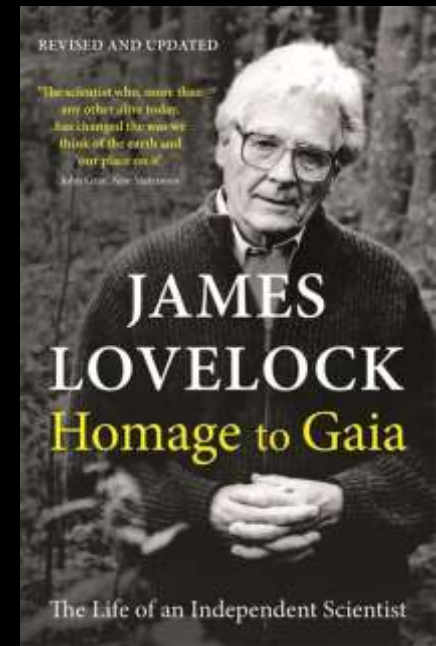
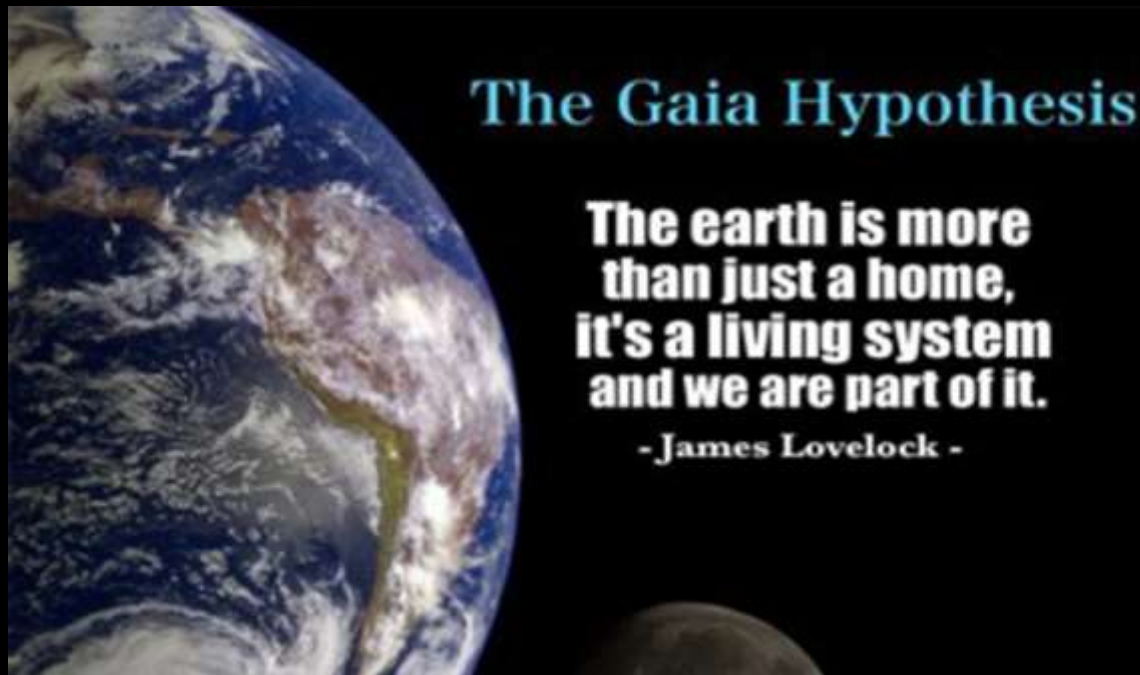
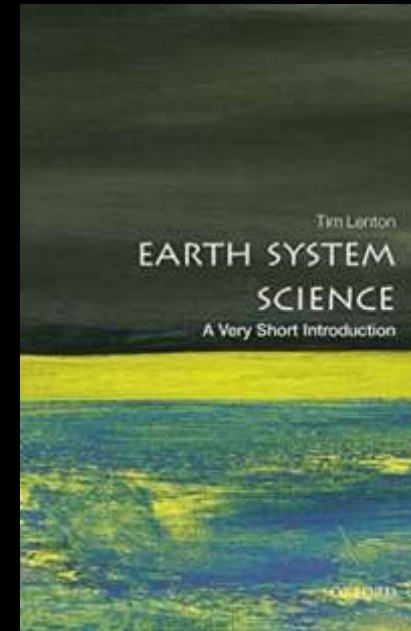
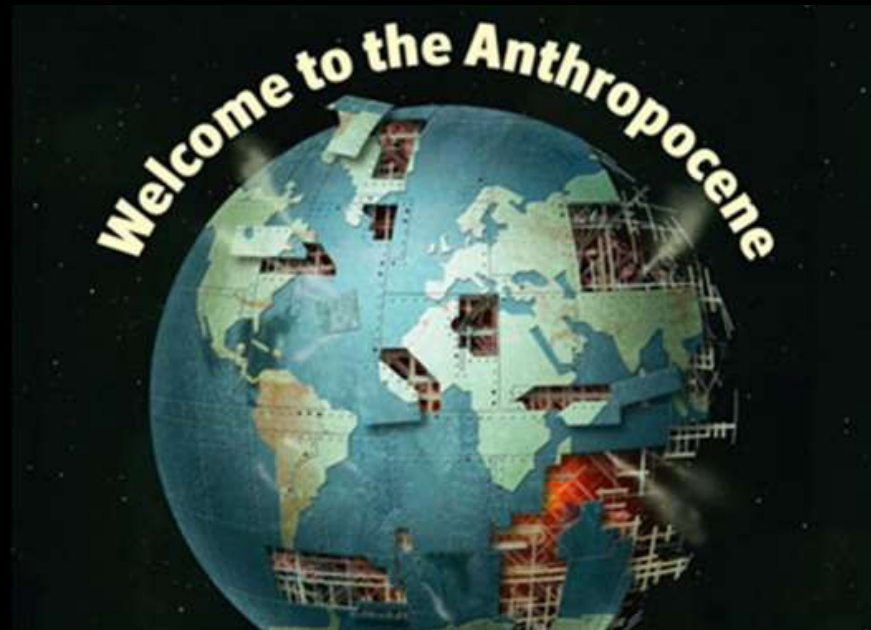
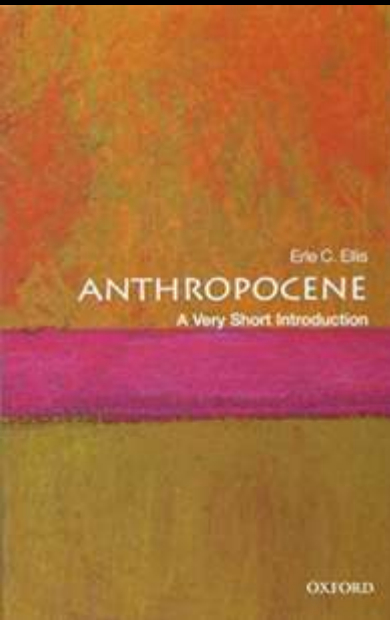
Anthropogenic biomes tell a completely different story, one of ‘human systems, with natural ecosystems embedded within them’.

This is no minor change in the story we tell our children and each other. Yet it is necessary for sustainable management of the biosphere in the 21st century.”

Erle Ellis



How does the Earth work? – A Theory for Earth Science



EARTH SPHERES

Lithosphere
solid Earth

Atmosphere
the gases that surround the Earth (its air)

Hydrosphere
all water found on, under, and over the surface of Earth

Biosphere
all life on Earth



Earth System Science

Interaction of the lithosphere, atmosphere, biosphere, and hydrosphere

[Education Home](#)

[AHS Home](#)

[Photo Gallery](#)

Tim Lenton
**EARTH SYSTEM
SCIENCE**
A Very Short Introduction

OXFORD

How does the Earth work? Abiotic and Biotic

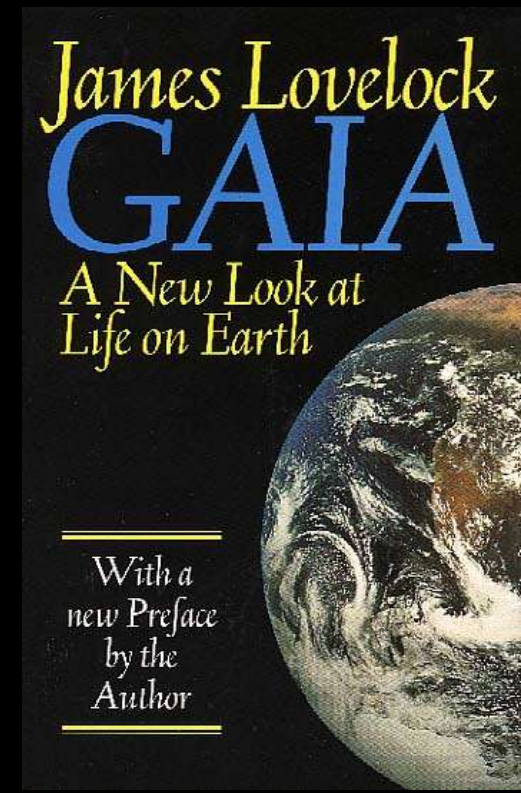
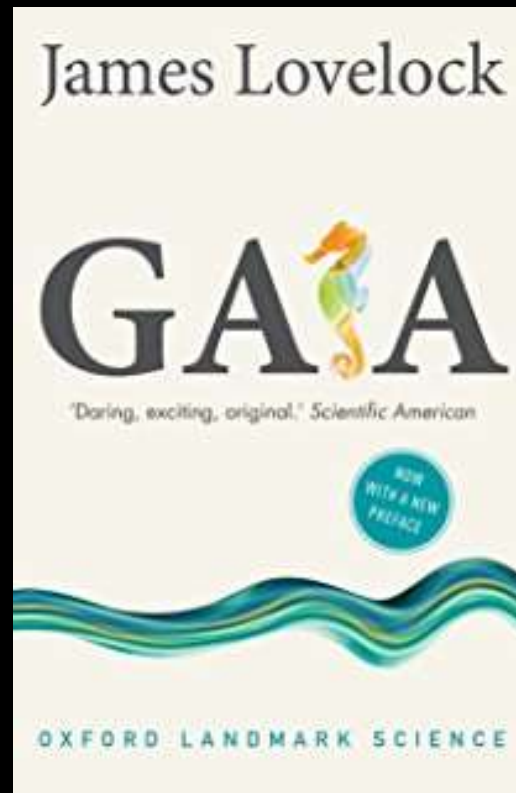
Earth system science assumes a holistic view of the dynamic interaction between the Earth's spheres and their many constituent subsystems fluxes and processes, the resulting spatial organization and time evolution of these systems, and their variability, stability and instability.

Why is there Life on Earth?

