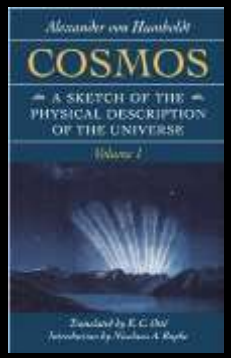
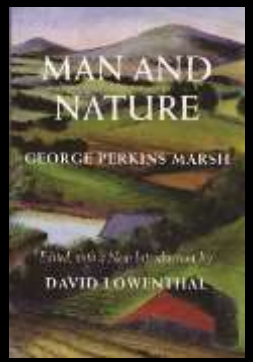
Center for Environmental Research at Hornsby Bend

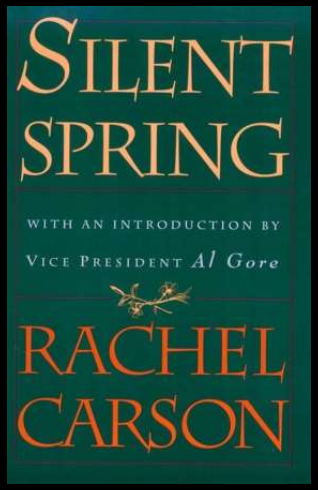
Austin Water

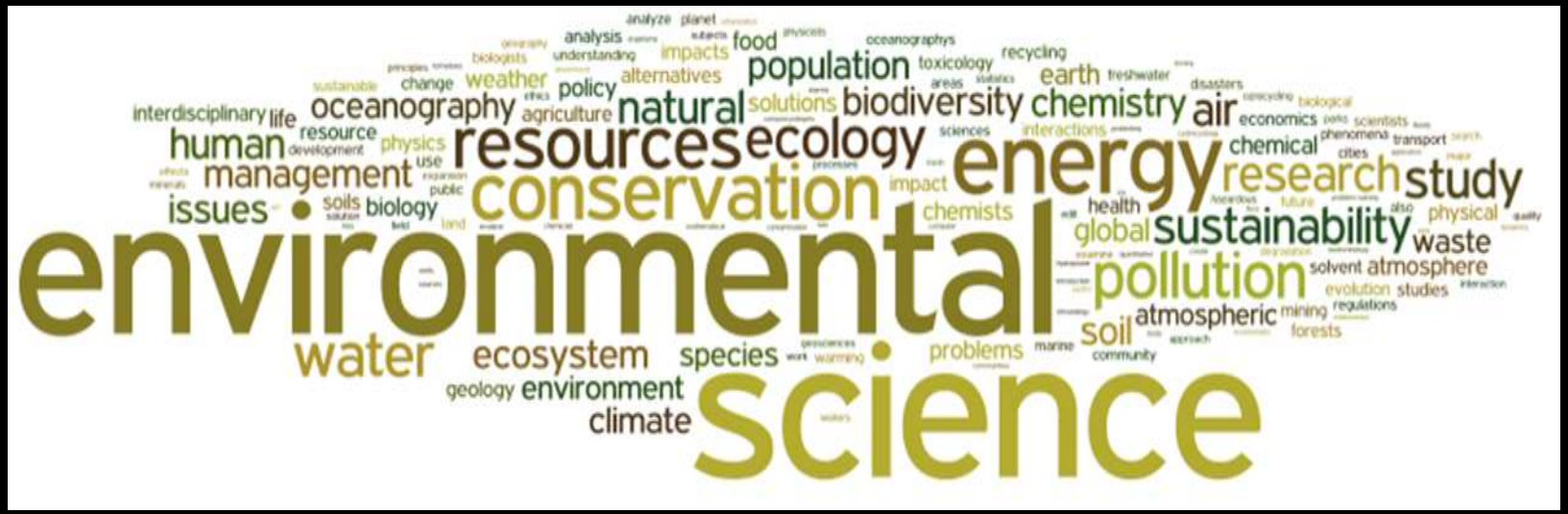
American Environmental Science: Carson and the Politics of Nature

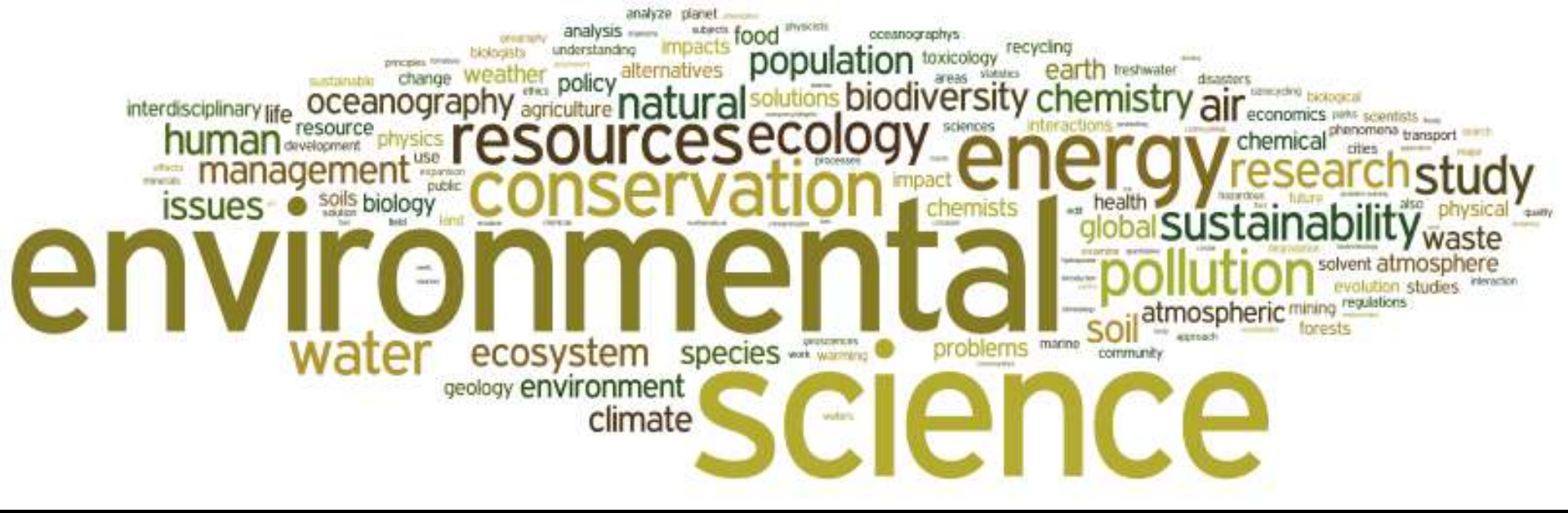
Kevin M. Anderson, Ph.D.
Austin Water – Center for Environmental Research





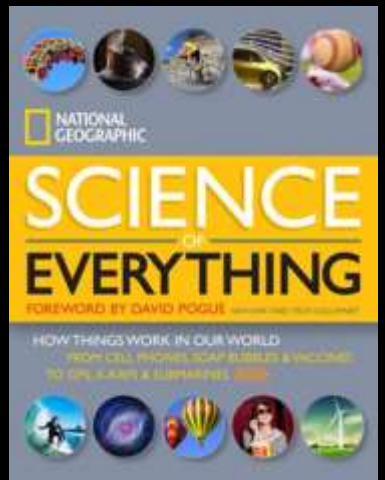


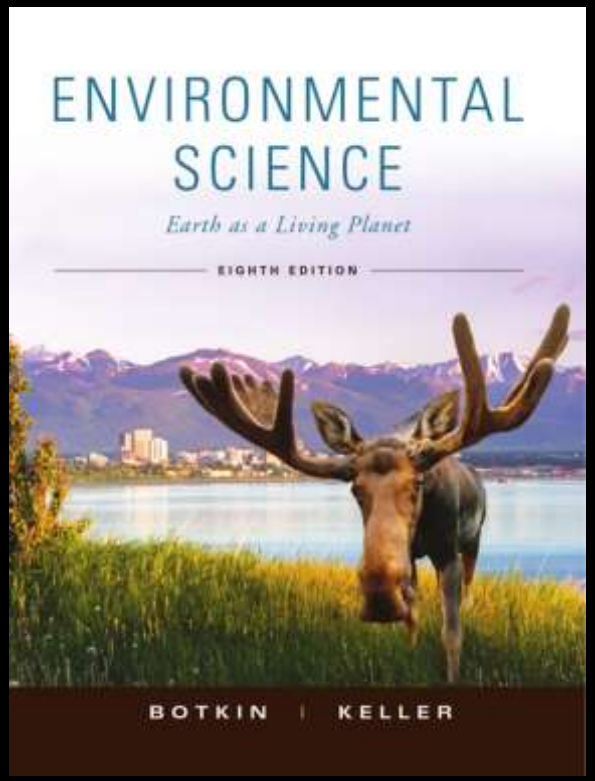




Science and American Nature

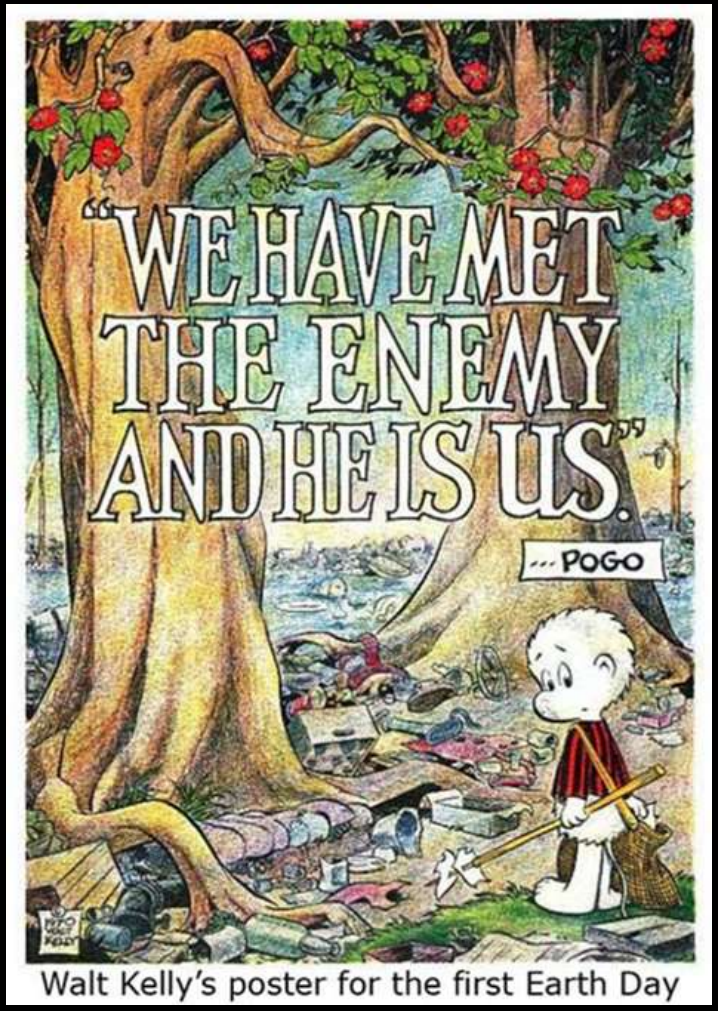
"Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems"





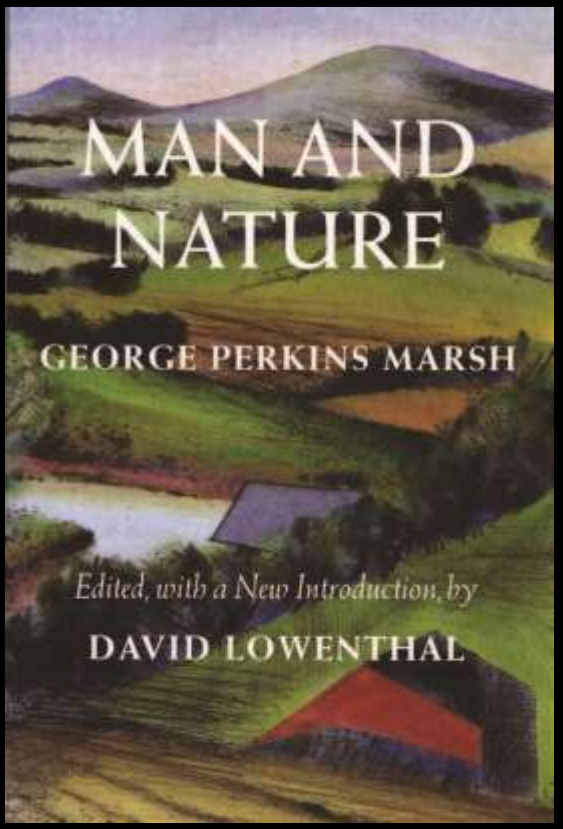
How does the Environment work?

How does the Environment work?



Walt Kelly's poster for the first Earth Day

18th and 19th Century Origins of Environmental Science



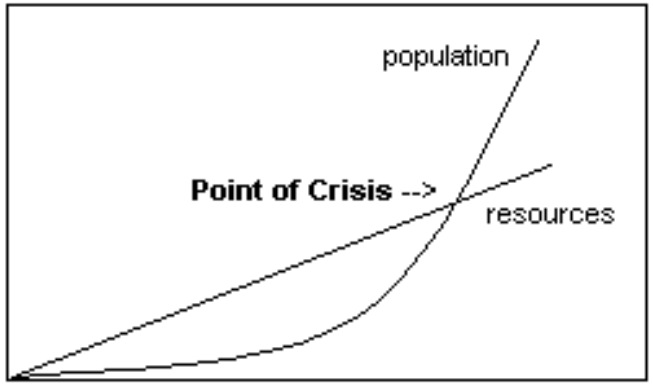
Carrying Capacity and the Struggle for Existence

Thomas Malthus (1766-1834)

An Essay on the Principle of Population 1798

Malthus believed that human populations would eventually be kept in check by famine, disease because populations grow exponentially, but food supply does not.

"This natural inequality of the two powers, of population, and of production of the earth, and that great law of our nature which must constantly keep their effects equal, form the great difficulty that appears to me insurmountable in the way to the perfectibility of society.“



Malthus' Basic Theory

Human Impacts on the Environment

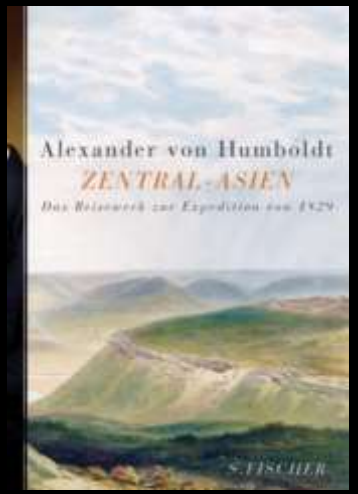
In his book *Central Asia*, Humboldt listed three ways in which the human species was even then affecting the climate:

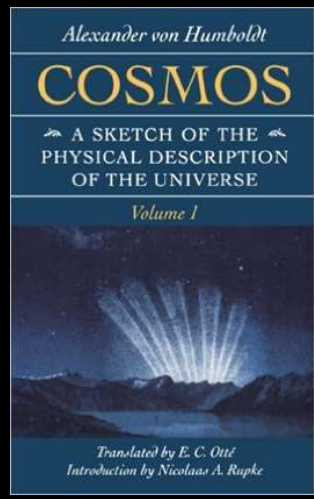
"Through the destructions of forests, through the distribution of water (irrigation and drainage), and through the production of great masses of steam and gas at the industrial centers."

