Where should we act and at what scale?

Defining the meaning of restoration from an ecological perspective

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Ecosystem Valuation: [http://www.ecosystemvaluation.org](http://www.ecosystemvaluation.org)

**Ecological functions**
- Groundwater recharge
- Reproductive success of duck/fish/deer populations
- Stand-level forest productivity
- Pollination
- Carbon/Nitrogen/Phosphorus cycling

**Ecological Services**
- Clean water availability
- Fishing/hunting recreation opportunities
- Lumber production
- Crop harvest success
- Pollutant processing capacity

**Ecological/evolutionary functions**
- Species diversity
- Rate of endemism
- Physical size
- Uniqueness
- Spatial arrangement
- Resilience

**Ecological/evolutionary services**
- Marketplace quality/scale
- Marketplace uniqueness
- Market size
- Regional network of markets (migration corridors, diversity generating regional configurations)
Decision critical criteria at three scales

• Global scale:
  – Support species diversity patterns
    • nested within this is reducing extinction risks.

• Regional scale:
  – Restoration programs that address regions with high diversity are a priority over those that don’t.
  – How we address each region is unique.

• Local scale:
  – supporting basin functions to ensure
    • Natural system level hydrology
    • Reference water quality (particularly TP)
Result

- A patchwork of preserved natural systems (national preserves) buffered by healthy landscape that expresses a mosaic of land uses which deliver desirable ecological services because they exhibit coherent ecological functions.

It is just that easy
National/Regional scale Restoration Programs


- River/Watershed Restoration:
  - Chesapeake Bay
  - Gulf Coast/Coastal Louisiana
  - Upper Mississippi River
  - Missouri River
  - *Everglades Ecosystem*
  - Platte River
  - Rio Grande River
  - Colorado River/Glen Canyon Dam
  - Klamath River/Watershed
  - Puget Sound
  - Columbia River
Preventing extinction

A RATIONAL GLOBAL APPROACH
Animals under threat

• Ten percent of all bird species are likely to disappear by the year 2100, and another 15 percent could be on the brink of extinction, according to a new study by Stanford University biologists. This dramatic loss is expected to have a negative impact on forest ecosystems and agriculture worldwide and may even encourage the spread of human diseases, according to the study published in the Online Early Edition of the Proceedings of the National Academy of Sciences (PNAS) in December.


• "Disconcertingly, avian declines may in fact portray a best-case scenario, since fish, amphibians, reptiles and mammals are 1.7 to 2.5 times more threatened [than birds]."
Delivering quality water

A RATIONAL LOCAL APPROACH
A rational local approach
Flanagan and Richardson 2010

Fig. 1 Location of study watersheds in eastern North Carolina, USA
Conclusions: Proportion of watershed in agriculture, prior land use, ratio of perimeter to area (edge/area ratio) of wetlands in basin determine water quality in NC basins.
Land uses and water quality

Conclusions: Proportion of watershed in agriculture, prior land use, ratio of perimeter to area (edge/area ratio) of wetlands in basin determine water quality in NC basins.
Basin Scale Conclusions:

• >20% natural function per basin necessary for appropriate WQ (consider this a minimum threshold that should be applied even to cities....).

• Spatial substructuring can be design-oriented (e.g. area sensitive bird species in FL. Keys, butterfly migration corridors in California, shallow lake function support in Central FL., Maximize agricultural production, high density urban system, etc....)
Decomartmentalization of the Everglades

How we are acting on what we’ve learned

A RATIONAL REGIONAL APPROACH
Figure 16. Satellite image of the western ridge and slough landscape, including Water Conservation Areas 3A and 3B, and the Shark Slough/Northeast Shark Slough portions of Everglades National Park. Largest circle indicates portion of landscape which most closely resembles original pattern of ridges and sloughs. Smallest circles show location of 1917 photographs that closely resemble pre-drainage descptions. Other circles indicate various degraded conditions of present day ridge and slough landscape.
Central Question

- What mechanisms create and maintain the ridge-slough landscape?
  - Corrugation (vertical dimension)
  - Anisotropy (longitudinal dimension)
  - Wavelength (lateral dimension)
Sediment redistribution can promote cross-sectional landscape stability

Larsen, Harvey, and Crimaldi, Ecological Monographs 2007
Larsen and Harvey, The American Naturalist, 2010
1995 aerial photos were used to identify tree islands (green) in WCA3; 60% of the 1940 islands have been lost.
Subsidence
(NSM v4.6.2 – HAED)
Tree Island inundation duration in 2005 - An average year

Elevation surveys by C. Coronado SFWMD

Each island displays the number of days its maximum elevation point was inundated during the year 2005. Water level data was acquired from the EDEN Network online database for each island.
Results from initial Decomp simulations

Entirely consistent with DBQ and other scoring processes

Habitat Units vs nmds Axis 1

\[ y = 673899x + 412337 \]
\[ R^2 = 0.9669 \]

Decomp alternatives

- ECB
- FWO
- AltB
- AltG
- AltA
- PCB

Habitat unit regression line

Dim 1 vs Dim 2
THANKS SO MUCH!