The Gaia Hypothesis 1975

James Lovelock 1919-2022

The biosphere acts like a living organism, one that self-regulates to keep conditions just right for life

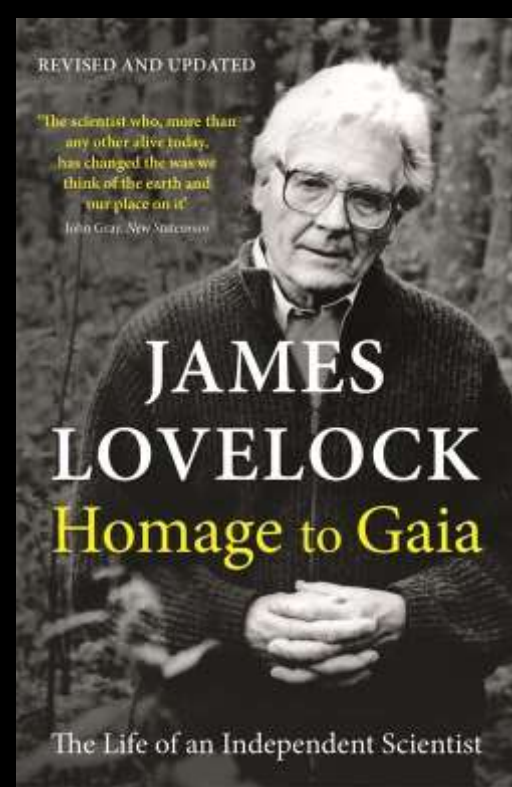


The Independent Scientist - James Lovelock (26 July 1919 – 26 July 2022)

English Independent Scientist and Inventor

He invented the ***electron capture detector*** (ECD) in 1957 - a device for detecting atoms and molecules in a gas and is used in gas chromatography **to detect trace amounts of chemical compounds in a sample.**

The detector measured tiny amounts of chlorine-based chemicals in the air, leading to the discovery of toxic chemicals in food, water and soil.



Rachel Carson and the Electron Capture Detector




DDT... FOR CONTROL OF HOUSEHOLD PESTS

Prepared by the
Bureau of Entomology and Plant Quarantine
Agricultural Research Administration
United States Department of Agriculture, and
the United States Public Health Service
Federal Security Agency
Washington, D. C. • Issued March 1947




SILENT SPRING

WITH AN INTRODUCTION BY
VICE PRESIDENT *Al Gore*



RACHEL CARSON

"DDT is good for me-e-e!"



The great expectations held for DDT have been realized. During 1946, exhaustive scientific tests have shown that, when properly used, DDT kills a host of destructive insect pests, and is a benefactor of all humanity.

Pennsalt produces DDT and its products in all standard forms and in quantities of the country's largest producers of this amazing insecticide. Today, everyone can enjoy added comfort, health and safety through the remarkable powers of Pennsalt DDT products... and DDT is only one of Pennsalt's many chemical products which benefit industry, farms and homes.

GOOD FOR STEPS—Red grass, spruce sawflies... but it is a general fact that... compared to untreated steps, treated steps give up to 30 percent extra when processed with DDT and many other pests with DDT insecticide.

GOOD FOR THE HOME—Helps in water facilities, more comfortable homes... protect you, food, from dangerous insect pests. Use Pennsalt DDT... and Sprays... also catch the bugs "like the dust".

GOOD FOR FRUITS—Huge apples, peaches, grapes that are free from smoggy, wormy... all insecticide-spraying from DDT dross and sprays.

GOOD FOR SUN CROPS—25 more barrels of produce per acre... DDT dross, and sprays help keep insects from doing harm along to you.

GOOD FOR HOUSES—Food and preservation, home care, fly, cleaning, plants, health... (control of insecticide pests, effective bug control, insecticide-spraying from DDT dross and sprays).

PENN SALT CHEMICALS

97 Years' Service to Industry • Farm • Home

PENNSYLVANIA SALT MANUFACTURING COMPANY
HUBERT BUILDING, PHILADELPHIA 2, PA.

Everything is connected.

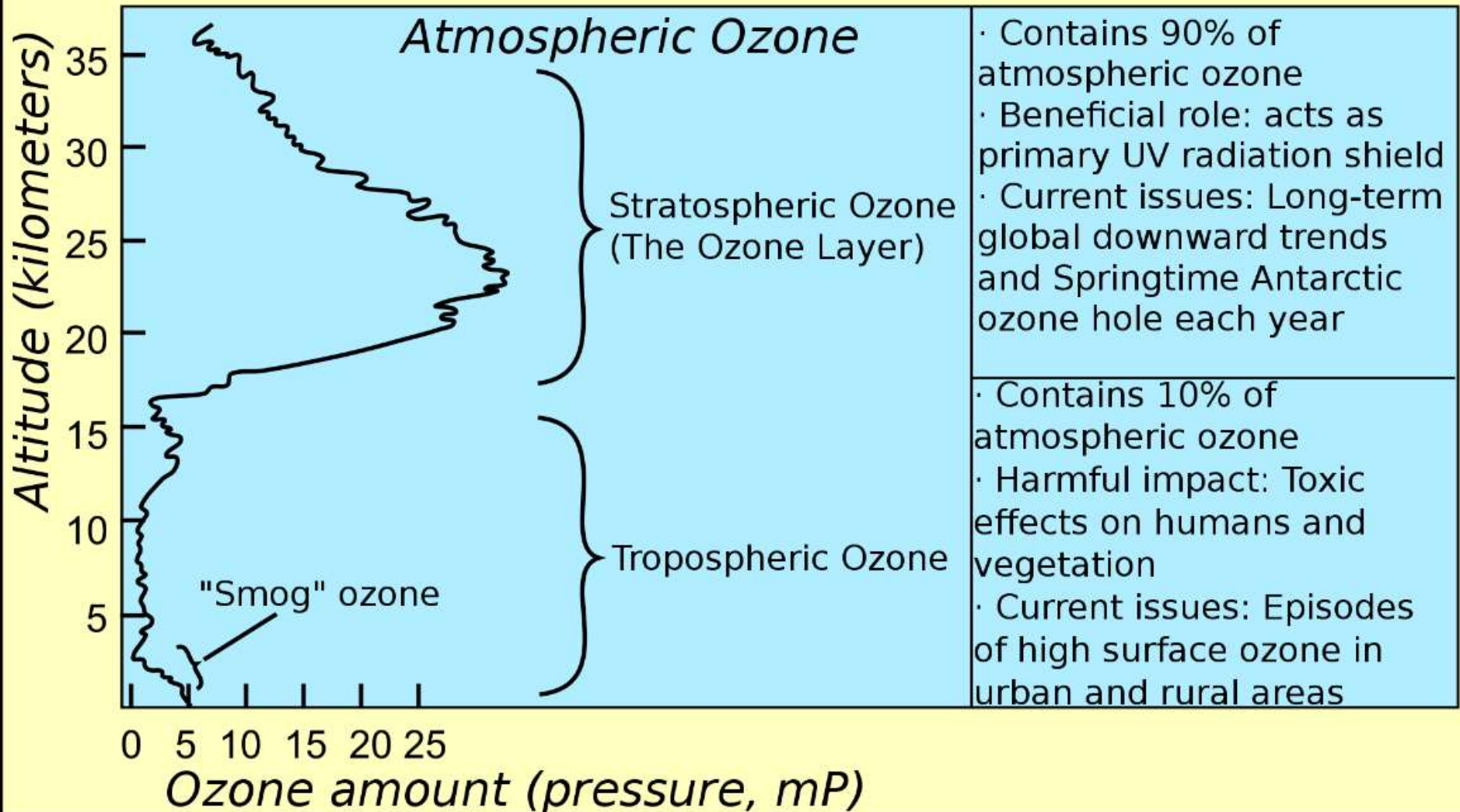
"In nature nothing exists alone."

Silent Spring 1962



Lovelock, CFCs, and the Ozone Hole

Using the ECD, Lovelock was the first to detect the widespread presence of CFCs - chlorofluorocarbons in the atmosphere and their role in stratospheric ozone depletion

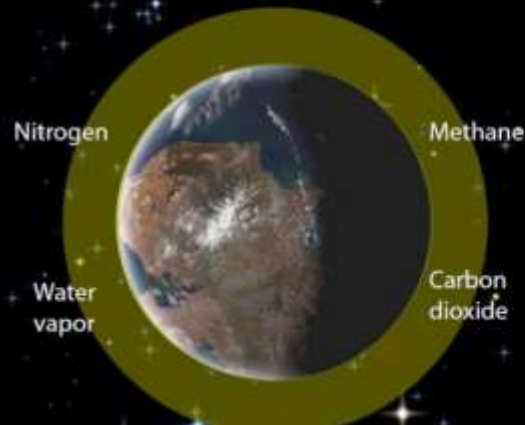


Extraterrestrial Atmospheres and Life

In early 1961, Lovelock was hired by NASA to develop sensitive instruments for the analysis of extraterrestrial atmospheres and planetary surfaces.

To Lovelock, the stark contrast between the Martian atmosphere and chemically dynamic mixture of the Earth's biosphere was strongly indicative of the absence of life on Mars.

Lovelock asked himself,
“Why didn’t the Earth’s atmosphere
end up like Mars’ atmosphere?”



The Gaia Hypothesis – A New Look at Life on Earth

- The hypothesis was formulated by Lovelock and co-developed by the microbiologist Lynn Margulis in the 1970s.
- Hypothesis - ***Earth is a self-regulating system maintained by communities of living organisms. These communities adjust oxygen and carbon dioxide levels in the atmosphere, salinity in the ocean and even the planet's temperature to keep them within the acceptable bounds for life to thrive.***
- Lovelock named the idea after Gaia, the primordial goddess who personified the Earth in Greek mythology.
- The suggestion that the theory should be called "the Gaia hypothesis" came from Lovelock's neighbor, the English writer William Golding (Noble Prize 1983, *Lord of the Flies*).



James Lovelock
GAIA
A New Look at
Life on Earth

With a
new Preface
by the
Author

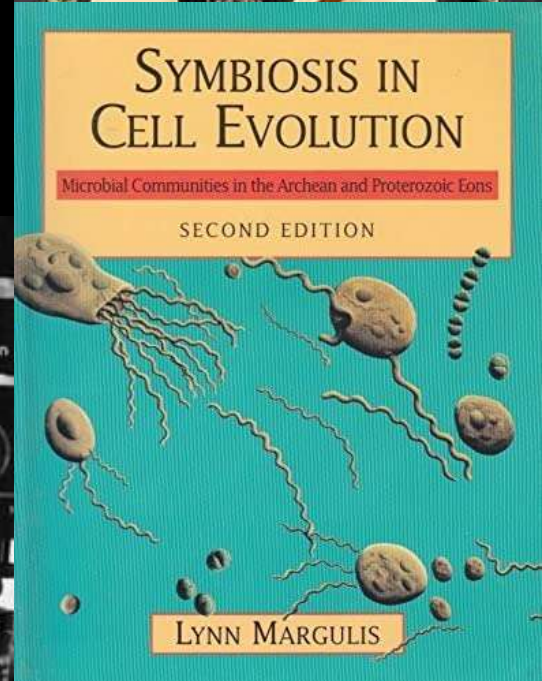


How Life Works – Lynn Margulis and Symbiosis

Lynn Margulis (1938 – 2011) was an American evolutionary biologist and the primary modern proponent for the significance of ***symbiosis in evolution***.