"The wants and restless activity of large communities of men gradually despoil the face of the Earth."

- Humans are part of nature
- Nature/Cosmos is bigger than us
- Most human impacts are unintended consequences
- Limits of human understanding should encourage caution

Humboldt said it was the duty of scientists to examine the changeable elements in the "economy of nature" to understand human impacts.

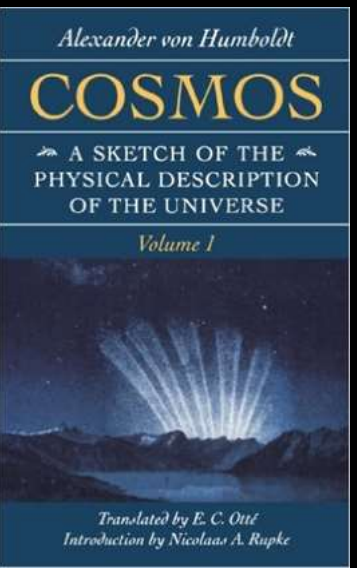


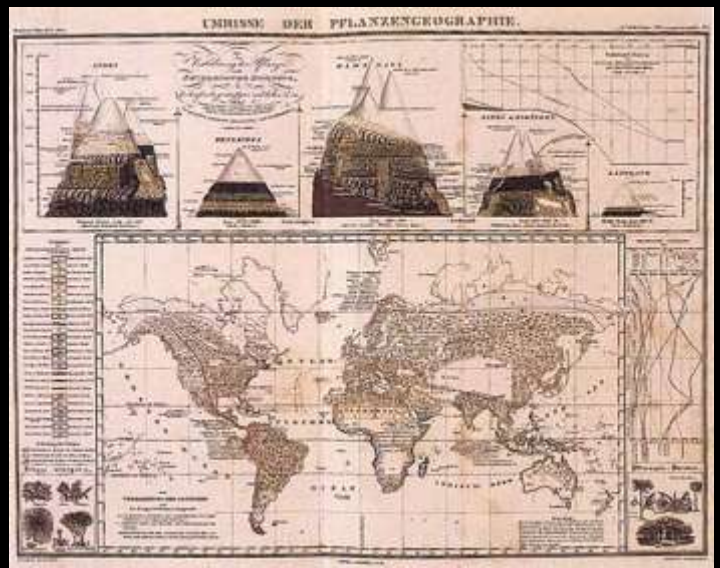


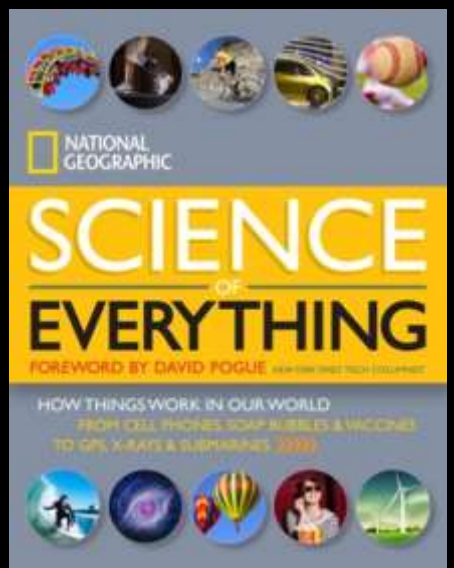
The Invention of Environmental Science - Humboldtian Physical Geography
An Environmental Science of a Systematic Dynamic Universe

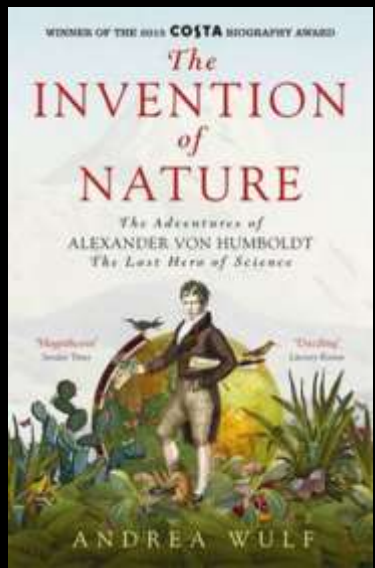
"the accurate measured study of widespread but interconnected real phenomena in order to find a definite law and a dynamic cause"

- The Systematic Universe – Everything is connected
- Nature - an inseparable organic whole, all parts of which were mutually interdependent, including humans.
- Interconnections not just particulars - though he began first with particulars and moved towards generalizations, his objective was never simply to measure one kind of phenomenon in nature.
- "In this great chain of cause and effects, no single fact can be considered in isolation"
- Humboldt's aim was to illustrate the manner in which the many phenomena of nature interact with each other at different places on the earth. Thus, he firmly believed that only by understanding the interconnections of phenomena could you evaluate any one of them.





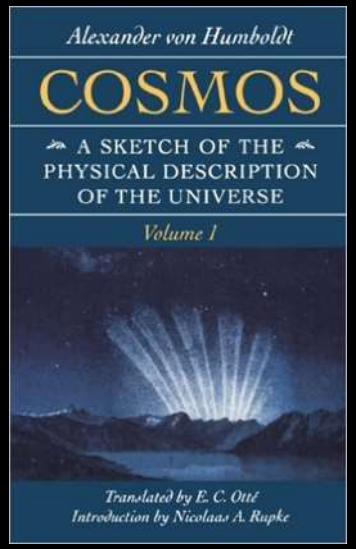


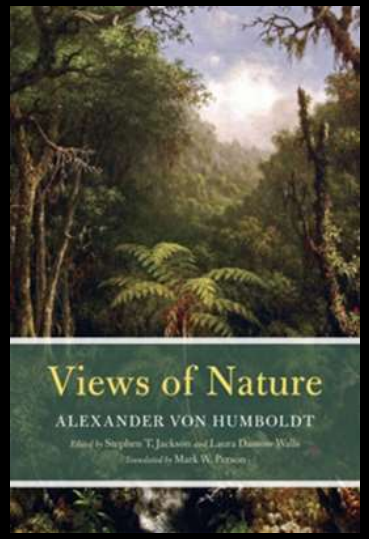


Humboldtian Science – Science of Dynamic Change – “One fair harmonious whole”

A Vision of the Harmony of Nature and Society
“Cosmos” referred to the universe as a “harmoniously ordered whole”

- One concept that is central to Humboldtian science is that of a general equilibrium of forces amidst change.
- Not balance and stability, but dynamic change
- “The general equilibrium which reigns amongst disturbances and apparent turmoil, is the result of infinite number of mechanical forces and chemical attractions balancing each other out.”
- “to recognize unity in the vast diversity of phenomena, and by the exercise of thought and the combination of observations, to discern the constancy of phenomena in the midst of apparent changes.”





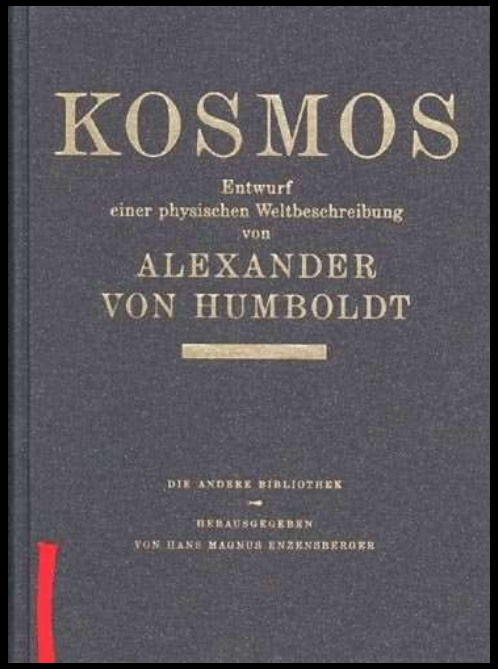
Kosmos/Cosmos - five volumes between 1845 and 1862 - Order and Beauty

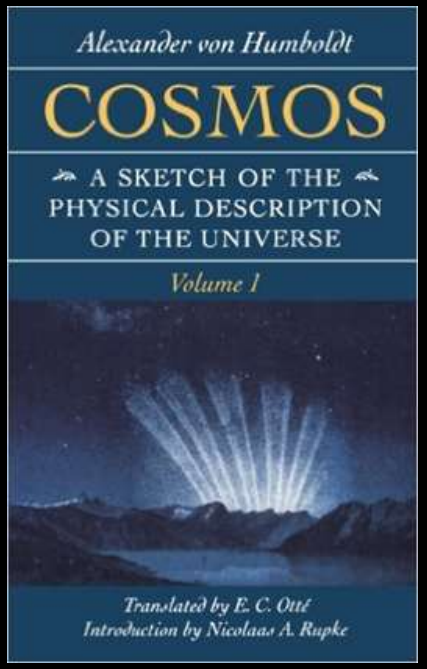
The ancient Greeks called the world a kosmos – "a beautifully ordered and harmonious system" Humboldt coined the modern word "cosmos" to use as the title of his final work.

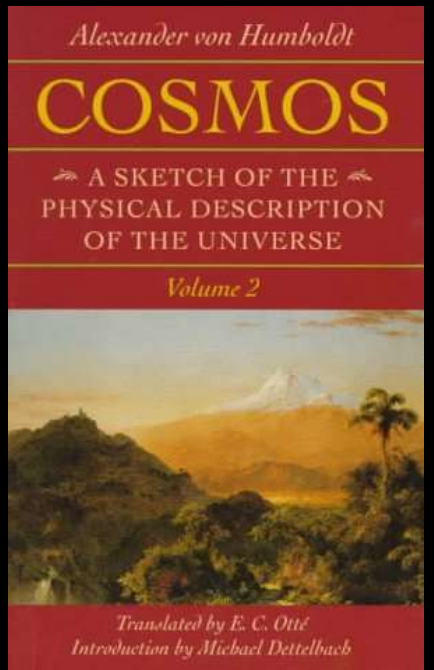
Cosmos signifies both the "order of the world, and adornment of this universal order."

- Order - the observed fact that the physical universe, independently of humans, demonstrates regularities and patterns that we can define as laws.
- Adornment - human interpretation and perception - beauty.
- To Humboldt, Cosmos is both ordered and beautiful.

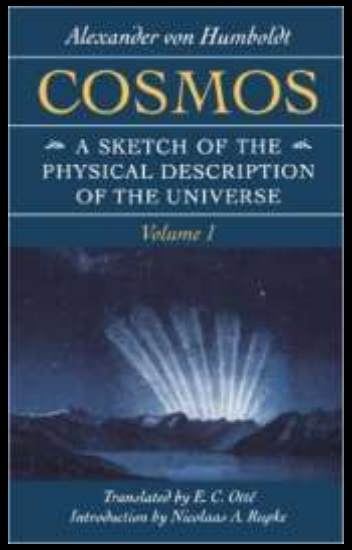
John Burroughs - Humboldt's "poetic soul, shines out in all his works and gives them a value above and beyond their scientific worth . . . . His 'Cosmos' is an attempt at an artistic creation, a harmonious representation of the universe that should satisfy the aesthetic sense as well as the understanding."

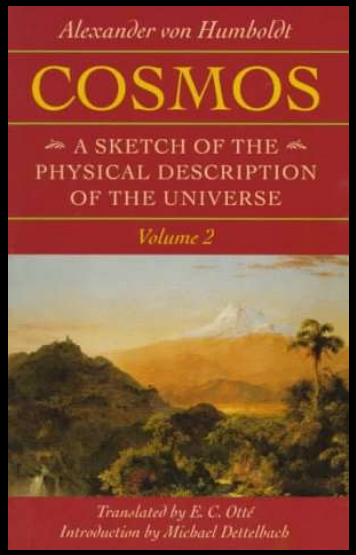


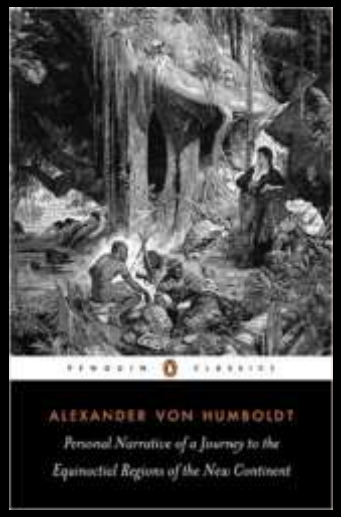


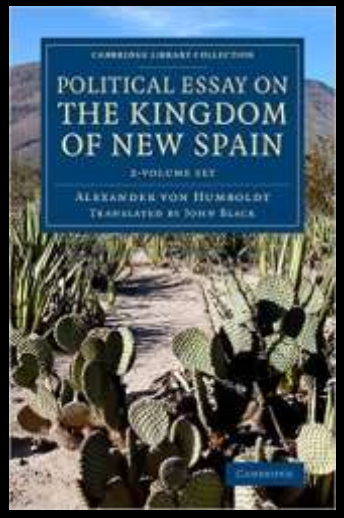


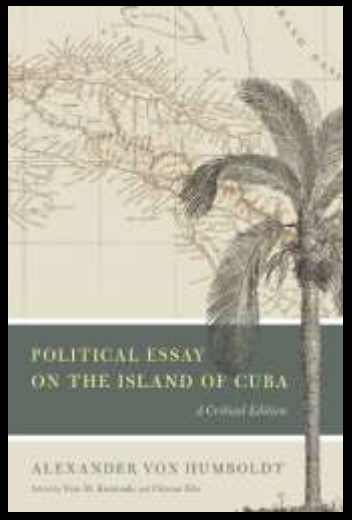
The Rediscovery of Humboldt

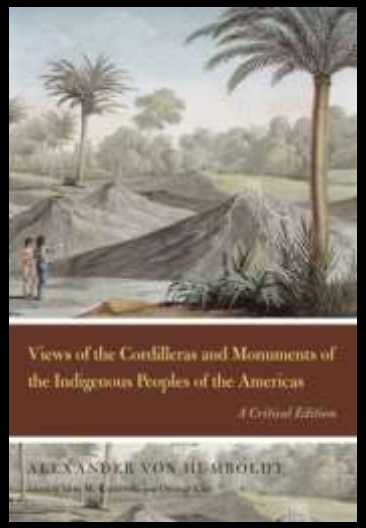


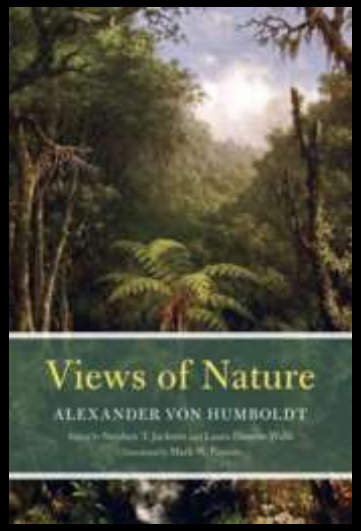










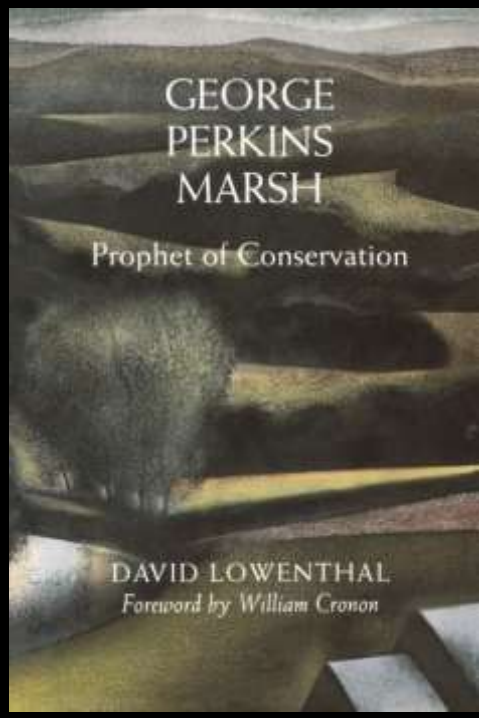


Rediscovery - The Birth of American Conservation

George Perkins Marsh 1801 – 1882

American diplomat and philologist and "Prophet of Conservation"

