Restoration Ecology to Ecological Restoration

restoring the future

1 GLRI Restoration Initiative

Ecological Restoration and the GLRI

The practice of restoration, for purposes of the GLRI, includes “ecosystem protection, enhancement, rehabilitation and remediation.”

Defining Restoration

“restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed.”

Reference Condition

In this recovery process, it is unrealistic to expect that the Great Lakes and surrounding ecosystems can be restored back to the conditions of pre-European settlement times.

Functional Integrity

“the restored ecosystem is resilient: its chemical, physical, and biological functions and processes provide the requisite conditions for life.”

Structural Integrity

“a restored ecosystem contains sustainable populations of native plant and animal species and their habitats. Potential threats or further damage have been eliminated or reduced as much as possible.”

Sound Science

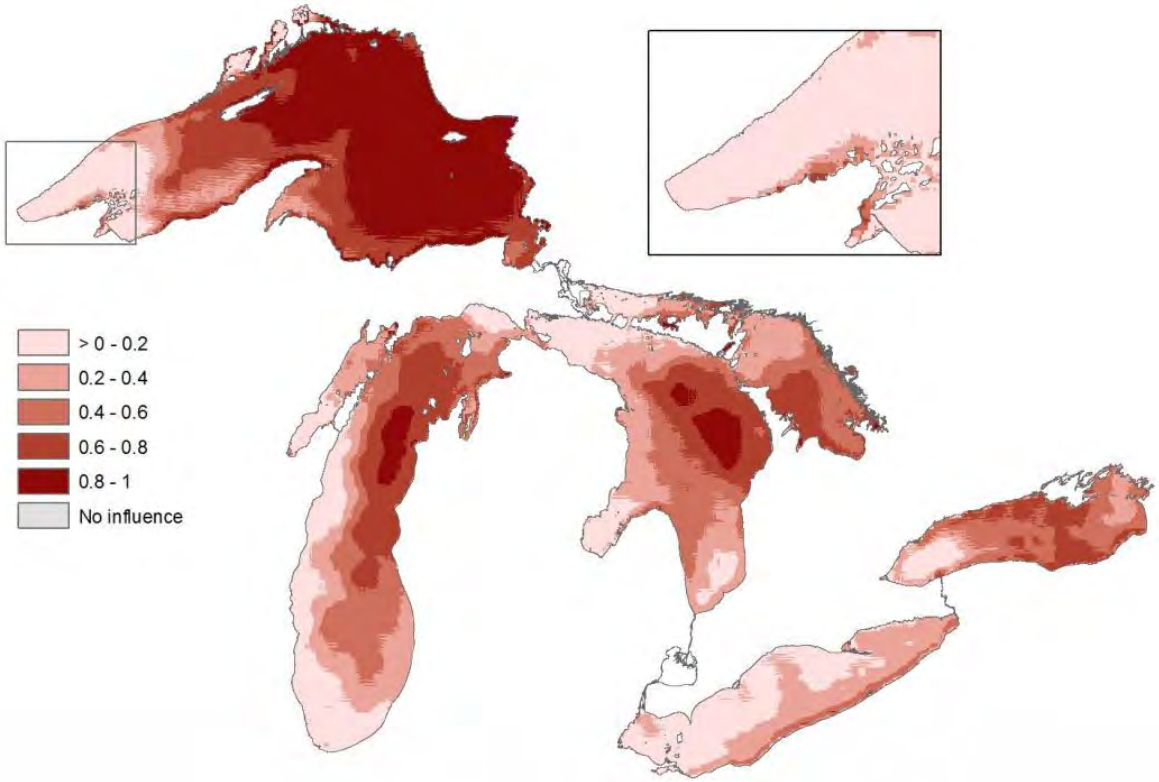
The process underlying restoration and protection depends on the availability of sound scientific information to understand the structure and function of natural and disturbed ecosystems in the Great Lakes basin.

A comprehensive scientific approach is needed given the complexity of ecosystem response to stressors and restoration actions.

Draft – GLRI An Adaptive Science Based Restoration Framework; Science Subgroup of the Great Lakes Regional Working Group May 21, 2013 Draft

8 restoration challenges

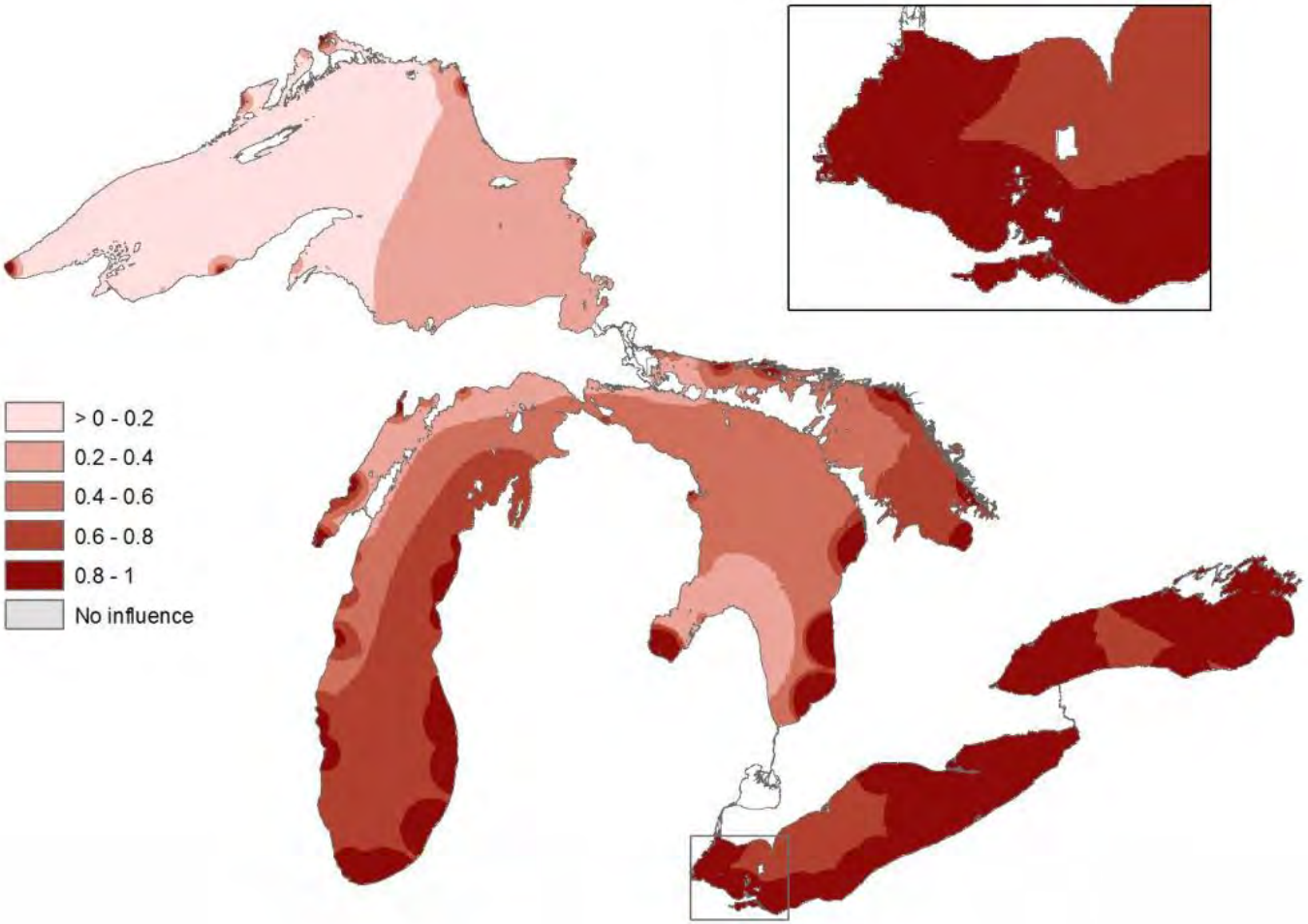
Climate change
Invasive species
Nutrient imbalances
Hydrologic disconnections
Habitat fragmentation
Trophic cascades
Growth
Apathy & Helplessness



Spatial distribution of warming water temperatures in the Laurentian Great Lakes (Inset: Western Lake Superior).