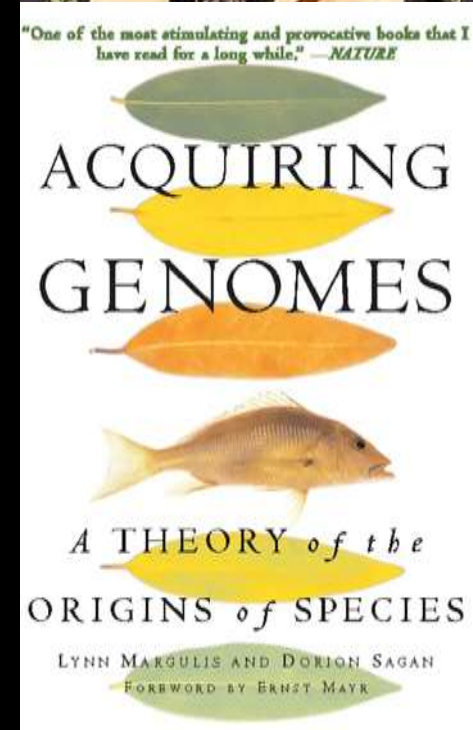
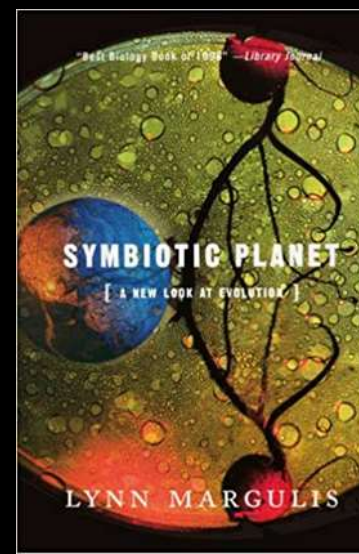
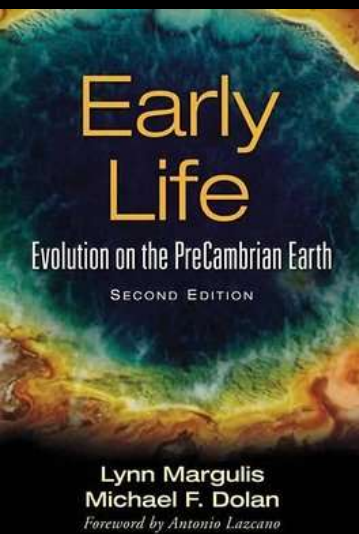
- Her formative paper, "On the Origin of Mitosing Cells", appeared in 1967 after being rejected by about fifteen journals. It was finally accepted by the *Journal of Theoretical Biology* and is considered today a landmark in modern endosymbiotic theory.
- Her theory that cell organelles such as mitochondria and chloroplasts were once independent bacteria was largely ignored for another decade, becoming widely accepted only after it was substantiated through genetic evidence.

Margulis ***opposed competition-oriented views of evolution, stressing the importance of symbiotic or cooperative relationships between species***



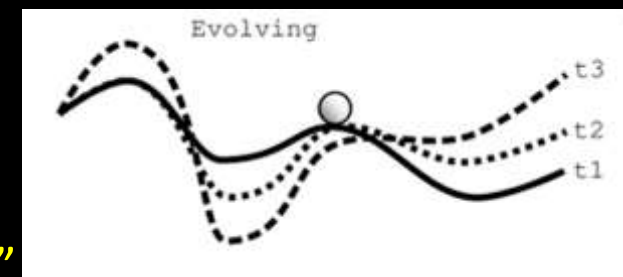
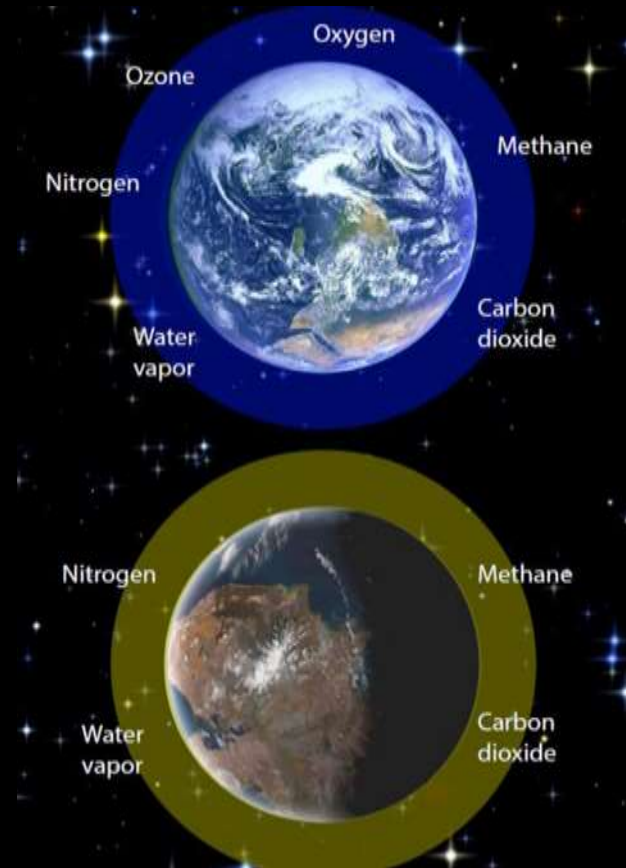
How Life Works – Lynn Margulis and Symbiosis

- Margulis transformed the understanding of the evolution of cells with nuclei by proposing it to have been the result of ***symbiotic mergers of bacteria***.
- "***Darwin's grand vision was not wrong, only incomplete***. In accentuating the direct competition between individuals for resources as the primary selection mechanism, Darwin (and especially his followers) created the impression that the environment was simply a static arena".
- The Agency of Nature - "***Life on earth is more like a verb. It repairs, maintains, re-creates, and outdoes itself.***"



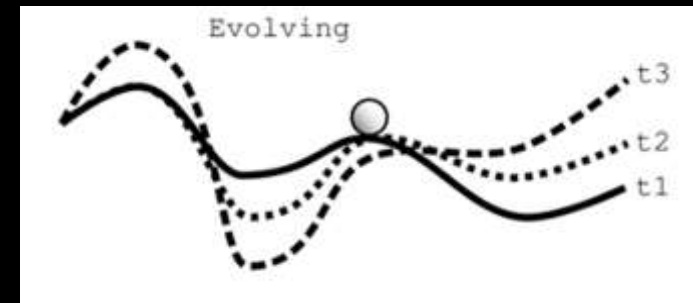
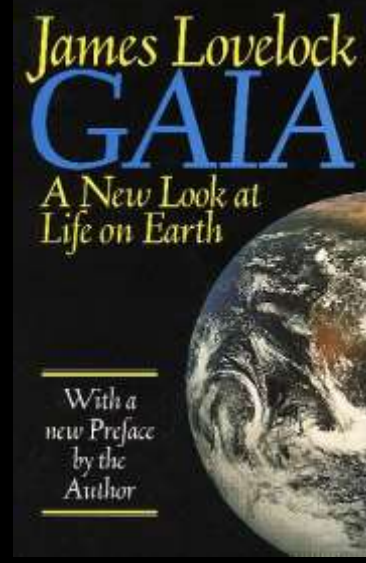
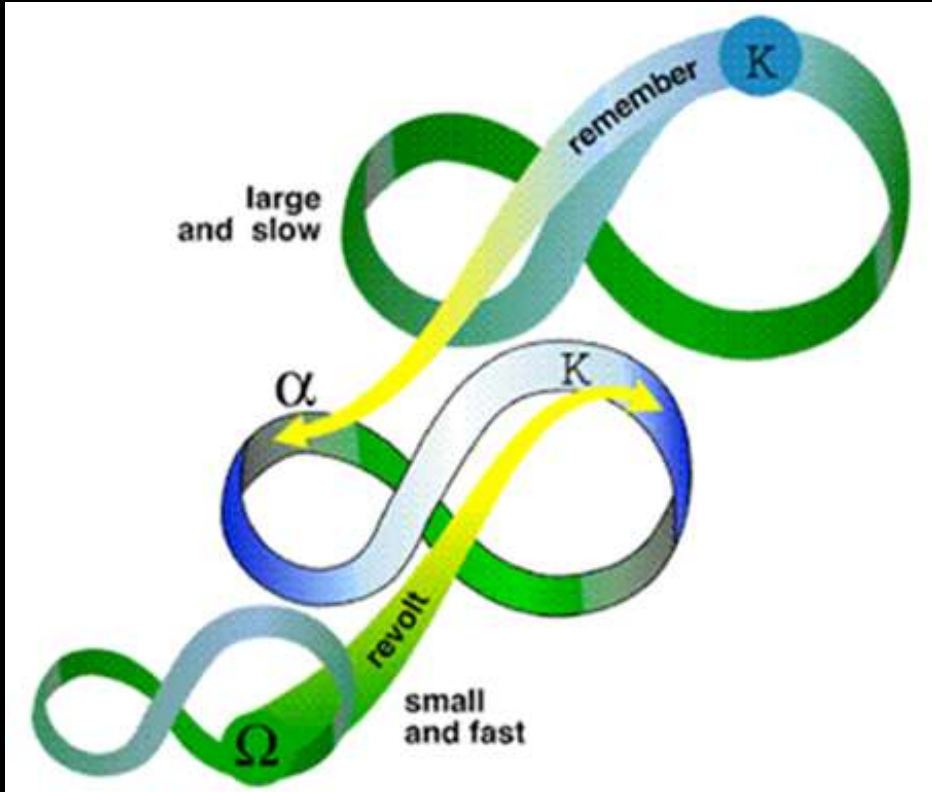
How Life on Earth Works - Gaia and Homeostasis

- The Earth is **a self-regulating complex system** involving the biosphere, the atmosphere, the hydrospheres and the pedosphere (soil) tightly coupled as **an evolving system**.
- Many processes in the Earth's surface, essential for the conditions of life, depend on the interaction of living forms, especially microorganisms, with inorganic elements.
- These processes establish **a global control system** that regulates Earth's surface temperature, atmosphere composition and ocean salinity, powered by the global thermodynamic disequilibrium state of the Earth system.
- “Gaia is the planetary life system that includes everything influenced by and influencing the biota. The Gaia system share with all living organisms the capacity for homeostasis – the regulation of the physical and chemical environment at a level that is favorable to life.”



Gaia and the Agency of (Biotic) Nature

- The system as a whole, called Gaia, seeks a physical and chemical environment optimal for contemporary life.
- Gaia evolves through a cybernetic feedback system operated *unconsciously* by the biota, leading to broad stabilization of the conditions of habitability.