- Greatly influenced by reading Humboldt to observe and compare Old World and New World environmental change.
- Marsh was born in Vermont, educated at Dartmouth College and taught Greek and Latin before becoming a lawyer and moving to Burlington, Vermont.
- In 1839, he was elected to the U.S. House of Representatives and went to Washington, where he was a key figure in the establishment of the Smithsonian Institution.
- Most known in his lifetime as a philologist. Knew 20 languages and wrote a history of the English language, championed Norse sagas.
- Marsh began the diplomatic phase of his career in 1849, when he was appointed to serve as the Minister to the Court at Constantinople.
- In 1861, Lincoln appointed him as US Minister to the newly united Kingdom of Italy where he spent the last 21 years of his life (1861-82)



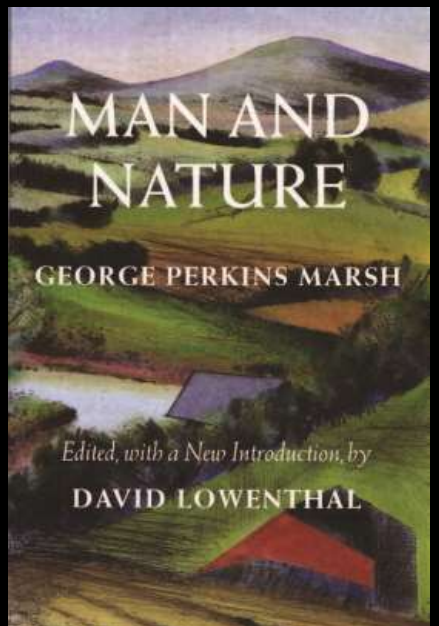
Change – Humans as “Disturbing Agents”

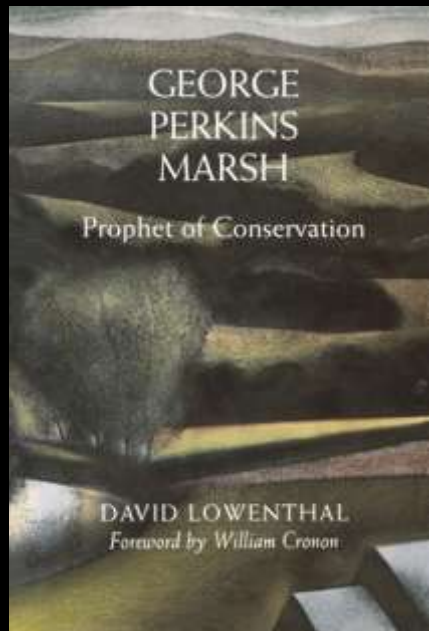
Man and Nature, or, Physical Geography as Modified by Human Action - George Perkins Marsh
Published 1864

"Man is everywhere a disturbing agent.
Wherever he plants his foot, the harmonies of nature are turned to discord"

- Most noteworthy was Marsh’s stress on the unforeseen and unintended consequences, as well as the heedless greed of technological enterprise.
- Wallace Stegner “the rudest kick in the face that American initiative, optimism and carelessness had yet received.”
- The book was instrumental in the creation of Adirondack Park in New York and the United States National Forest. Gifford Pinchot, first Chief of the United States Forest Service, called it "epoch making"

George Perkins Marsh
1801-1882





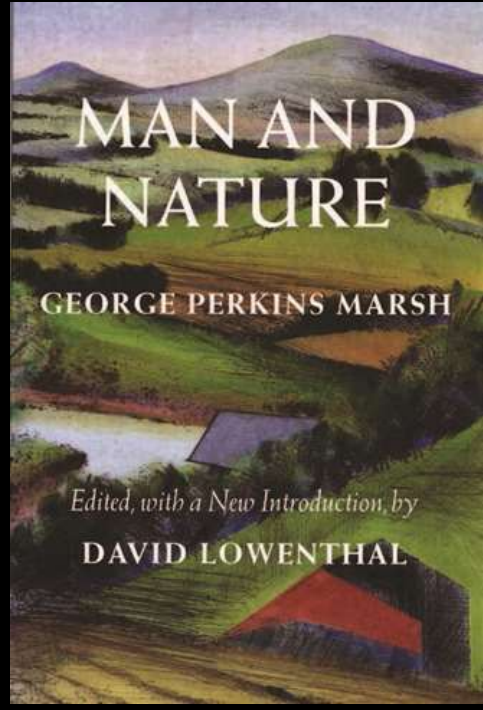
Man and Nature, or, Physical Geography as Modified by Human Action

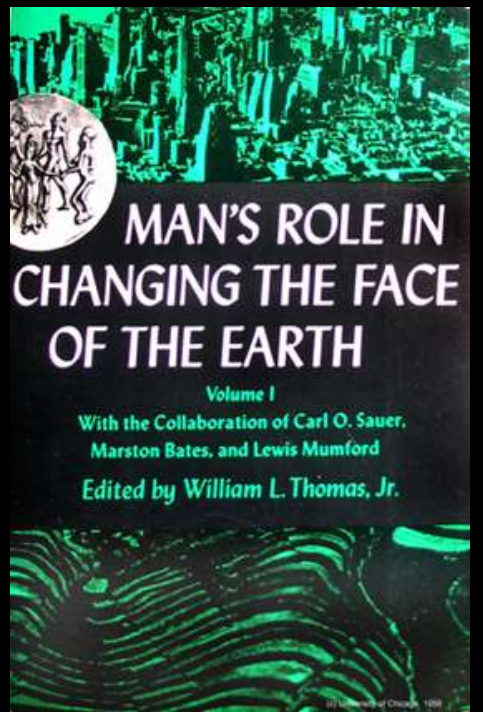
1.“Vast as is the . . . magnitude and importance [of] intentional changes”, they are “insignificant in comparison with the contingent and unsought results which have flowed from them”.

2."...Man, who even now finds scarce breathing room on this vast globe, cannot retire from the Old World to some yet undiscovered continent, and wait for the slow action of such causes to replace, by a new creation, the Eden he has wasted"

3.“Man has too long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste. Nature has provided against the absolute destruction of any of her elementary matter... But she has left it within the power of man irreparably to derange the combinations of inorganic matter and of organic life.”

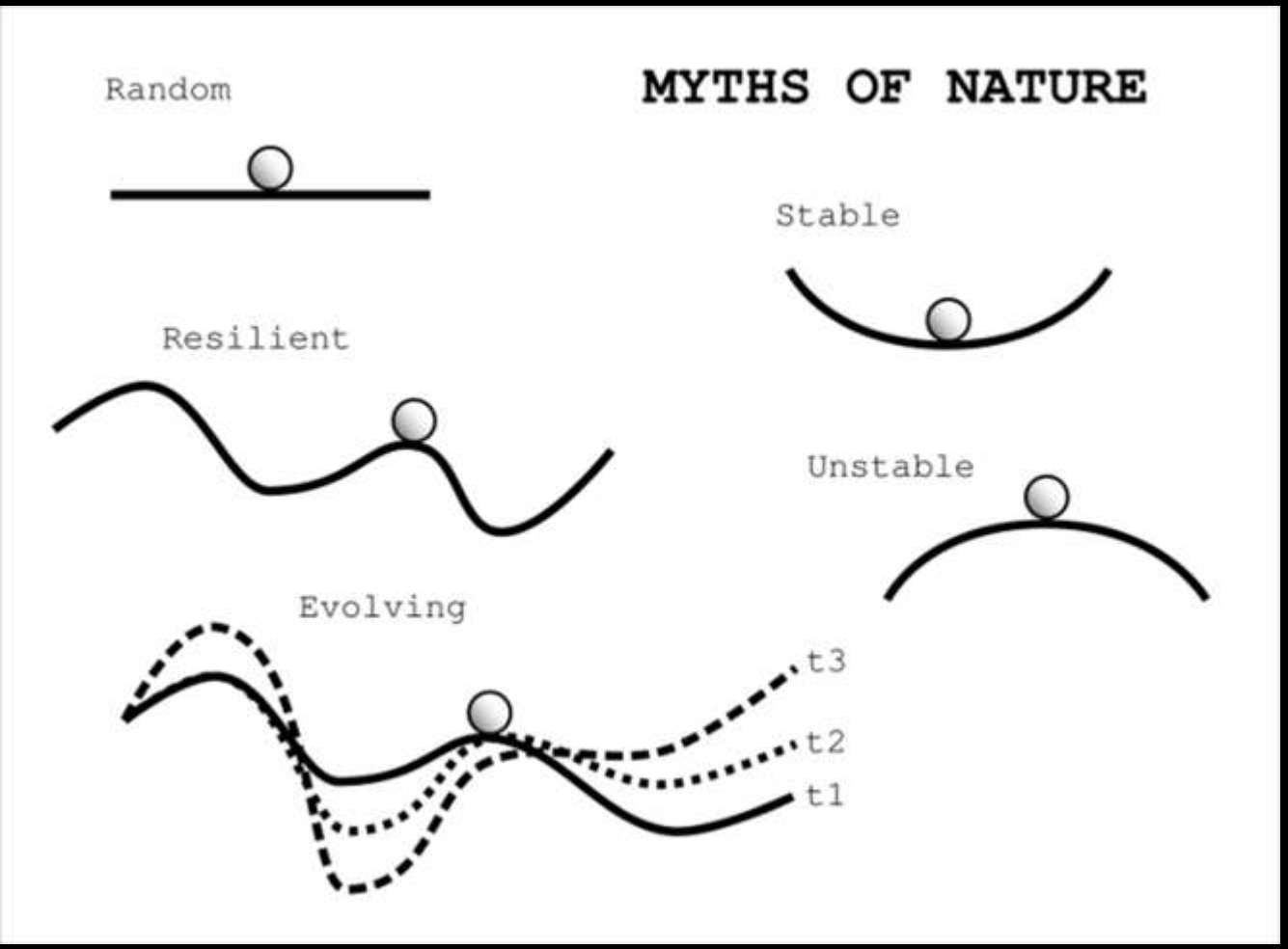
The Rediscovery of George Perkins Marsh 1956

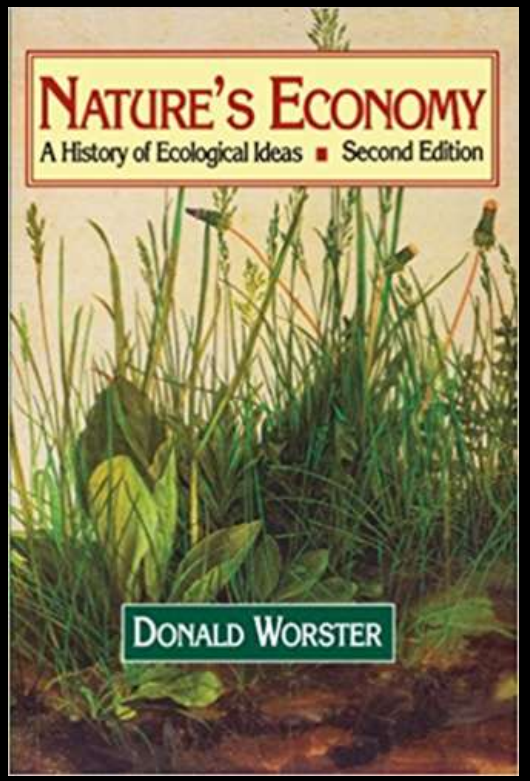




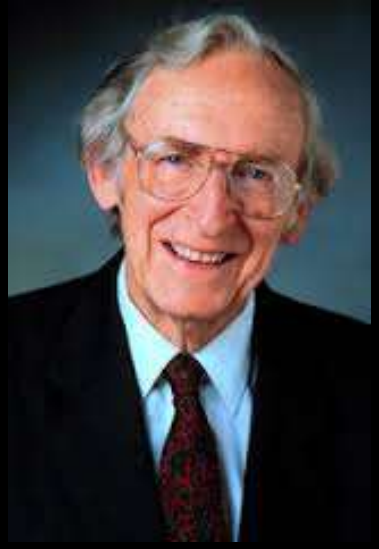
20th and 21st Century Ecology
How Nature Works – Ecology's Myths of Nature

"Every generation…writes its own description of the natural order, which generally reveals as much about human society and its changing concerns as it does about nature."
Donald Worster



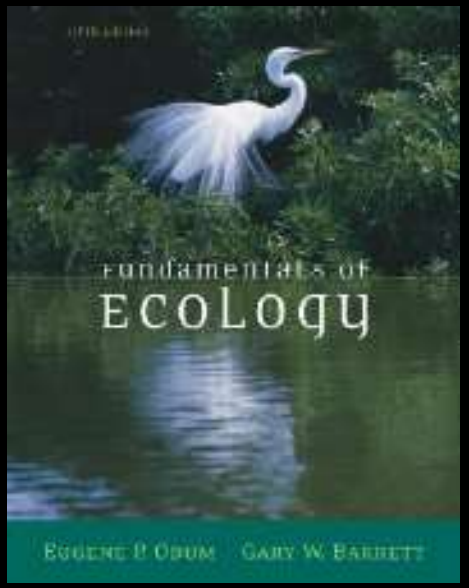


Ecosystem, Stability, and the Equilibrium Paradigm

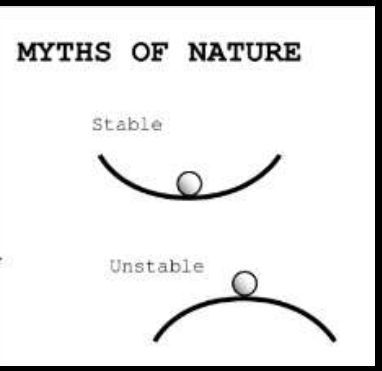


Eugene Odum
Fundamentals of Ecology (1953)

- The law of organic nature is to bring order and harmony out of chaotic materials of existence
- Nature is a series of balanced ecosystems – the basic functional unit of ecology, and so a need for a unified theory of the ecosystem [a pond, a watershed, a meadow]
- Rather than climax stage he used "mature ecosystem" – the ecosystem was often disturbed but fluctuated around a single homeostatic point = health = stability/equilibrium
- Humans the Great Disrupters



By the 1960s, these scientific beliefs are questioned…



1. But is an ecosystem a reality or an abstraction?
2. Are ecosystems inherently stable?
3. How does disruption fit in?
4. How do the great disrupters – Humans - fit in?