GREAT LAKES ENVIRONMENTAL ASSESSMENT AND MAPPING PROJECT

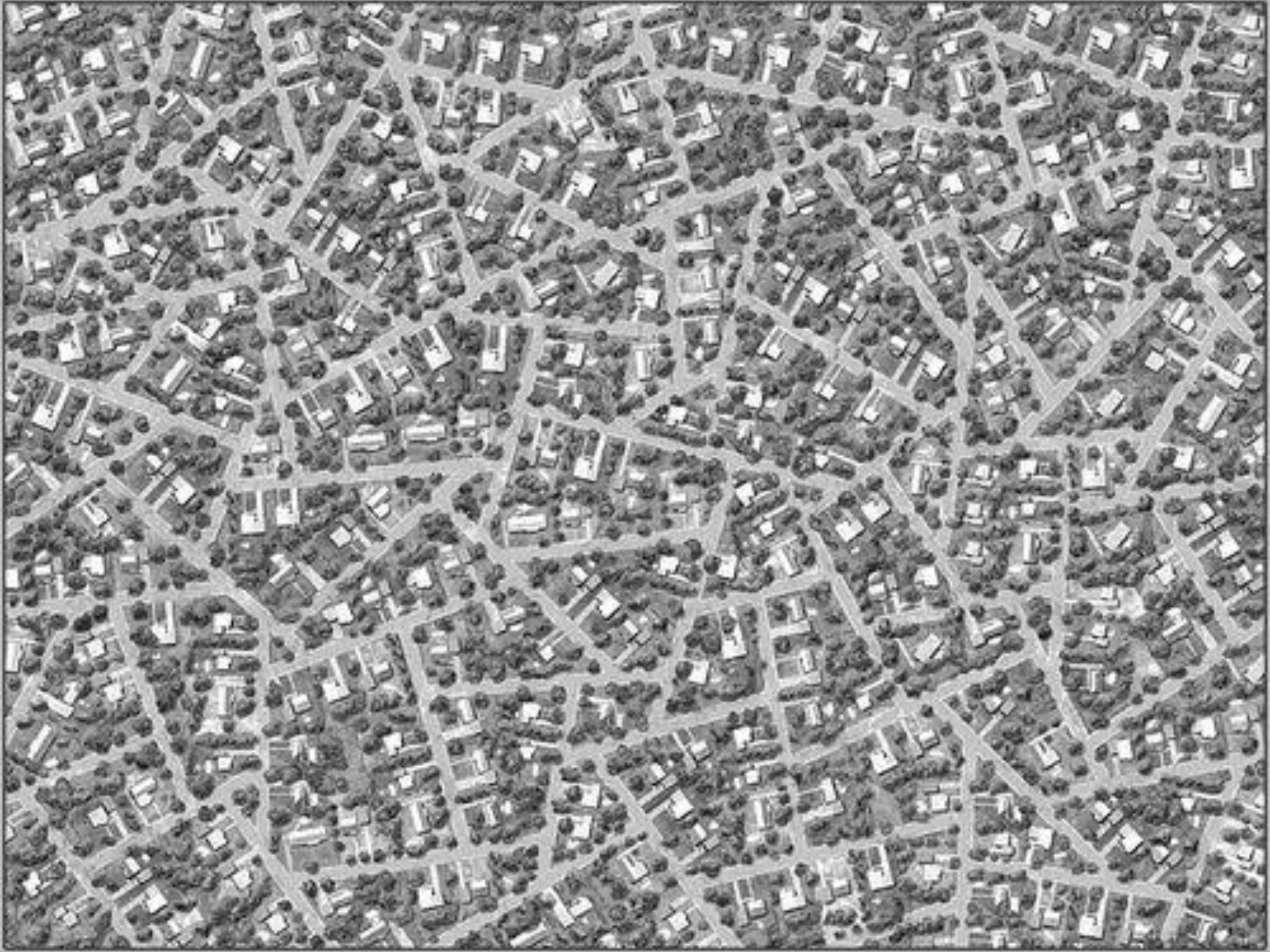
Zebra mussels washed up on beach, Lake Erie Bay City Times (courtesy Great Lakes Environmental Research Lab).



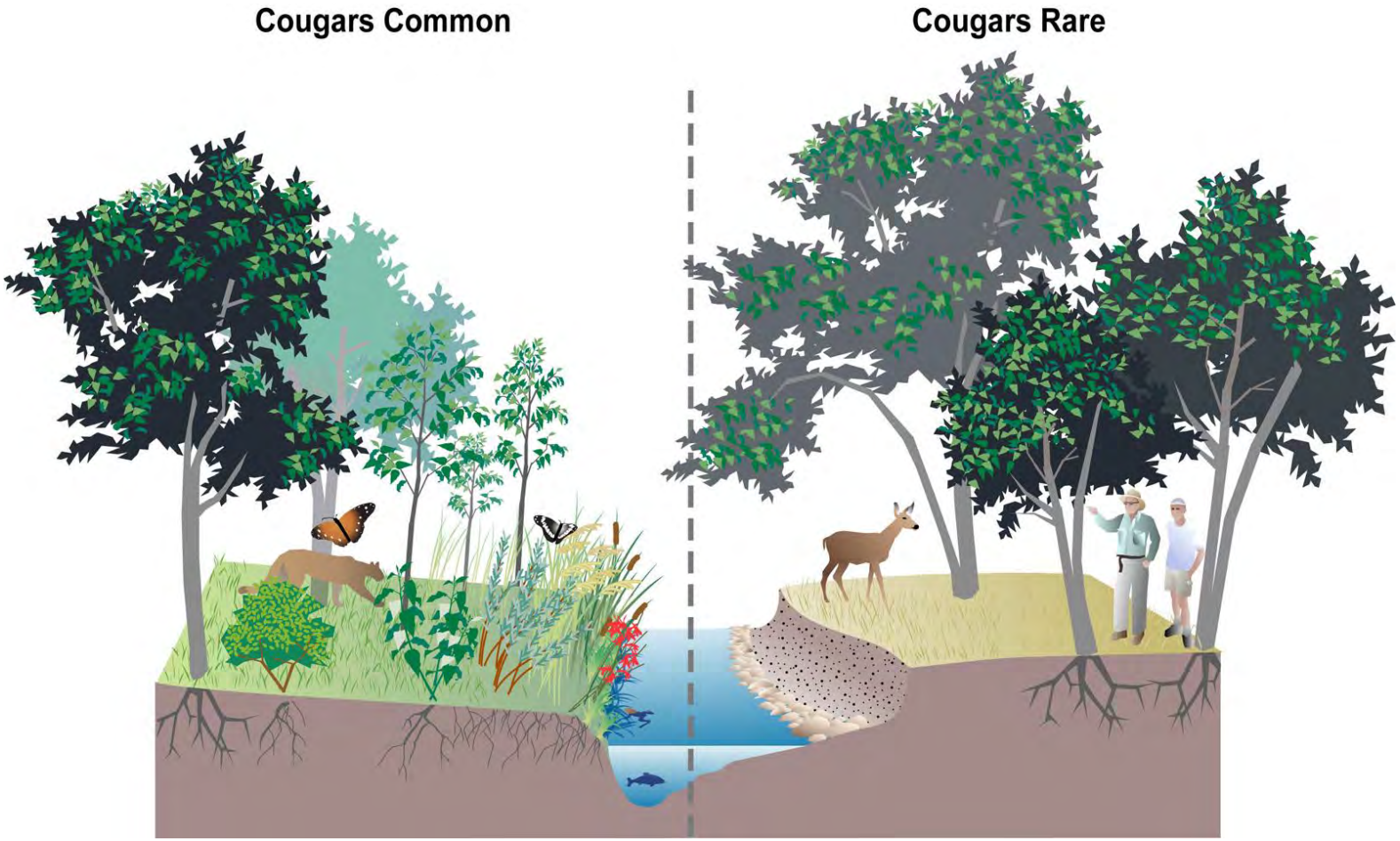
Spatial distribution of nitrogen loading as a stressor in the Laurentian Great Lakes, (inset: Western Lake Erie).

