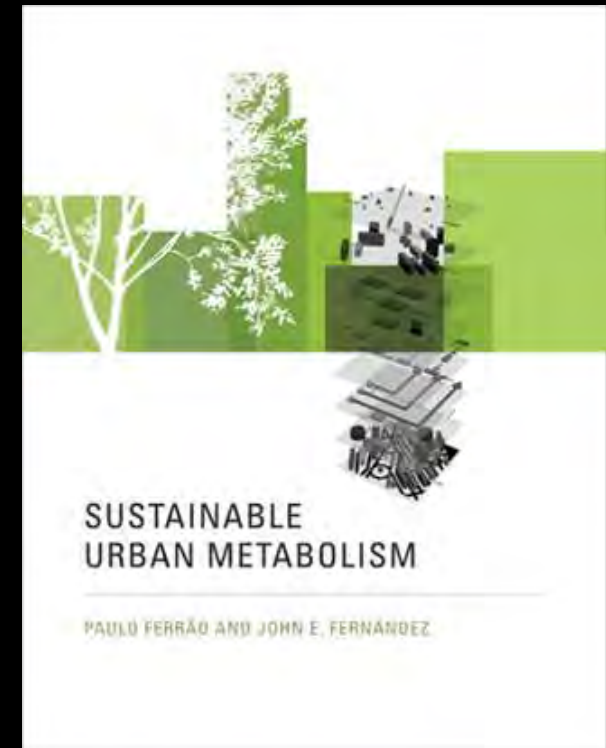
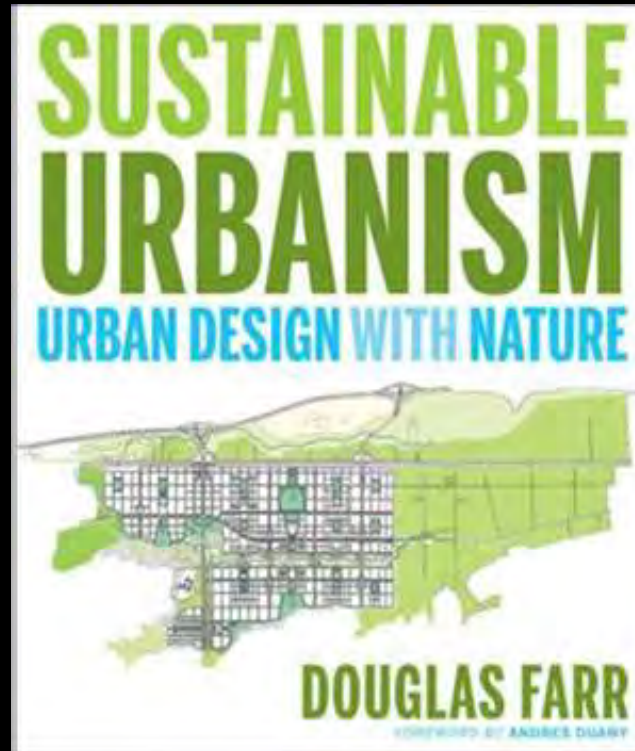
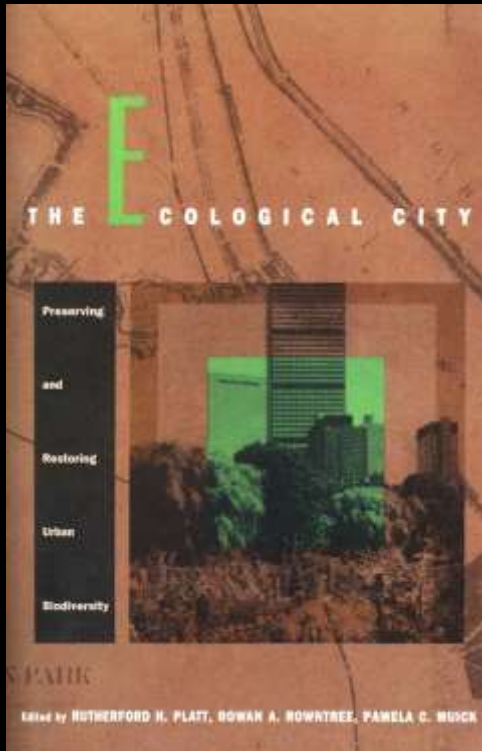




The Ecological City: Sustainability, Ecology, and Urban Metabolism



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

The Ecological City

Nature and Culture

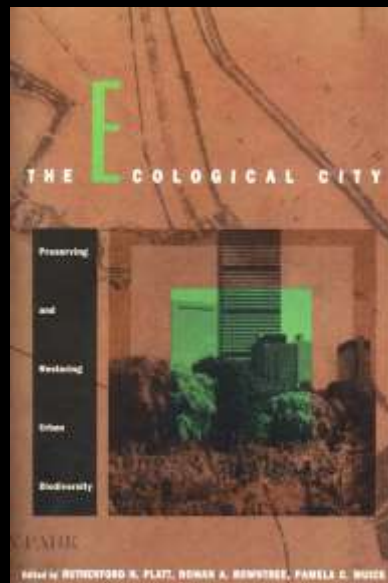
Are cities part of Nature?

Urban Design and Management

Sustainable?

Narratives of Urban Nature

- Redemptive
- Restorative
- Functional



What it means - The Problem of Urban Nature

- In American cities, we perceive nature in the urban landscape filtered through a conceptual framework that prejudices its ecological and cultural value.
- Our understanding of what constitutes good urban nature in American cities is shaped by culturally dominant metaphors of nature.

Wilderness

Pastoral

Urban Nature?



“Established Notions of Nature” and Urban Nature

“Urban nature is not sublime...There’s too much sterility in the form of roofs and pavement, and, oddly enough, there’s also too much wildness, too many weeds and wooded borders and tangled banks, not to mention vacant lots going to brush.

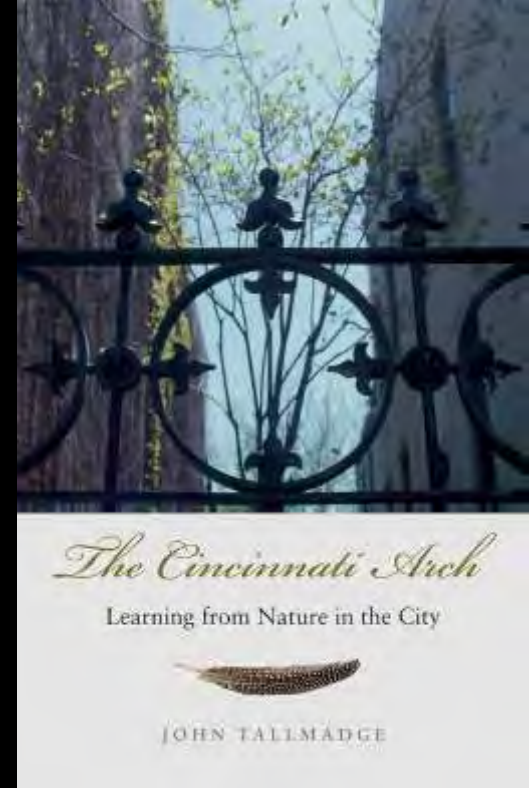
Of course, “wilderness” won’t do to describe such landscapes either. Despite the degree of wildness, there’s too much human impact, too many alien species, too few large animals to meet the legal and cultural criteria.

The fact is that urban landscapes are just too mixed up, chaotic, and confused to fit our established notions of beauty and value in nature.

Maybe it’s not really nature at all, not a real ecosystem, just a bunch of weeds and exotics mixed up with human junk.”

John Tallmadge

The Cincinnati Arch: Learning from Nature in the City (2004)



Established Notions of Nature

Classical Western Ideas of Nature

Iterative Natures

1. First nature - wilderness or pristine (untrammelled by humans) the realm of the gods or “primitive” humans
2. Second nature – pastoral arcadia – farms, gardens
3. Third nature – Renaissance geometrical gardens



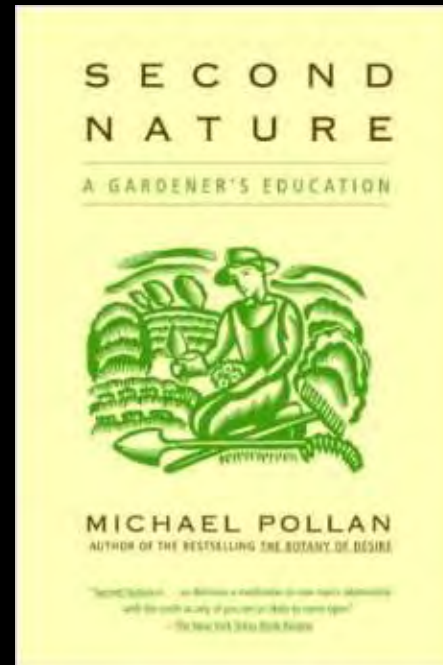
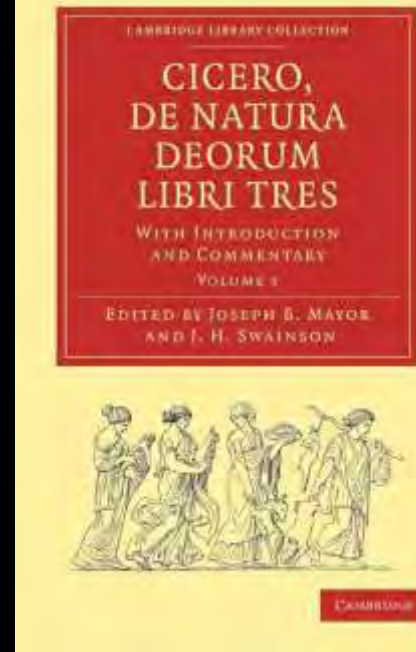
The illustration shows a distant mountain (first nature) giving way to cultivated agricultural land (second nature) and then a formal garden (third nature).

Frontispiece to l'Abbé de Vallemont's *Curiositez de la nature et de l'art* (1705)

Second Nature – The Pastoral – Humanizing Nature

Cicero *De natura deorum* (45BC)

“We enjoy the fruits of the plains and of the mountains, the rivers and the lakes are ours, we sow corn, we plant trees, we fertilize the soil by irrigation, we confine the rivers and straighten or divert their courses. In fine, by means of our hands we essay to create as it were a ***second world within the world of nature.***”



Myth/Narrative - The Pastoral and The Garden

Harmony and Innocence within the Garden Wall

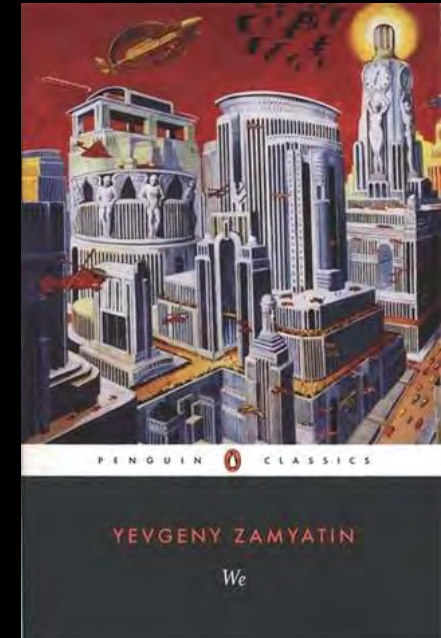


What Nature Means - Wild Nature and The City Irrational, Ugly Nature vs. Urban Modernity

“Oh, how great and divinely limiting is the wisdom of walls. This Green Wall is, I think, the greatest invention ever conceived.

Man ceased to be a wild animal the day he built the first wall; Man ceased to be a wild man only on the day when the Green Wall was completed, when, by this wall we isolated our machine-like, perfect world from the irrational, ugly world of trees, birds, and beasts.”

- Eugene Zamyatin, *We* (1921)



Negative Second Nature – The Death of Nature and The Urban

“Nature, destroyed as such, has already had to be reconstructed at another level, the level of ‘second nature’ i.e. the town and the urban.

The town, anti-nature or non-nature and yet second nature, heralds the future world, the world of the generalized urban.

Nature...dies. It gives way to produced space, to the urban.”

(1974)



THE PRODUCTION OF
SPACE

Henri Lefebvre



TRANSLATED BY
DONALD NICHOLSON-SMITH

Thoreau, the City, and the Tonic of Nature

“The West of which I speak is but another name for the Wild; and what I have been preparing to say is, that in Wildness is the preservation of the world.

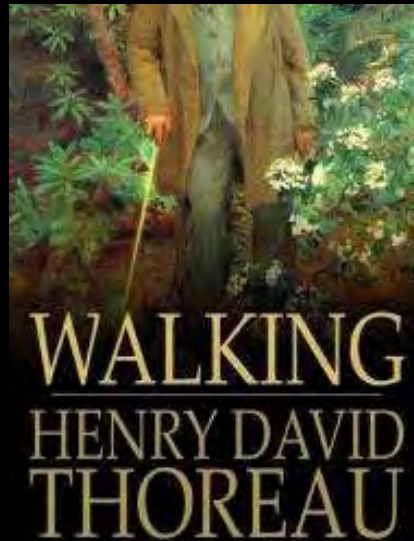
Every tree sends its fibers forth in search of the Wild. ***The cities import it at any price.*** Men plow and sail for it. From the forest and wilderness come the tonics and barks which brace mankind.

Hope and the future for me are not in lawns and cultivated fields, not in towns and cities...”

The Transcendentalist concept of nature as a tonic for the urban dis-ease



1817-1862



(1862)

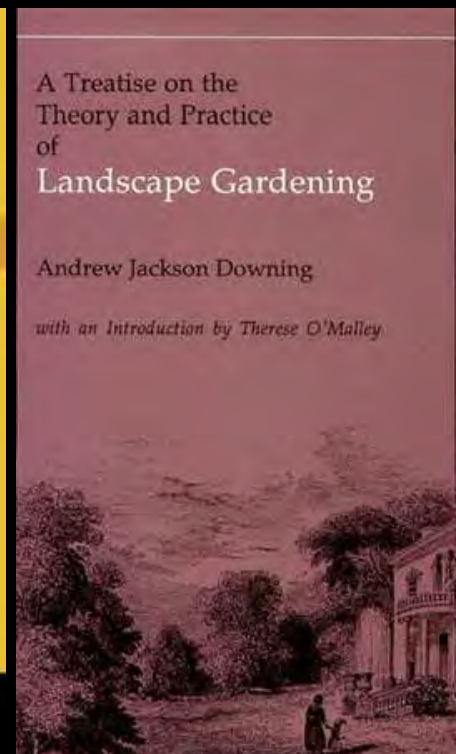
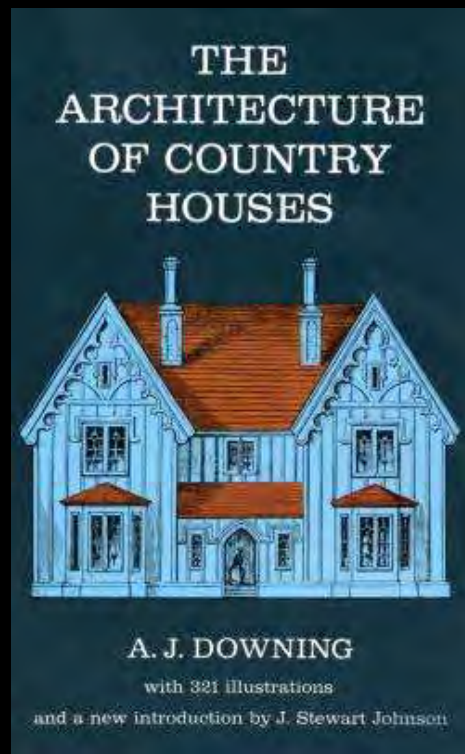
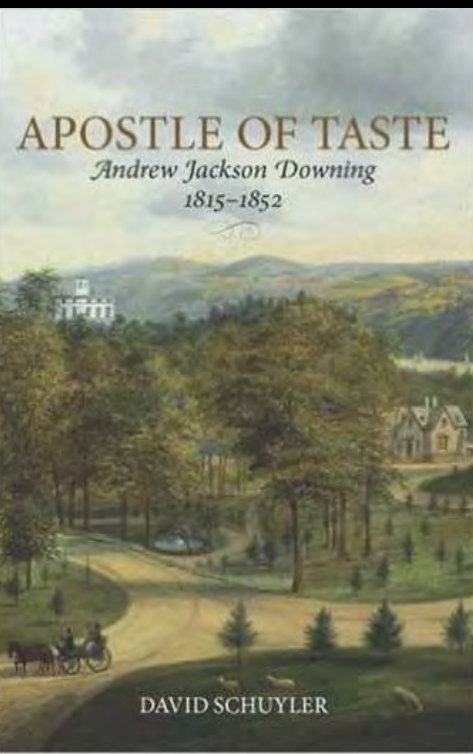
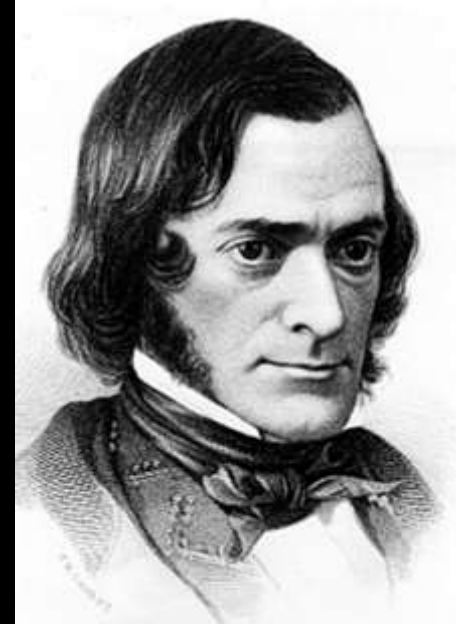


The Cure – Import Nature at Any Price

Andrew Jackson Downing 1815-1852

A Treatise on the Theory and Practice of Landscape Gardening, Adapted to North America (1841) it was the first book of its kind published in the United States.