How do the great disrupters – Humans - fit in?

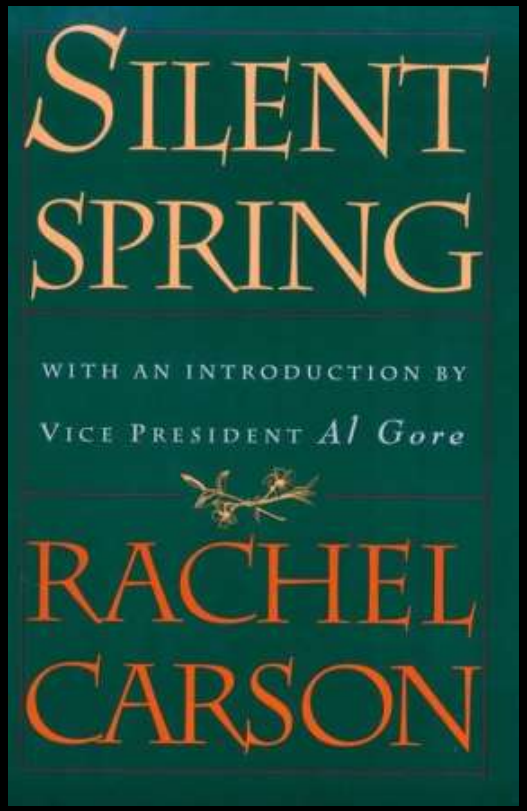
The Emergence of Environmental Science from Ecology

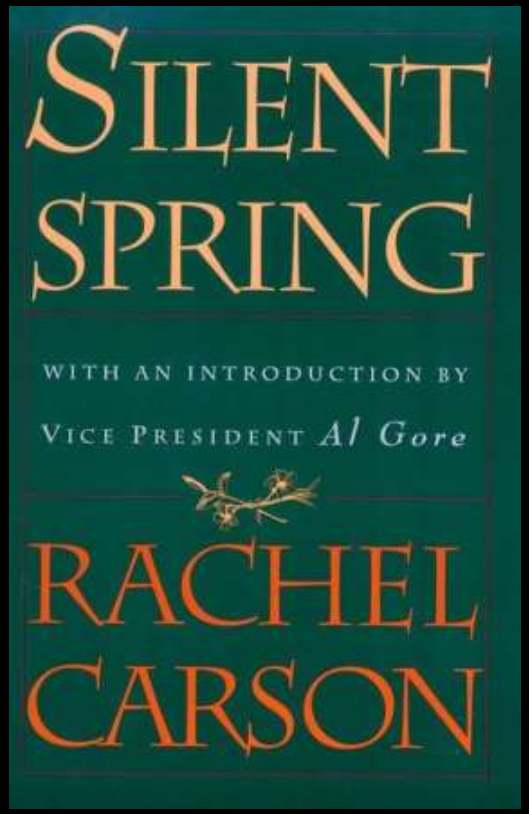
"One of the most spectacular fish kills of recent years occurred in the Colorado River below Austin, Texas, in 1961. Shortly after daylight on Sunday morning, January 15, dead fish appeared in the new Town Lake in Austin and in the river for a distance of about 5 miles below the lake. None had been seen the day before. On Monday there were reports of dead fish 50 miles downstream. ... By January 21, fish were being killed 100 miles downstream...

investigators in Austin noticed an odor associated with the insecticides .... The manager of the (chemical) plant admitted that quantities of powdered insecticide had been washed into the storm sewer recently and, more significantly, he acknowledged that such disposal of insecticide spillage and residues had been common practice for the past 10 years.

.... For 140 miles downstream from the lake the kill of fish must have been almost complete, for when seines were used later in an effort to discover whether any fish had escaped they came up empty. Dead fish of 27 species were observed, totaling about 1000 pounds to a mile of riverbank."

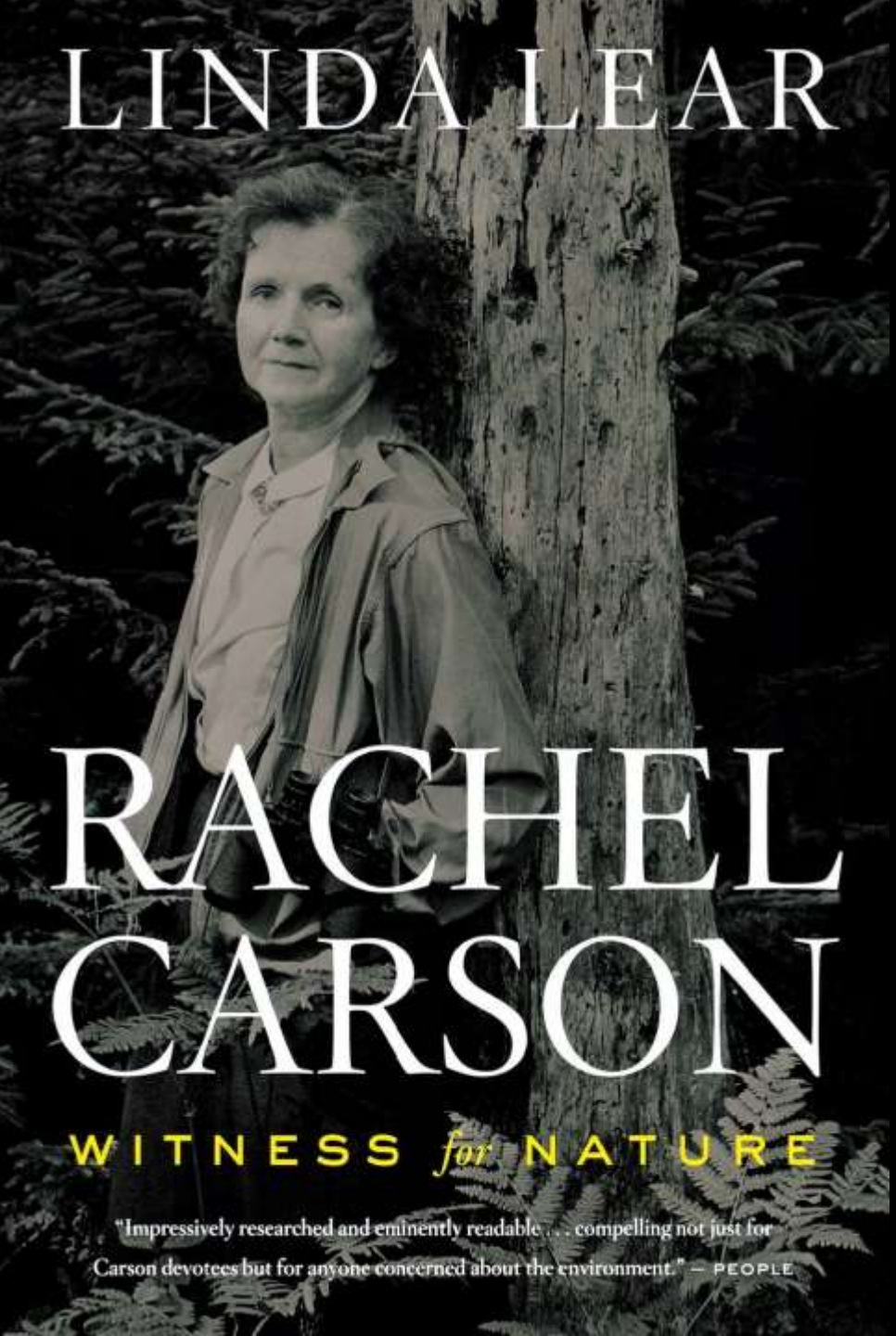
Rachel Carson, 1962, *Silent Spring*





Rachel Carson
And
The Politics of Nature

"In nature nothing exists alone."
— Rachel Carson, *Silent Spring*



Rachel Carson 1907-1964

Born in Springdale, Pennsylvania and grew up simply in the rural river town of Springdale, Pennsylvania. Her mother bequeathed to her a life-long love of nature and the living world that Rachel expressed first as a writer and later as a student of marine biology.

Carson graduated from Pennsylvania College for Women (now Chatham University) in 1929, studied at the Woods Hole Marine Biological Laboratory, and received her MA in zoology from Johns Hopkins University in 1932.

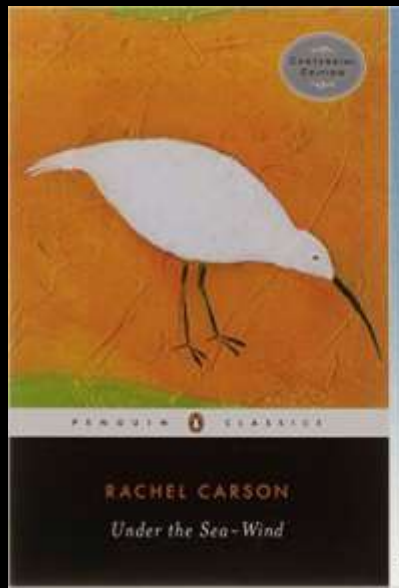
The Scientist

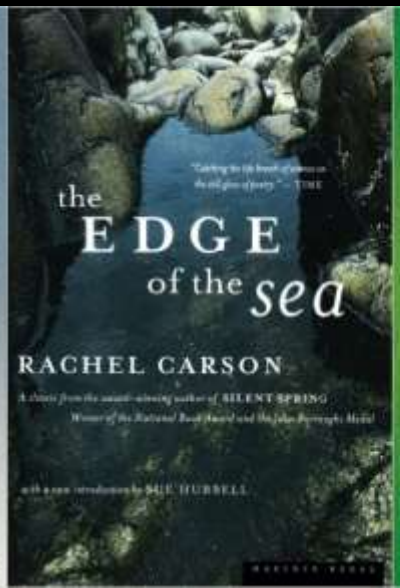
In 1935, she was hired part-time by the U.S. Bureau of Fisheries to write radio scripts during the Depression and supplemented her income writing feature articles on natural history for the Baltimore Sun.

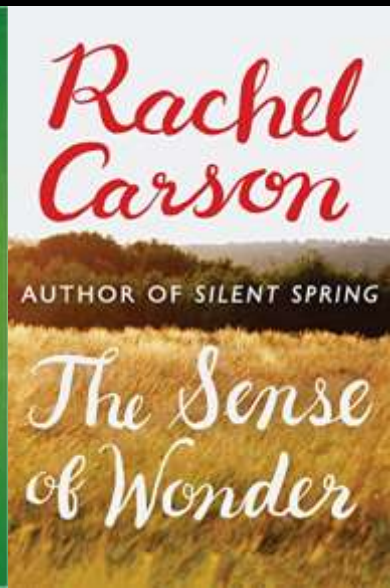
In 1936, she became the second woman hired by the Bureau of Fisheries for a full-time professional position, as an aquatic biologist. She had a fifteen-year career in the federal service as a scientist and editor in 1936 and rose to become Editor-in-Chief of all publications for the U. S. Fish and Wildlife Service.

Under the Sea-Wind (1941)
The Sea Around Us (1951) National Book Award
The Edge of the Sea (1955)
Silent Spring (1962)
The Sense of Wonder (1965)

In July 1937, the Atlantic Monthly accepted a revised version of an essay, “The World of Waters”, that she originally wrote for her first fisheries bureau brochure. Her supervisor had deemed it too good for that purpose. The essay, published as “Undersea”, was a vivid narrative of a journey along the ocean floor. Publishing house Simon & Schuster, impressed by Undersea, contacted Carson and suggested that she expand it into a book. Several years of writing resulted in *Under the Sea Wind* (1941), which received excellent reviews but sold poorly.





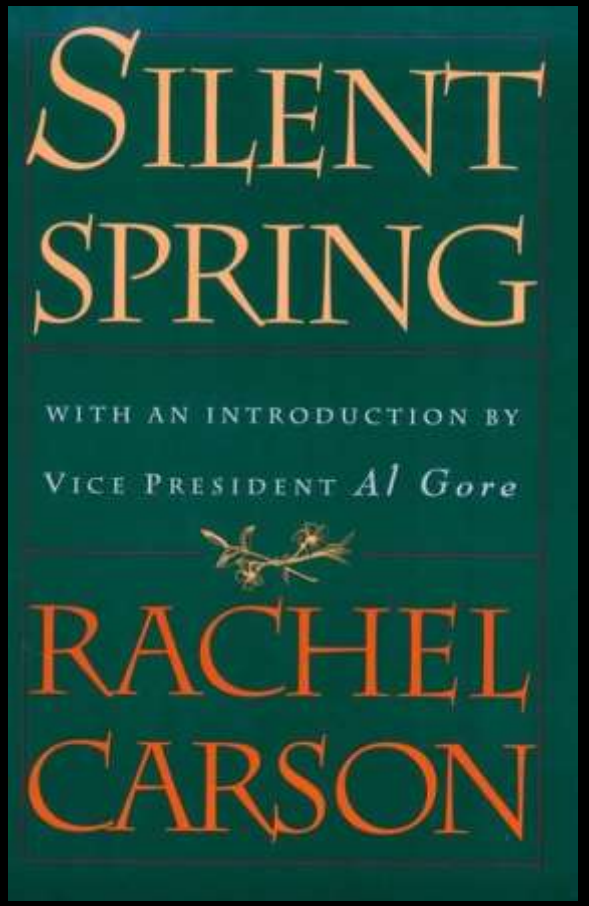


Rachel Carson 1907-1964

Miss Rachel Carson's reference to the selfishness of insecticide manufacturers probably reflects her Communist sympathies, like a lot of our writers these days. We can live without birds and animals, but, as the current market slump shows, we cannot live without business. As for insects, isn't it just like a woman to be scared to death of a few little bugs! As long as we have the H-bomb everything will be O.K.