GREAT LAKES ENVIRONMENTAL ASSESSMENT AND MAPPING PROJECT

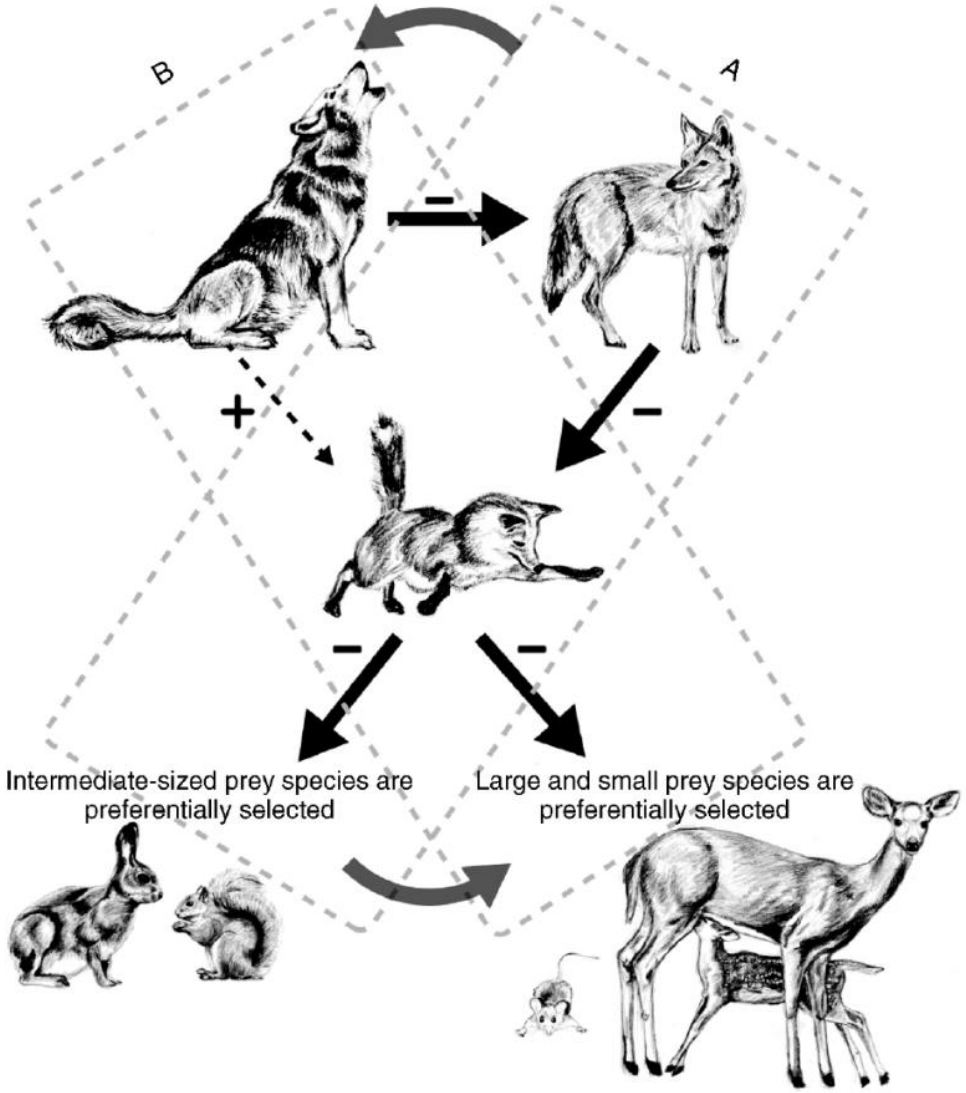
Lisa DeJong, The Plain Dealer

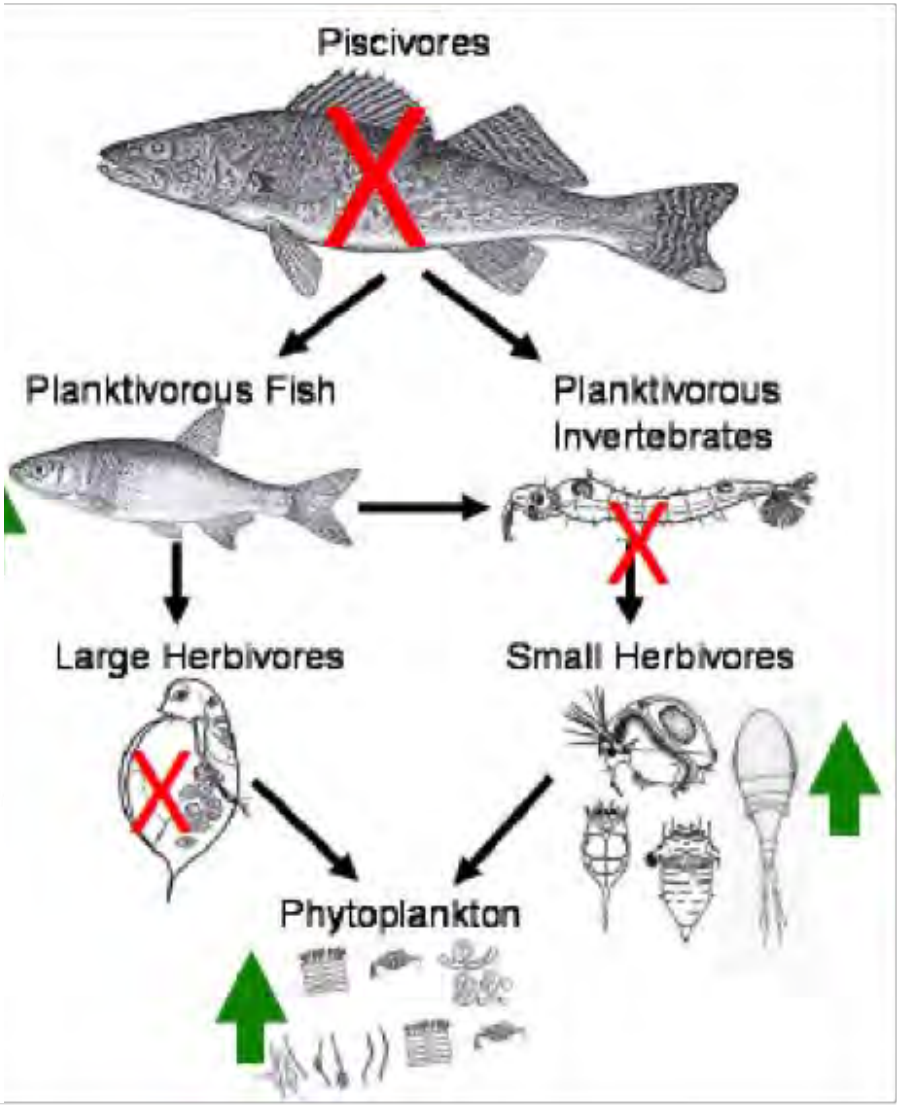


The “Ecology of Fear”



Bill Ripple, Bob Beschta -OSU





Ecology, 93(4), 2012, pp. 921–929 Ó 2012
by the Ecological Society of America
Wolves–coyotes–foxes: a cascade among carnivores
TAAL LEVI AND CHRISTOPHER C. WILMERS

Overstepping Ourselves