Gaia and the Agency of Nature

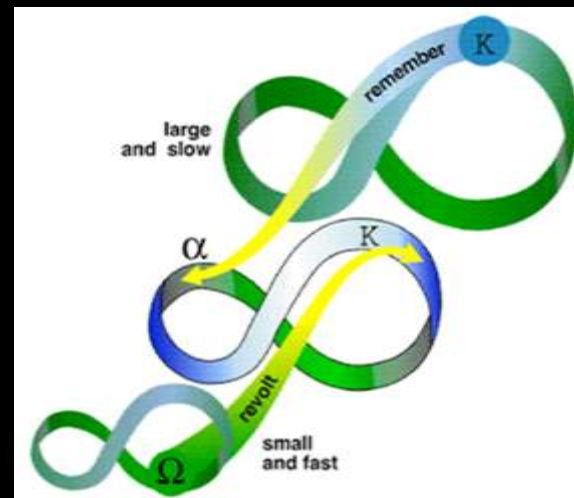
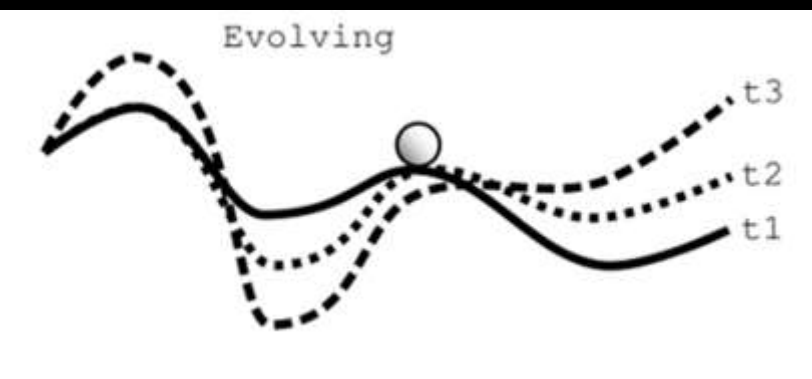
James Lovelock

- “When I talk of Gaia as a super organism, ***I do not for a moment have in mind a goddess or some sentient being.*** I am expressing my intuition that the Earth behaves as a self regulating system, and that the proper science for its study is physiology.”
- The originality of the Gaia hypothesis relies on the assessment that such ***homeostatic balance is actively pursued to keep the optimal conditions for life on Earth, even when terrestrial or external events menace them*** – like a chemical reaction or cybernetic system (thermostat).



James Lovelock
GAIA
A New Look at
Life on Earth

With a
new Preface
by the
Author



The Balance of Nature – The End of Harmony?

“The existence of a balance of nature has been a dominant part of Western philosophy since before Aristotle.

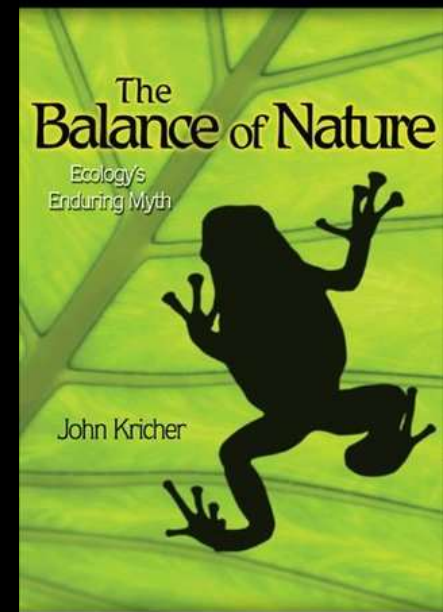
But the science of ecology and evolutionary biology together demonstrate that ***there is no balance of nature—not today and not at anytime in Earth’s long history.***

The paradigm is based on belief, not data; ***it has no scientific merit.***

Nature is constantly in flux varying in scales of space and time, and most of that flux is due entirely to natural causes. At this time of extraordinary human influence on Earth’s ecosystems and biota, I argue that it is essential for humanity to understand how evolution occurs and why ecology is ***far more dynamic than static.***”

The Balance of Nature: Ecology’s Enduring Myth (2009)

John Kricher

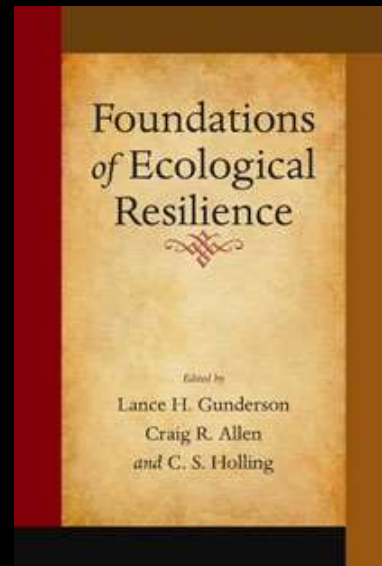
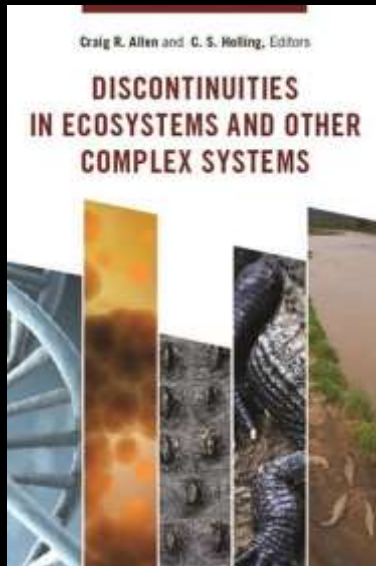


The New Ecology of Change - Ecological Resilience

- **The concept of resilience** in ecological systems was first introduced by the Canadian ecologist C.S. Holling in order *to describe the persistence of natural systems in the face of changes in ecosystem variables due to natural or anthropogenic causes*.
- **Resilience**, derived from its Latin roots 'to jump or leap back', is the ability to recover from or adjust easily to misfortune or change.
- Ecosystem resilience is **the capacity of an ecosystem to tolerate disturbance** - to be changed and then to reorganize and still have the same identity (retain the same basic structure and ways of functioning without collapsing into a qualitatively different state that is controlled by a different set of processes).

Holling, C.S. (1973). "Resilience and stability of ecological systems"

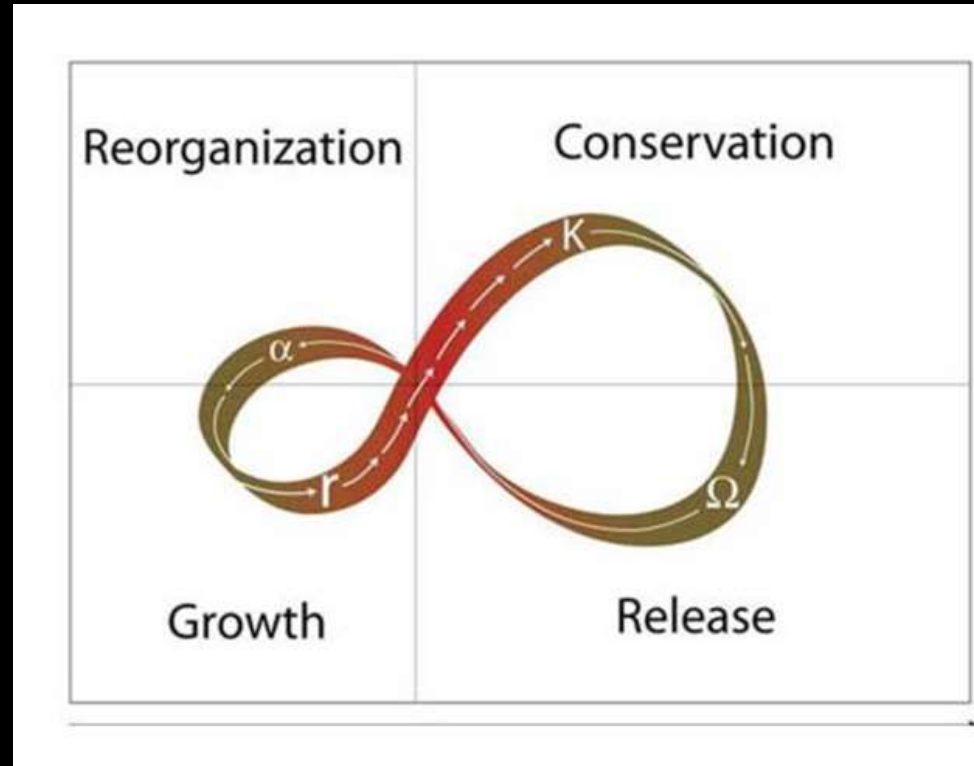
C.S. Holling 1930-2019



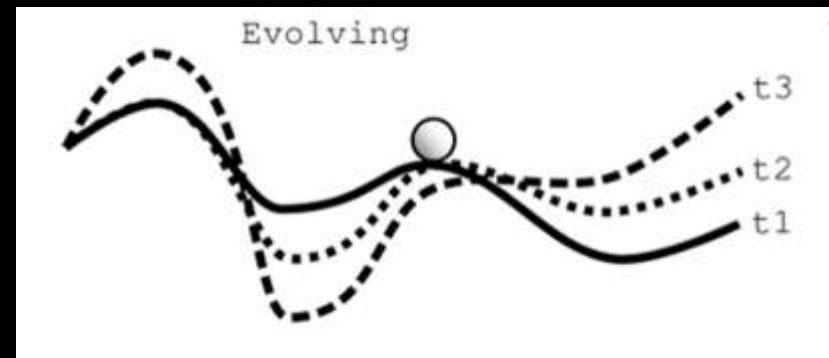
Science of Change

The Adaptive Cycle

- **Growth** - species and systems grow and diversify to exploit new opportunities and develop entirely new ecological ways of being.
- **Conservation** - species are tightly connected and organized, and systems “stabilize” into often hierarchically nested systems, where there is little or no room for innovation or growth.
- **Release** – where “mature” systems destabilize and collapse and become increasingly discontinuous and chaotic
- **Reorganization** – systems return in new ways, which creates a new field of conditions and possibilities for the next growth phase



- **Incremental change** in the r and K phases, which are smooth and fairly predictable
- **Abrupt change** in the transitions from K through Ω and α

