Sustainability Forum

Resilience and Adaptation Considerations for Natural Systems in an Urban Context

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Resilience and Adaptation

- Critical loss of ecosystem services is largest threat
- Adaptations:
  - Selection of relevant accounting unit and mindful balancing of ecosystem services
  - Restoration of systems to balanced service provision
- R&D into service provision, inventory, and restoration
- Challenges:
  - Thresholds and alternative states
  - Determining scales
  - Don't know how well management actions work
  - Spatial matching of effort and benefits

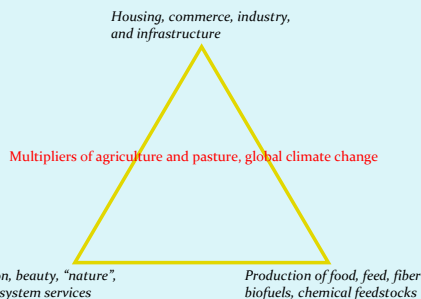## Consequences of Ecosystem Change for Human Well-being
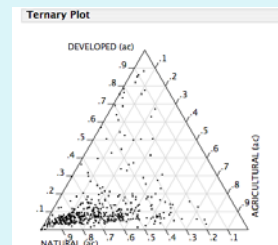

Five Challenges for S&T

- Meeting the basic needs of the poor
- Managing the competition for land, water, and terrestrial biota
- Maintaining the integrity of the oceans
- Mastering the energy-economy-environment dilemma
- Moving toward a nuclear-free world

John A. Holdren, Presidential Address, Science 319: 424-434

Three-way challenges for land, water, and biota

Housing, commerce, industry, and infrastructure

Multipliers of agriculture and pasture, global climate change

Recreation, beauty, "nature", other ecosystem services

Production of food, feed, fiber biofuels, chemical feedstocks

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Land cover in the Appalachian Region: primary land cover by county

Tradeoffs in Water Use

Photo source: USGS, Florida lake before/after gw development

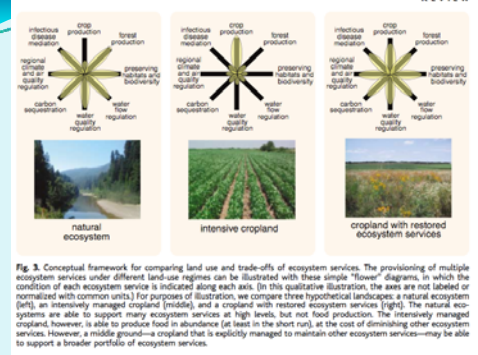- Choices between water supply and ecosystem state

Fig. 3. Conceptual framework for comparing land use and trade-offs of ecosystem services. The provisioning of multiple ecosystem services under different land-use regimes can be illustrated with these simple "flower" diagrams, in which the condition of each ecosystem service is indicated along each axis. (In this qualitative illustration, the axes are not labeled or normalized with common units.) For purposes of illustration, we compare three hypothetical landscapes: a natural ecosystem (left), an intensively managed cropland (middle), and a cropland with restored ecosystem services (right). The natural ecosystems are able to support many ecosystem services at high levels, but not food production. The intensively managed cropland, however, is able to produce food in abundance (at least in the short run), at the cost of diminishing other ecosystem services. However, a middle ground—a cropland that is explicitly managed to maintain other ecosystem services—may be able to support a broader portfolio of ecosystem services.

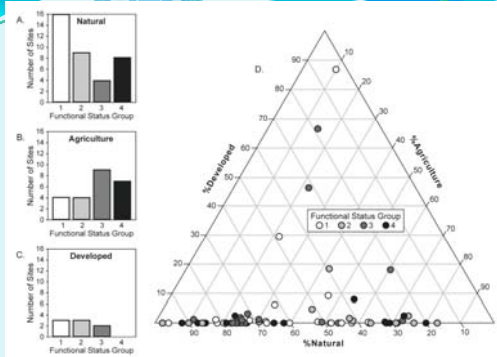Foley et al., Global Consequences of Land Use, *Science* **309**, 570 (2005)

Figure 8. Mean acreage of wetlands in an agricultural setting (defined as >40% agricultural land cover in a 1-km radius circle centered on the wetland), by Isserman category.
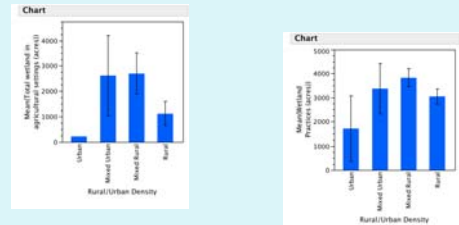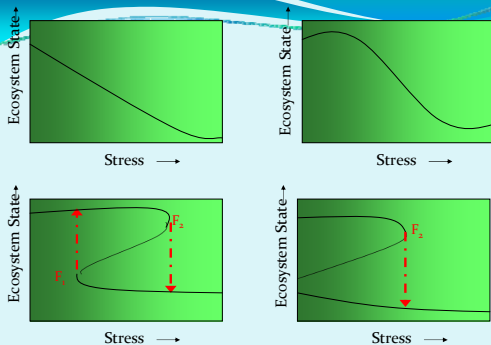
Figure 9. Mean application of wetland conservation practices, in acres, by Isserman category.

Resilience and stability: four possible responses of ecosystems to stress.
Reproduced from *Panarchy*, 2002, Island Press.

Watershed Partners Senior Managers Say:

The delisting of the tidal segments of the Bay and determining the effectiveness of our management actions are the responsibilities of the partnership, and should be the priorities of the monitoring program

Growing a culture of adaptive management and accountability

- Establishing a process that reconciles management priorities and research realities
- Recognizing a resource-limited world
- Building a portable framework that is adaptable and incorporates accountability
- Determining the difference between interesting and important problems using an overarching prioritization of management needs
- Mindful consideration of scales (extent and resolution), both ecological and social