As our Ecological Footprint continues to exceed Earth's biocapacity, we overdraw from our future.

1961

74%

of biocapacity

1985

114%

of biocapacity

2012

156%

of biocapacity

Source: Global Footprint Network, Earth Overshoot Day, 2012

Forms of Capital

Natural

Financial

Physical

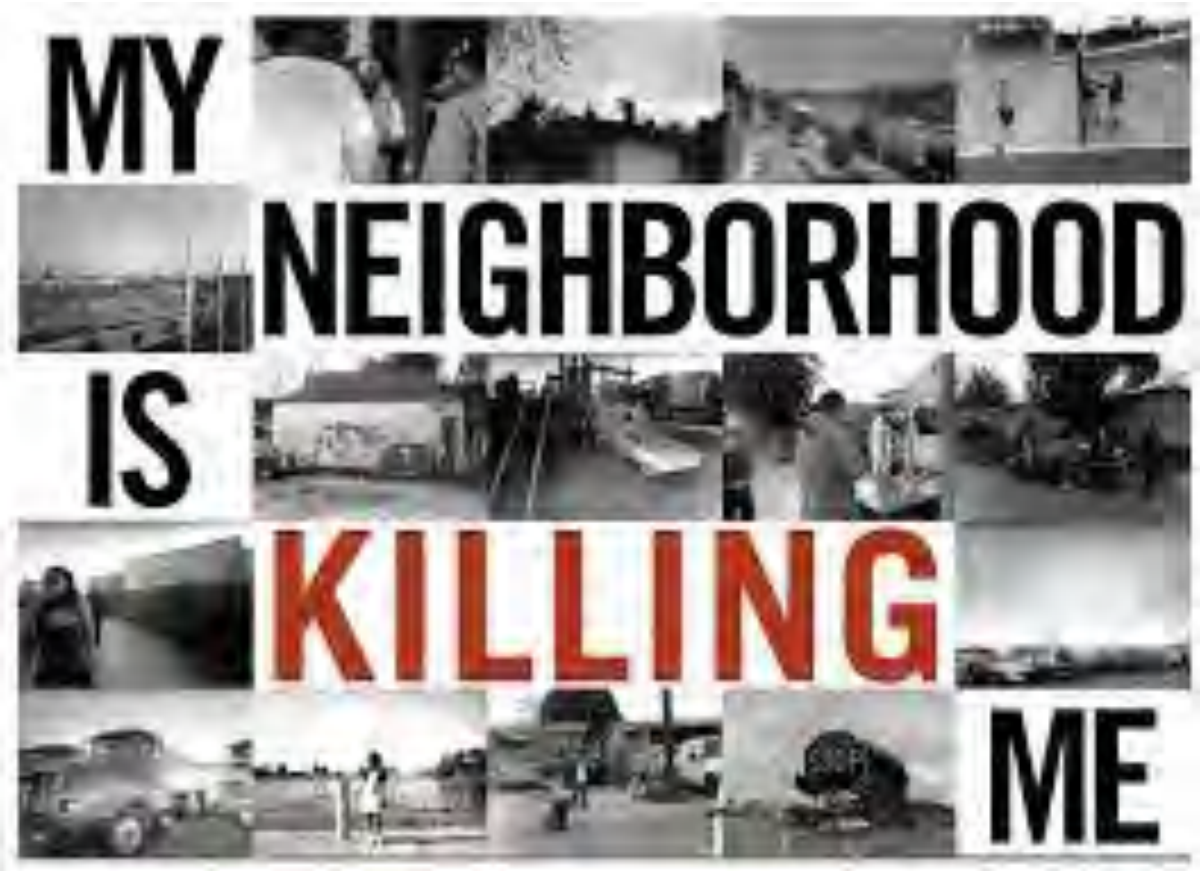
Intellectual

Spiritual

Human

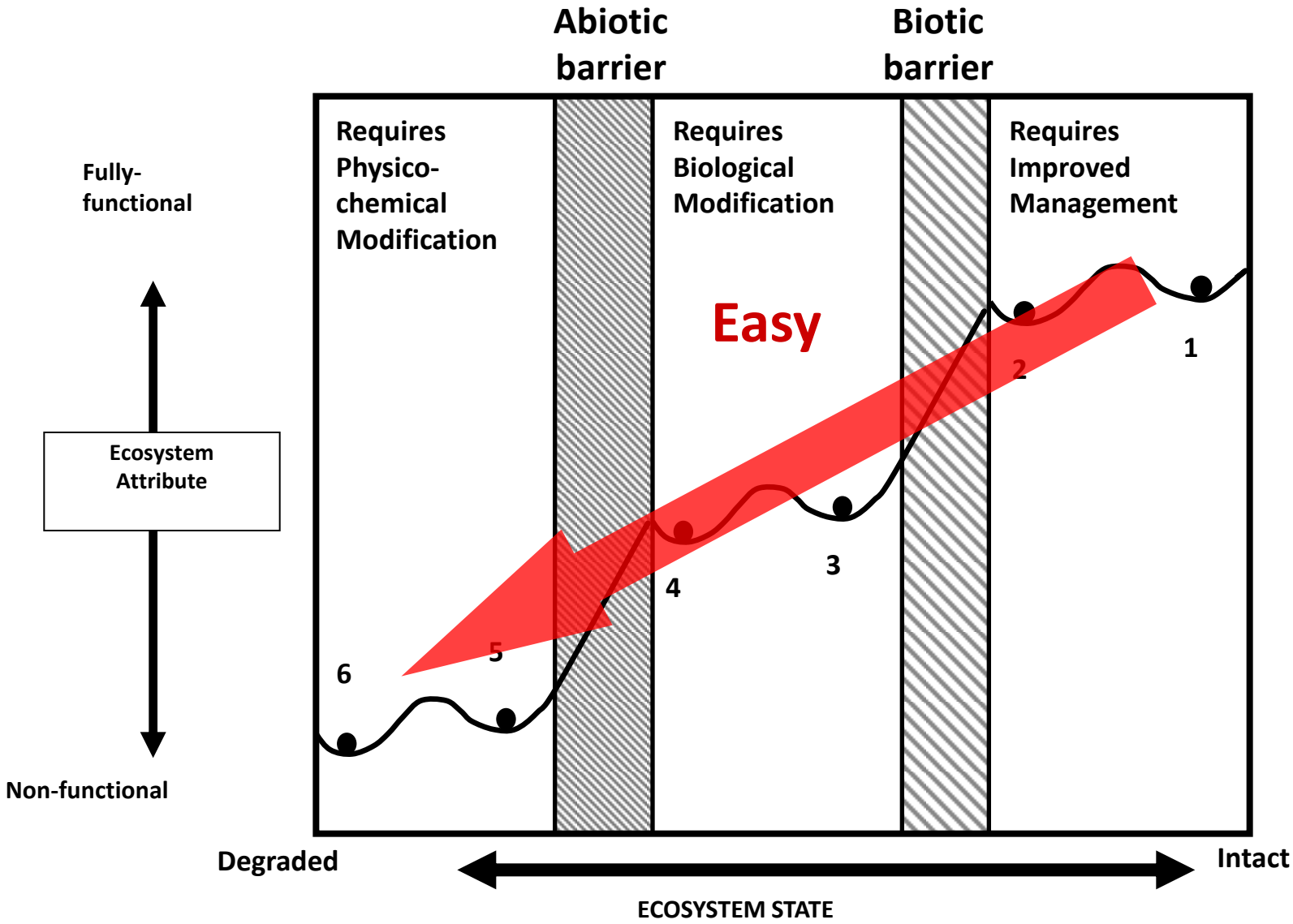
Financial capital represents a mean of 5% and a high of 10% of the total of all forms of capital

