Connecting Ecosystem Service Production to Users as a Measure of Realized Benefits in Coastal Communities

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Introductory Concepts

- Human use is a prerequisite in defining a feature of the ecosystem as an ecosystem good or service. Assessments that do not factor in human use are not complete and can be misleading.
- Ecosystem goods and services are often produced in locations far away from where humans use and benefit from them.

Catch and Release Anglers

Recreational Birdwatchers

Final Ecosystem Goods and Services (FEGS)

"[biophysical] components of nature, directly enjoyed, consumed, or used to yield human well-being" *(Boyd & Banzhaf 2007)*

Beneficiary + Environmental Context → Final Ecosystem Good or Service

Recreational Food Pickers and Gatherers

Estuaries and Near Shore Marine

Flora and fauna, such as mussels, seaweed, crabs, etc.

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Recreational Birdwatchers

Wetlands

Birds, such as the Roseate Spoonbill

Assessment of Ecosystem Services Production

To assess production of FEGS we need to account for three factors:

1. What is the quantity and quality of FEGS produced by a unit of the landscape?
2. What are the spatial production pathways that deliver FEGS to areas were humans use them?
3. What are the spatial access pathways that humans use to access areas were they use FEGS?

Estuaries and Near Shore Marine

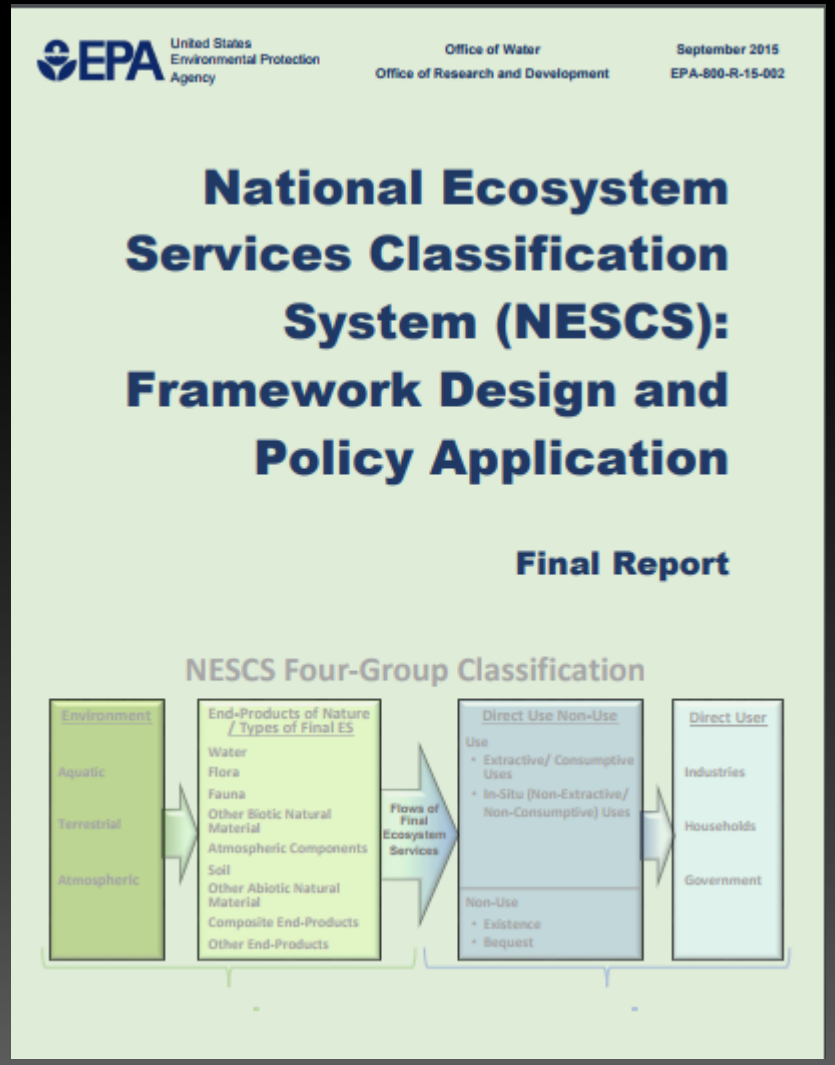
Identifying Final Ecosystem Goods and Services – What do individuals care about?