—Letter to the editor of the New Yorker

"But man is a part of nature, and his war against nature is inevitably a war against himself."
— Rachel Carson

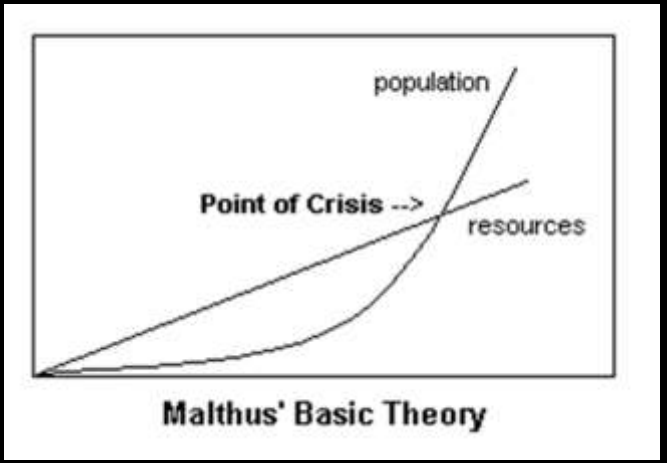


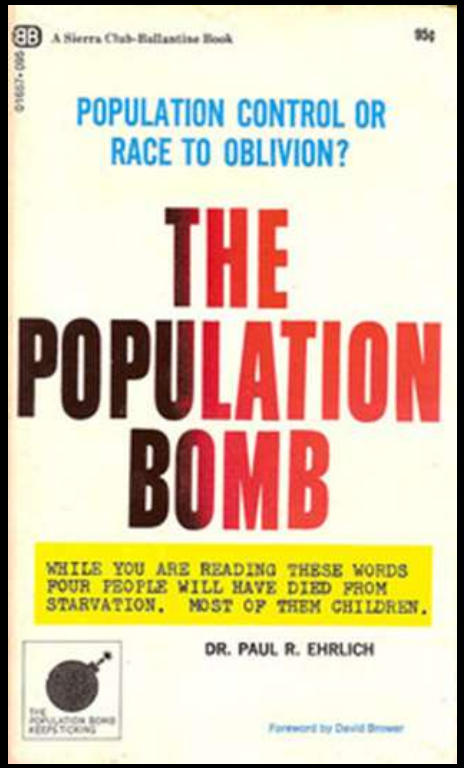
The Neo-Malthusians
Politics of Population

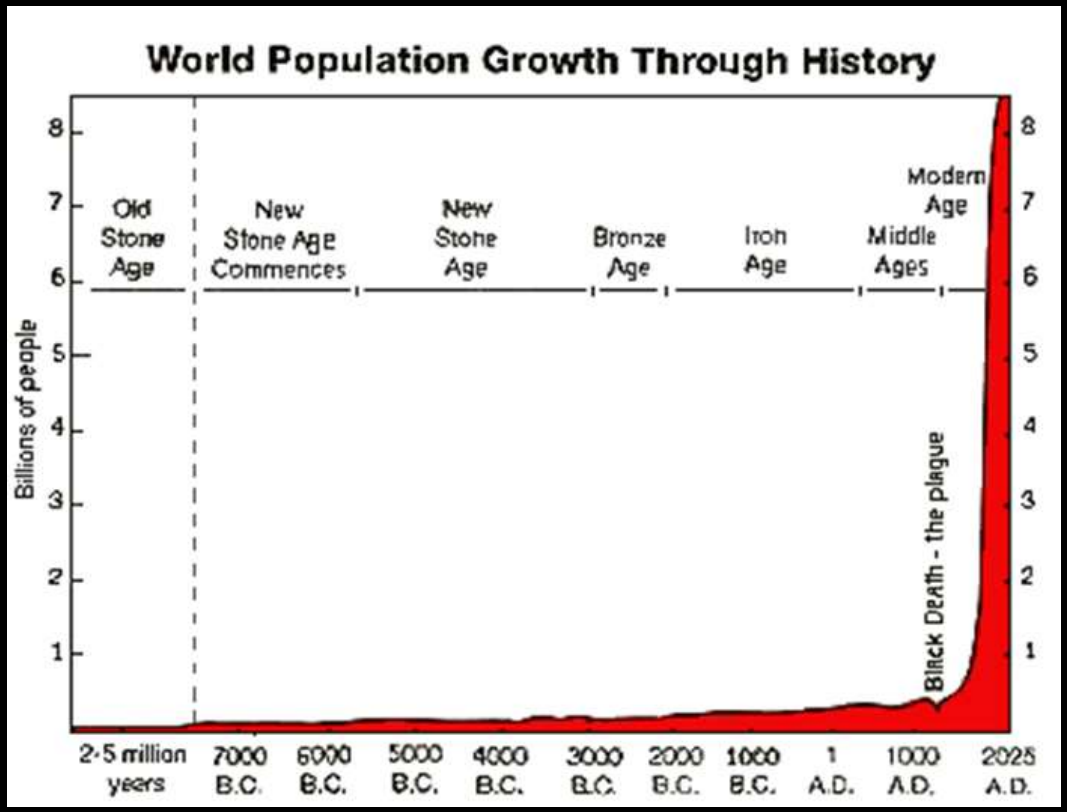
Paul Ehrlich b.1932

The Population Bomb 1968

Population Control







The Neo-Malthusians
The Commons and Politics of Population

Garrett Hardin 1915 -2003 *The Tragedy of the Commons* 1969

The population problem has no technical solution, it requires a fundamental extension in morality.

Hardin's parable involves a pasture "open to all."

"Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons."

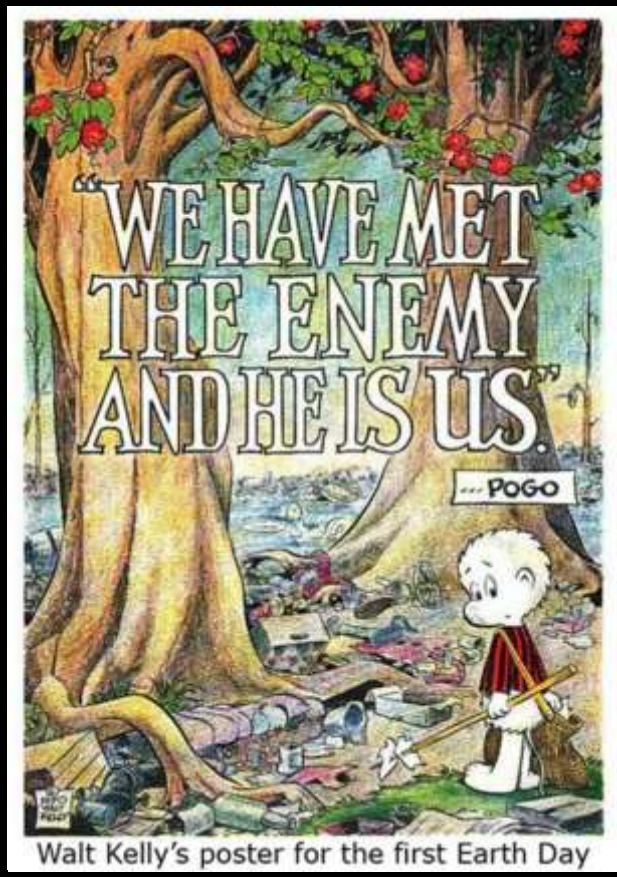
Under conditions of overpopulation, freedom in an unmanaged commons brings ruin to all.

The Environment, Mass Culture, and the Politics of Nature
Earth Day – April 22, 1970

The idea came to Earth Day founder Gaylord Nelson, then a U.S. Senator from Wisconsin, after witnessing the ravages of the 1969 massive oil spill in Santa Barbara, California.

Senator Nelson announced the idea for a "national teach-in on the environment" to the national media; persuaded Pete McCloskey, a conservation Republican Congressman, to serve as his co-chair

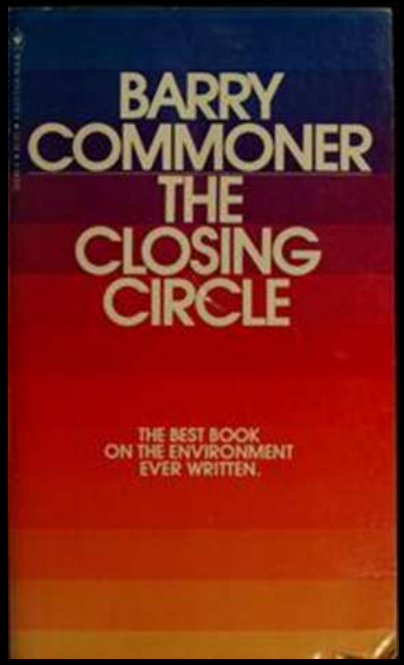
As a result, on the 22nd of April, 20 million Americans took to the streets, parks, and auditoriums to demonstrate for a healthy, sustainable environment in massive coast-to-coast rallies.



Walt Kelly's poster for the first Earth Day

The Environment and the Politics of Nature

Barry Commoner 1917-2012
The Closing Circle 1971



Commoner's 4 Principles

1. Everything is connected to everything else.
2. Everything must go somewhere.
3. Nature knows best.
4. There is no such thing as a free lunch.

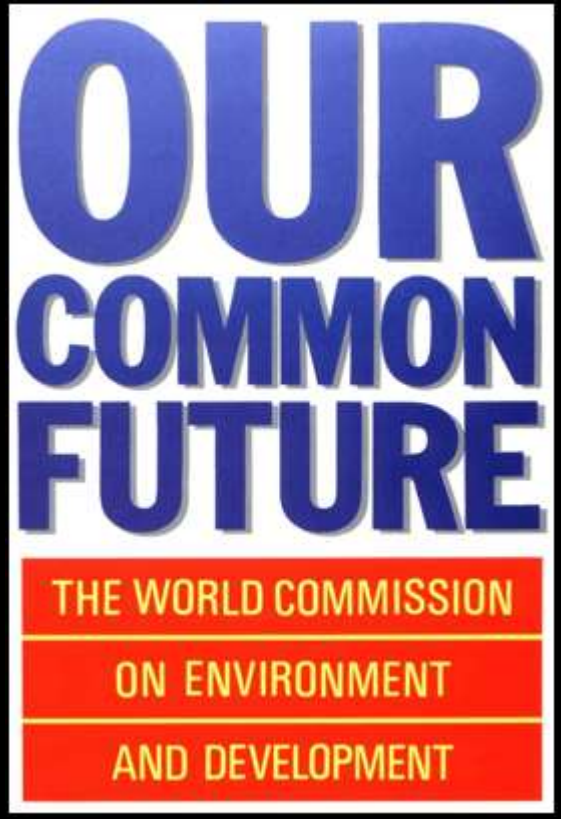
- He had a long-running debate with Ehrlich and his followers, arguing that they were too focused on overpopulation as the source of environmental problems, and that their proposed solutions were politically unacceptable because of the coercion that they implied, and because the cost would fall disproportionately on the poor.

- He believed that technological and, above all, social development would lead to a natural decrease in both population growth and environmental damage

Environmental Equity - Sustainability Defined

Our Common Future, also known as the *Brundtland Report*, from the United Nations World Commission on Environment and Development was published in 1987.

- Sustainable development is defined in the report as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
- Environment – Economy – Equity



"In the middle of the 20th century, we saw our planet from space for the first time. Historians may eventually find that this vision had a greater impact on thought than did the Copernican revolution of the 16th century, which upset the human self-image by revealing that the Earth is not the center of the universe.

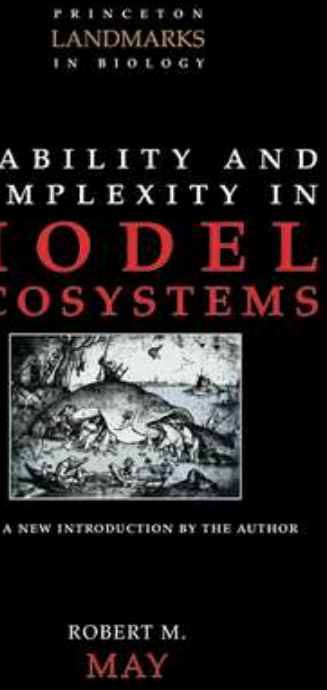
From space, we see a small and fragile ball dominated not by human activity and edifice but by a pattern of clouds, oceans, greenery, and soils. Humanity's inability to fit its activities into that pattern is changing planetary systems, fundamentally. Many such changes are accompanied by life-threatening hazards.

This new reality, from which there is no escape, must be recognized - and managed."

How Does Nature Work?
The New Ecology - No inherent stability

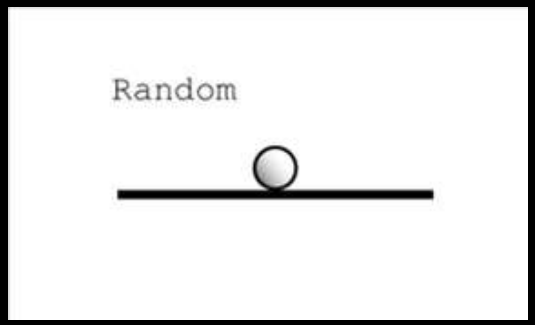
Robert May
Stability and Complexity in Model Ecosystems (1973)

- Mathematical models demonstrate that the more species there were, the more fragile the ecosystem
- Chaos theory and complexity, "Confronted with disturbances beyond their normal experience" complex systems like rainforests tended to crumple.



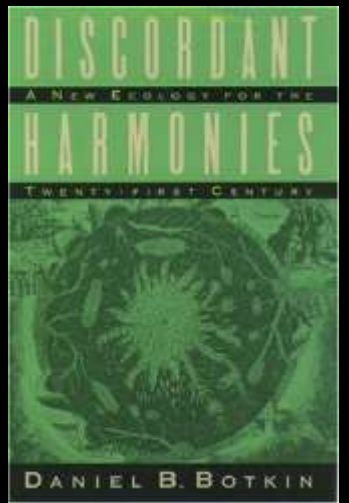
The new ecology emphasizes

- Disequilibria
- Instability
- Chaotic fluctuations

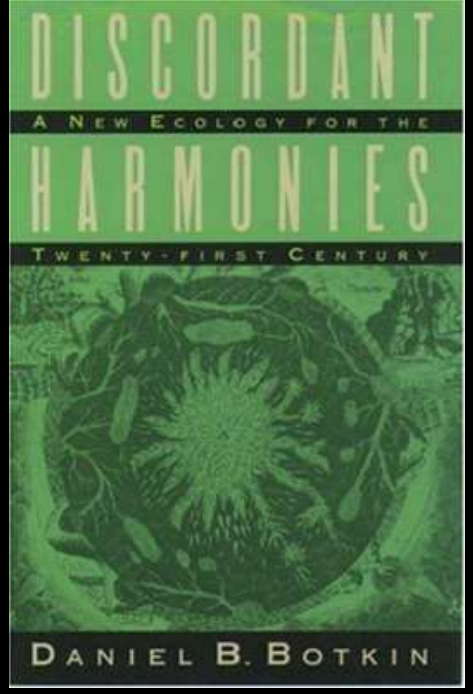


in ecosystems both "natural" and human impacted

If 20th-century ecology was marked by an infatuation with balance, then our era is one of disturbance, disruption, non-equilibrium, chaos, and randomness.
– Daniel Botkin 1990



Discordant Harmonies – Daniel Botkin
The New Ecology and Sustainability?