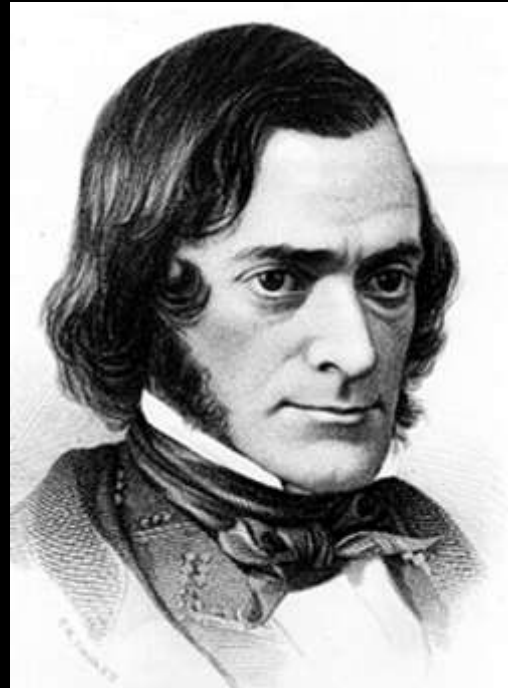
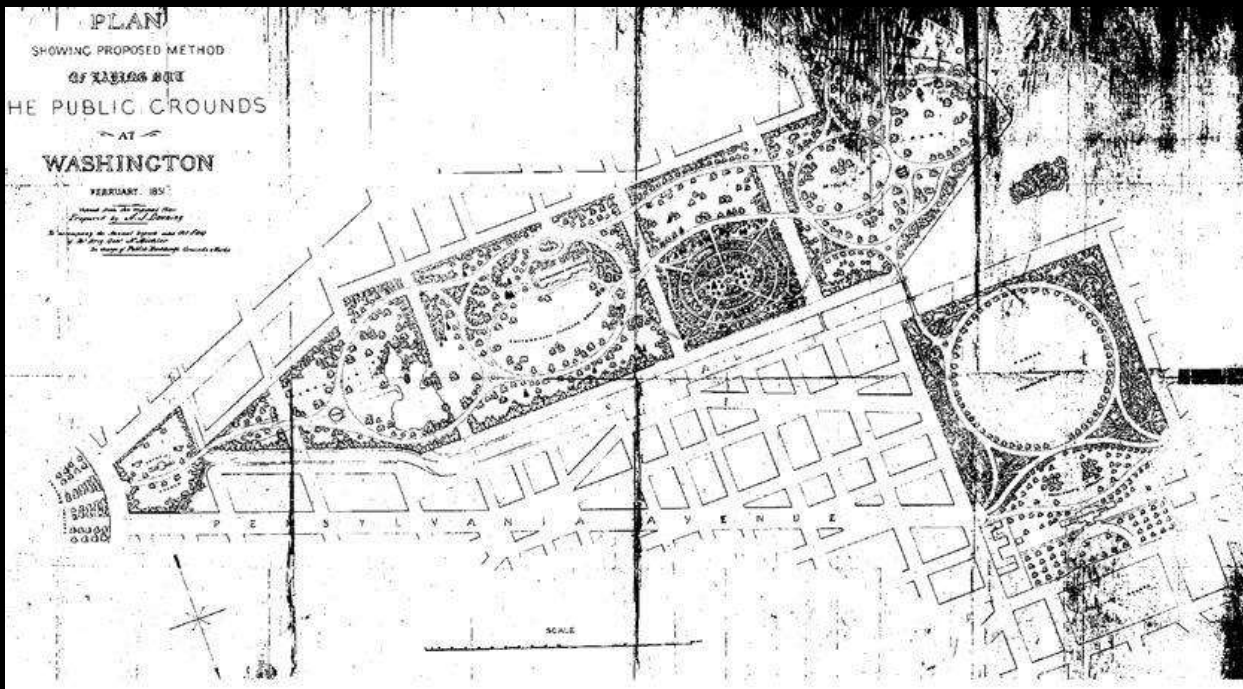
Editor of *The Horticulturist* magazine (1846–52)



The Cure

Proper Nature, Proper Place – the Role of Parks

- Downing wrote that public parks would play an important role “in elevating the national character.”
- “Let our people see for themselves the influence for good which [the founding of a public park] would effect, no less than the healthful enjoyment it will afford”
- President Millard Fillmore commissioned Downing to create a plan that would redeem the Mall from its physical neglect.



“banish the plague-spots of democracy”

The Social and Political Role of Urban Nature

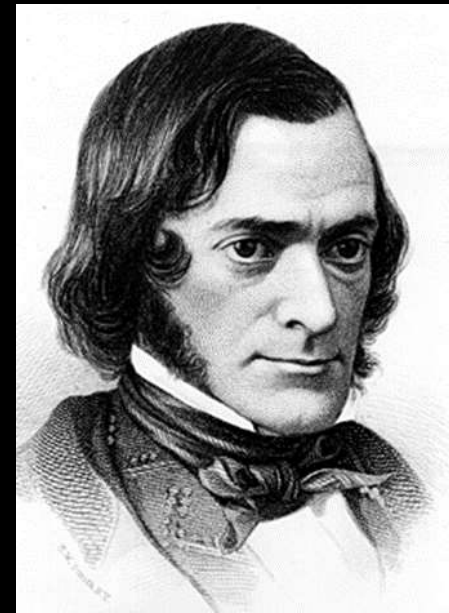
“Plant spacious parks in your cities, and unloose their gates as wide as the gates of morning to the whole people...

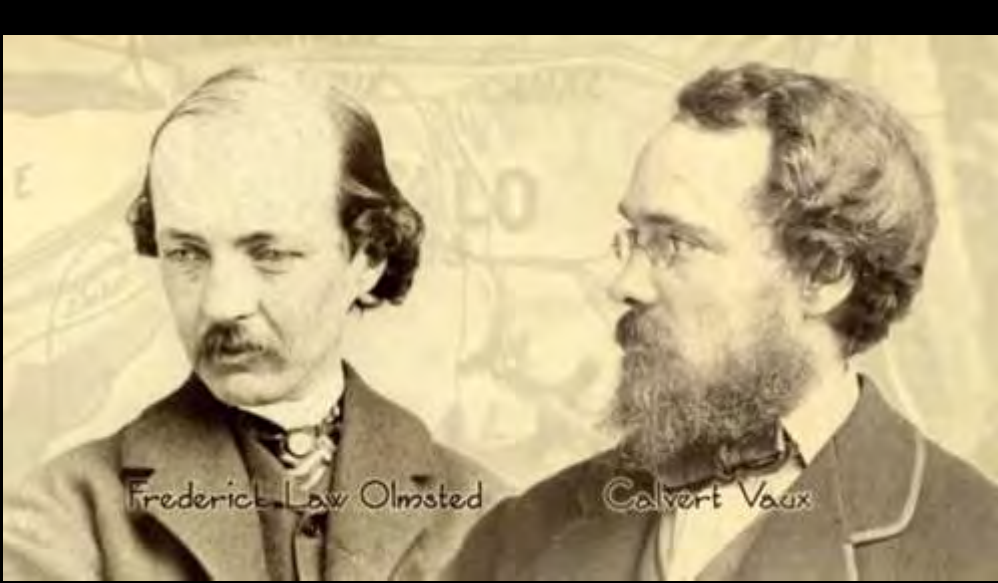
As there are no dark places at noonday, so education and culture – the true sunshine of the soul – ***will banish the plague-spots of democracy.***”

The New York Park 1851



Dies 1852 – at 37



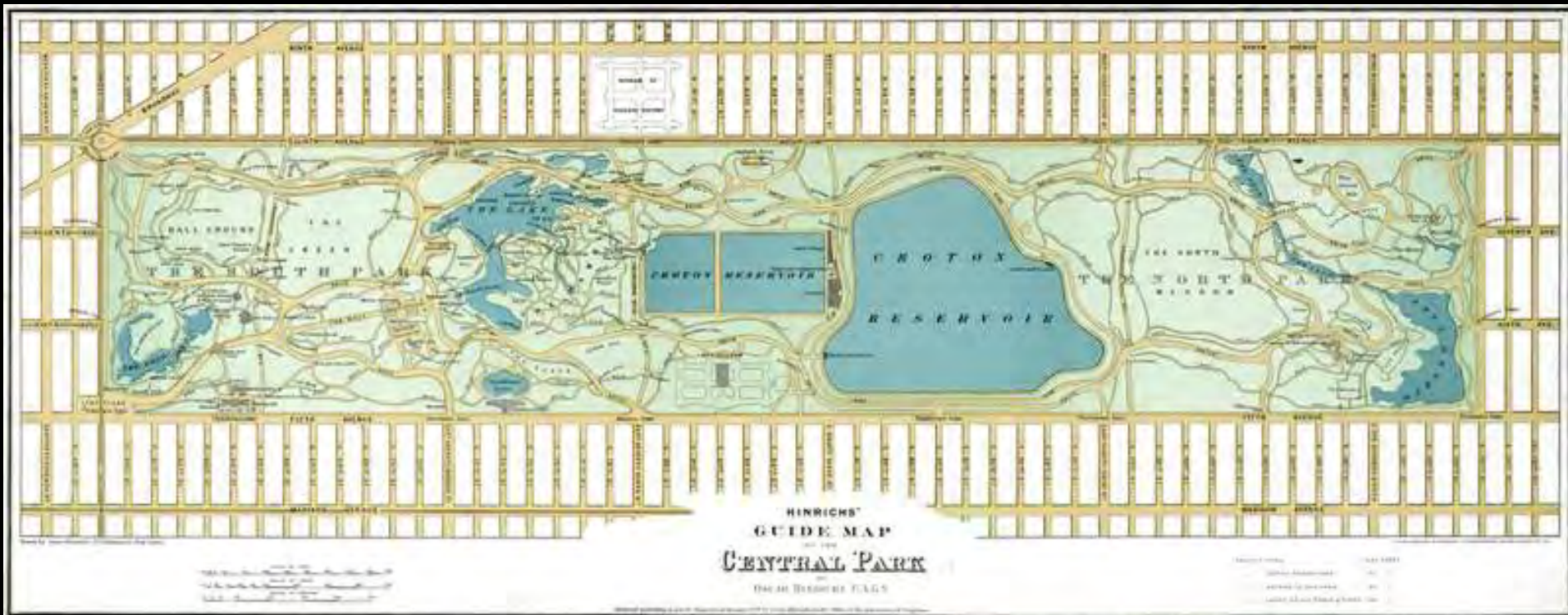


Frederick Law Olmsted

Calvert Vaux

Banish the Plague-spots of Democracy

Olmsted observed that New York's Central Park had a "harmonizing and refining influence upon the most unfortunate and most lawless classes of the city - an influence favorable to **courtesy, self-control, and temperance.**"

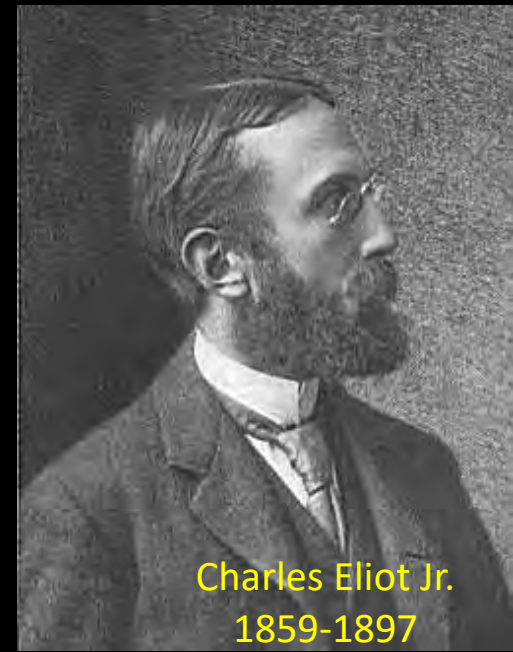


Narrative of Redemptive Urban Nature

“Should the forces which push men into the arms of ignorance, sin, and death, be allowed a free field in our cities or should there be parks and open spaces to redeem the city with all that mingling of the natural and the human which we call landscape?”

Metropolitan Park System of Greater Boston

First Regional Park System – First Land Trust

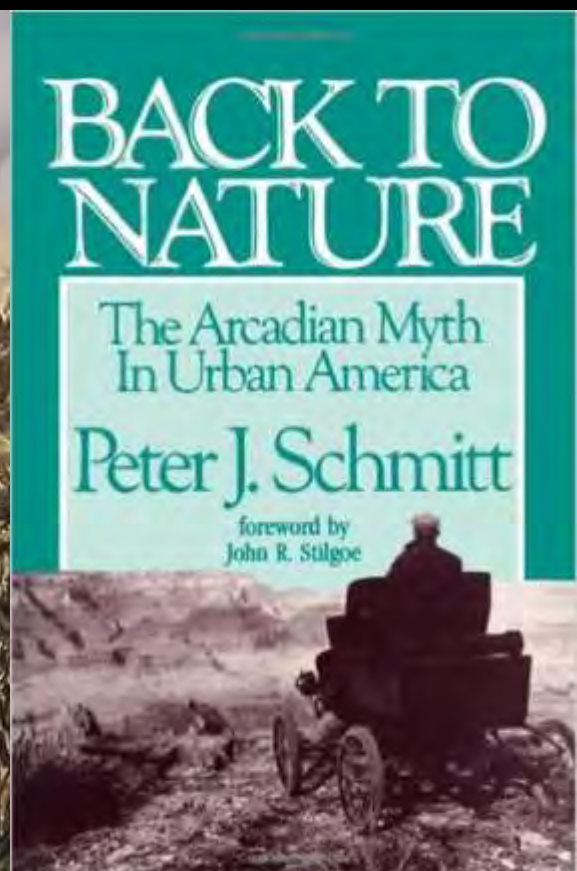


Charles Eliot Jr.
1859-1897



Urban Pastoral Democracy – All Classes Mingle

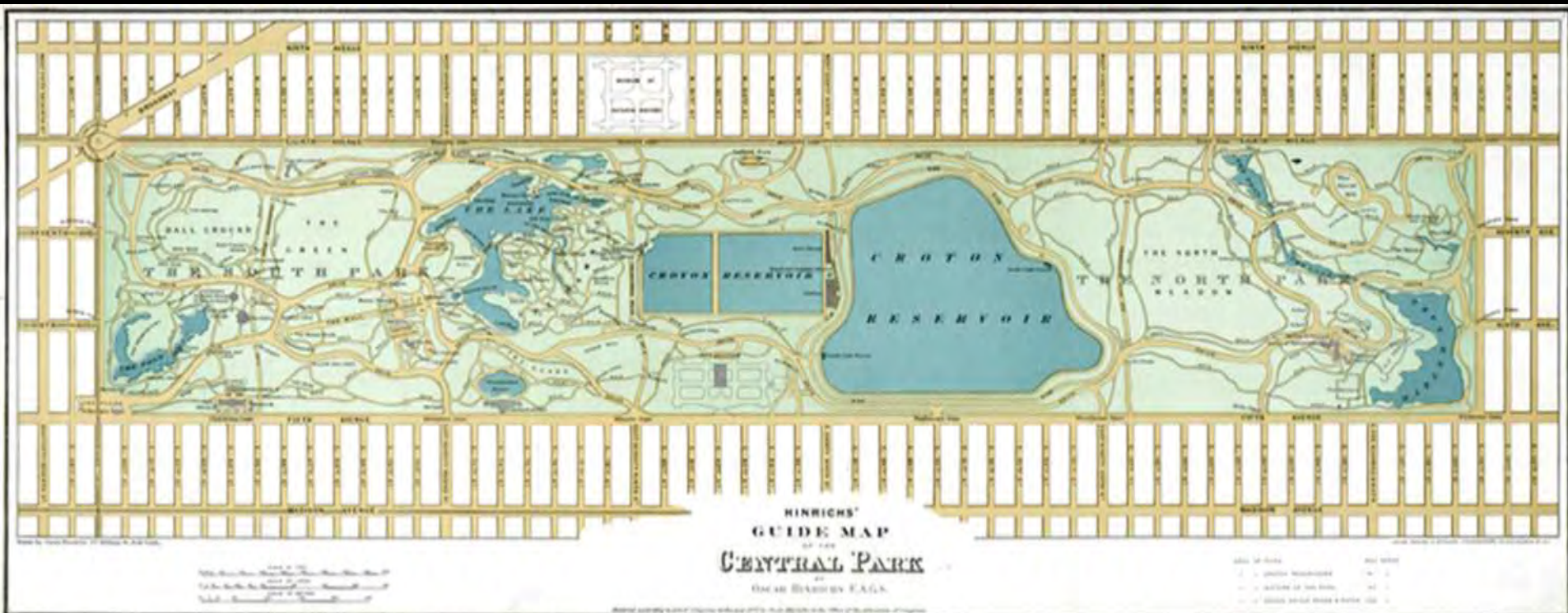
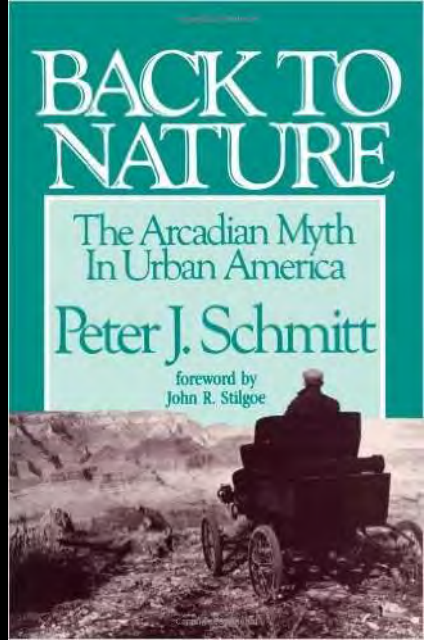
“Like Downing, Olmsted believed that the rural, picturesque landscape contrasted with and counteracted the confining and unhealthy conditions of the crowded urban environment and served to strengthen society by providing a **place where all classes could mingle** in contemplation and enjoyment of the pastoral experience.” Schmitt



The Arcadian Myth in Urban America (Middle) Class Consciousness

“...modern landscape designers were less concerned with refining the taste of the rich than with *reintroducing nature to the middle class*. In doing so they faced a double task – *interpreting the beauty of nature and educating the public to appreciate their skill*.”