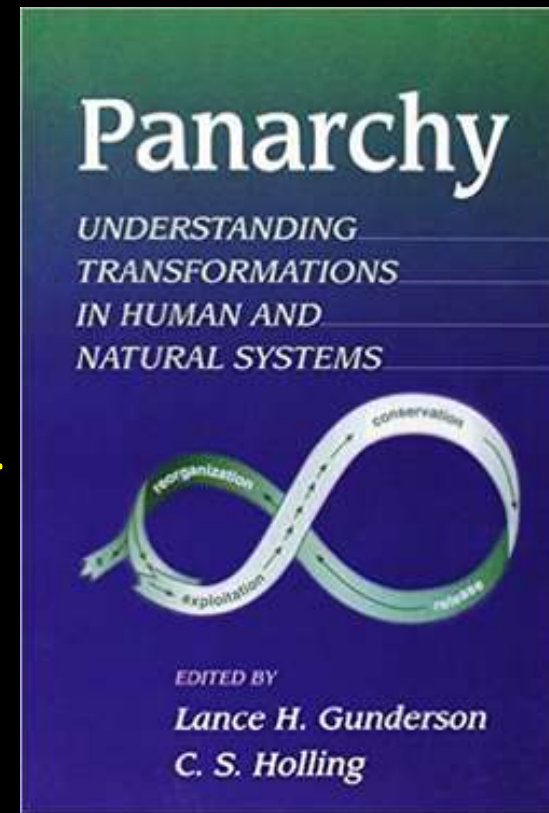


How does Nature work? A New Narrative of Nature

Transformation - Evolving Nature and Panarchy

A Story of Resilience and Change

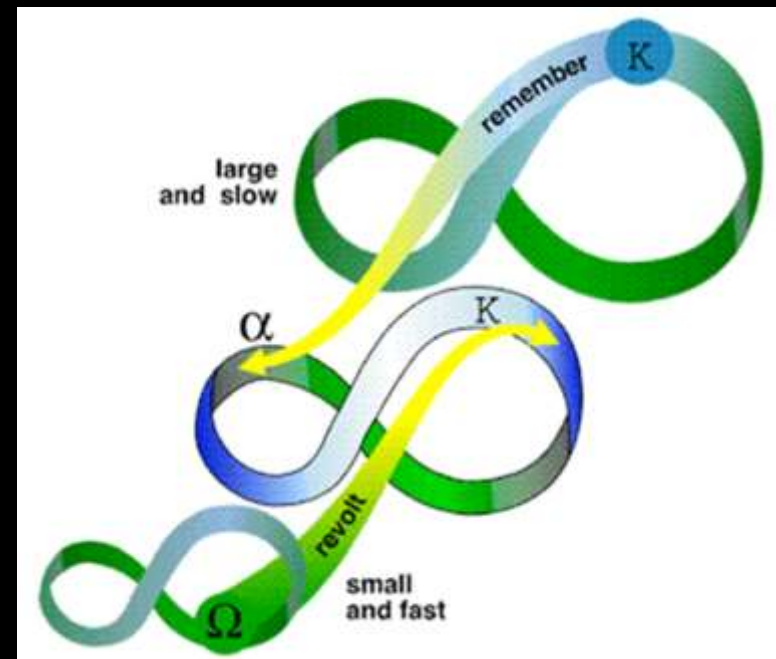
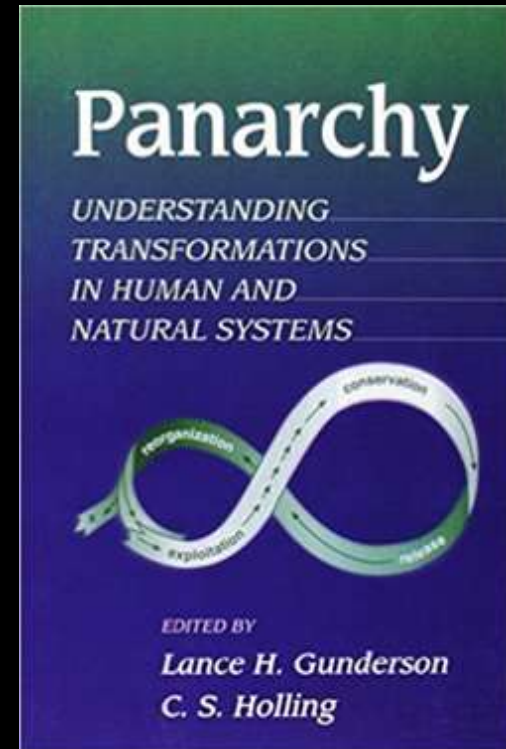
- **Panarchy is a new narrative or myth of evolving nature**, hinted at by the name of the Greek god of nature - Pan - whose persona also evokes an image of unpredictable change.
- **Change is not always for the good** - Pan has a destabilizing role that is captured in the word panic, directly derived from one facet of his paradoxical personality.



Resilience, Panarchy, and Adaptive Management

A Narrative of Permanence and Change

- 'Panarchy' is a term that “**explains the evolving nature of complex adaptive systems**” Human and Natural systems - Socioecological systems
- **No socioecological system can be understood or managed by focusing on it at a single scale.**
- All systems exist and function at multiple scales of space, time and social organization, and the **interactions across scales are fundamentally important** in determining the dynamics of the system at any particular focal scale.
- Ecological and social-ecological systems form **nested sets of adaptive cycles**. The larger, slower cycles generally constrain the smaller, faster ones and maintain system integrity
- **The essential focus of Panarchy is to rationalize the interplay between change and persistence, between the predictable and unpredictable.**



Resilience, Nature Conservation, and Humans

Peter Kareiva, former UCLA Institute of the Environment and Sustainability and Nature Conservancy Chief Scientist



“Conservation is widely viewed as the innocent and uncontroversial practice of purchasing special places threatened by development. *In truth, for 30 years, the global conservation movement has been racked with controversy arising from its role in expelling indigenous people from their lands in order to create parks and reserves.*”

The modern protection of supposed wilderness often involves resettling large numbers of people, too often without fair compensation for their lost homes, hunting grounds, and agricultural lands.

- If there is no wilderness,
- if nature is resilient rather than fragile, and
- if people are actually part of nature and not the original sinners who caused our banishment from Eden,
- what should be the new vision for conservation?”



Resilience, Nature Conservation, and Humans - Peter Kareiva

“Protecting biodiversity for its own sake has not worked. Protecting nature that is dynamic and resilient, that is in our midst rather than far away, and that sustains human communities -- these are the ways forward now. Otherwise, conservation will fail, clinging to its old myths. It would start by appreciating the strength and resilience of nature while also recognizing the many ways in which we depend upon it.

Conservation should seek to support and inform the right kind of development -- development by design, done with the importance of nature to thriving economies foremost in mind. And it will utilize the right kinds of technology to enhance the health and well-being of both human and nonhuman natures.

None of this is to argue for eliminating nature reserves or no longer investing in their stewardship. But we need to acknowledge that a conservation that is only about fences, limits, and far away places only a few can actually experience is a losing proposition.”



UCLA
Institute of the Environment
and Sustainability



LABORATORY FOR ENVIRONMENTAL
NARRATIVE STRATEGIES

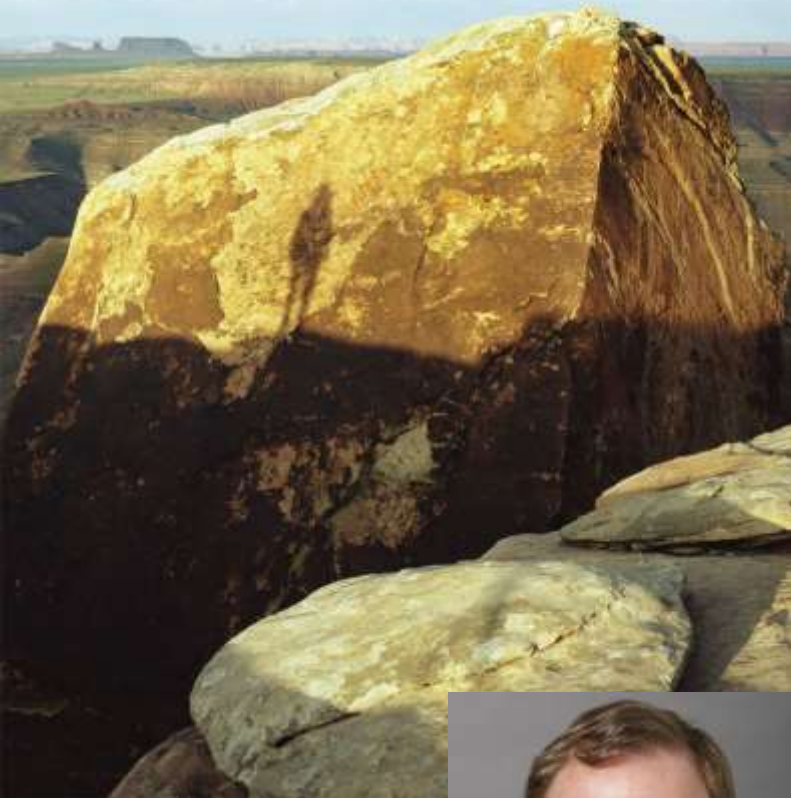
The Nature
Conservancy 

Protecting nature. Preserving life.™

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Stephen J. Pyne

SAVING AMERICAN
NATURE IN THE AGE
OF HUMANS

AFTER PRESERVATION



Preserving Nature on US Federal Lands: Managing Change in the Context of Change

Norman L. Christiansen

Duke

NICHOLAS SCHOOL of
the ENVIRONMENT

“Restoration and conservation goals are often articulated in terms of ‘desired future conditions’ when they ought to be focused on ‘desired future change.’

We should care about history, but not too much. Historic range of variation in disturbance and the change it produces may inform restoration and conservation goals, but we live in a rapidly changing world. ***We cannot simply assume that restoring the past processes will result in restoration or conservation success...***

All of this has significant implications for what it is we deem natural. In an ideal world, we would like to believe that we preserve nature when we preserve the natural processes that maintain it.

Yet, we can no longer be sure that is true.”

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*Ben A. Minteer &
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***“We are now left with the unsettling task of defining nature for ourselves, and we must do this in the context of complex ecosystem change and a limited understanding of the consequences of our own actions.*”**

We are tinkering with nature, and we would do well to follow Aldo Leopold’s admonition that ‘to keep every cog and wheel is the first precaution of intelligent tinkering.’ More than ever, preservation of nature depends on humility, rather than hubris. Perhaps that ought to be our first precaution.”

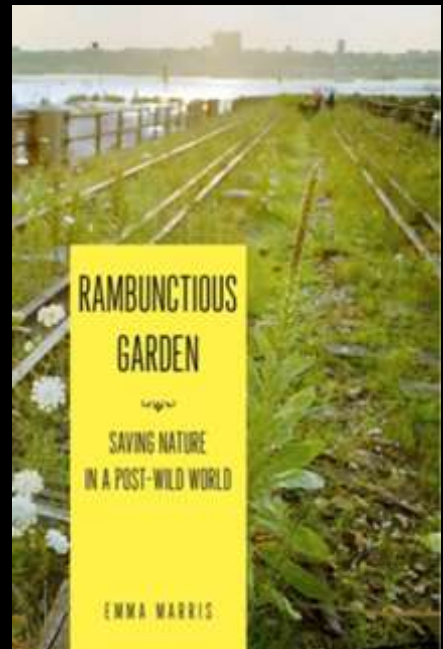
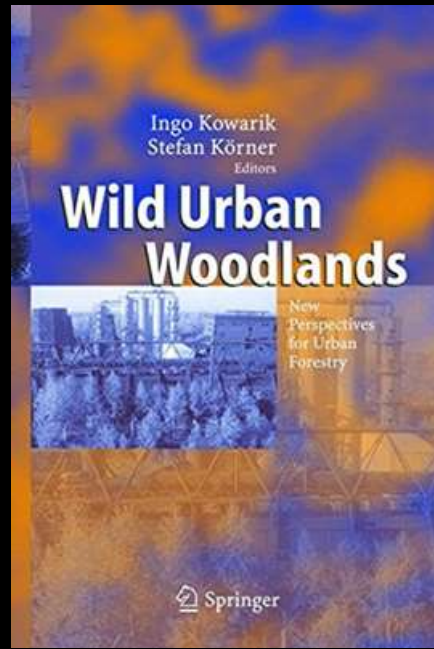
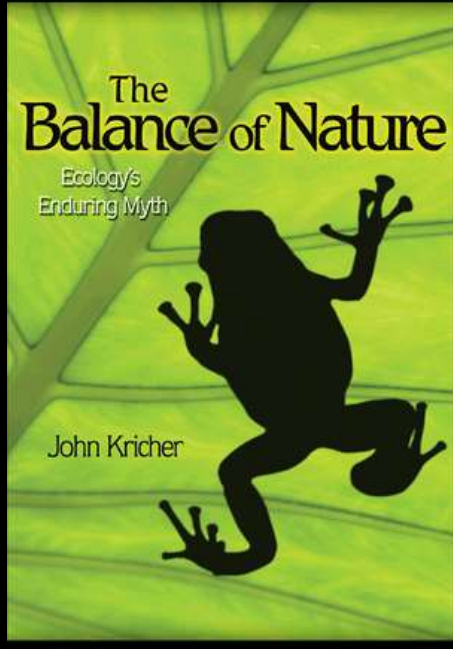
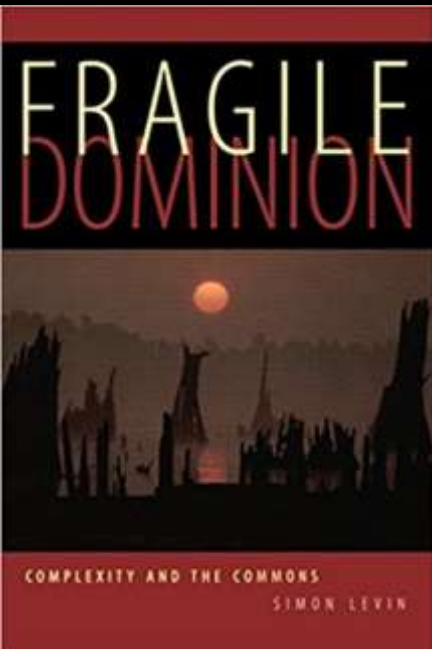
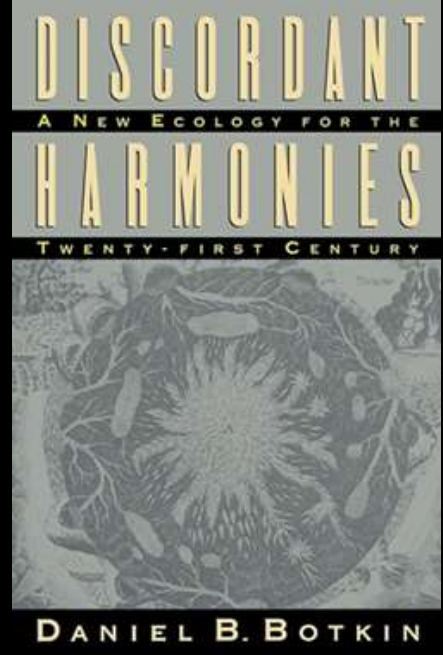