…yet we make >90% of decisions based on short term financial capital – first costs

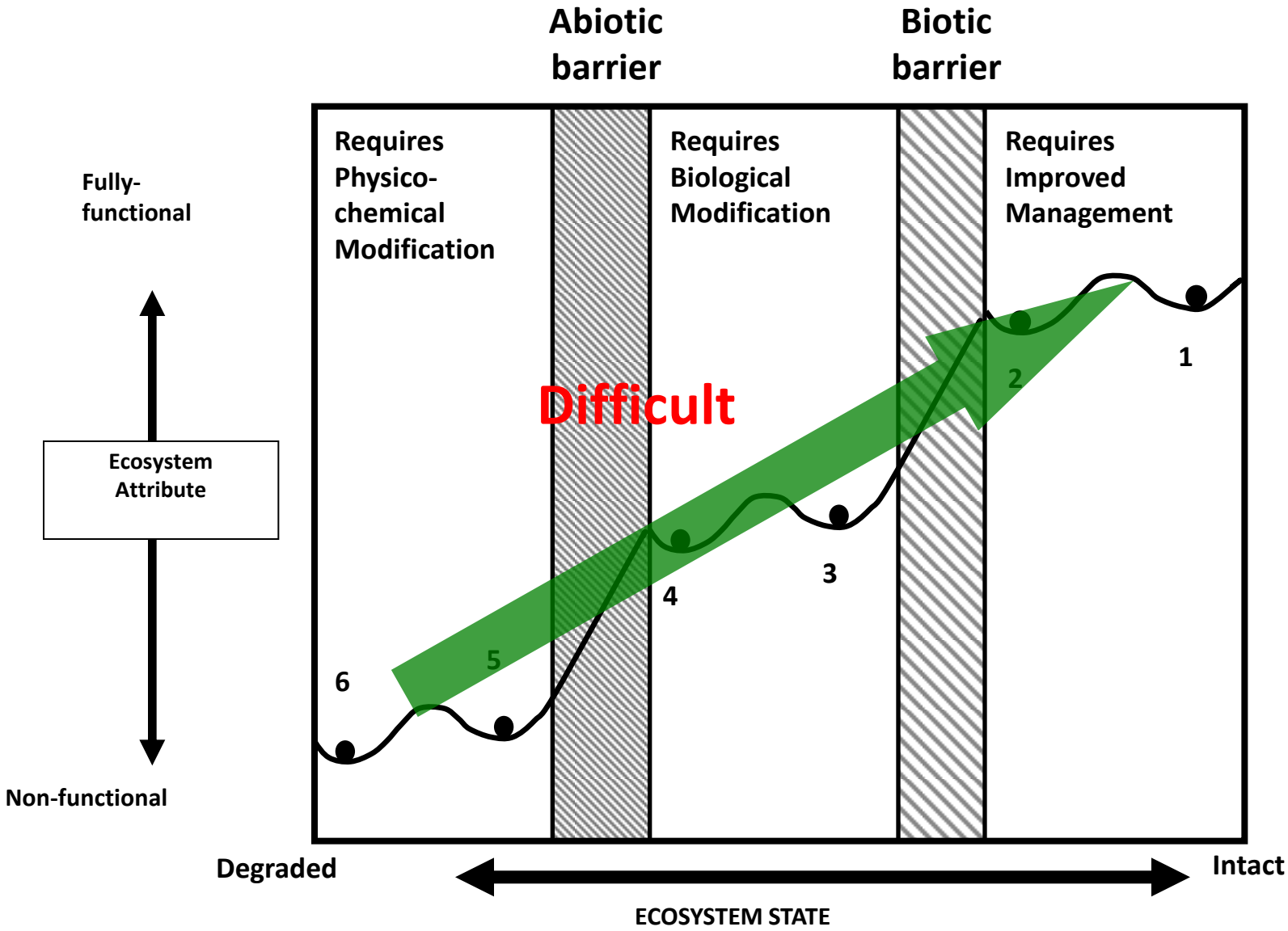

MY
NEIGHBORHOOD
IS
KILLING
ME

2 restoration conundrums

Restore to what?
How?


Abiotic barrier
Biotic barrier
Requires Physico-chemical Modification
Requires Biological Modification
Requires Improved Management
Easy
Fully-functional
Ecosystem Attribute
Non-functional
1
2
3
4
5
6
Degraded
Intact
ECOSYSTEM STATE