"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."

- Begin to observe nature as it is, not as we imagine it to be.
- Nature in the 21st Century will be a nature that we make; the question is the degree to which this molding will be intentional or unintentional, desirable or undesirable.
- If nature in the twenty-first century will be a nature that we make, then the guide to action is:

1. our knowledge of living systems and our willingness to observe them for what they are,
2. our commitment to conserve natural areas,
3. to recognize the limits of our actions, and
4. to understand the roles of metaphor and myths in our perceptions of our surroundings.

Harmony vs. Disharmony

The Balance of Nature: Ecology's Enduring Myth 2009

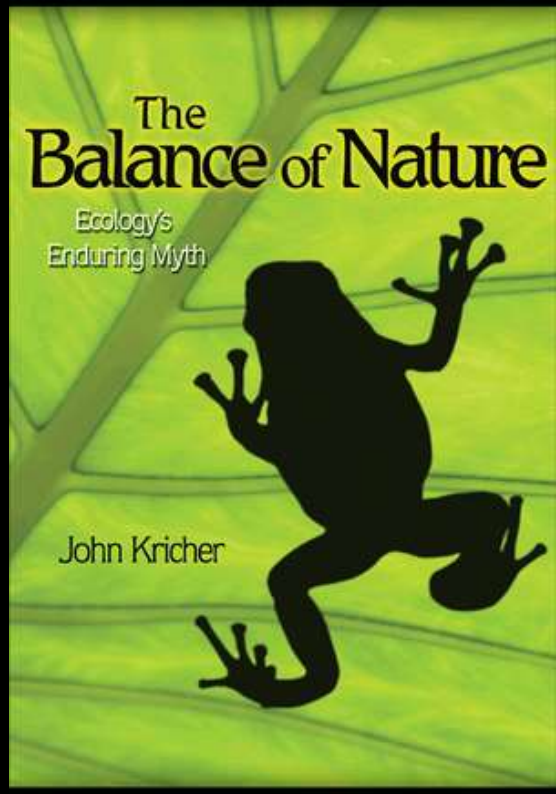
John Kricher

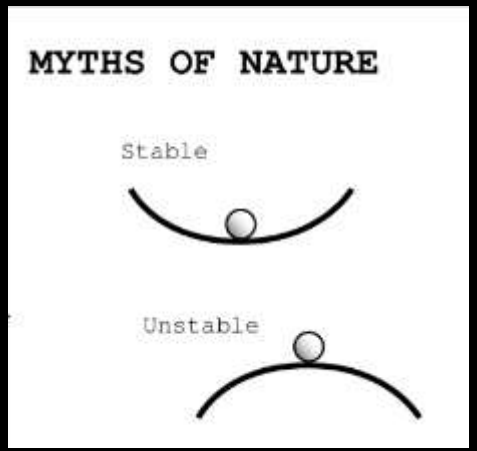
"The existence of a balance of nature has been a dominant part of Western philosophy since before Aristotle.

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.

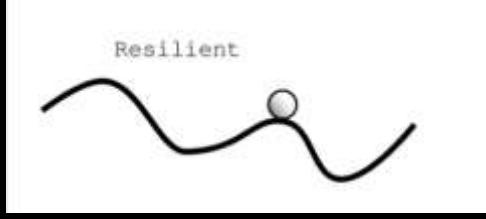
The paradigm is based on belief, not data; it has no scientific merit.

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."





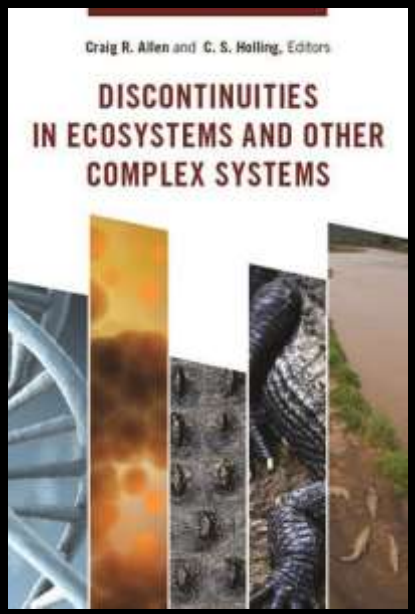
The New Ecology of Change - Ecological Resilience

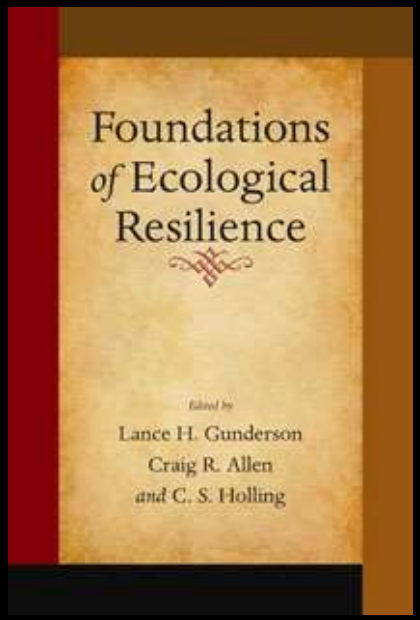


Balance vs. Disequilibrium
Permanence vs. Change
"to discern the constancy of phenomena in the midst of apparent changes."

- 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.
- The general meaning of resilience, derived from its Latin roots 'to jump or leap back', is the ability to recover from or adjust easily to misfortune or change.

Holling, C.S. (1973). "Resilience and stability of ecological systems". Annual Review of Ecology and Systematics 4: 1–23.





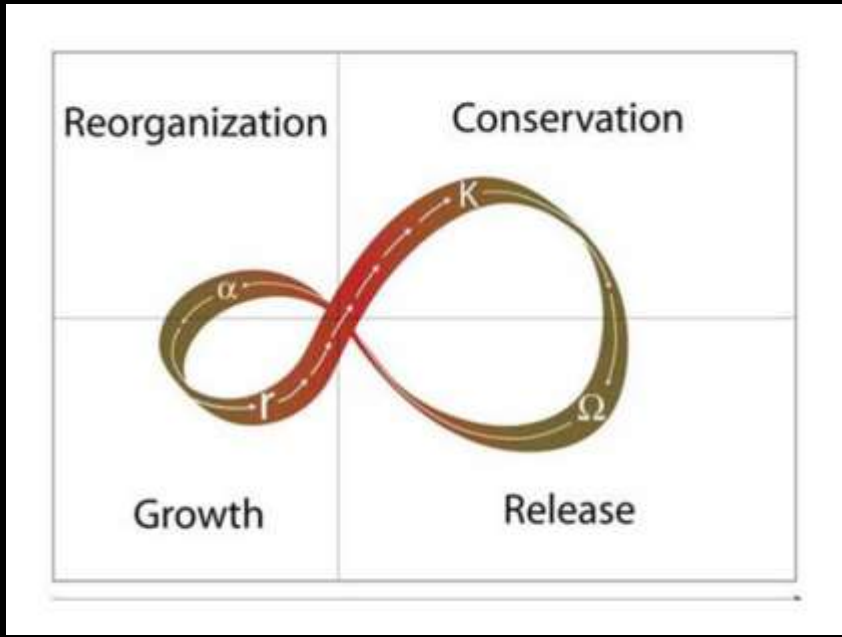
Structured Change – The Adaptive Cycle

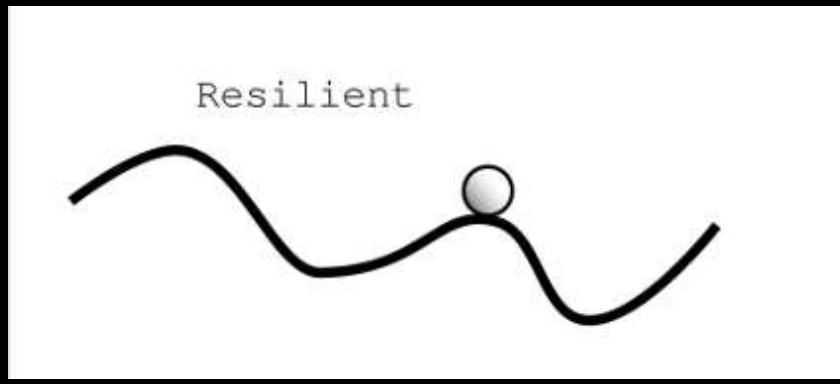
Growth - where species and systems grow and diversify to exploit new opportunities and develop entirely new ecological ways of being.

Conservation - where climax species are tightly connected and organized, and systems stabilize into mature, often hierarchically nested systems, where there is little or no room for innovation or growth.

Release (the "backside" of the mobius strip) - where mature systems destabilize and collapse, and become increasingly discontinuous and chaotic which opens the field for…

Reorganization – where systems return in completely new ways, which creates a new field of conditions and possibilities for the next growth phase

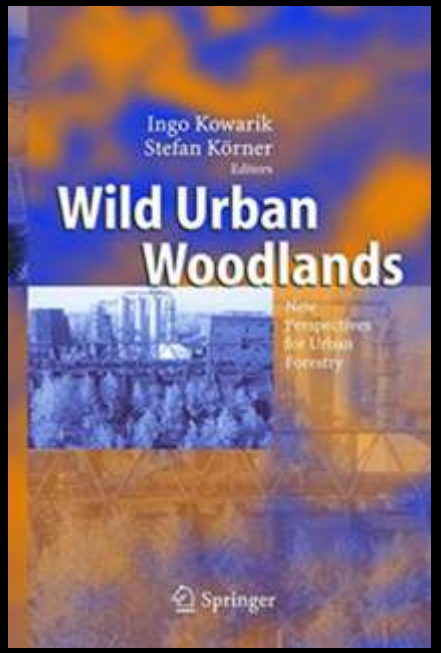




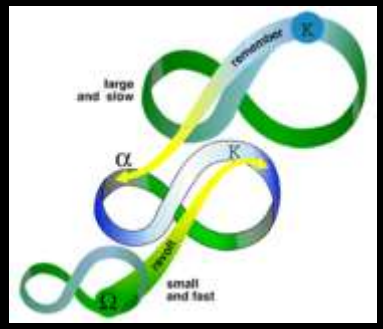
The New Ecology
Permanence and Change

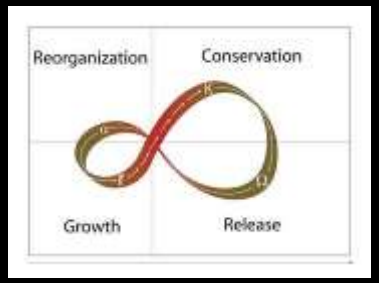
"the reference point is not an original condition of a natural landscape, but rather a condition defined based on the current site potential and the greatest possible degree of self-regulation.

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



2005





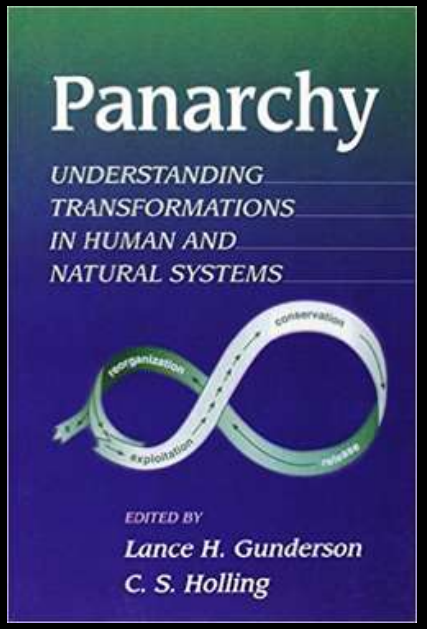
2017

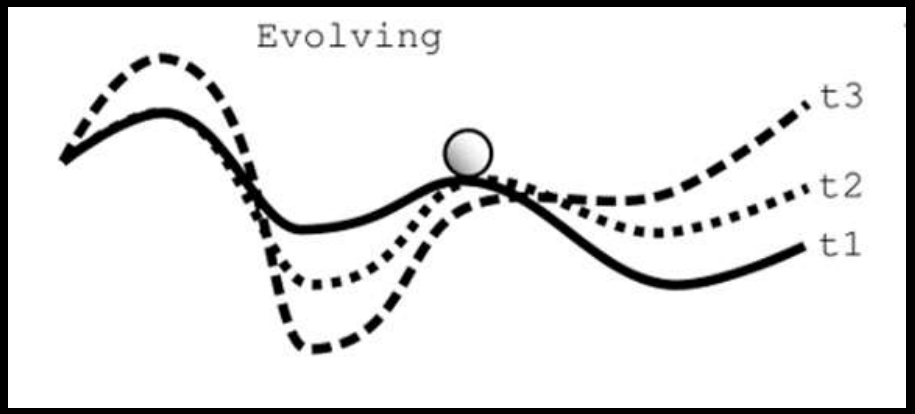
New Myth of Nature: Evolving Nature and Panarchy
A Myth of Permanence and Change

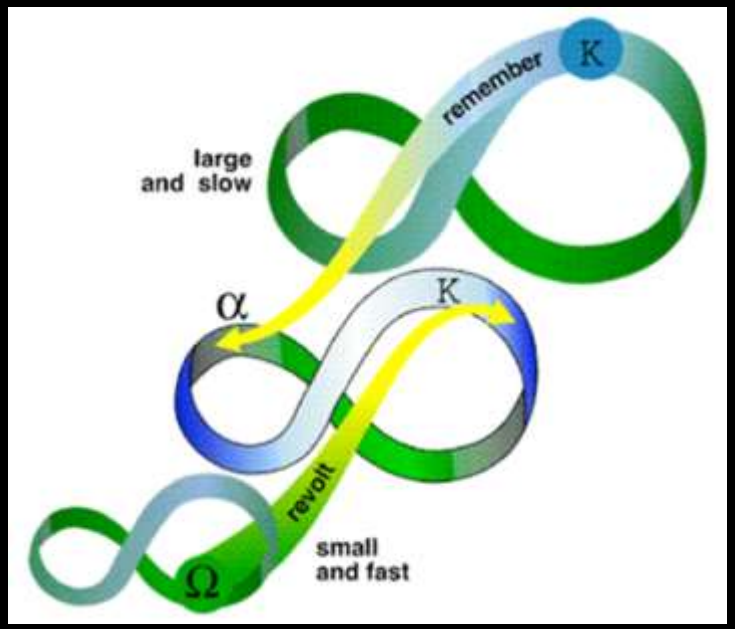
Unpredictable Change and Unintended Consequences

•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.

•Unintended consequences - 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, Environmental Science, and Socio-Ecological Systems

We define resilience, formally, as the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks - and therefore the same identity.