...the Romantic aesthetic gained wider acceptance as more and more people came to share something of the Arcadian dream.”



Redeeming the City with Nature continues today...

21st Century Officially Sanctioned Urban Nature “Imported at Any Price”

In America, we celebrate urban nature that is either deliberately cultivated pastoral “greenspace” like parks, gardens, and urban farms or formally protected as remnants of the “wild” native landscapes obliterated by the creation of the city in preserves, sanctuaries, refuges, and other “wildlands”.

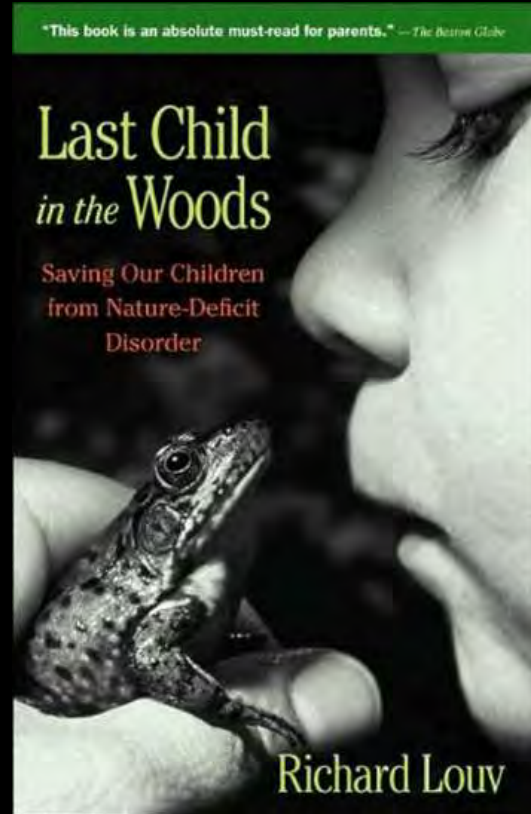


21st Century Narrative of Redemptive Urban Nature

The Wild and The Pastoral Imported - Presuppositions

- **The framework of iterative natures** - wildlands, preserves, parks, and gardens established for imaginative urban landscapes of wild first nature and pastoral second nature.
- **Degradation and Redemption** - Urban industrial second nature is degradation in need of redemption.
- **Transcendentalist concept of nature** - a tonic for body and spirit which is deliberately incorporated into urban design.

Nature Deficit Disorder - Space for nature is essential - to provide recreation for physical health and for mental health – children must know nature to be proper humans

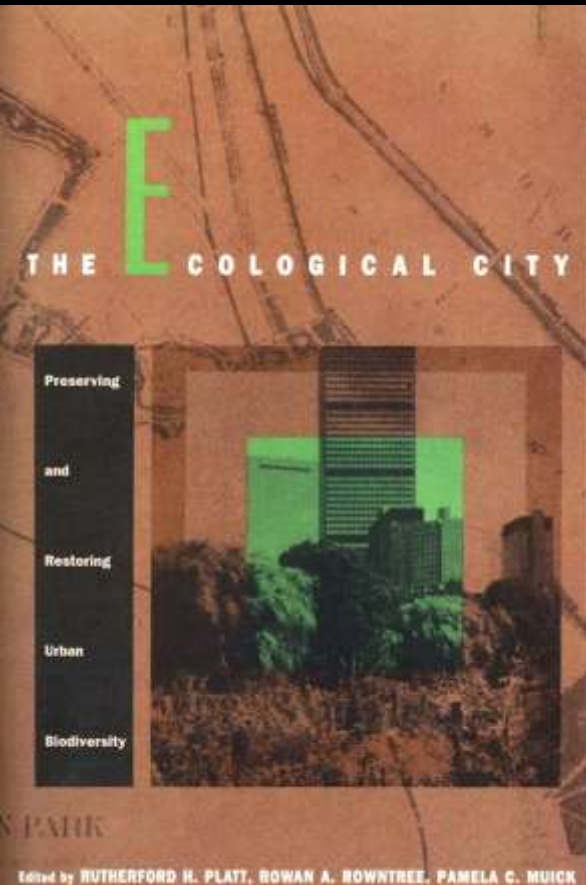


The Ecological City - Urban Design and Management

Narrative of Restorative Urban Nature

Versions 1 and 2

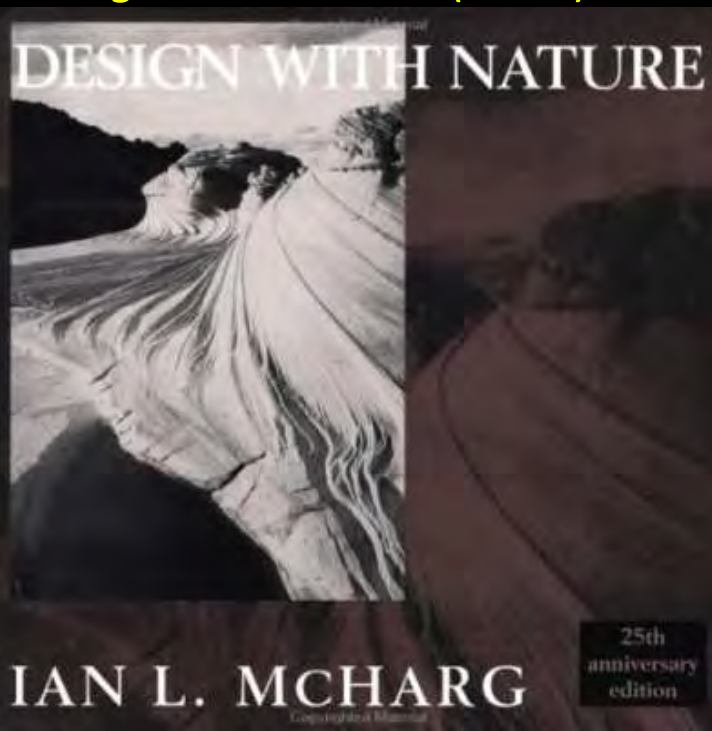
Degradation and Restoration - Urban industrial second nature is degradation in need of restoration through ecological design, planning, and management



Version 1 - Architecture and Urban Design

- Presuppositions - a positive view of cooperation with nature and pastoral ideals of improvement of nature.
- Presupposition - McHarg presupposes that “the city is a pathological environment” which can be restored to ecological sustainability through design and planning.
- Presupposition – “ecological planning” can make development “sustainable”
- Ian McHarg (1920-2001) – Science is the principal authority for landscape design

Design with Nature (1969)



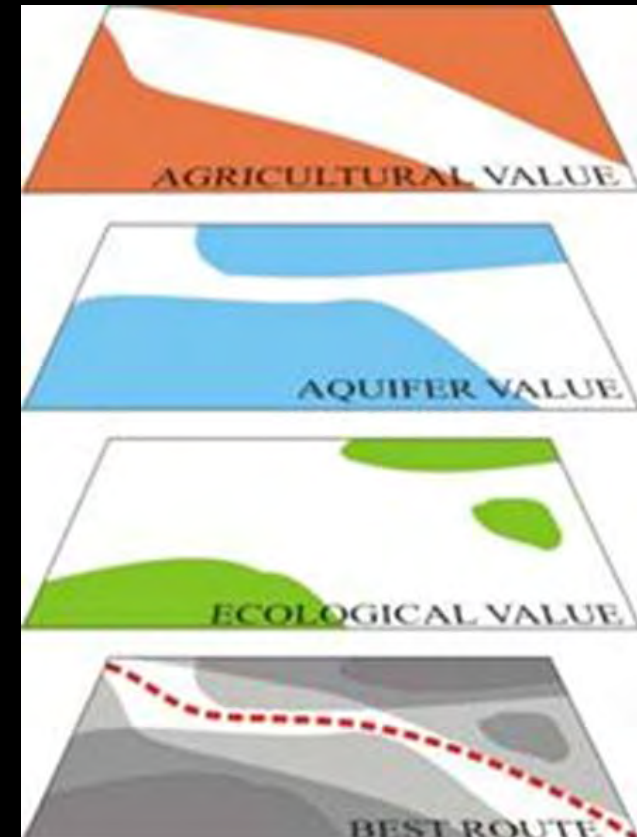
A 'Design with Nature' approach to community design means...



- Develop compact, complete communities
- Increase transportation options
- Reduce the loads on water, waste and energy systems
- Protect and restore urban 'green' space
- Strive for a lighter 'hydrologic footprint'
- Achieve higher levels of stream, wetland and lake protection

Ian L. McHarg (1920 - 2001)

- Born in Clydebank, Scotland
- He was the founder of the Department of Landscape Architecture at the University of Pennsylvania.
- His 1969 book *Design with Nature* pioneered the concept of ecological planning. It continues to be one of the most widely celebrated books on landscape architecture and urban land-use planning.
- McHarg's method produces a pattern diagram that identifies the best route for a road →



Narrative of Restorative Urban Nature – the Tonic of Nature

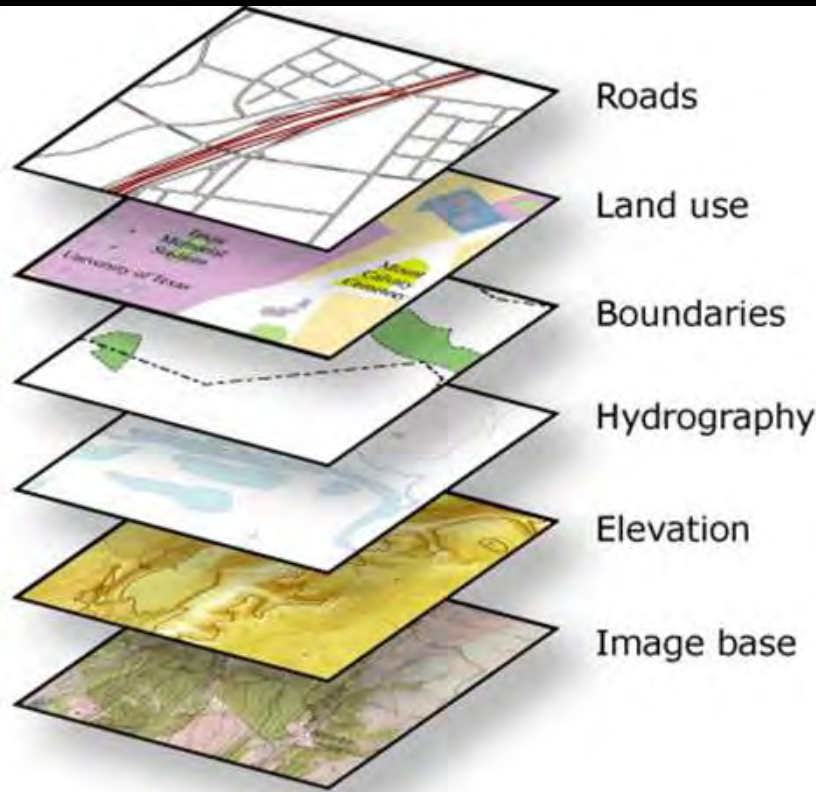
- Humans are the problem
- Ecology – Nature in the city - is the solution
- *Design with Nature*
 - Prioritize incorporating nature throughout the urban landscape
 - Promote “landscape architecture as the instrument of environmentalism.”



Design with Nature and Science

McHarg insisted that urban design should -

- Find its “rules” in nature.
- Those rules emerged from the scientific study of nature = Ecology.
- Ecology – the Science of How Nature Works.
- Scientific Design - Ecologists provide **“not only an explanation, but also a command.”**



A 'Design with Nature' approach to community design means...

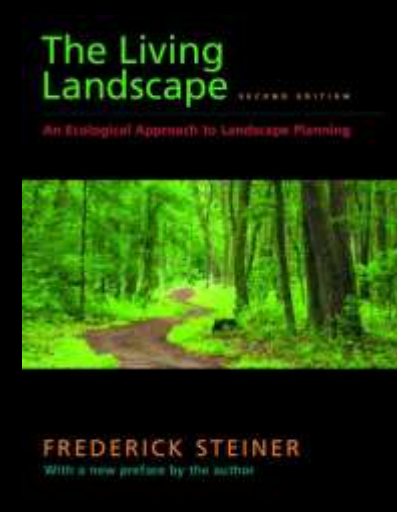
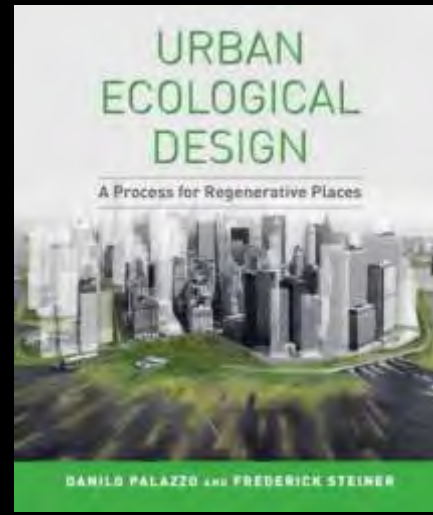
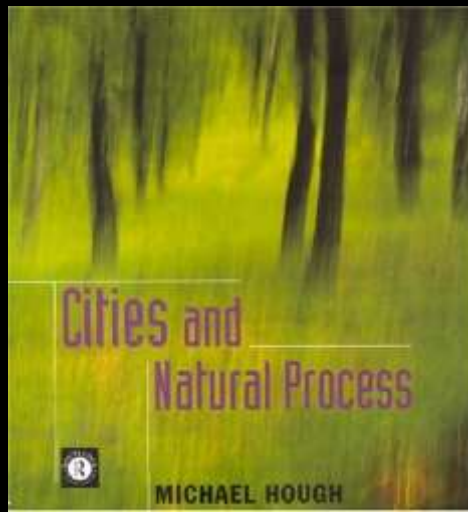
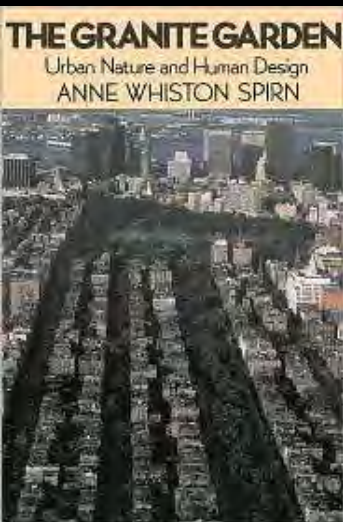


- Develop compact, complete communities
- Increase transportation options
- Reduce the loads on water, waste and energy systems
- Protect and restore urban 'green' space
- Strive for a lighter 'hydrologic footprint'
- Achieve higher levels of stream, wetland and lake protection

Design with Nature

“As we begin to understand the true complexity and holistic nature of the earth system, and begin to appreciate humanity’s impact within it, we can build a new identity for society as a constructive part of nature. This is ethical. This is optimistic. This is a necessity.

This is what it means to “design with nature”.”