New Metaphors of Change and Permanence

“Clearly, to abandon a belief in the constancy of undisturbed nature is psychologically uncomfortable...

The way to achieve a harmony with nature is first **to break free of old metaphors and embrace new ones** so that we can lift the veils that prevent us from accepting what we observe, and then to make use of technology to study life and life-support systems as they are.”

Botkin, *Discordant Harmonies* (1990)

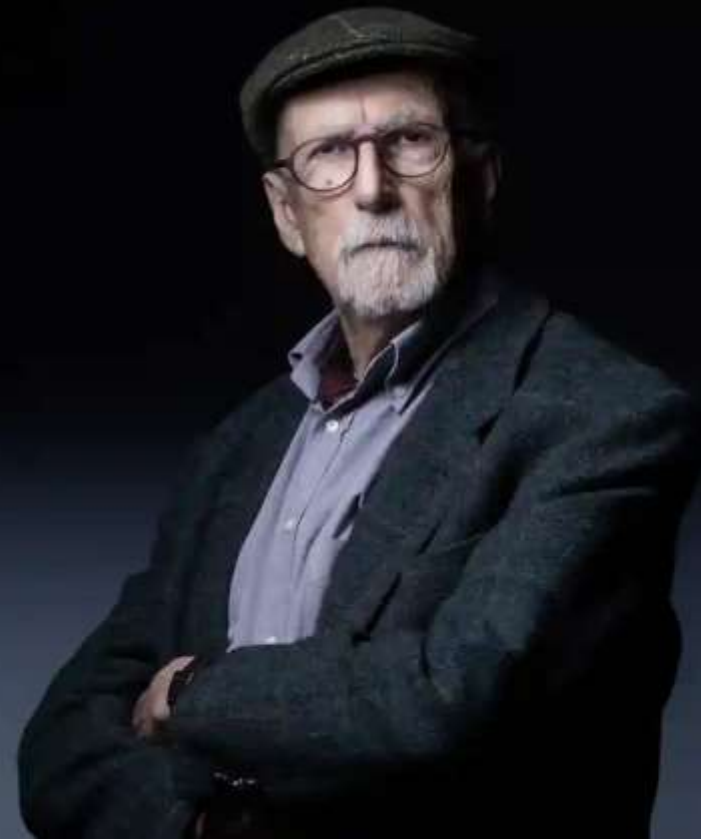
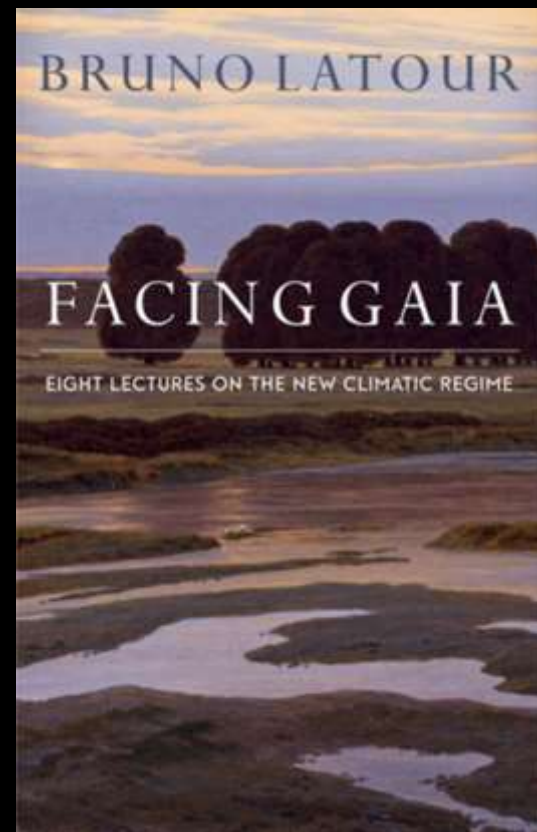


Nature as a verb – The Agency of Nature and 21st Century Philosophy

Bruno Latour (1947-2022)

“Contrary to the old nature, Gaia does not play either the role of inert object that could be appropriated or the role of a higher arbiter on which, in the end, one could rely.

It was old Nature that could serve as a general framework for our actions even as She remained *indifferent* to our fate... ***Gaia is no longer indifferent to our actions...Gaia can treat us as enemies. We can respond in kind.***”

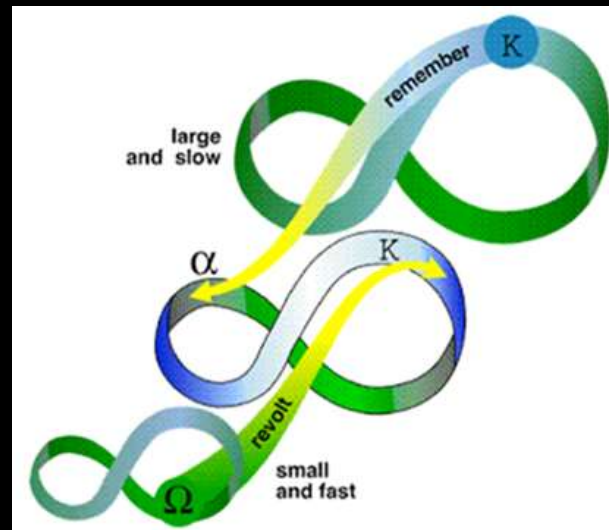
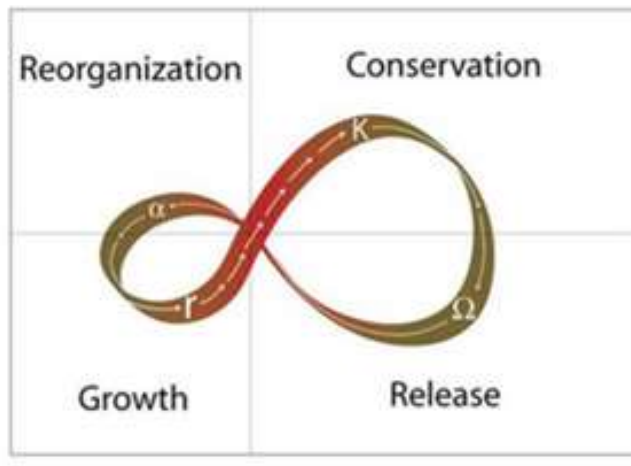
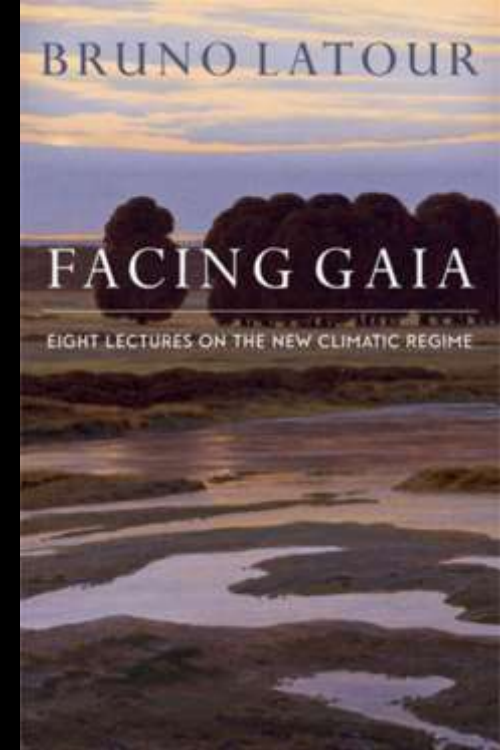


The Anthropocene and Being “of the Earth”

Bruno Latour

“That’s what the Anthropocene is all about... we have to weave ourselves, to cocoon ourselves within a great many loops so that progressively, thread after thread, the knowledge of where we reside and on what we depend for our atmospheric condition can gain greater relevance and feel more urgent.

This slow operation of being wrapped in successive looping strips is what it means to be ‘of this Earth’ and it has nothing to do with being human-in-nature or human-on-a-globe.”



Biotic Change - Integrity and Instability

New Nature - Novel Ecosystems

- Assemblages of species in a given area that have not previously occurred.
- They lack historically natural analogs
- Novel ecosystems are not really all that novel, except in their species composition.