Consider a Wading Recreational Catch and release (use) Angler (user) –

- Angler identifies Fish Quantity (species abundance, size, diversity)
- Catch and release identifies Fish Quality (coloration, fight behavior etc.),
- Recreational identifies Site Quality (view, sound, smell, temperature etc.)
- Wading identifies Water Quantity and Quality (depth, current speed, clarity, temperature, contaminants etc.)

Generating the list

- User/use combinations in NESCS guided identification of a holistic set of ecological endpoints that are directly beneficial for humans (FEGS).
- Target for production and use pathways.



https://www.epa.gov/eco-research/national-ecosystem-services-classification-system-framework-design-and-policy

Draft List of User/Use Specific FEGS

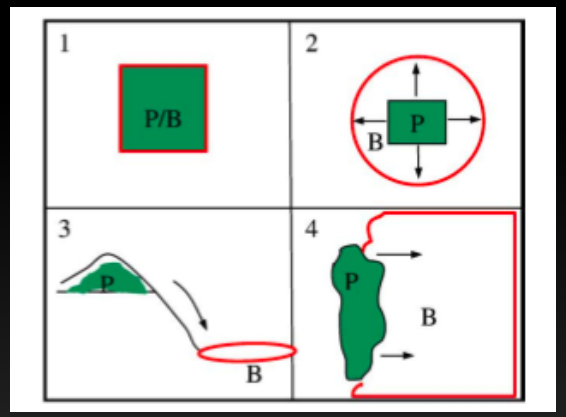
- Quantity of fertilizing, decomposing, pollinating, pest controlling, seed dispersing, charismatic, ornamental, spiritually or culturally important species and nutritional, medicinal, combustible, structural, behavioral qualities
- Quantity of water, nutrients, contaminants, particulates, dissolved matter and qualities such as temperature, depth, wave height and energy, clarity, current speed
- Quantity of gases, particulates, water content and qualities such as wind speed, temperature, smell
- Quantity and quality of view and sound-scapes
- Quantity of solar, geothermal, and electromagnetic energy
- Quantity of rock, clay, mud, nuclear material and qualities of soil fertility

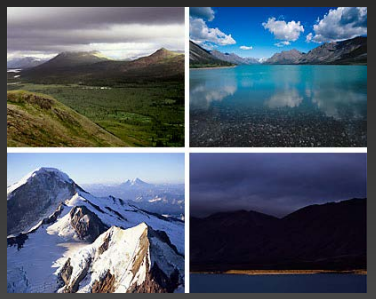
Spatial Production pathways assigned to FEGS

Biophysical networks: Feature produced in area connected to area it is used by biophysical network

1) Land - Biotic movement: Feature carried by faunal movement
2) Water - Hydrologic flow: Feature carried by gravitational flow of water to, over, and through land and Biotic movement: Feature carried by faunal movement
3) Air - Atmospheric flow: Feature carried by wind, light and Biotic movement: Feature carried by faunal movement
4) In-situ: Feature produced in the same place it is used

BIOPHYSICAL SPATIAL CONNECTIONS BETWEEN PRODUCTION AND BENEFIT





- Connectivity networks
  - www.youtube.com/watch?v=z6vtkLUIYUI

"Service Path Attribution Networks (SPANs) Spatially Quantifying the Flow of Ecosystem Services from Landscapes to People"