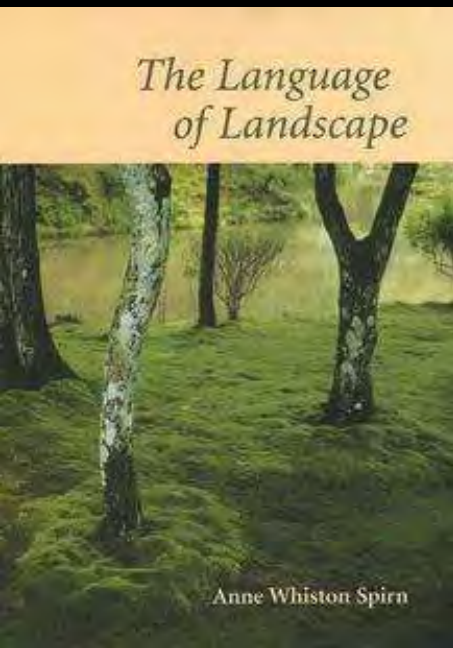
Criticism – Privileging of Science – Anne Spirn

McHarg conflates,

- Ecology as a science [a way of describing the world]
- Ecology as a cause [a mandate for moral action]
- Ecology as an aesthetic [a norm for beauty]

“It is important to distinguish the insights ecology yields as a description of the world, on the one hand, from how these insights have served as a source of prescriptive principles and aesthetic values, on the other.” (Can’t Derive an Ought from an Is)

Anne Spirn “Ian McHarg, Landscape Architecture, and Environmentalism” 2000

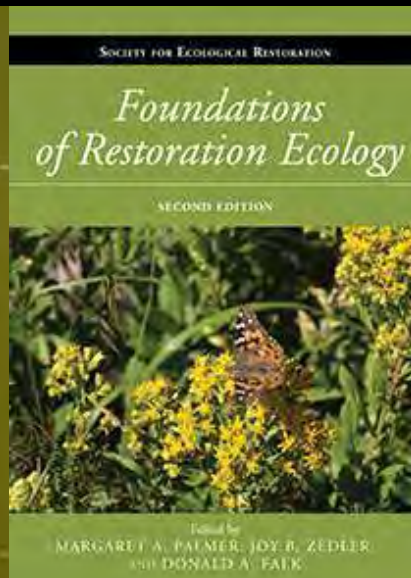


Narrative of Restorative Urban Nature

“not only an explanation, but also a command.”

Version 2 – Science – Restoration Ecology and Conservation Biology

- Urban restoration ecology and conservation biology share the social goal of **not just conserving remnant historical habitats and species but to actively restore “native” ecosystems to heal the ecological damage of urban development.**
- Presupposition - **Good (Urban) Nature = Native Nature**



Degraded Nature in American (Urban) Ecology

Perceptions of American Urban Biologists, Ecologists, and Environmentalists

Ecology “in” cities – A weedland community of inappropriate nature

“(Urban growth) replaces the native species that are lost with widespread “weedy” nonnative species. This replacement constitutes the process of biotic homogenization that threatens to reduce the biological uniqueness of local ecosystems.”

Michael L. McKinney, “Urbanization, biodiversity, and conservation”. *Bioscience* 52(10), (2002), 883–890.

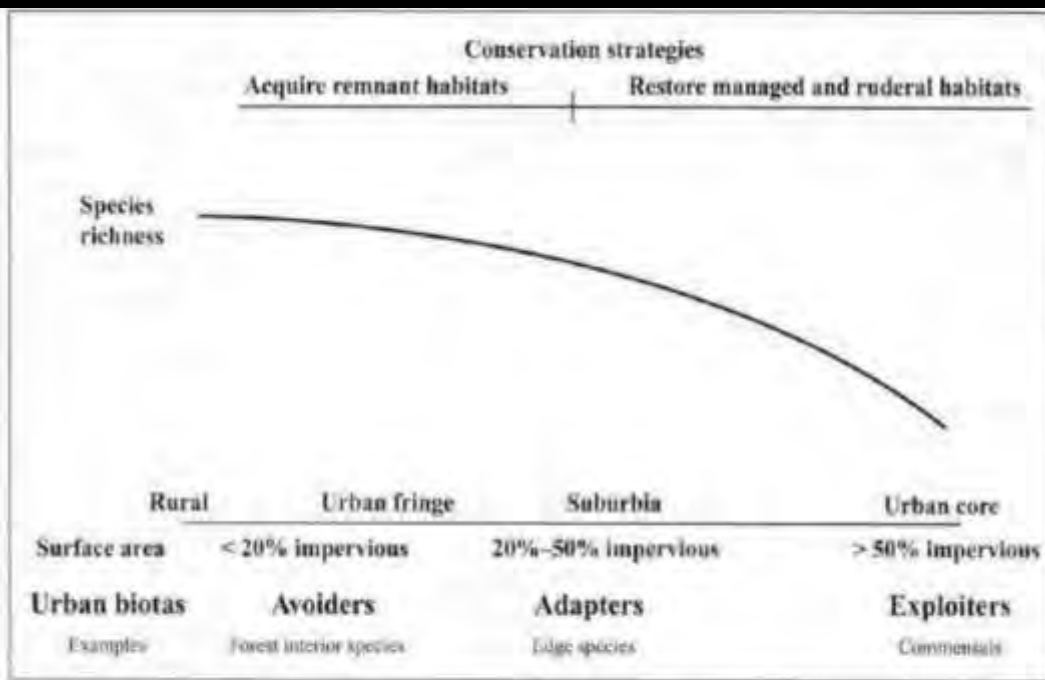
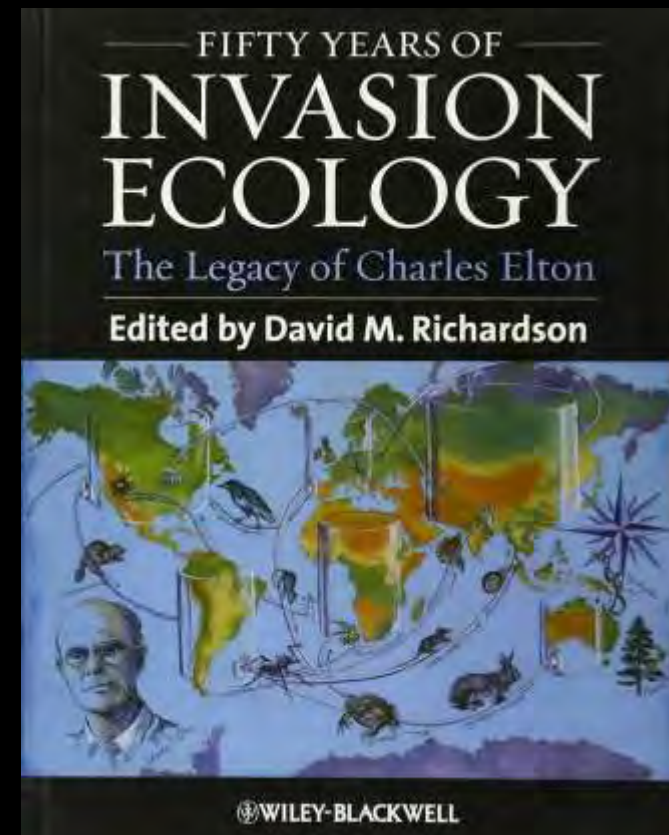


Figure 2. Urban-rural gradient. This is a very generalized and simplified depiction of changes in surface area, species richness, and composition, as compiled from a number of sources discussed in the text. Two basic conservation strategies with respect to urban sprawl are shown at the top.



Narrative of War – Invasive Species

TEXASINVASIVES.ORG HELLO INVASIVE SPECIES. GOODBYE TEXAS.

ABOUT | INVASIVES | SPOTLIGHT | CONTACT | RSS

INVASIVES 101 TAKE ACTION CITIZEN SCIENTISTS PROFESSIONALS RESOURCES

INVASIVES DATABASE
GO ▶

CITIZEN SCIENTISTS

WELCOME CITIZEN SCIENTISTS

BECOME A CITIZEN SCIENTIST

TOOLKIT

SATELLITES

WORKSHOPS

ONLINE TRAINING

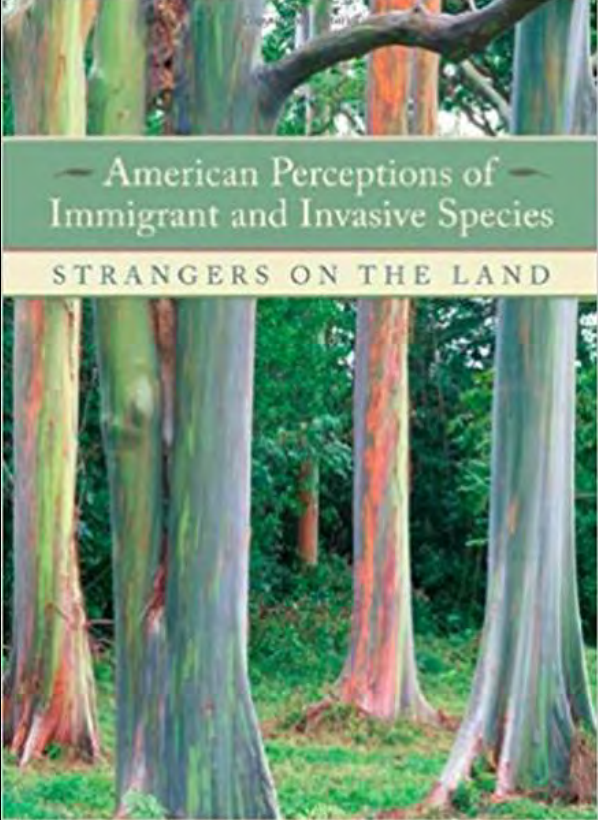
LOGIN & REPORT



EYES IN THE FIELD CITIZEN SCIENTISTS

CITIZEN SCIENTISTS

The Invaders of Texas Program is an innovative campaign whereby volunteer "citizen scientists" are trained to detect the arrival and dispersal of invasive species in their own local areas. That information is delivered into a statewide mapping database and to those who can do something about it. The premise is simple. The more trained eyes watching for invasive species, the better our chances of lessening or avoiding damage to our native landscape.



American Perceptions of
Immigrant and Invasive Species

STRANGERS ON THE LAND

PETER COATES



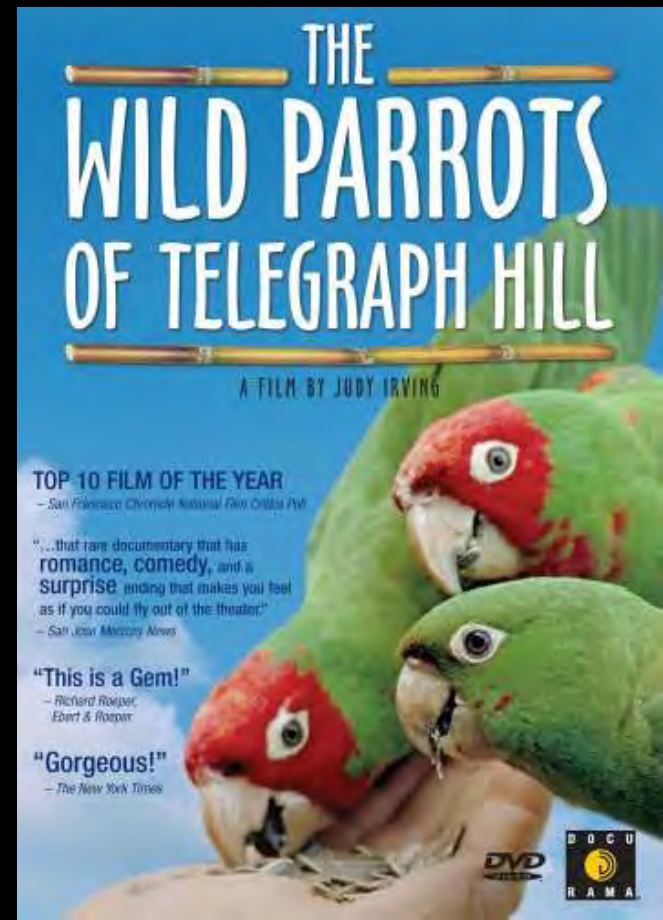
**INVASIVE SPECIES
ARE INVADING!**

INVASIVE HUNTERS, WE NEED YOU!

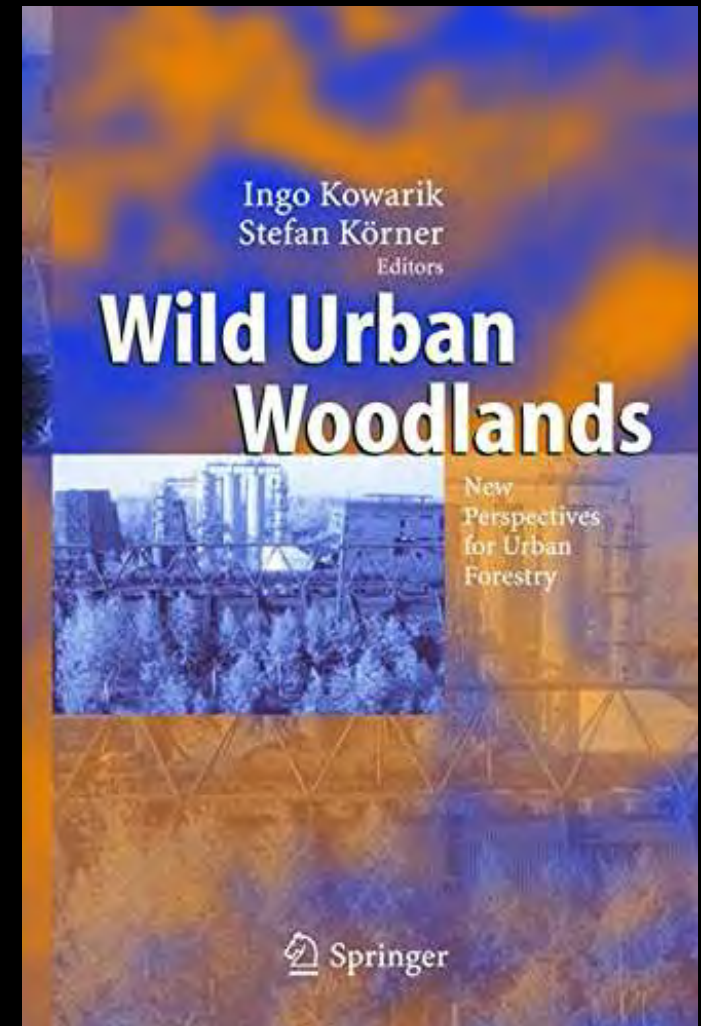


© John D. Ingram / 2002

Trash or Treasure?



21st Century Ecology and the City
The Problem of Scientific Knowledge and Urban Nature
Retrospective Ecology vs. Prospective Ecology



Retrospective Ecology, Historical Naturalness and American Urban Ecology

Good Nature vs. Bad Nature

“The Mannahatta Project began in 1999, when landscape ecologist Dr. Eric Sanderson moved to New York City to work for the Wildlife Conservation Society.... to fully appreciate the concrete landscape of streets and buildings that was his new home, he would have to ‘go back in time’ to recreate the its ecology from the ‘ground up.’

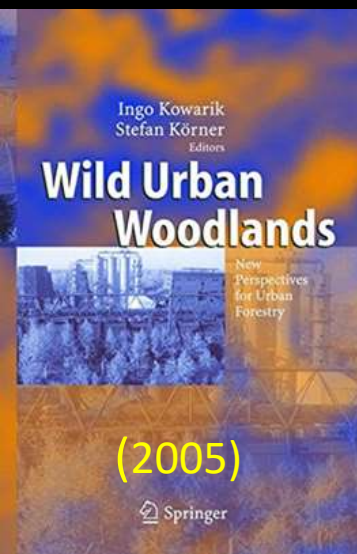
Going back to 1609 allows us to see what New York City was before it was a city and ***to reimagine the city’s development in a way that would incorporate more of the natural cycles and processes (such as the hydrological cycle) that made the island the ecological gem that it was.***”



Urban Ecology – The European Perspective

Retrospective Naturalness

- “The point of reference is therefore, **pristine vegetation uninfluenced by humans**. Based on the cultural history of the relevant area, **the reference period may lie decades or a few millennia in the past.**”
- “remnants of pristine woodlands are **most natural** and woodlands used for forestry are at least semi-natural.”
- “the development back to nearly natural or **natural woodlands composed of historical native species can be analyzed well.**”

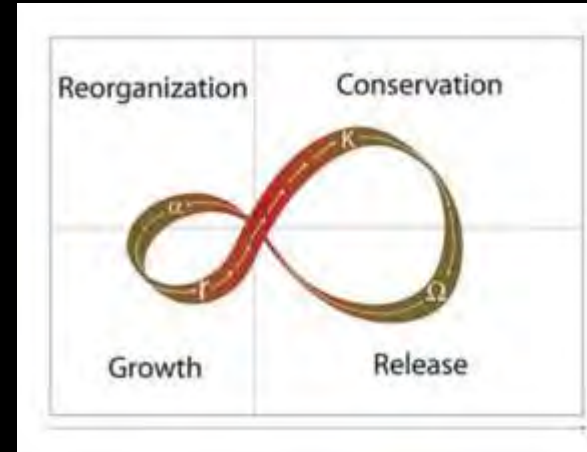
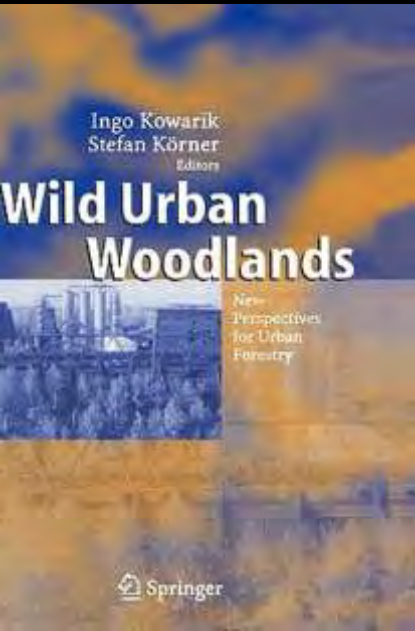


The Problem of Wild Urban Woodlands

“With the evaluation of new development of ‘wild’ urban woodlands, however, the traditional concept of naturalness oriented toward *historical comparisons runs aground.*”

Prospective naturalness

Wild Urban Woodlands – Waller Creek 7th Steet Bridge



2024



2005



2009



2012



2017

Ecology - How does Nature work?