Harris, et.al


Abiotic barrier
Biotic barrier
Requires Physico-chemical Modification
Requires Biological Modification
Requires Improved Management
Fully-functional
Ecosystem Attribute
Non-functional
Difficult
1
2
3
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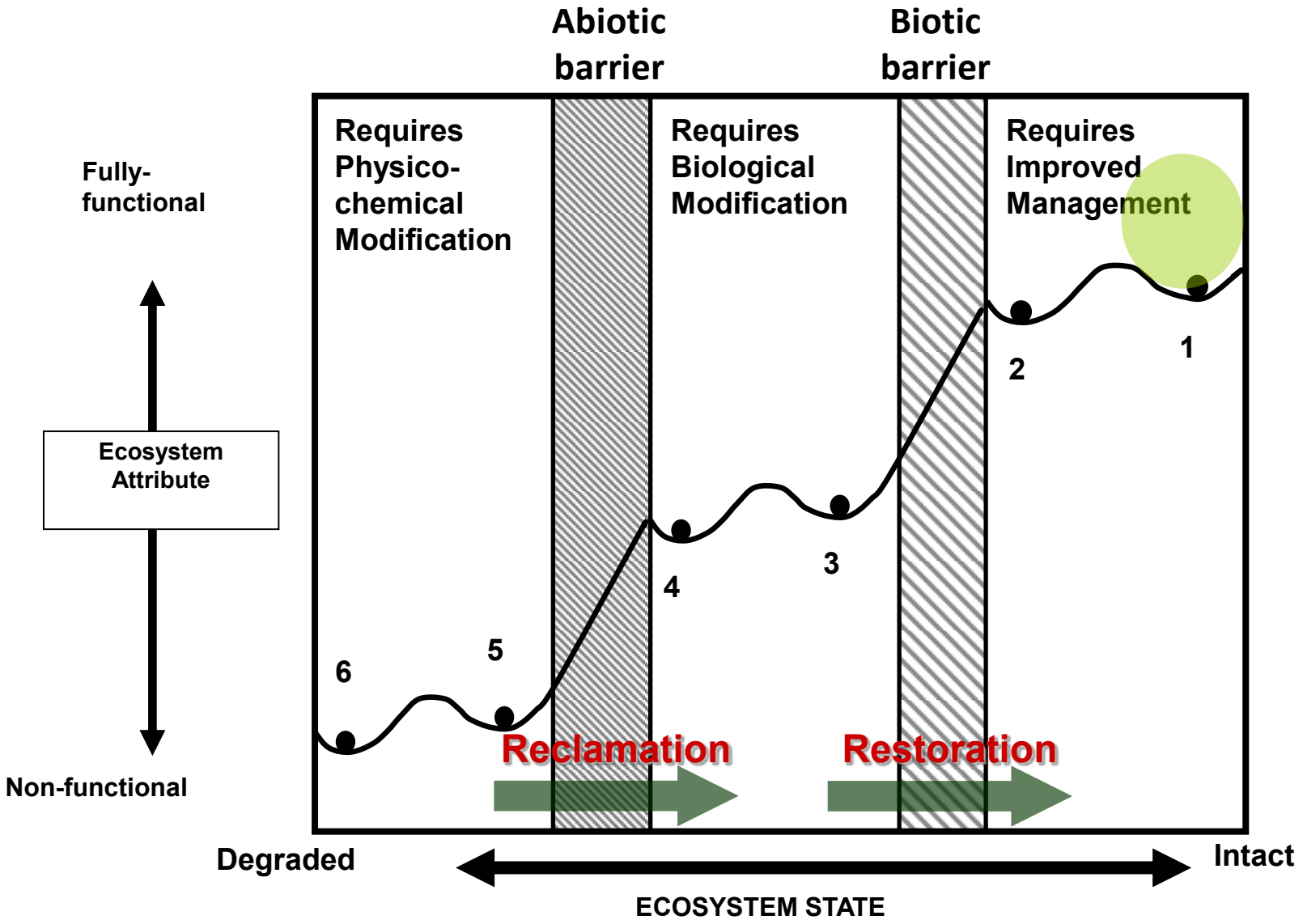
ECOSYSTEM STATE

Harris, et.al


Abiotic barrier
Biotic barrier
Requires Physico-chemical Modification
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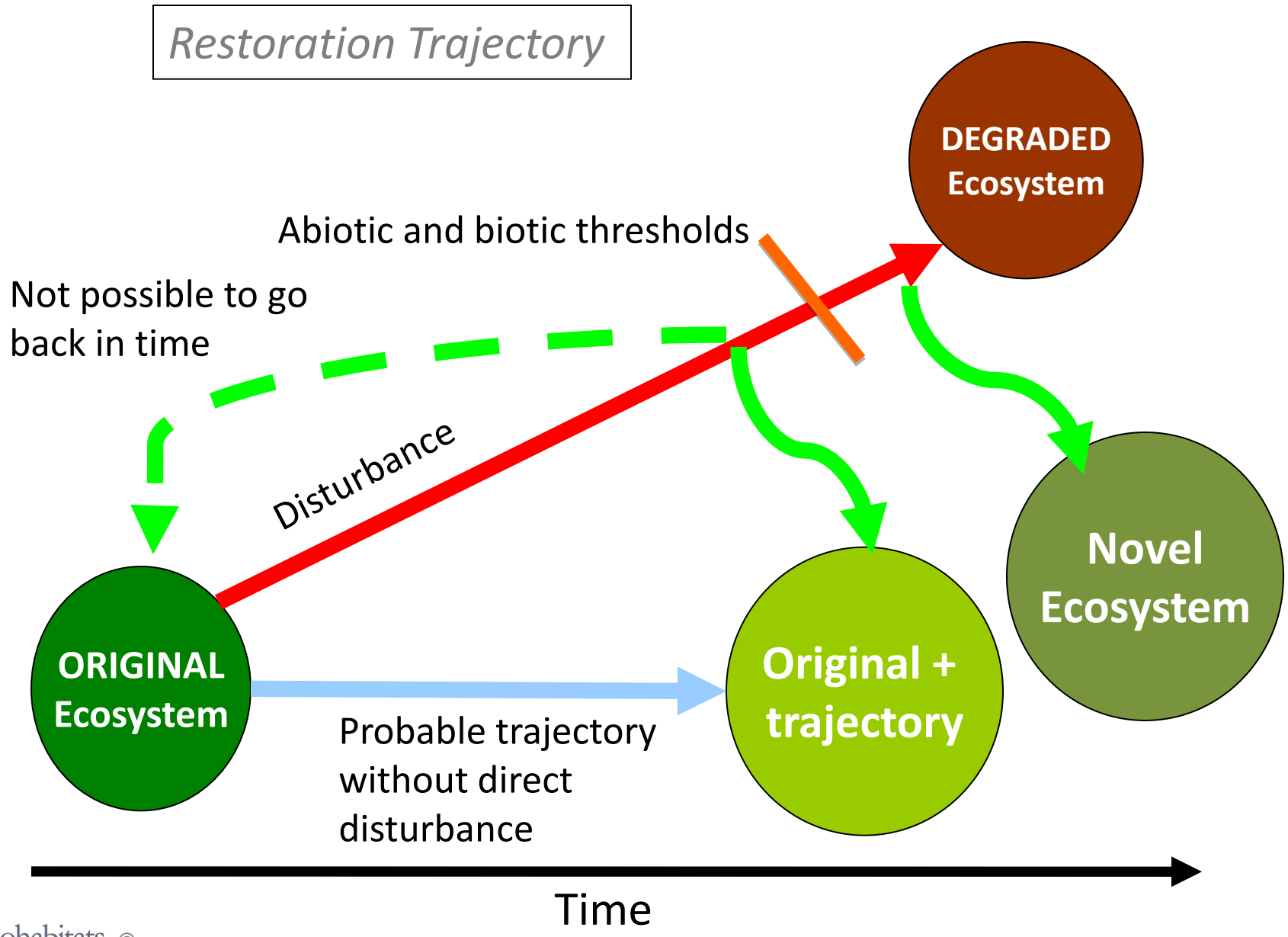
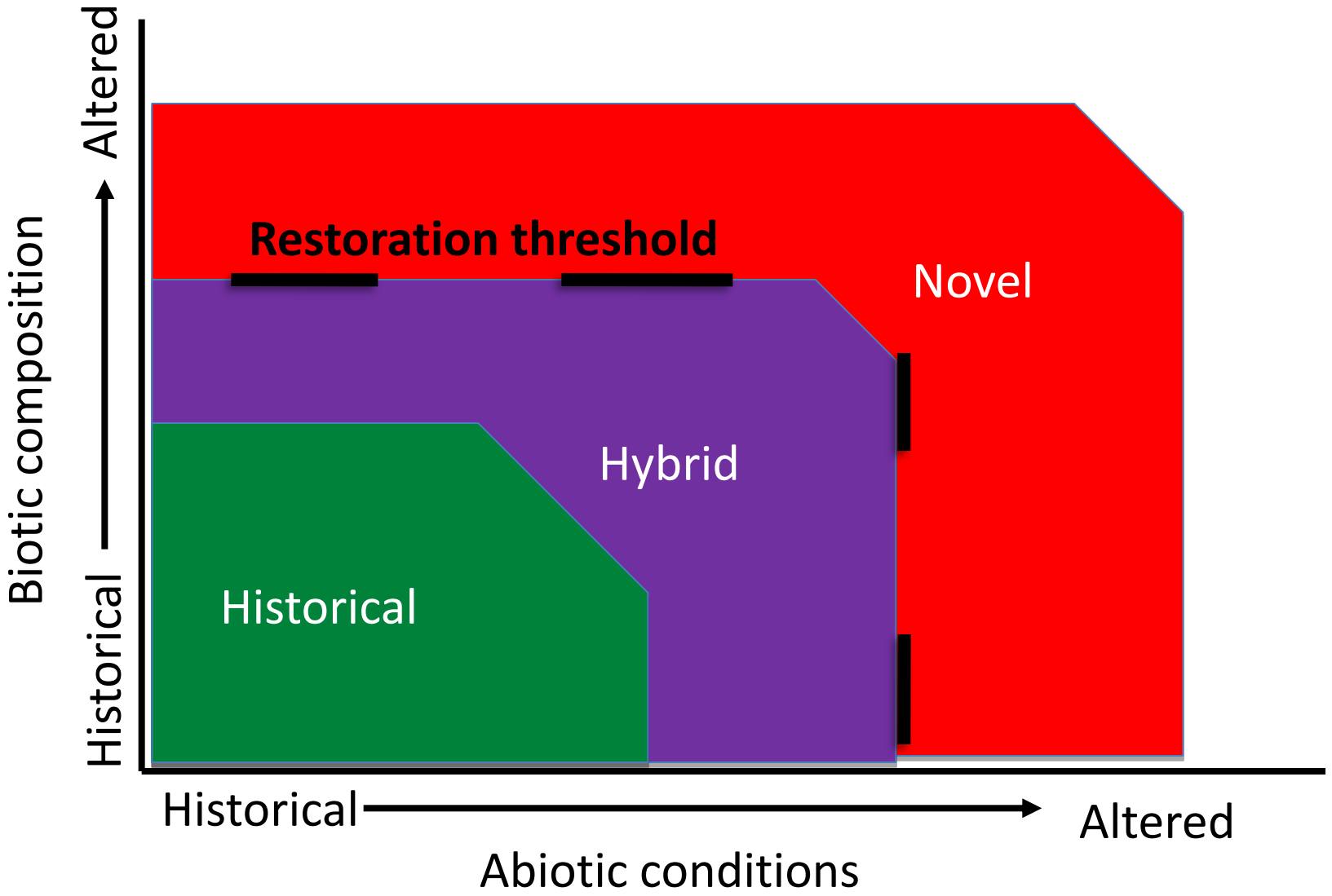
Fully-functional
Ecosystem Attribute
Non-functional
1
2
3
4
5
6
Reclamation
Restoration
Degraded
Intact
ECOSYSTEM STATE