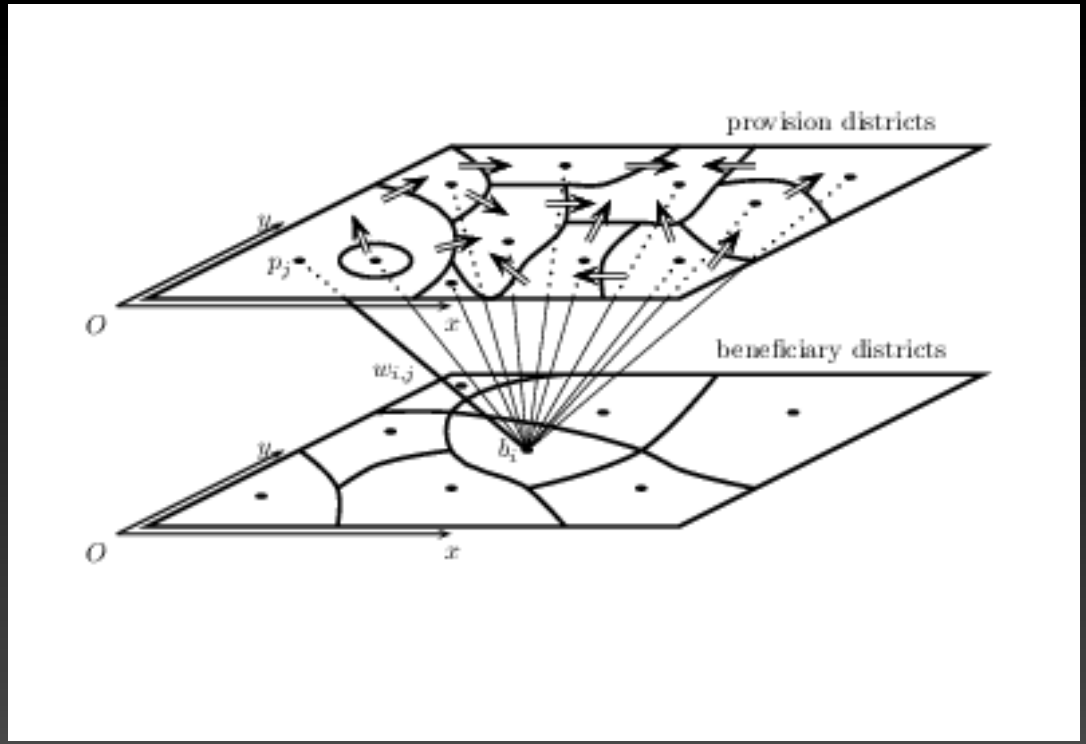
Gary W. Johnson, Kenneth J. Bagstad, Robert R. Snapp, and Ferdinando Villa

Ecoinformatics Collaboratory, Gund Institute for Ecological Economics, Department of Computer Science, University of Vermont

Presented at ACES 2010

Service flows will accrue at use locations on the landscape.

- **Benefitsheds:** To <u>where (and whom)</u> the benefits from each region flow.
- **Provisionsheds:** The <u>sources</u> of ecosystem service benefits.



Note: Beneficiary regions may be of different scale than provisioning regions.

As Presented by Gary W. Johnson et al. 2010 Ecoinformatics Collaboratory, Gund Institute for Ecological Economics, Department of Computer Science, University of Vermont

Land mediated production pathways

- Terrestrial connectivity
  - Active ground based dispersal of Floral/Faunal production

Water mediated production pathways

- Hydrologic connectivity
  - Passive or active aquatic based dispersal of Floral/Faunal production
  - Flow of Liquid Water

Air mediated production pathways

- Atmospheric connectivity
  - Passive and active air based dispersal of Floral/Faunal production
  - Flow of air, particles, gases
  - Light transmission

In-situ production

- Non-motile Floral/Faunal production
- Energy
- Materials

Human use/access pathways

- There are 3 spatial access pathways:
  - In-situ – User resides or has assets at point of use
  - Transportation network– User travels to place of use
  - Knowledge networks – User develops a non-proximal appreciative use

Land/water classification Schema

Source area, structure or function, connection to use areas, and human access/demand

Examples for air, water and species quantity and quality:

- Vegetated area's air pollutant removal upwind of residents that experience unhealthy air quality
- Pervious area's rain retention upstream of built infrastructure vulnerable to flooding
- Catchment area's water purification upstream of drinking supply extraction pipe
- Public land or water's flora and fauna species within travel distance of wildlife viewers

Next steps - Spatial accounting of natural capital production

- Cross-walk FEGS list with revised hierarchical NESCS list of User/Uses
- Mapping of draft FEGS list using the 4 component land categorization
- Development of Supply/Use tables for ecosystem accounts
- Access geospatial dataset availability and populate tables with quantities for at least two time periods for change analysis.