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

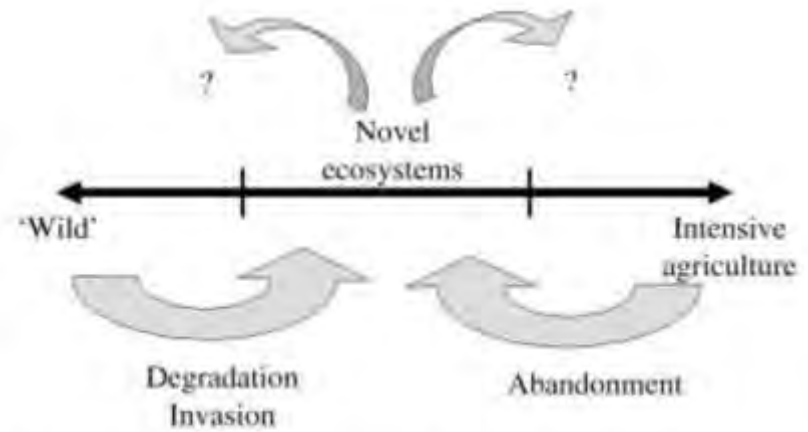
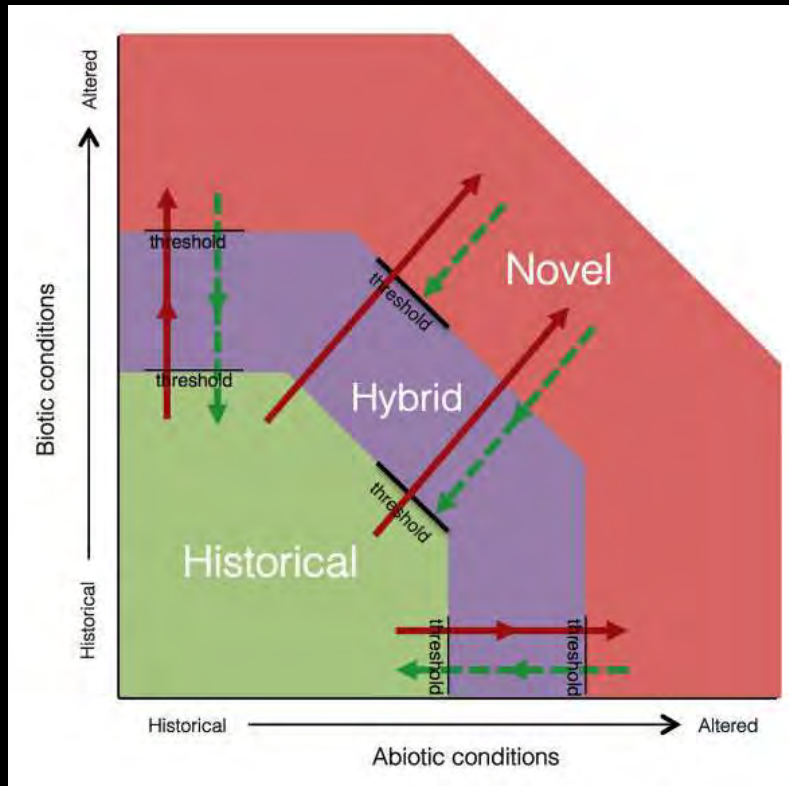
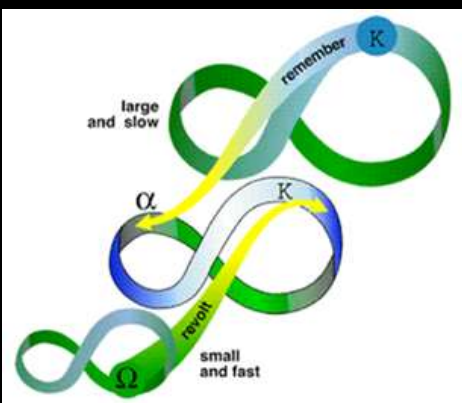
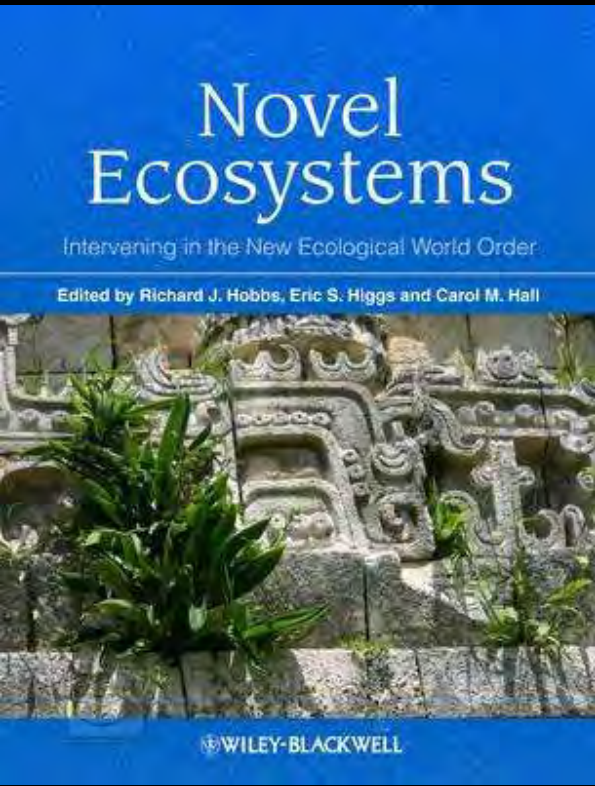


Figure 1 Novel ecosystems arise either from the degradation and invasion of 'wild' or natural/seminatural systems or from the abandonment of intensively managed systems.

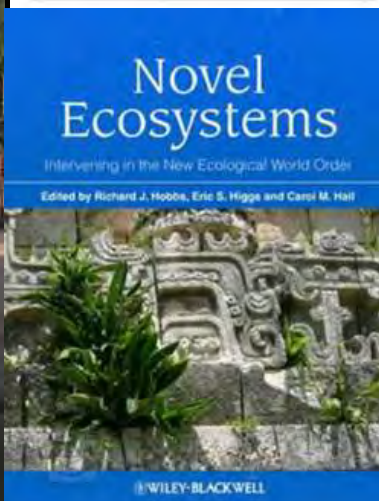
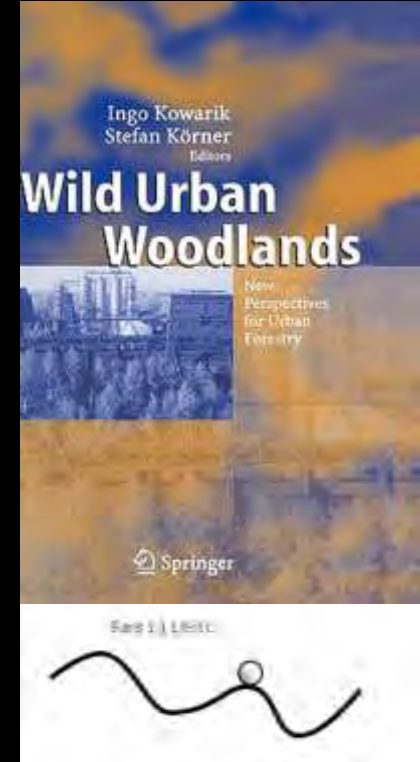


The New Ecology – How does Nature work?

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.*”

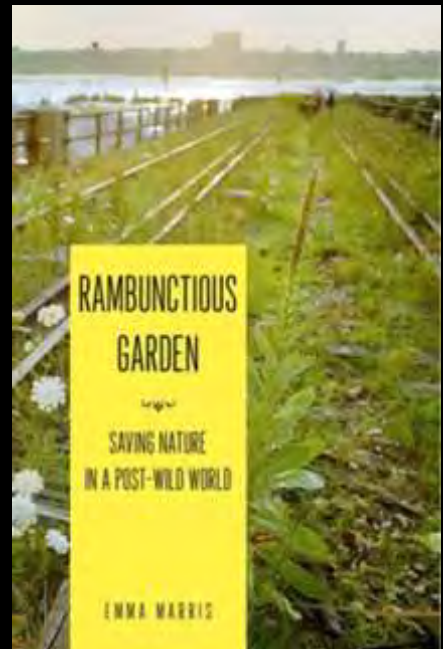
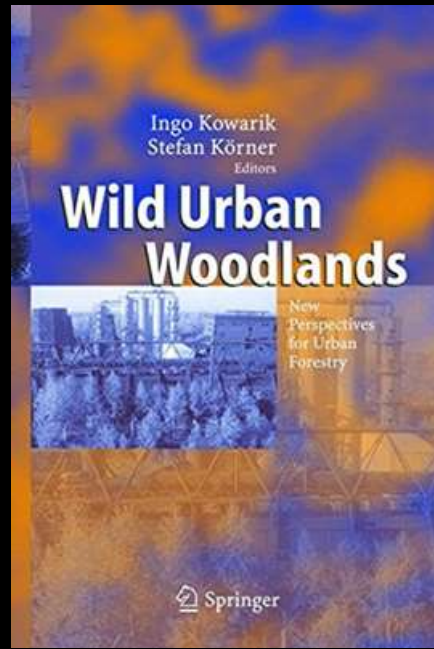
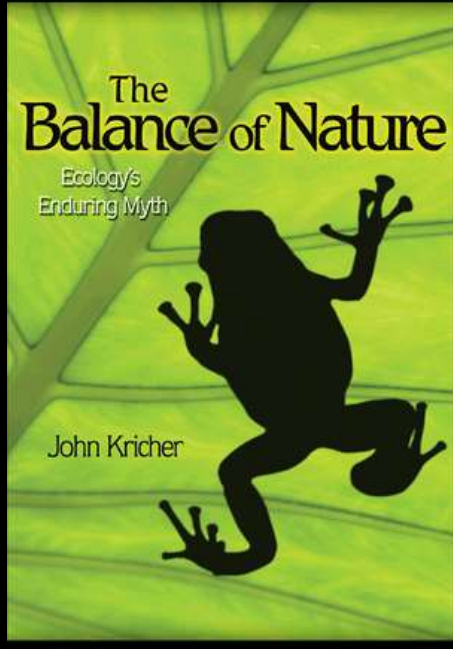
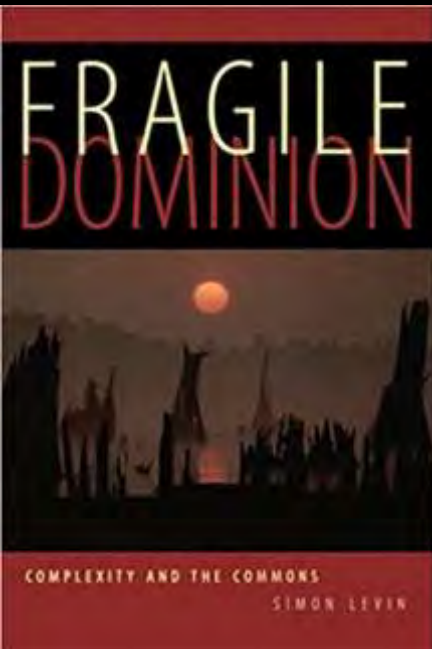
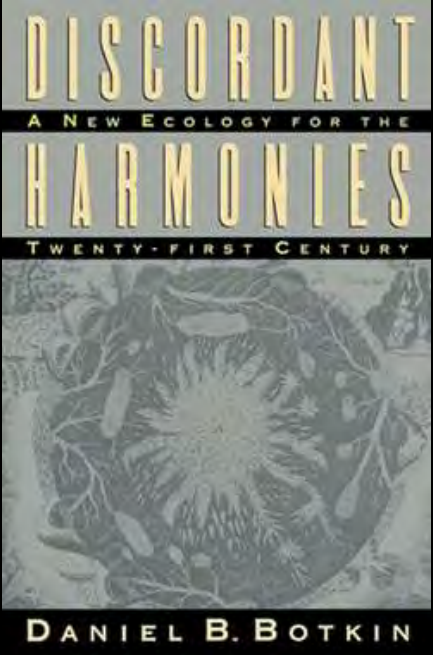


New Metaphors of Change and Permanence

“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)

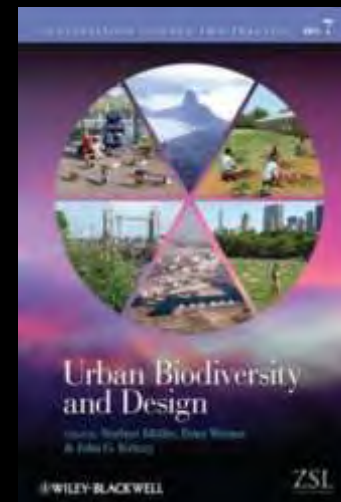
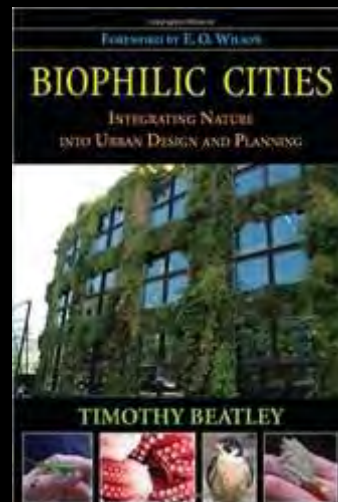
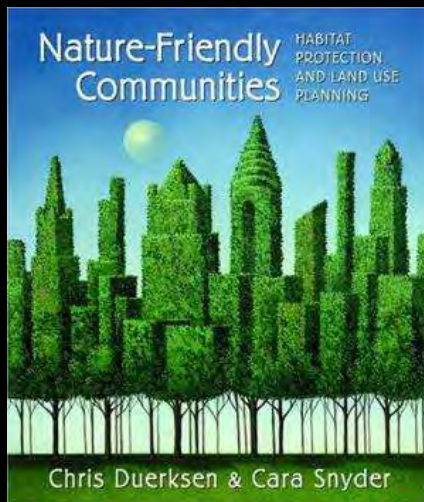
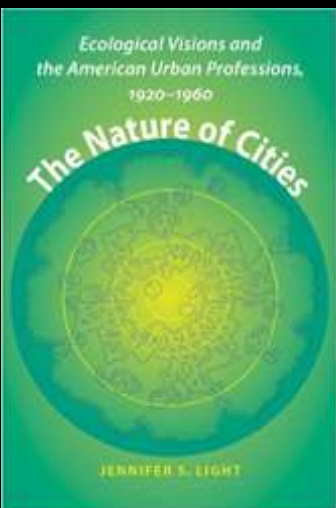


New Narrative of Urban Nature and the Ecological City?