Harris, et.al


Restoration Trajectory
DEGRADED Ecosystem
Abiotic and biotic thresholds
Not possible to go back in time
Disturbance
ORIGINAL Ecosystem
Probable trajectory without direct disturbance
Original + trajectory
Novel Ecosystem
Time

novel ecosystem

Hobbs et al (2009): “a novel ecosystem … is one in which the species composition AND / OR function have been completely transformed from the historic system”



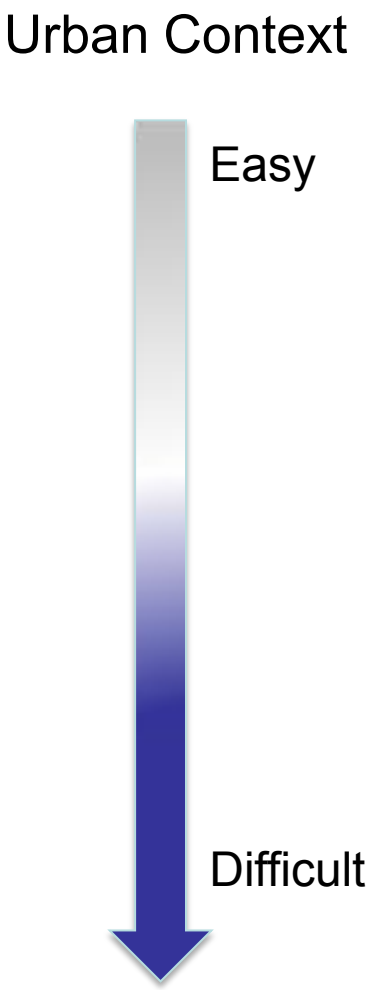
Novel ecosystems: implications for conservation and restoration
Richard J. Hobbs1, Eric Higgs2 and James A. Harris3