The basic concepts are:

- non-linearity, alternate regimes and thresholds
- adaptive cycles
- multiple scales and cross-scale effects - "panarchy"
- adaptability
- transformability
- general versus specified resilience

The Nature Conservancy
Protecting nature. Preserving life.™

http://www.resalliance.org

Resilience Alliance
research on resilience in social-ecological systems - a basis for sustainability

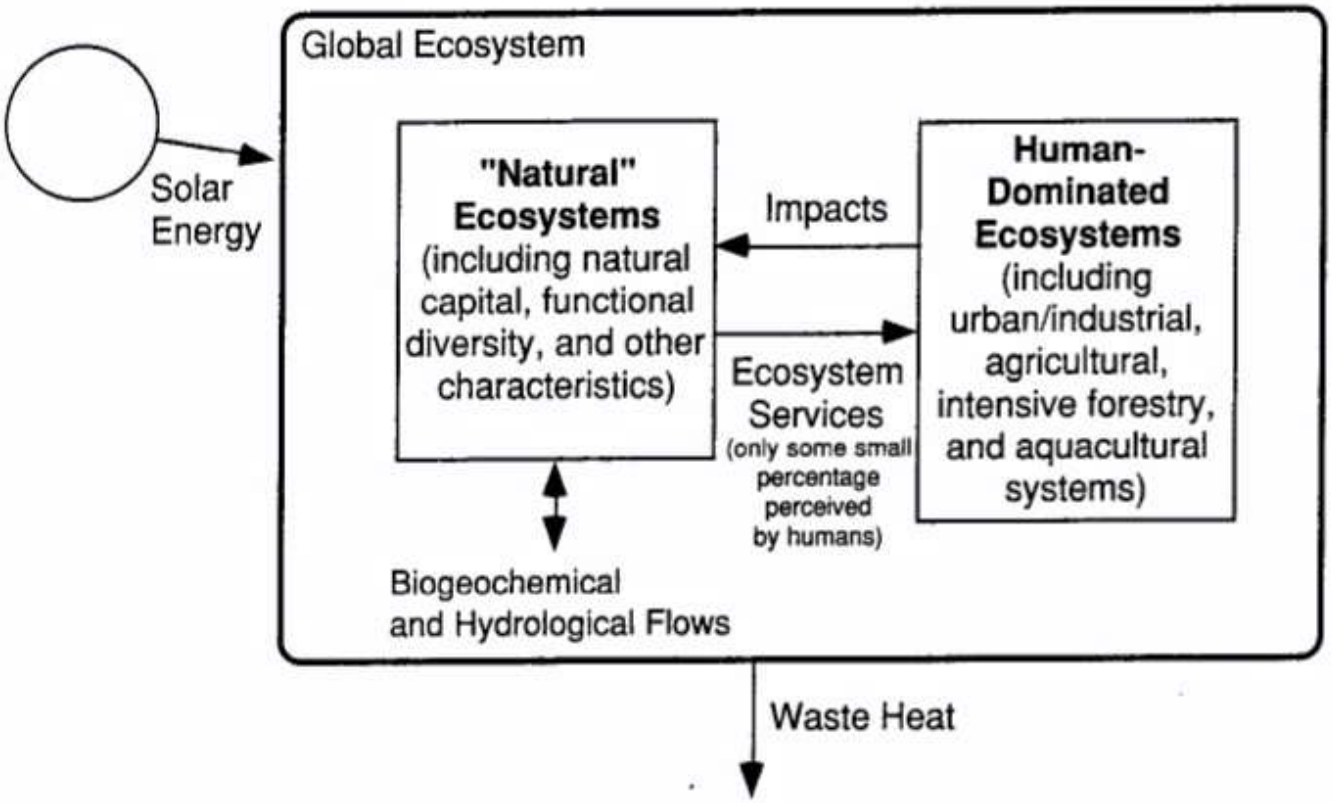
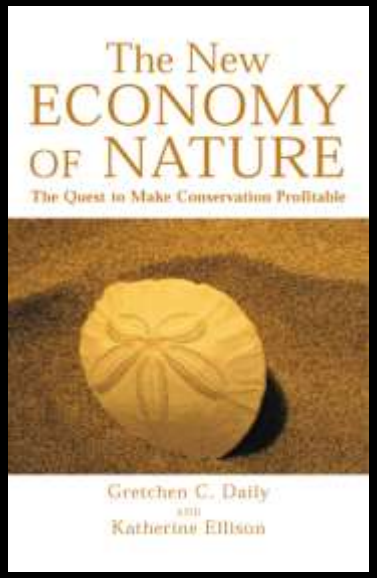


Figure 4.1. Human-dominated ecosystems are parts of the overall global system. Ecosystem services are essential for the development and well-being of human society, but only a fraction of this work is covered by market prices or perceived by humans.

From Daily, *Nature's Services* 1997

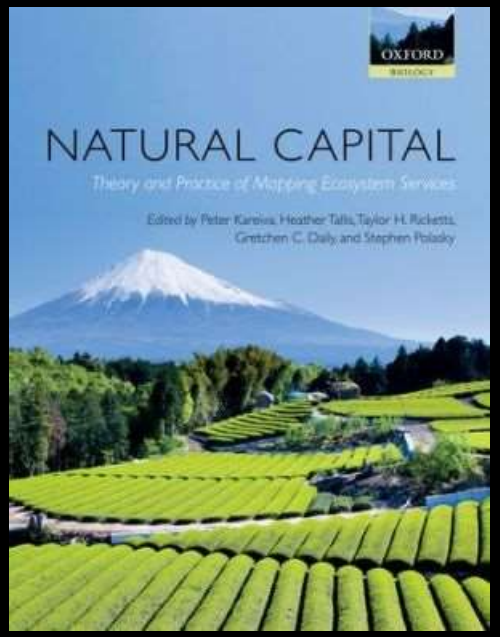


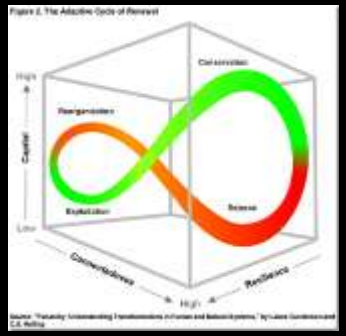
Environmental Science – the Biogeochemical Earth

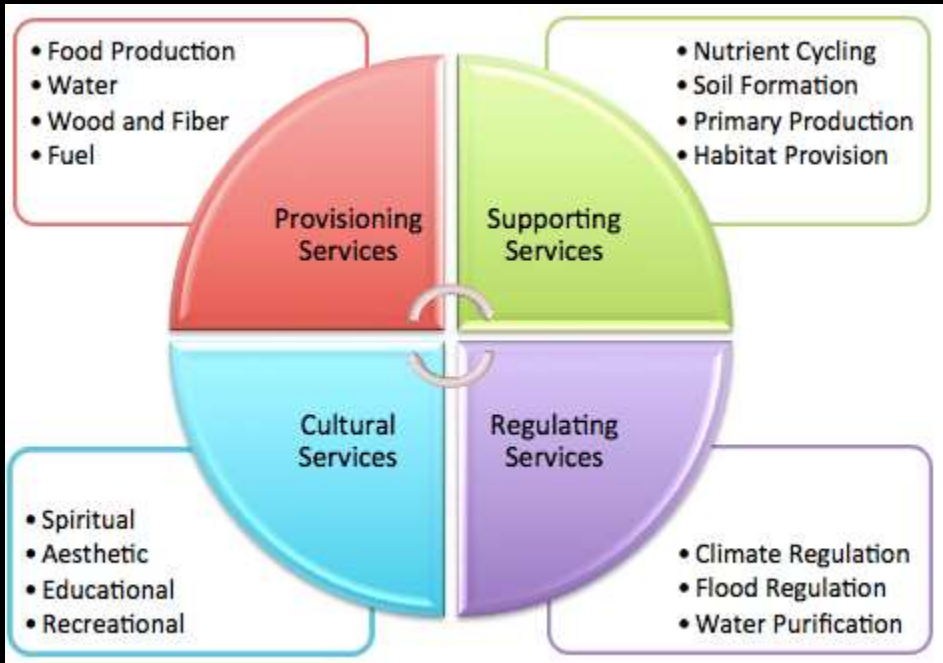
Ecosystem Services - Socioecological Systems and Human-Nature Symbiosis

Ecosystem Services

- Maintenance of atmosphere
- Protection from ultraviolet rays
- Regulation of climate
- Maintenance of genetic diversity
- Purification of air and water
- Detoxification and decomposition of wastes
- Generation of soil and renewal of soil fertility
- Pollination of vegetation
- Control of agricultural pests
- Dispersal of seeds
- Translocation of nutrients







Source: Millenium Ecosystem Assessment, 2005.

Global Change and Environmental Science

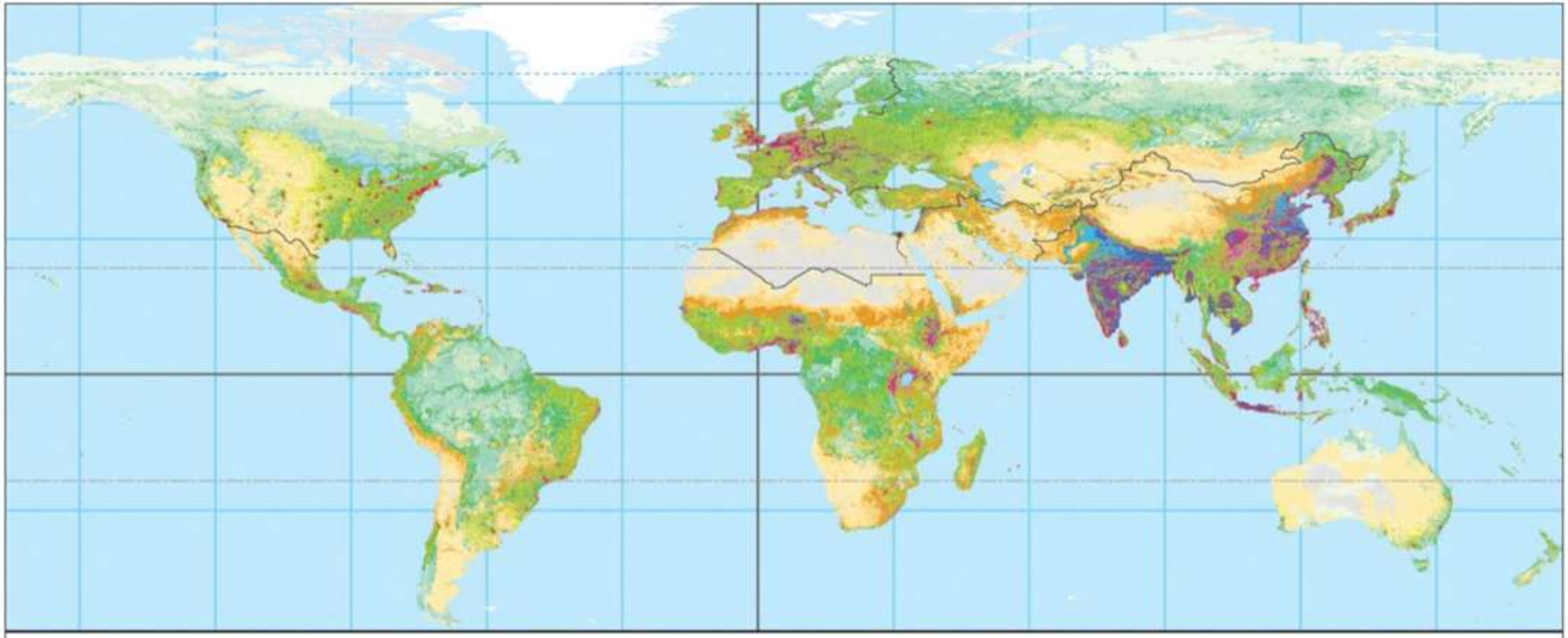
Anthropocene – the Age of Humans

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 and indirectly impacted ecosystems.

These processes include species introduction and domestication, population management and harvest, the tillage transport and cover of soils by impervious structures, fossil fuel combustion, irrigation and the fertilization of ecosystems with nitrogen, phosphorus and other limiting nutrients.



Anthropogenic biomes: legend

Dense settlements
- 11 Urban
- 12 Dense settlements

Villages
- 21 Rice villages
- 22 Irrigated villages
- 23 Cropped and pastoral villages
- 24 Pastoral villages
- 25 Rainfed villages
- 26 Rainfed mosaic villages

Croplands
- 31 Residential irrigated cropland
- 32 Residential rainfed mosaic
- 33 Populated irrigated cropland
- 34 Populated rainfed cropland
- 35 Remote croplands

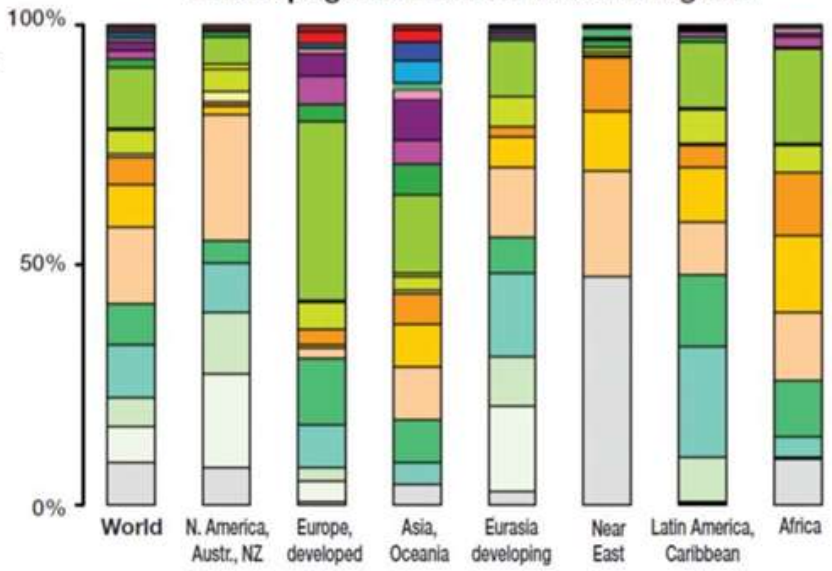
Rangelands
- 41 Residential rangelands
- 42 Populated rangelands
- 43 Remote rangelands

Forested
- 51 Populated forests
- 52 Remote forests

Wildlands
- 61 Wild forests
- 62 Sparse trees
- 63 Barren

Region boundary

Anthropogenic biomes: % world regions

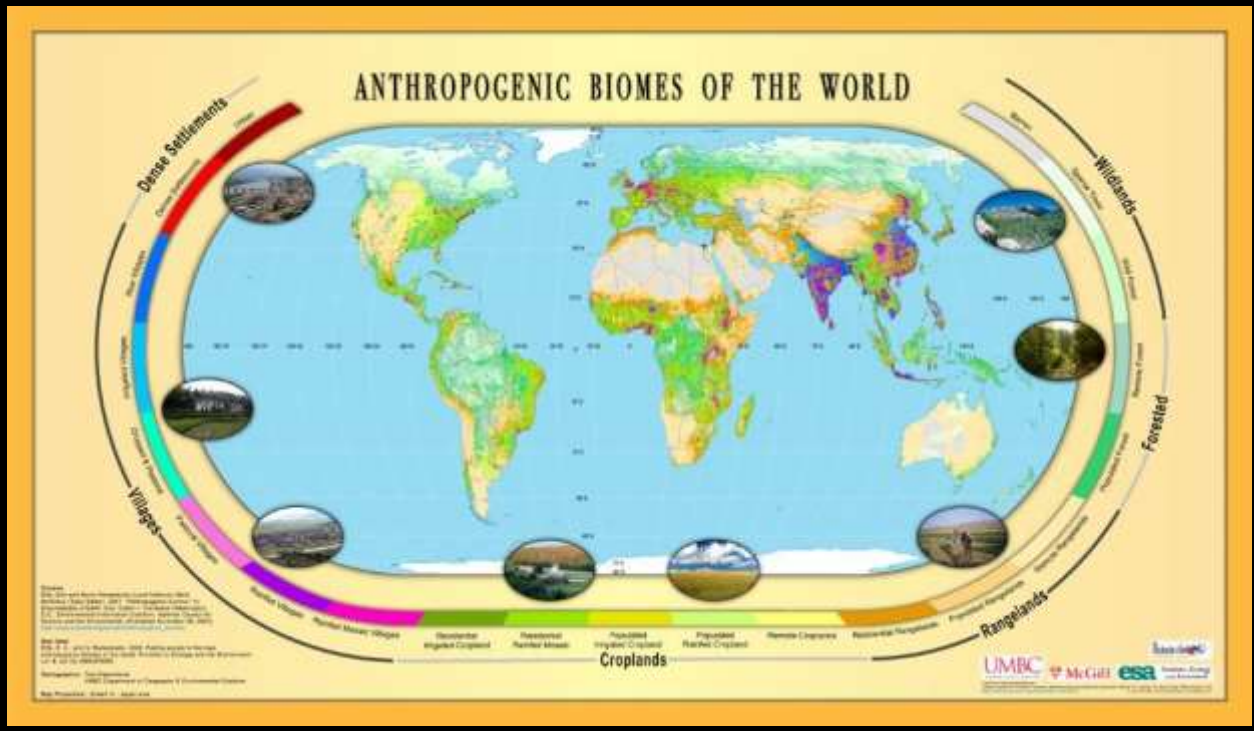


Envisioning the Changing Socioecological Earth
Humans as part of Nature

"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'.