Redemptive? Restorative? Other?
Urban Design, Management, and Science

The Nature of Cities is a “boundary organization” interested in ideas at the frontiers of science, design, policy, and the arts — an idea hive that puts different approaches and points of view together, to discover what novel perspectives might emerge.

a virtual magazine and discussion site



Narrative of Functional Urban Nature

Prospective Naturalness and Resilience



21st Century Narrative of Functional Nature - Urban Ecology

Ecosystem Processes

Science and Environmental Management

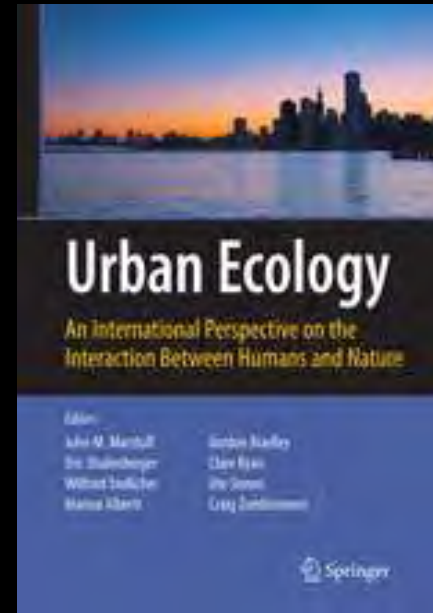
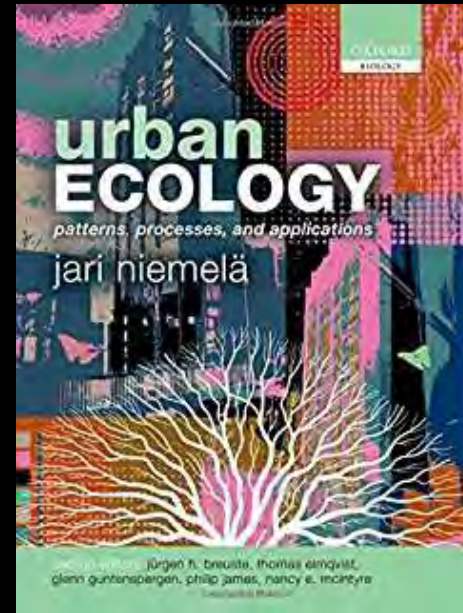


- The study of urban ecosystem functionality
- The restoration of urban ecosystem functionality not historical “native” nature
- Ecological Process and Resilience “the natural capacity for *process* is the central point”

Martina Alberti
**Advances in
Urban Ecology**
Integrating Humans and Ecological
Processes in Urban Ecosystems



Richard T. T. Forman
Urban Ecology
Science of Cities



Narrative of Functional Urban Nature - *The Idea of Urban Metabolism*

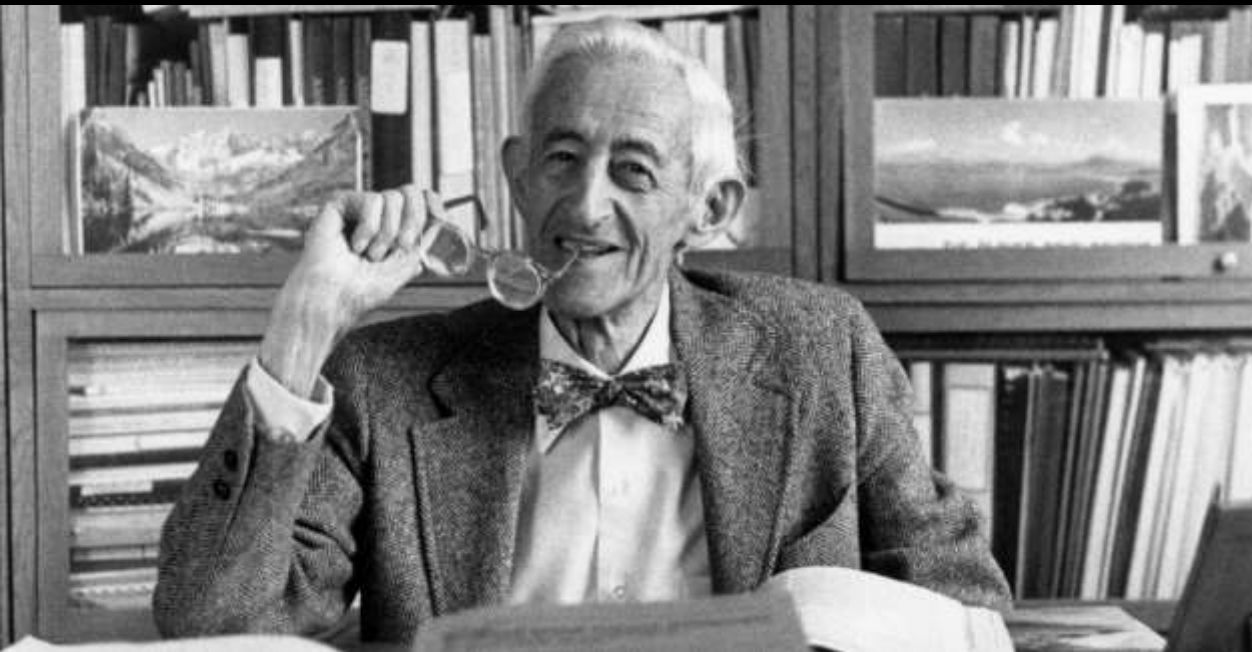
Engineering and Environmental Management - Cities as Material Systems

Process and Functionality – Inputs and Outputs – Linearity

“The metabolic requirements of a city can be defined as the materials and commodities needed to sustain the city’s inhabitants at home, at work and at play...The metabolic cycle is not completed until wastes and residues of daily life have been removed and disposed of with a minimum of nuisance and hazard.”

- Abel Wolman (1892 – 1989) “The metabolism of cities” *Science* (1965)

Urban Sustainability = Equilibrium = Homeostasis



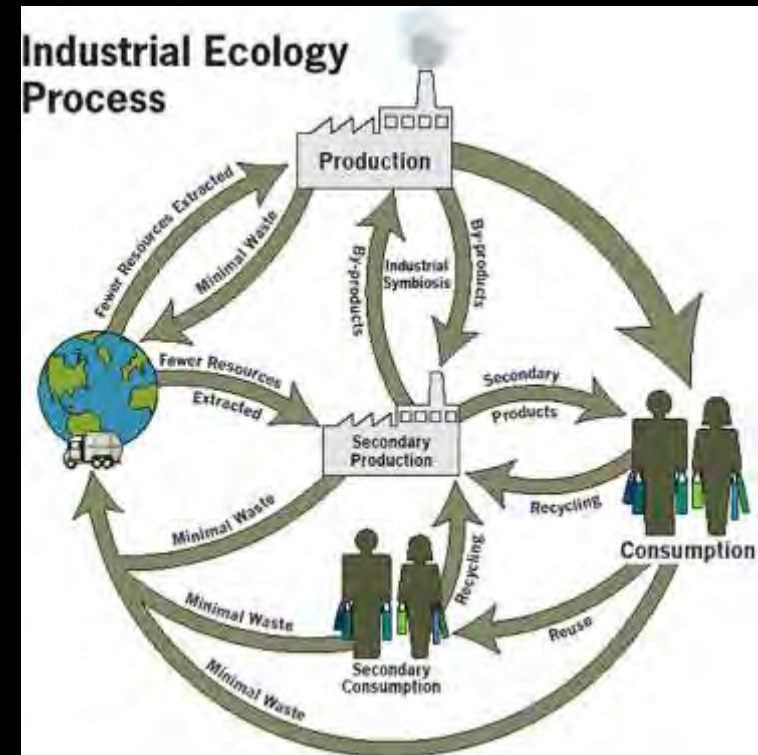
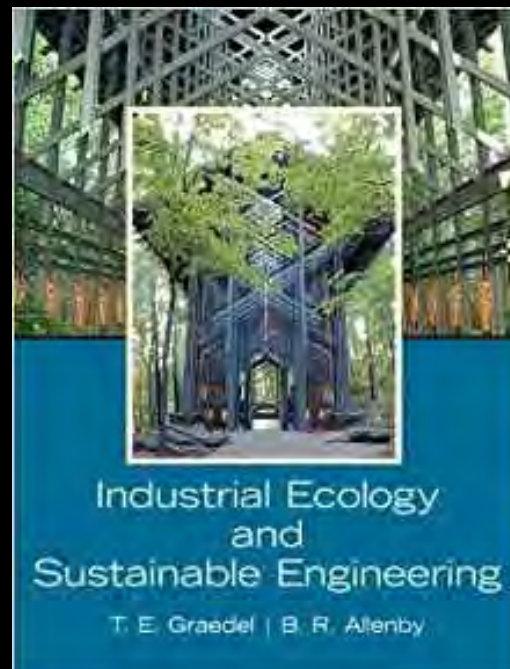
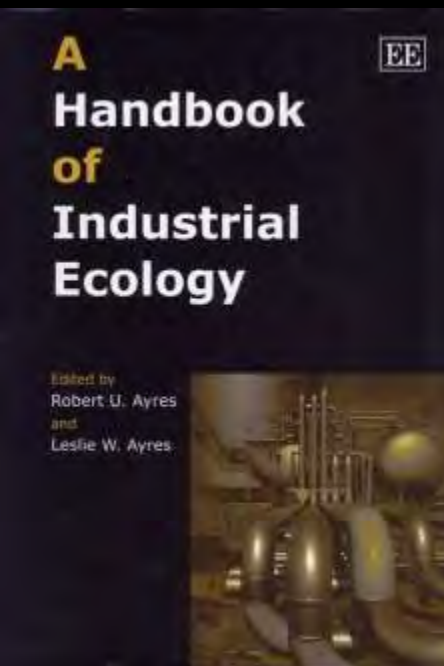
Industrial Ecology and the Earth as an “industrial ecosystem”

Process and Functionality

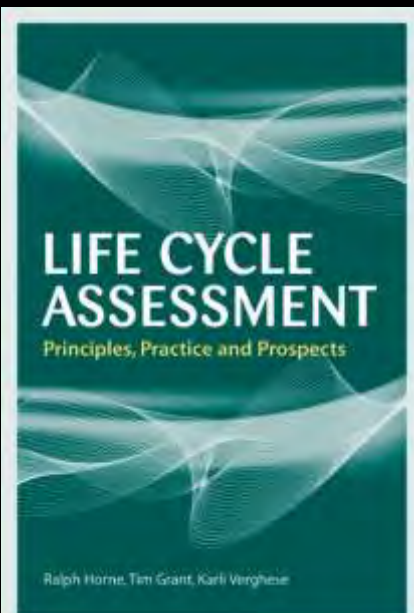
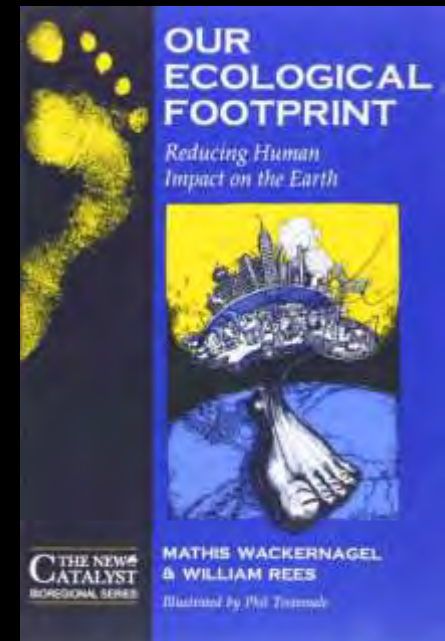
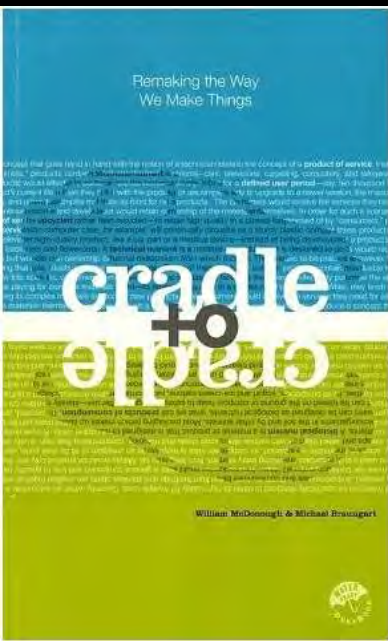
Industrial ecology (IE) is the study of material and energy flows through industrial systems.

The global industrial economy can be modelled as a network of industrial processes that extract resources from the Earth and transform those resources into commodities which can be bought and sold to meet the needs of humanity.

Balance Inputs and Outputs = Sustainable Industry



Measuring and Mimicking Natural Cycles



"from cradle to grave"

Life Cycle Assessment

Basis for assessing environmental sustainability

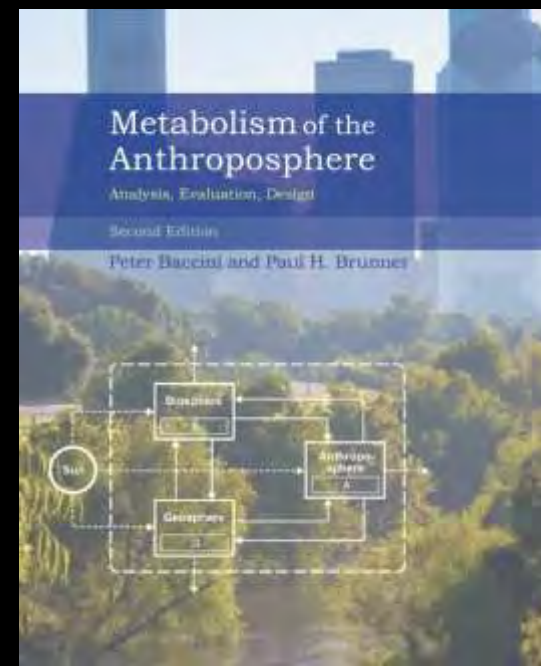
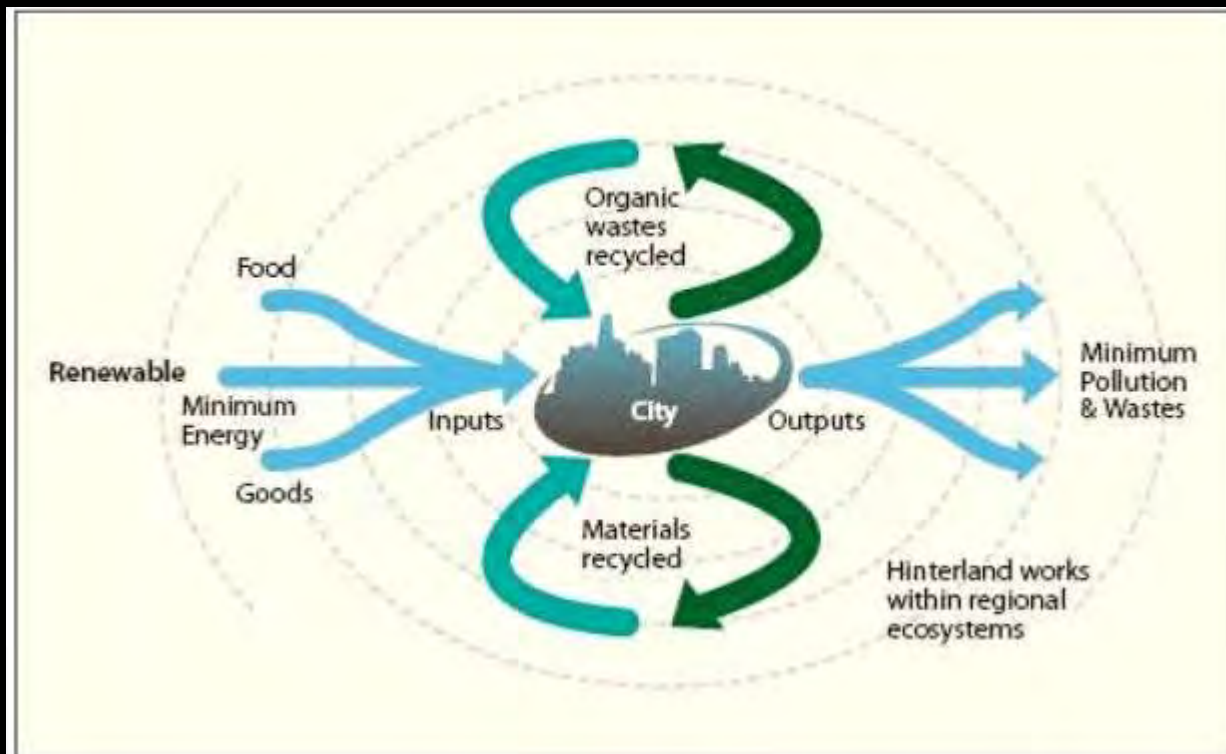
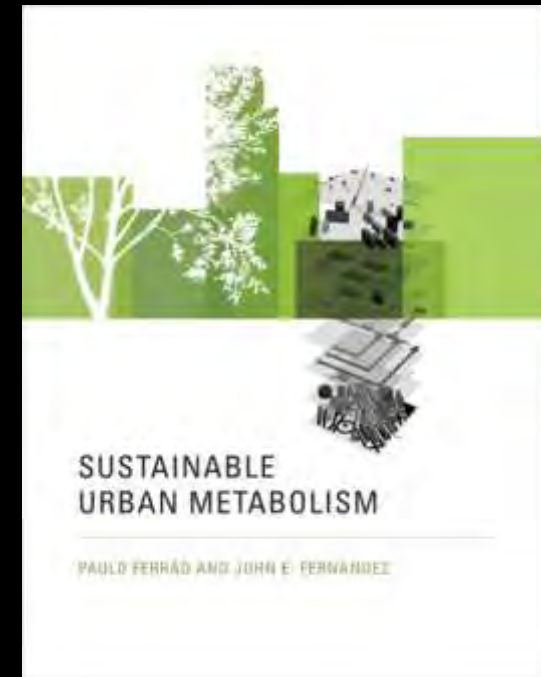


Urban Metabolism – The Earth as an “urban system”