The interplay between change and persistence

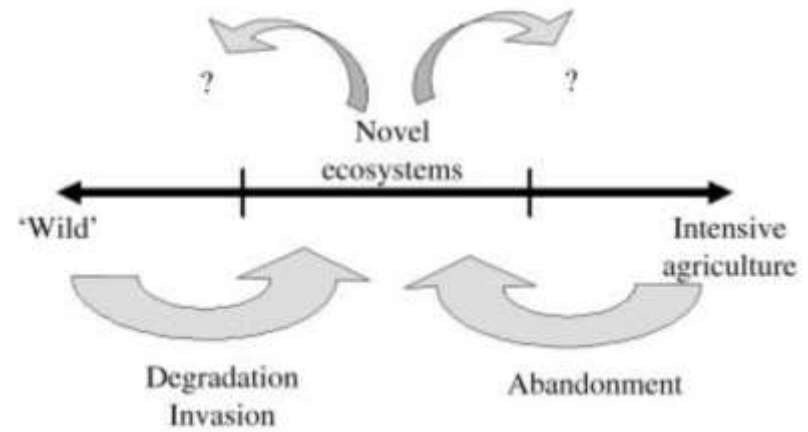
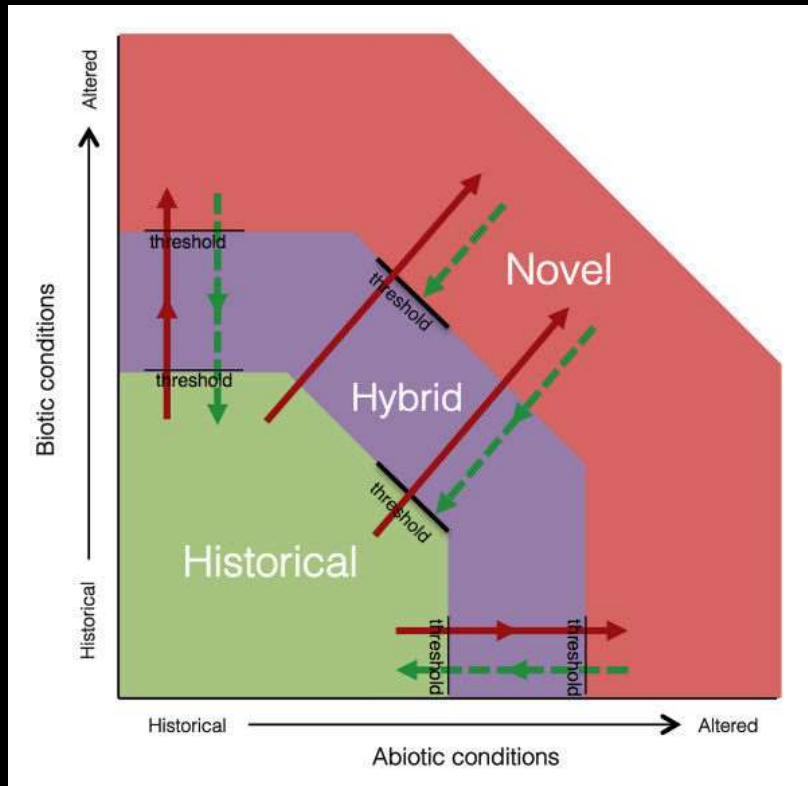
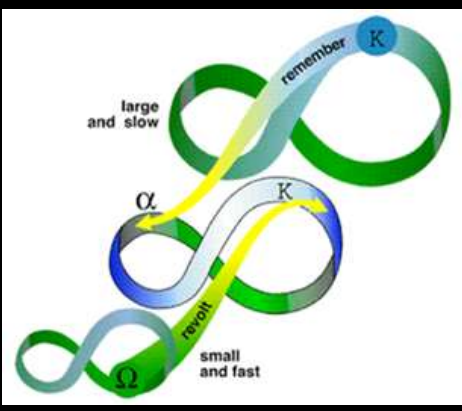
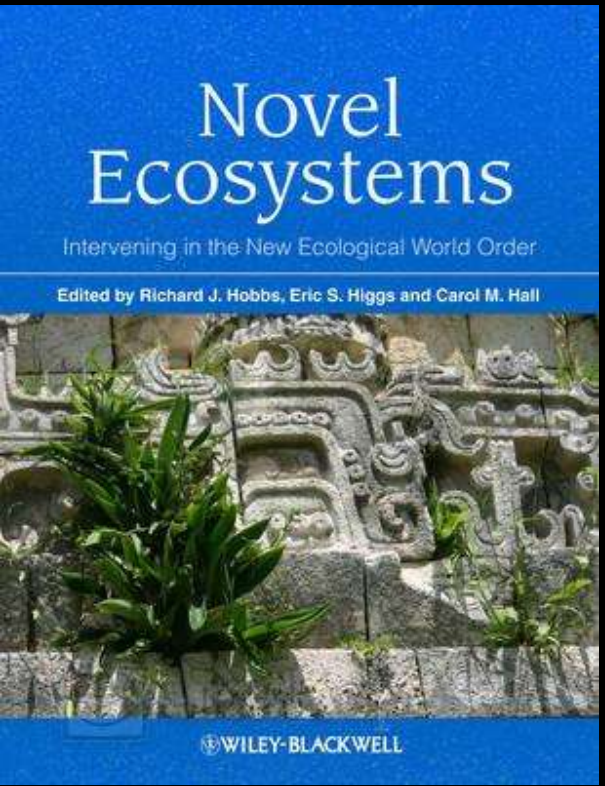


Figure 1 Novel ecosystems arise either from the degradation and invasion of 'wild' or natural/seminatural systems or from the abandonment of intensively managed systems.

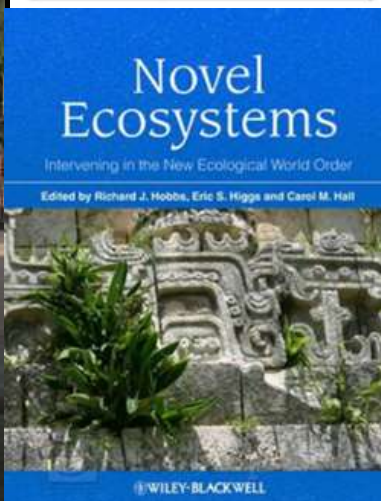
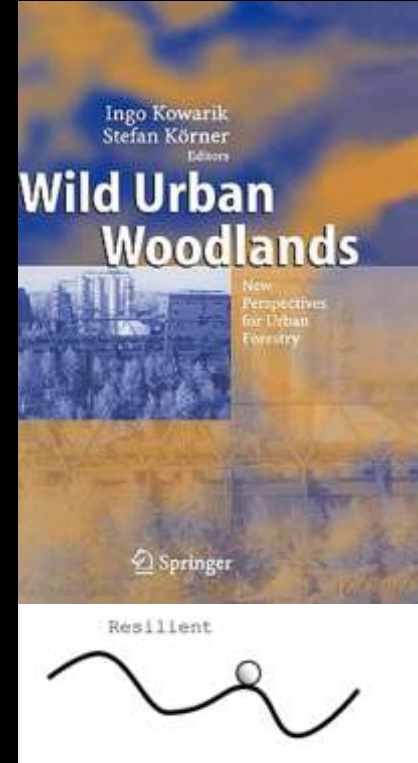


The New Ecology – How does Nature work?

Permanence and Change = Process

“the reference point is not an original condition of a natural landscape, but rather a condition defined based on the current site potential and the greatest possible degree of self-regulation.

From this perspective, therefore, the natural capacity for *process* is the central point, not a particular, retrospectively determined and often idealized, *picture of nature.*”

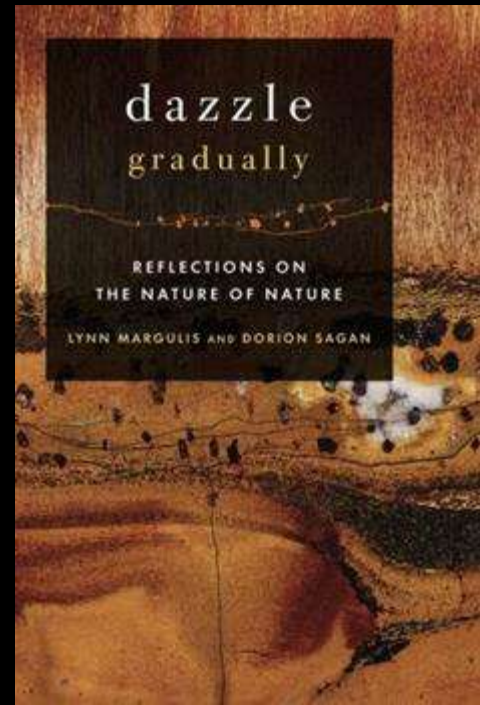


Inhabiting the Earth – Rhetoric of the Powerless

Lynn Margulis

- “Life is a planetary level phenomenon and the Earth has been alive for at least 3000 million years. To me the human move to take responsibility for the living Earth is laughable - the rhetoric of the powerless.
- ***The planet takes care of us, not we of it.***
- Our self inflated moral imperative to guide a wayward Earth or heal a sick planet is evidence of our immense capacity for self-delusion.
- ***Rather, we need to protect us from ourselves.”***

The Agency of Nature - “Life on earth is more like a verb. It repairs, maintains, re-creates, and outdoes itself.”

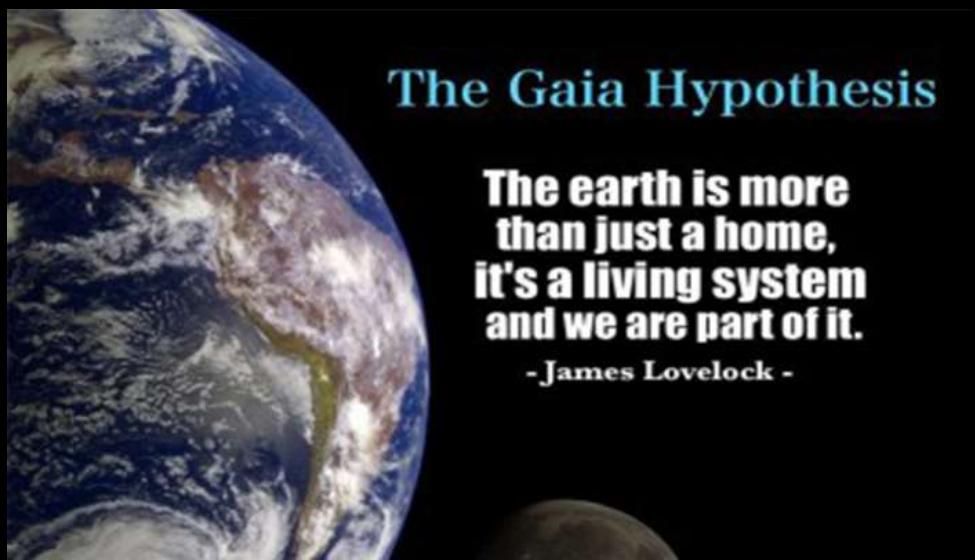
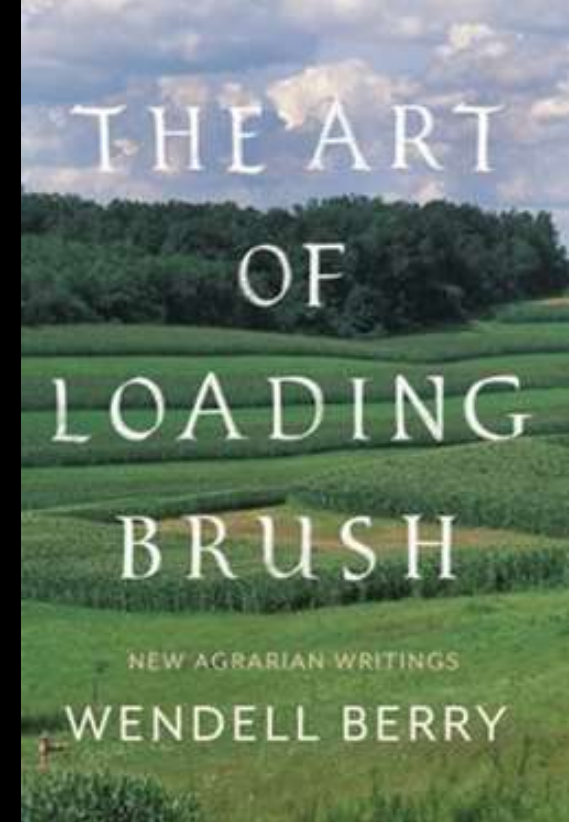


Nature – Nonetheless Our Mother

Wendell Berry and Gaia

“As many hunters, farmers, ecologists, and poets have understood, Nature (and here we capitalize her name) is ***the impartial mother of all creatures, unpredictable, never entirely revealed, not my mother or your mother, but nonetheless our mother.*** If we are observant and respectful of her, she gives good instruction.