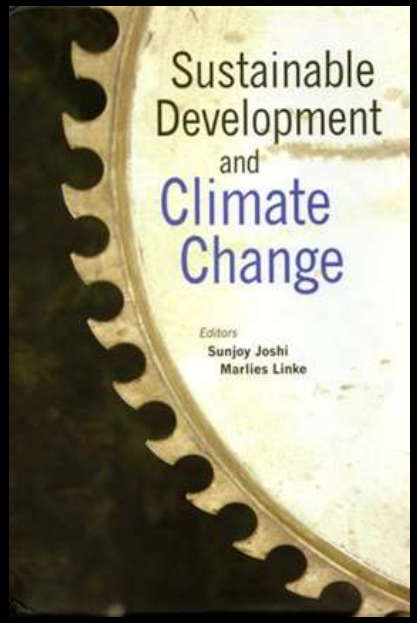
Anthropogenic biomes tell a completely different story, one of 'human systems, with natural ecosystems embedded within them'. This is no minor change in the story we tell our children and each other. Yet it is necessary for sustainable management of the biosphere in the 21st century." Erle Ellis

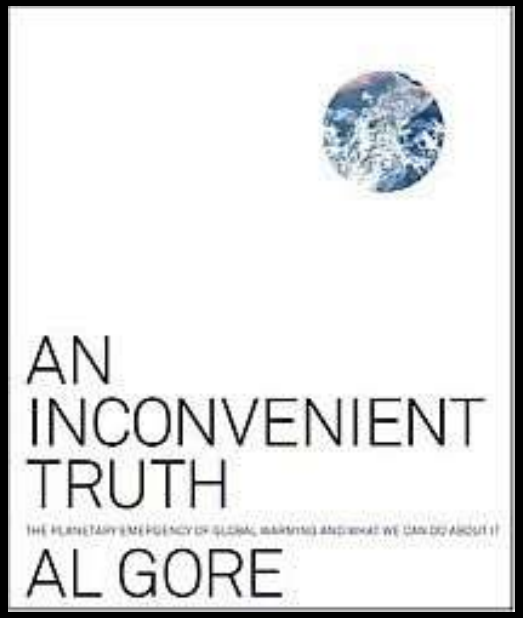
http://ecotope.org/ Dr. Erle Ellis

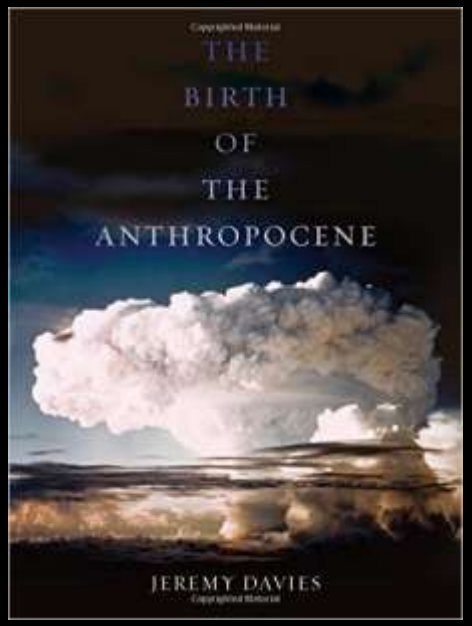


YOU CONTROL CLIMATE CHANGE.

TURN DOWN. SWITCH OFF. RECYCLE. WALK. CHANGE

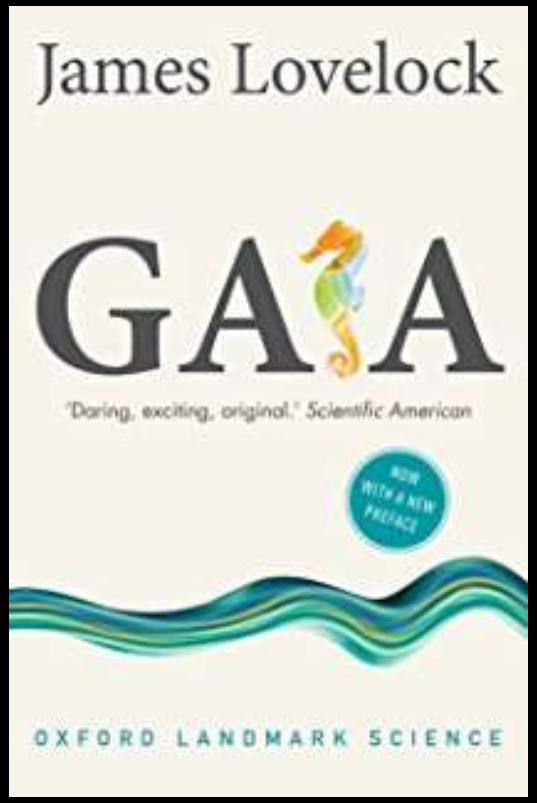


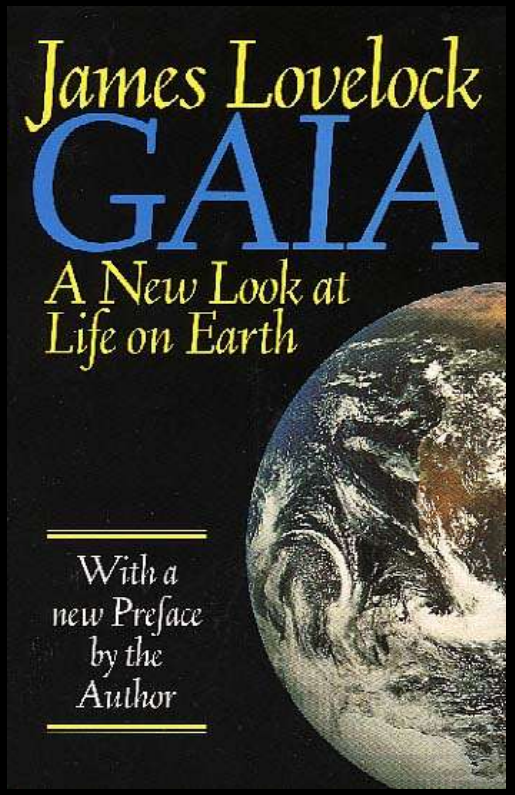




Environmental Science, Sustainability, and New Metaphors
Gaia – James Lovelock

James Lovelock's Gaia hypothesis – that the biosphere acts like a living organism, one that self-regulates to keep conditions just right for life



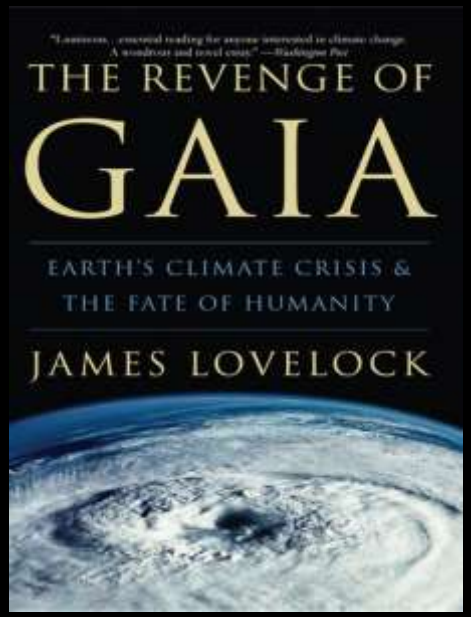


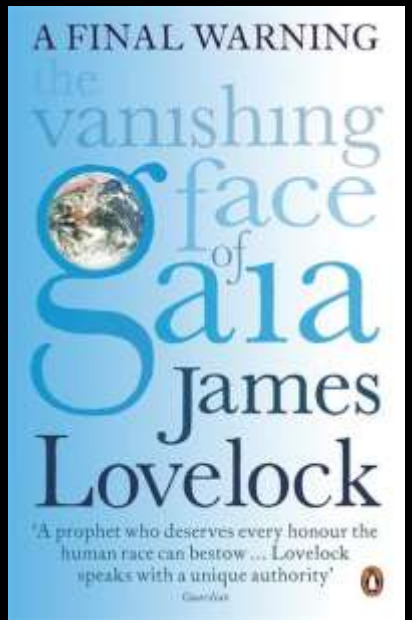
Environmental Science, Sustainability, and New Metaphors - Sustainable Retreat
Gaia – James Lovelock

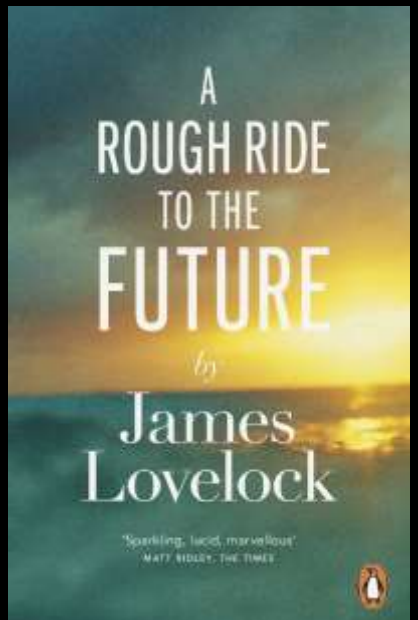
Lovelock thinks the time is past for sustainable development, and that we have come to a time when development is no longer sustainable. Therefore, we need to retreat.

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, he says, 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."

The concept of sustainable retreat emphasized a pattern of resource use that aims to meet human needs with lower levels and/or less environmentally harmful types of resources.





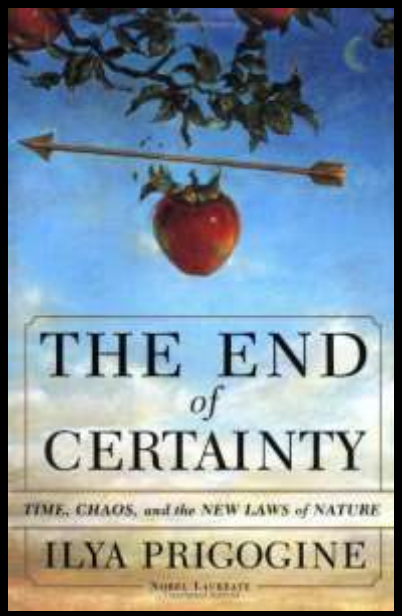


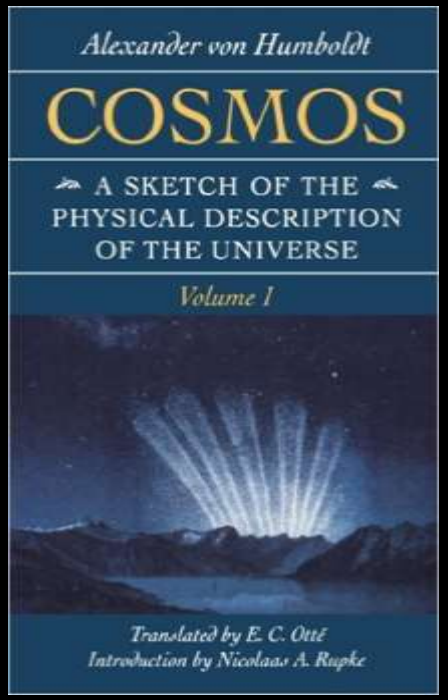
Humanity's Limitations in Comprehending The Cosmos

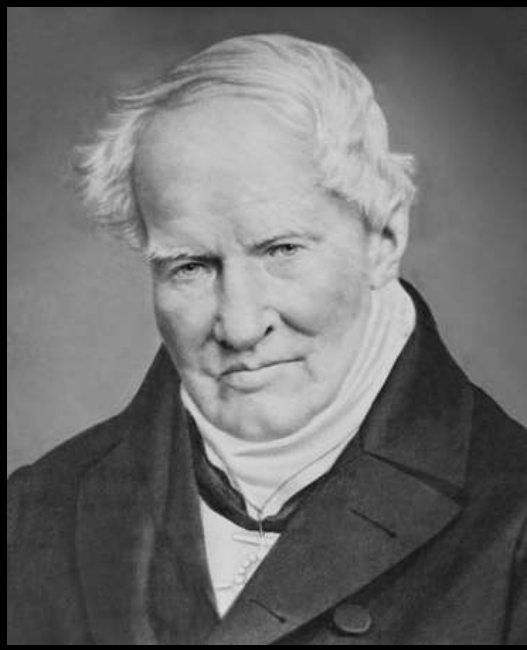
<u>to discern the constancy of phenomena in the midst of apparent changes."</u>

"The attempt perfectly to represent unity in diversity must …necessarily prove unsuccessful…If nature be illimitable in extent and contents, it likewise presents itself to the human intellect as a problem which cannot be grasped, and whose solution is impossible."

The Universe is wider than our views of it.
- Henry David Thoreau







Cosmos - “a beautifully ordered and harmonious system”