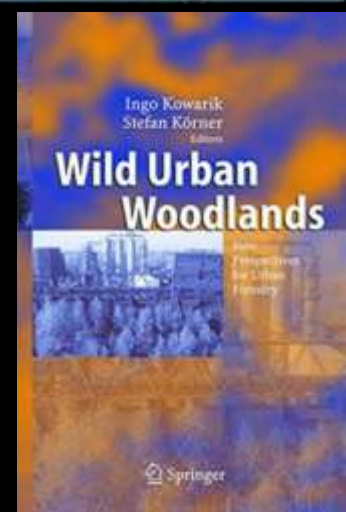
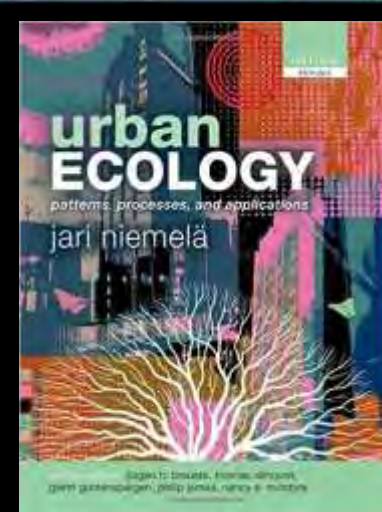
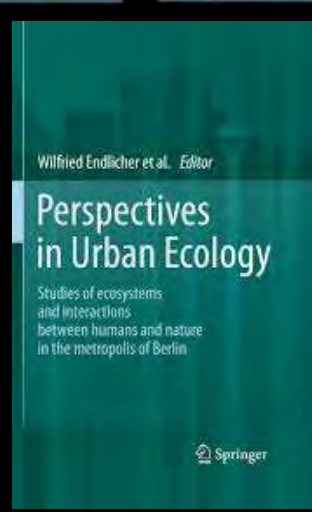
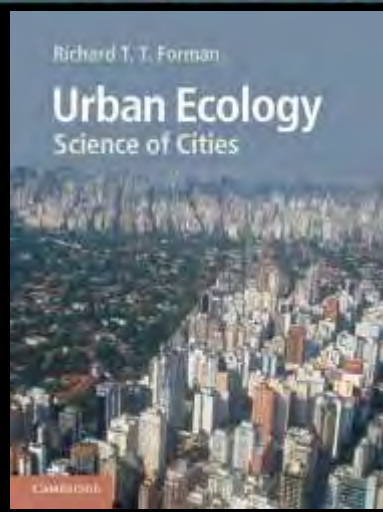
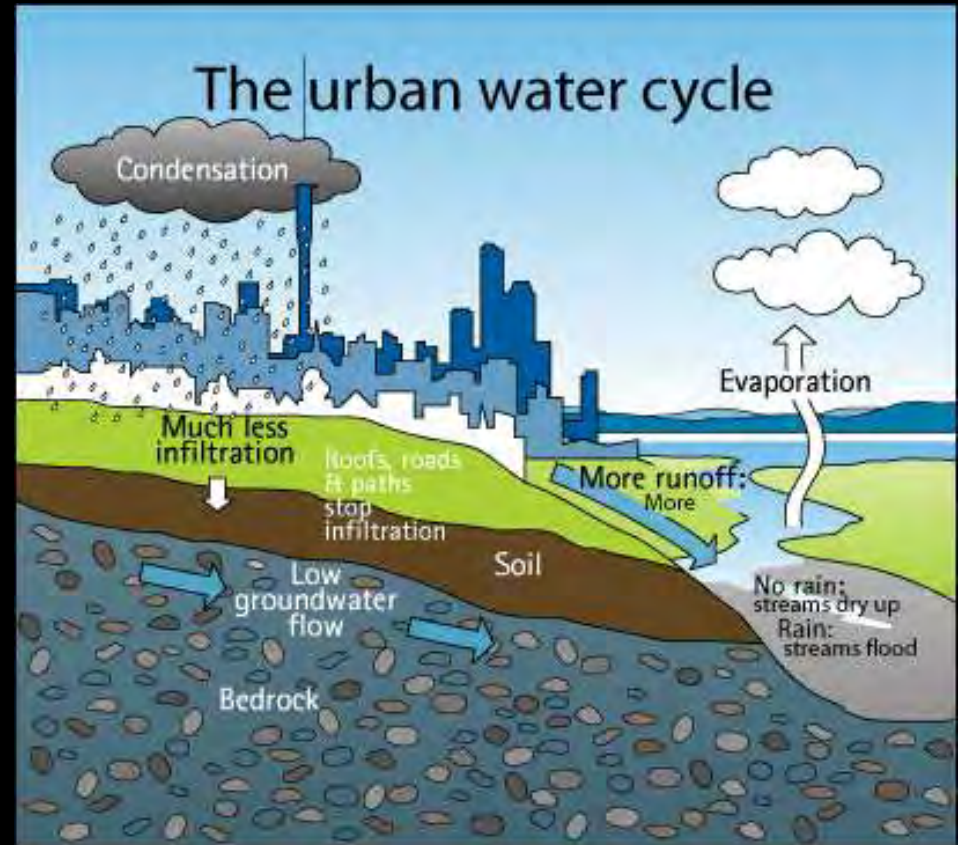
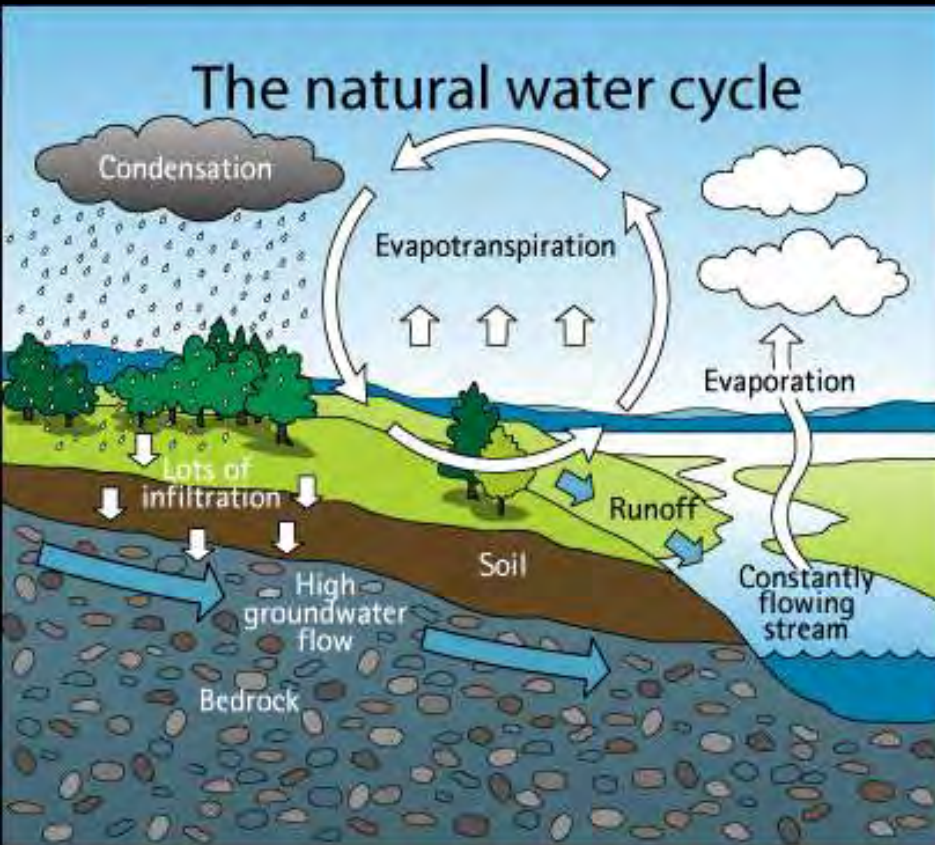
Environmental Engineering - Process and Functionality

This global network of urban systems, including ecosystems, is the anthroposphere; the physical flows and stocks of matter and energy within it form its metabolism.

The characterization of these flows and the relationships between anthropogenic urban activities and natural processes and cycles defines the urban metabolism.



Urban Ecology - Urban ecosystem functionality

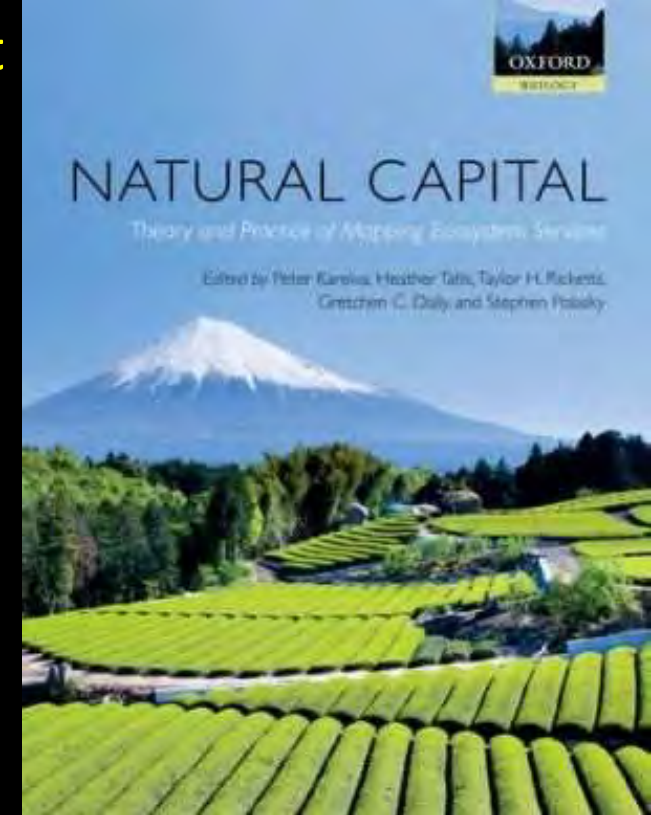


The Global Environment and Earth Management

Socio-Ecological Systems - Symbiosis

Ecosystem Services

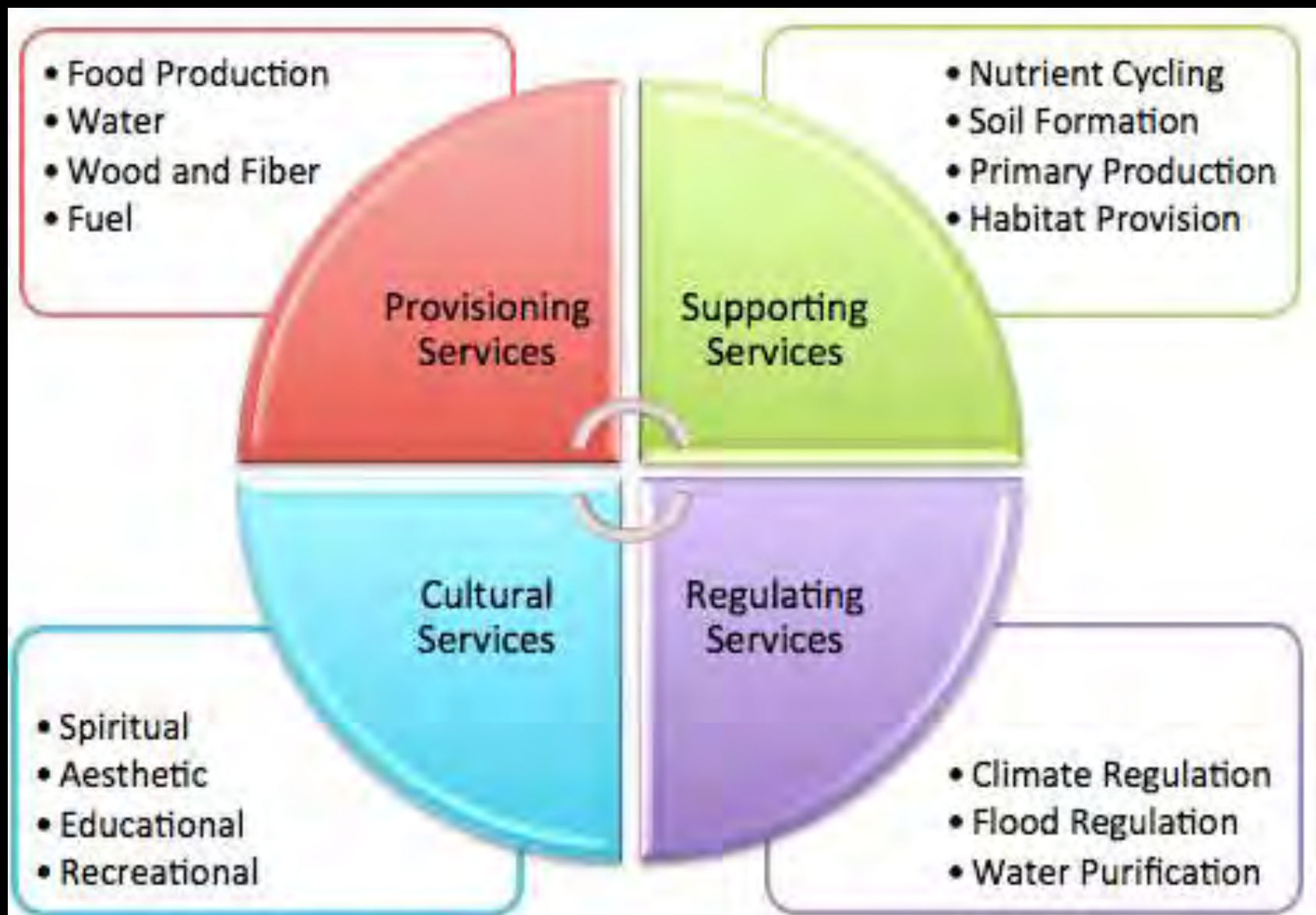
- Maintenance of atmosphere
- Protection from ultraviolet rays
- Regulation of climate
- Maintenance of genetic diversity
- Purification of air and water
- Detoxification and decomposition of wastes
- Generation of soil and renewal of soil fertility
- Pollination of vegetation
- Control of agricultural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



Source: Millenium Ecosystem Assessment, 2005.

Sustainability – To Live in Balance with Nature – Stability over Time

How Nature Works?



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.

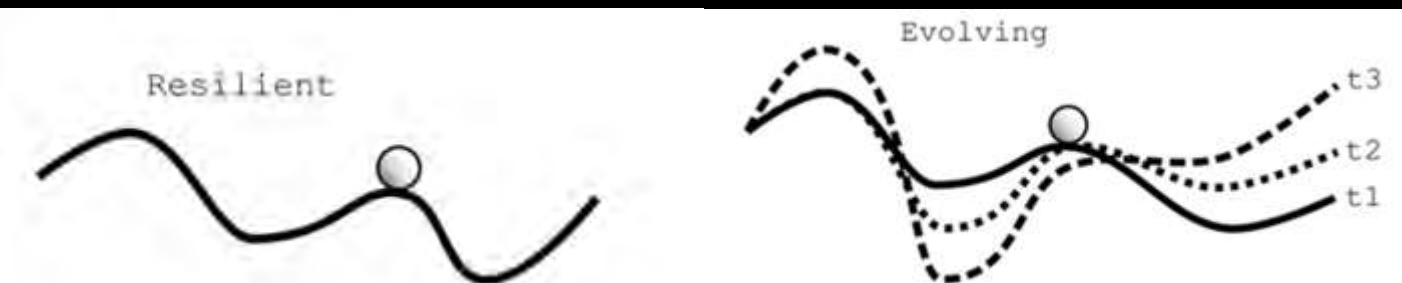
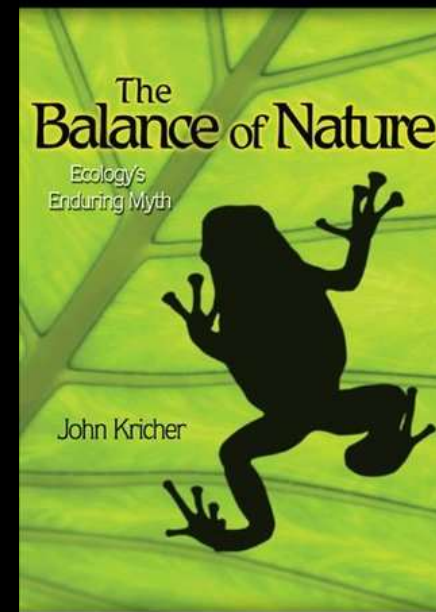
But the science of ecology and evolutionary biology together demonstrate that ***there is no balance of nature—not today and not at anytime in Earth’s long history.***

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

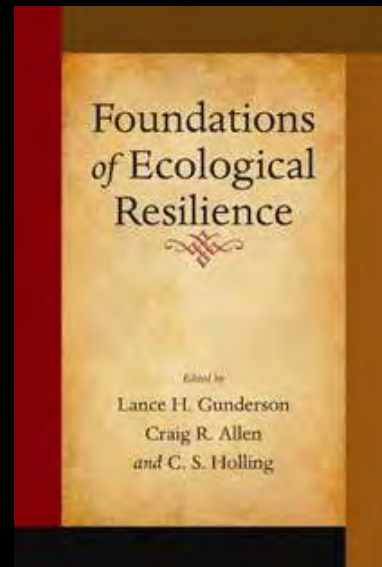
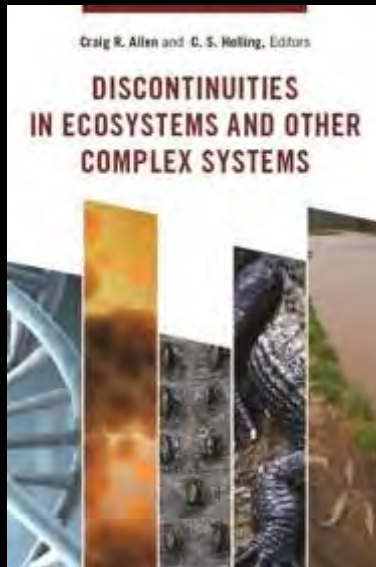