...If we ignore or offend her, she enforces her will with punishment. She is always trying to tell us that we are not so superior or independent or alone or autonomous as we may think.”



Living with Gaia

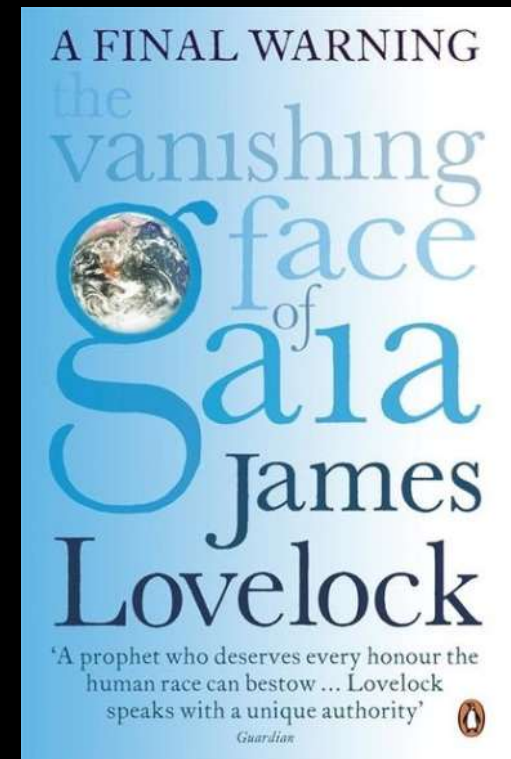
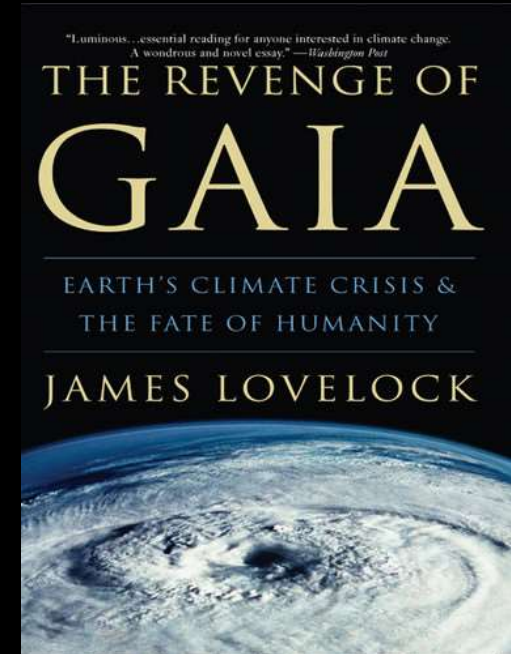
Lovelock - Sustainable Retreat

Lovelock thinks the time is past for sustainable development, and that we have come to a time when development is no longer sustainable. Therefore, we need to retreat.

“We should be strengthening our defenses and making a sustainable retreat rather than trying to ‘save the planet’. We are not clever nor determined enough to serve in this way, but we could still be the progenitors of those that can.”

“Retreat means it's time to start talking...

- about changing where we live and how we get our food;
- about making plans for the migration of millions of people from low-lying regions like Bangladesh into Europe;
- about admitting that New Orleans is a goner and moving the people to cities better positioned for the future.
- Most of all, it's about everybody ‘absolutely doing their utmost to sustain civilization, so that it doesn't degenerate into Dark Ages, with warlords running things, which is a real danger. We could lose everything that way.’”



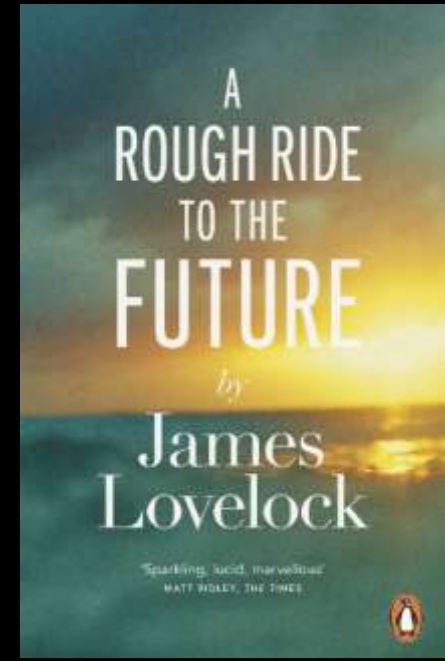
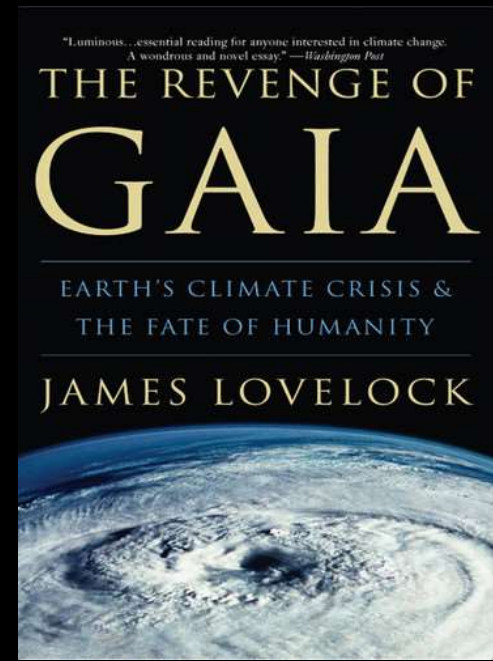
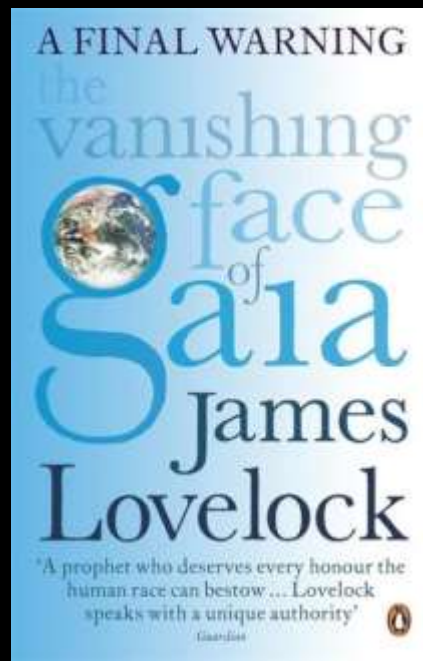
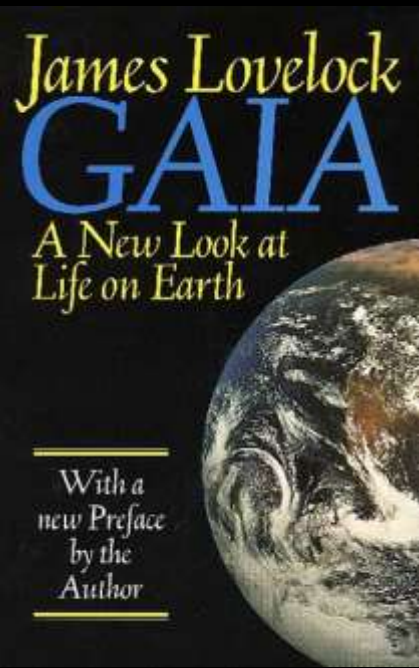
Lovelock – Mind and Nature

Human Creativity - Invention, Intuition, and Rationality

“If you think as I do that we are an organic part of the Earth, then perhaps our intelligence is a property of the Earth. This is why it is so important that we survive.”

“Rational thinking is not necessarily our greatest property, and, although we prize it, it may be a handicap.

We have to recognize that in addition to conscious rational thinking our minds are capable of other more powerful mental processes that lead us by intuition to grasp a tiny sparkling fragment of reality.”



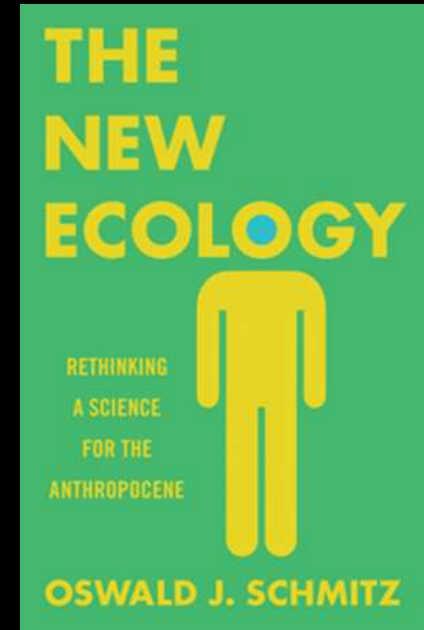
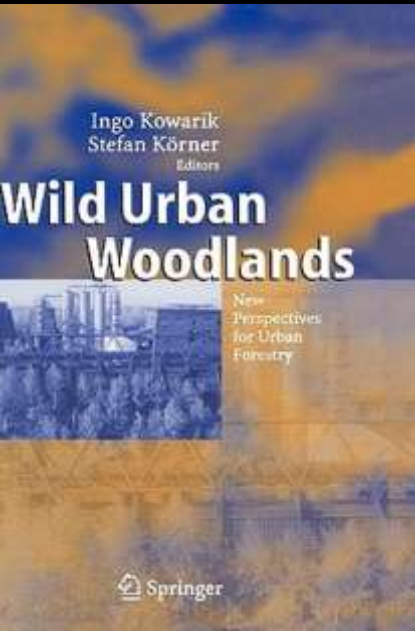
“Chances are that we will continue to deal with the coming transition to a civilization operating within the biospheric limits with a combination of aggressive inventiveness and inexplicable procrastination, of effective adaptability and infuriating failure to respond. Will we succeed?”

The answer hinges on the definition of success, but once all the gains and losses have been factored in, it would be surprising if transitions likely to be accomplished during the 21st century were less transformative than those experienced in the 20th century.

Another epochal transition is unfolding and its outcome is not foreordained; it remains contingent on our choices.”



Nonhuman Creativity - Wild Urban Woodlands – Waller Creek 7th Street Bridge



2024



2005



2009



2012



2017

Permanence and Change

Nothing Endures But Change

Heraclitus 540-480BC