With novel ecosystems, we can…

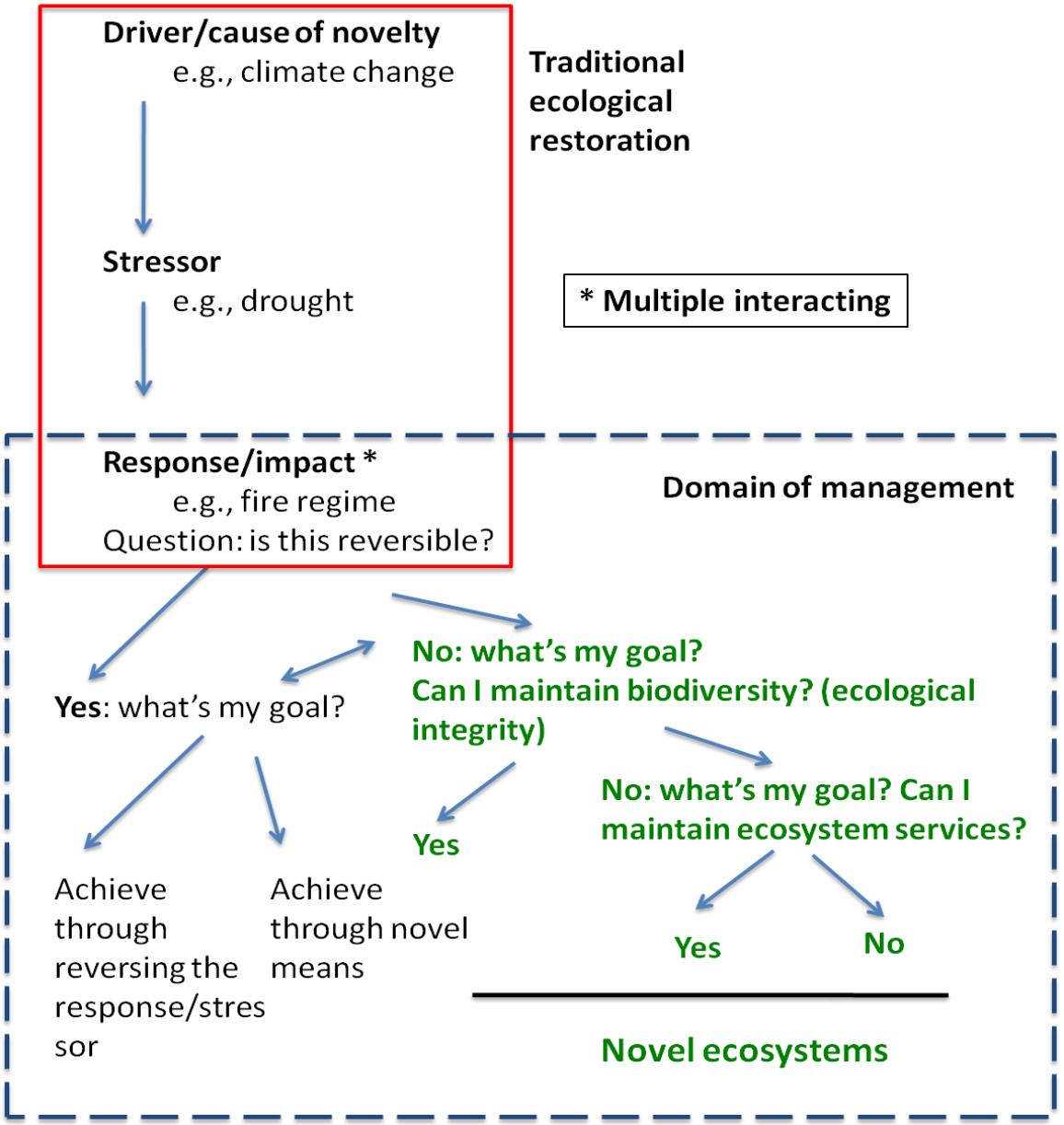
A.Leave them alone and let them sort themselves out;

B.Restore ecosystem functions to achieve socially desirable ecosystem values;

C.Restore ecosystem functions that favor the continued survival, and evolutionary potential, of native endemic species



Management decision tree



(Hobbs, et.al. 2011)

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- A meta-analysis of 89 restorations for biodiversity and ecosystem service provision
- Restorations ranged from <5 to 300 years(!?)
- Degraded vs restored vs pristine comparisons made
- Biodiversity increased by 44% in restored vs degraded
- Ecosystem service provision increased by 25%
- Both lower than in pristine systems
- TIME???

How?

5. Adaptive

4. Whole Systems – Nested Scales

3. Sound Science

2. Ecological Democracy
(Randal Hester, Landscape Architect)

1. The Power/Desire to Transcend Paradigms
(Donella Meadows, Systems Analysis)

Living Infrastructure

"Increasingly, communities are relying on **"natural infrastructure" as a least-cost approach to protecting surface water quality, which can generate multiple benefits such as habitat preservation, carbon sequestration, and aesthetics.**

- ASCE Report Card

Las Vegas Springs P
Stormwater Wetlands
Las Vegas, NV

living infrastructure

Strategically planned and managed networks of natural lands, working landscapes and other green spaces – at many scales – that conserve ecosystem functions, restore ecosystem processes and regenerate healthy, robust and resilient communities.

- Biologically complex
- Self Organizing
- Self Maintaining
- Life Giving

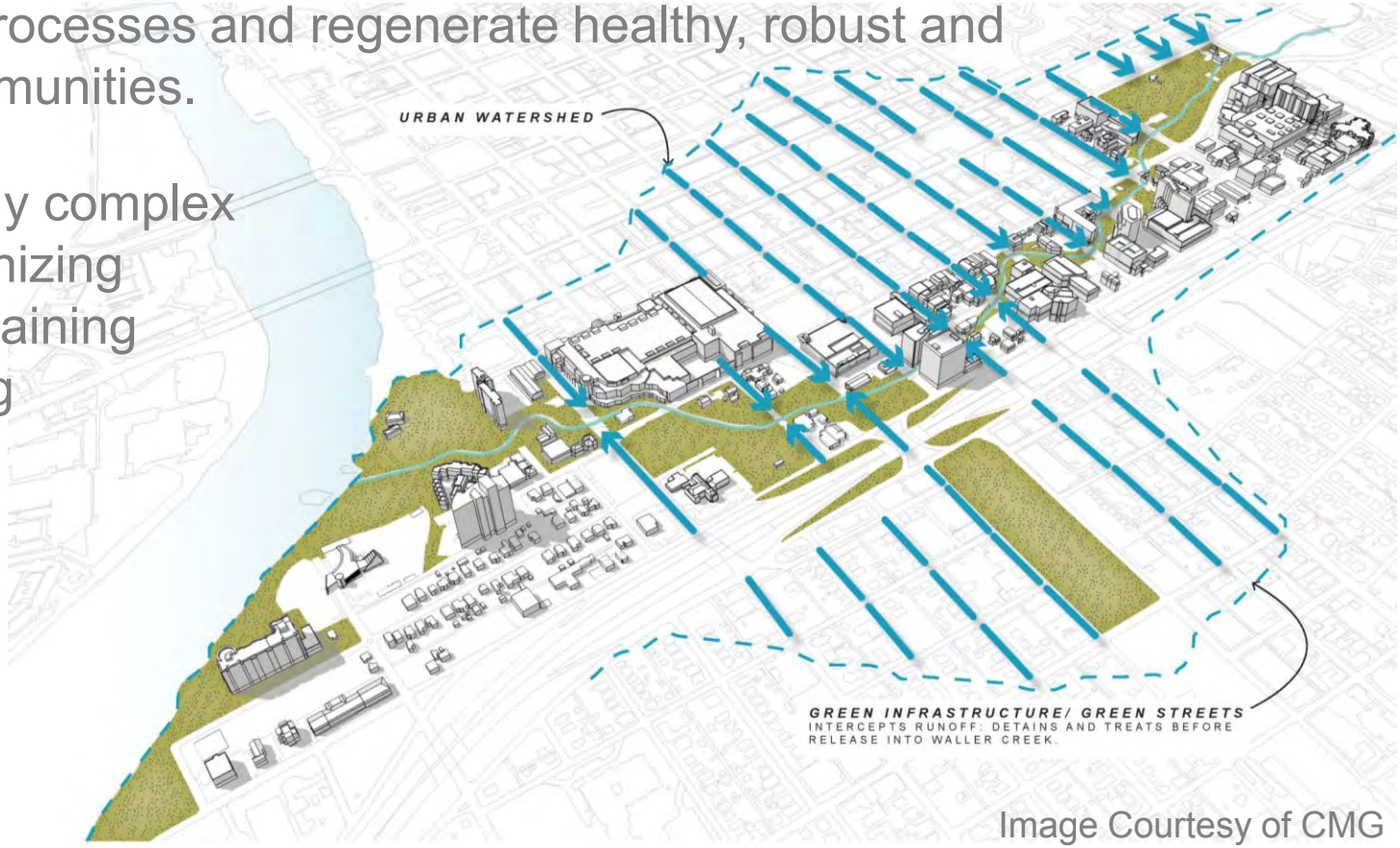

Image Courtesy of CMG