The New Ecology of Change - Ecological Resilience

- **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"

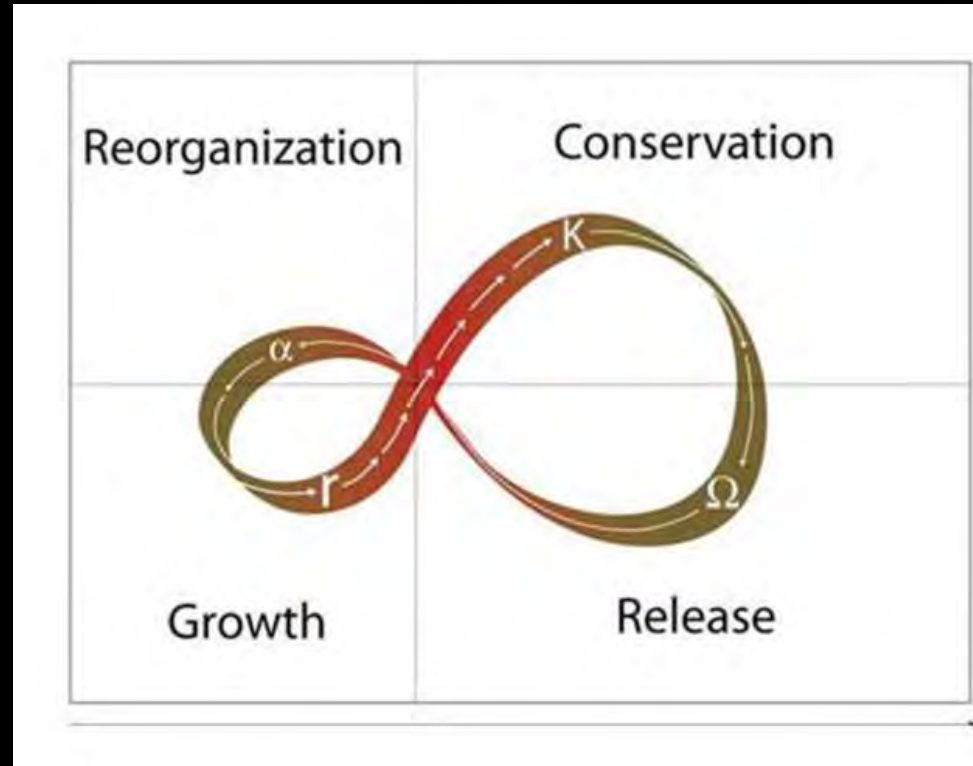
C.S. Holling 1930-2019



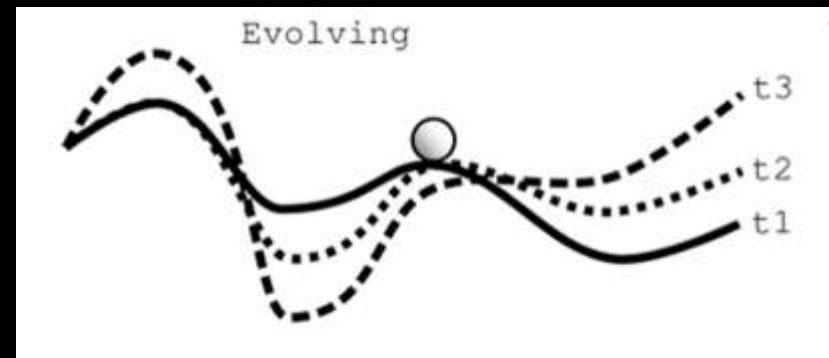
Science of Change

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



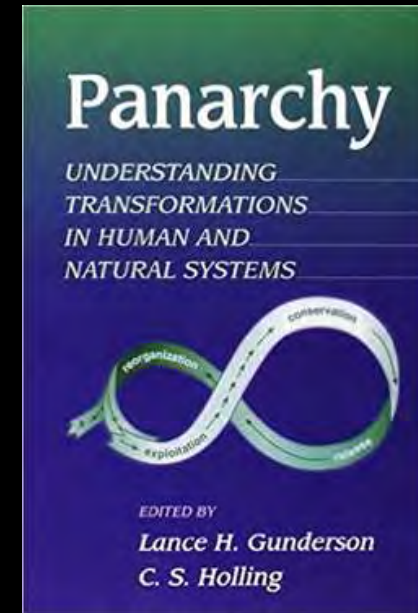
- **Incremental change** in the r and K phases, which are smooth and fairly predictable
- **Abrupt change** in the transitions from K through Ω and α



How does Nature work? A New Narrative of Nature

Transformation - Evolving Nature and Panarchy A Story of Resilience and Change

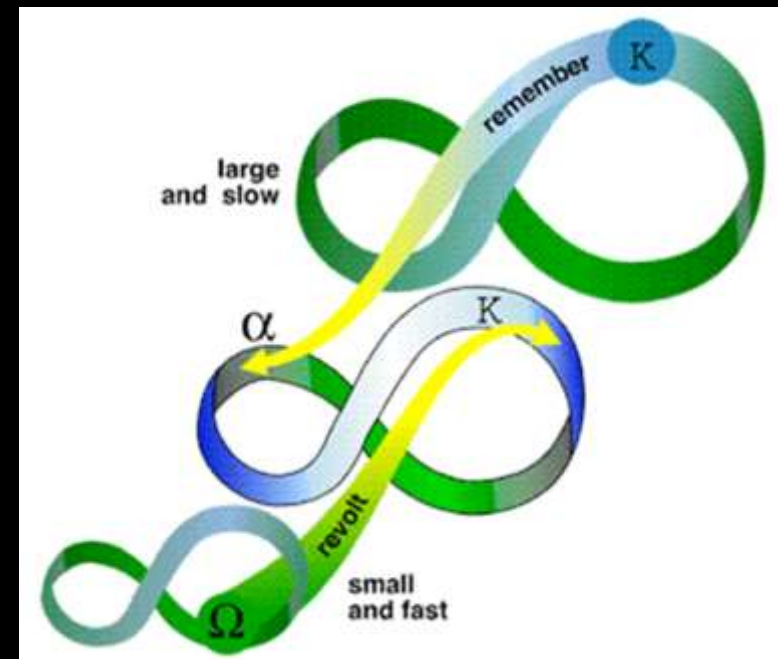
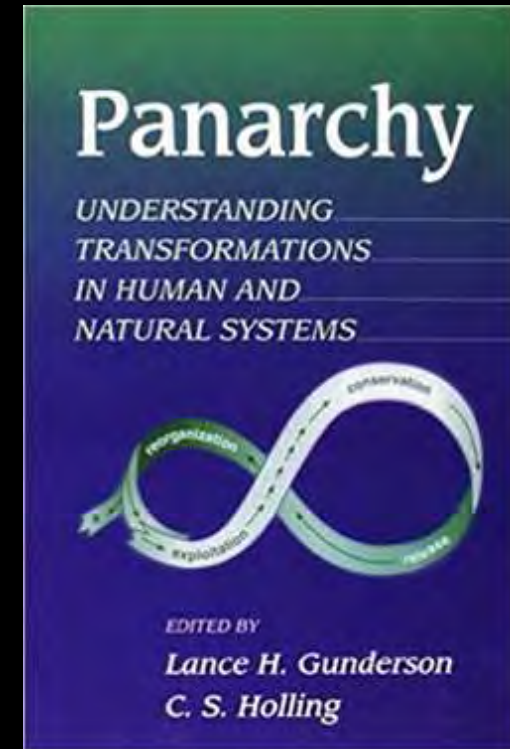
- **Panarchy is a new narrative or myth of evolving nature**, hinted at by the name of the Greek god of nature - Pan - whose persona also evokes an image of unpredictable change.
- **Change is not always for the good** - Pan has a destabilizing role that is captured in the word panic, directly derived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



Resilience, Panarchy, and Adaptive Management

A Narrative of Permanence and Change

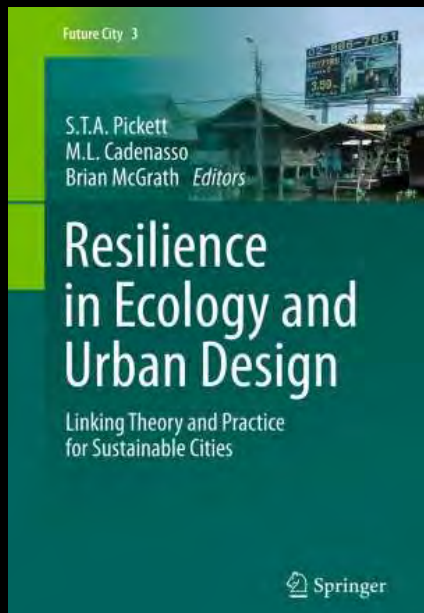
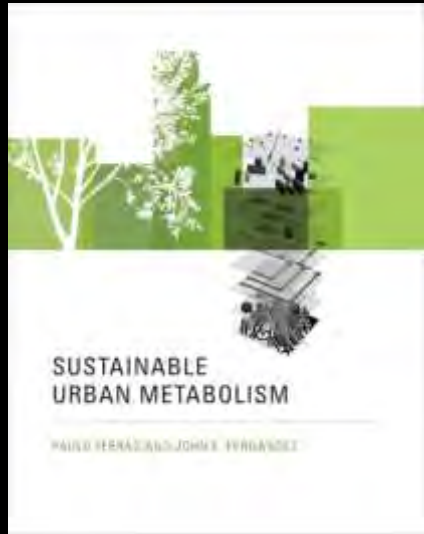
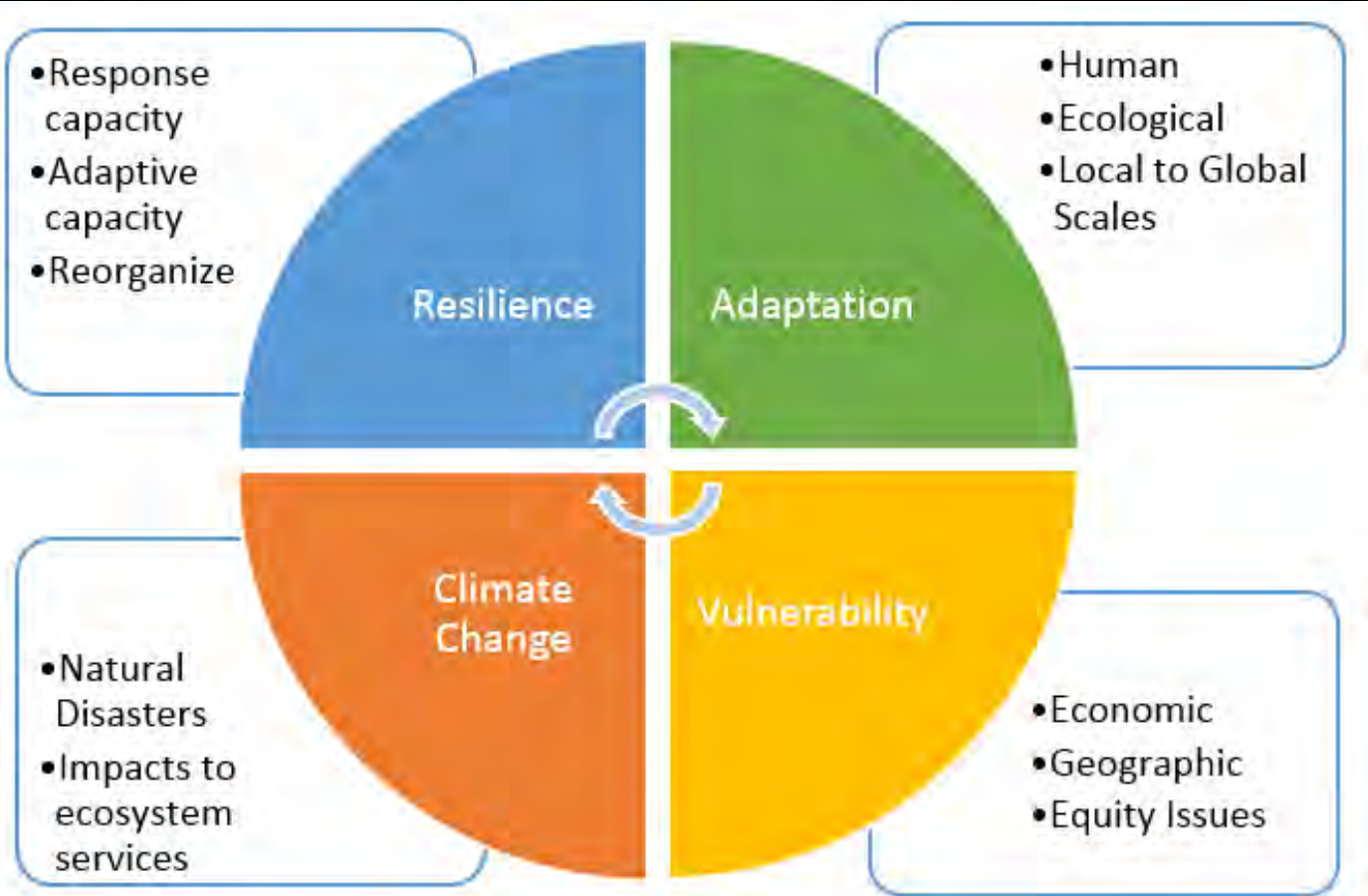
- 'Panarchy' is a term that **“explains the evolving nature of complex adaptive systems”** Human and Natural systems - Socioecological systems
- **No socioecological system can be understood or managed by focusing on it at a single scale.**
- All systems exist and function at multiple scales of space, 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 and Urban Metabolism – Homeostasis

The characterization of flows and the relationships between anthropogenic urban activities and natural processes and cycles defines the behavior of urban production and consumption.

Homeostasis - Self-regulating process by which biological systems tend to maintain stability while adjusting to conditions that are optimal for survival.



Resilience, the Ecological City, and Socioecological Systems

Resilience - 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.

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



<http://www.resalliance.org>



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

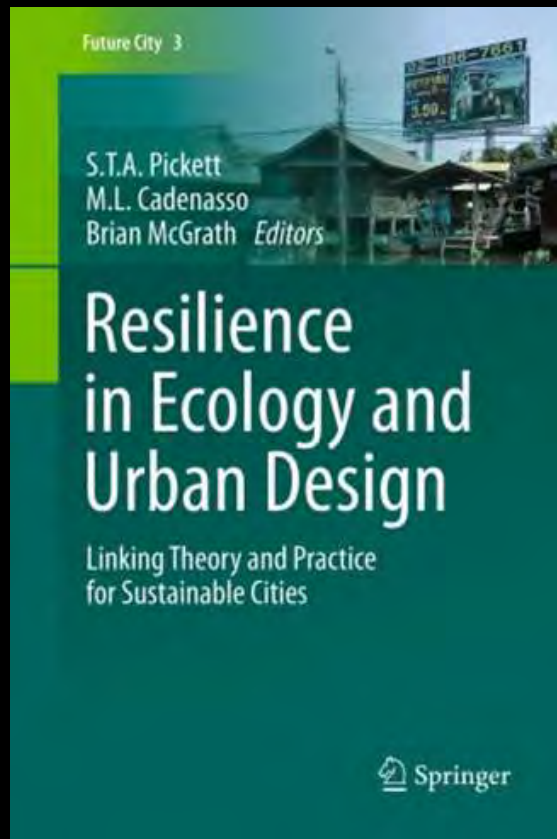
The Ecological City

Nature and Culture

Are cities part of Nature?

Urban Design and Management

Sustainable → Resilience



Concepts of American Nature

Wilderness



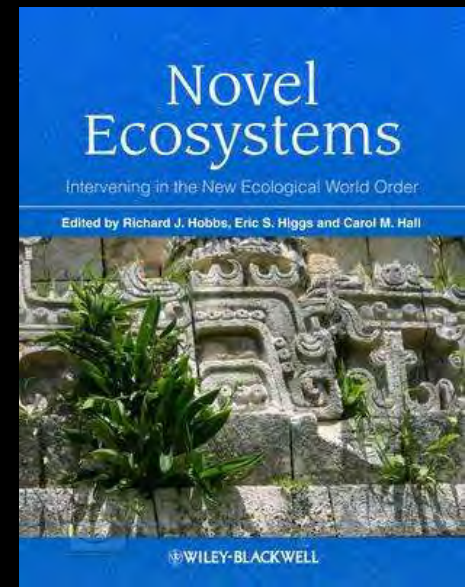
Pastoral



Urban



New



Applause



Questions?





Management of American Nature

- September Saving American Nature: Preservation, Conservation and the Wild
- October Farming with Nature: Sustainable Agriculture and the Pastoral Ideal
- November The Ecological City: Sustainability, Ecology and Urban Nature
- December The End of Nature: Prospective Ecology, Gaia and the Anthropocene

