Finding Common Ground between Ecosystem Services and Environmental Ecosystems

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A system formed by the interaction of a community of organisms with their physical environment.
Ecosystems...

- Composed of species that are connected in one way or another
- Relationships among species are complex
- Relationships among habitats are complex
- Changes in these relationships can cause big changes in the ecosystem
- Humans and their constructed environments are now part of the ecosystem
- Ecosystems that occur along watercourses and water bodies
- Unique soil and vegetation characteristics
- Influenced by free or unbound water in the soil
- Occupy transitional area between terrestrial and aquatic ecosystems
Riparian Cross Section

Riparian Ecosystem Plant Communities

UPLAND

RIDGE & SWALE

STREAM CHANNEL

GRADUAL SLOPE

UPLAND

http://www.kenaiwetlands.net/images/ConradFiledRiparian.jpg
Watershed

An area of land where all of the water that is under it or drains off of it goes into the same place

Source: http://water.epa.gov/type/watersheds
Watershed Characteristics

Adapted from FISRWG 1998
River Continuum Concept

Stream Size (Order)

Adapted from FISRWG 1998
Watershed Characteristics

- Relative volume of stored alluvium
- Headwaters
- Drainage Area (~downstream distance²)
- Transfer
- Deposition
- Increase
- Characteristic stream discharge
- Bed material grain size
- Channel width
- Channel depth
- Mean flow velocity
- Slope

Adapted from FISRWG 1998
# River Continuum Concept

<table>
<thead>
<tr>
<th>Simplified RCC Stream Order</th>
<th>Upper Reaches (1-3)</th>
<th>Middle Reaches (3-6)</th>
<th>Lower Reaches (6 and above)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>saturated</td>
<td>periodic deficits</td>
<td></td>
</tr>
<tr>
<td>Sunlight</td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>Temperature</td>
<td>max. &lt;20°C, fairly constant</td>
<td>high variable</td>
<td>max. &gt;20°C, variable</td>
</tr>
<tr>
<td>Nutrients</td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>Simplified RCC Stream Order</td>
<td>Upper Reaches 1-3</td>
<td>Middle Reaches 3-6</td>
<td>Lower Reaches 6 and above</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Dominant energy source</strong></td>
<td>leaf litter</td>
<td>primary producers</td>
<td>transport detritus</td>
</tr>
<tr>
<td><strong>Dominant primary producers</strong></td>
<td>rare</td>
<td>attached</td>
<td>plankton</td>
</tr>
<tr>
<td><strong>Dominant inverts</strong></td>
<td>shredders</td>
<td>grazers (scrapers), collectors</td>
<td>collectors</td>
</tr>
<tr>
<td><strong>Fish habitat &amp; food preferences</strong></td>
<td>cool water, swift current insects</td>
<td>fish &amp; insects</td>
<td>slow current, plankton, bottom matter</td>
</tr>
<tr>
<td><strong>Biological diversity</strong></td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
</tbody>
</table>
Riparian Functions

- Fluvial processes
- Hydrology
- Base Flows
- Nutrient Cycling
- Energy Transfer
- Downstream Flooding
- Water Quality
- Aquatic Life
- Terrestrial Life
Riparian Values

- Food Resources
- Aesthetic
- Recreation
  - Hunting
  - Nature Viewing
  - Photography
Ecosystem Services Defined

- Benefits people obtain either directly or indirectly from ecological systems
- Free?
- Expensive if replacement is required?
Ecosystem Services & Ecosystems

- Important to define objective or intended outcome
- “Common Ground” must be reached among ecological, economic, and social interests to ensure useful application
Riparian Ecosystem Services

- Decreased erosion
- Improved water quality
- Reduction in water temperatures
- Healthy land-based and river ecosystems
- Maintaining biodiversity
- Maintaining river courses
- Decrease in insect pests
- Decreased algal growth
- Maintaining fish stocks
- Increase in capital values

- Shelter efforts
- Retention of nutrients
- Lowered watertables
- Denitrification
- Opportunities for diversification
- Recreation
- Cultural and spiritual fulfillment
- Ecotourism

www.ecosystemservicesproject.org
# Benefits derived from Riparian Ecosystem Services

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Economic</th>
<th>Environmental</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity Improvement</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Reduced sediment &amp; nutrient export, Improved Water Quality</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Aesthetic improvements</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Reduced need for &amp; expenditure on remedial works downstream</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Improved livestock management</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Less breakouts from creeks &amp; lower maintenance of creek crossing</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Other benefits to agricultural system, such as pollination services</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon sequestration</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

[www.ecosystemservicesproject.org](http://www.ecosystemservicesproject.org)
Supportive Functions and Structures

- Ecosystem approach assures an understanding of relationships among physical and biological components

- Ecosystems service approach provides linkage mechanism between the environmental system and economic/human valuation
“Common Ground” Challenges

- What is the +/- relationship among ecosystem services for environmental systems?
- Whose value system is used?
- At what scale is the ecosystem operating vs what scale is valuation occurring?
The +/- Perspective: Examples

Raw Materials (production function) provides building and manufacturing materials (+).

Removal of these materials may affect regulation functions:

- Carbon sequestration (-)
- Disturbance protection (-)
- Water regulation (-)
- Water supply (-)
- Soil retention (-)
- Pollination (-)
The +/- Perspective: Examples

Raw Materials (production function) provides building and manufacturing materials (+)

Removal of materials may affect habitat functions:
- Refugium (-)
- Nursery (-)
The +/- Perspective: Examples

Raw Materials (production function) provides building and manufacturing materials (+)

Removal of materials may affect information functions:

- Aesthetic information (-)
- Recreation (-)
Who is Determining Value?

- Indigenous/native/local people using riparian for food/shelter
- Informed people using riparian for water quantity/quality, sediment retention, biodiversity conservation, recreation
- Uninformed people using riparian for production
- Indifferent people using riparian for production
The Scale Perspective

- Local scale valuation does not address connectivity or reliance of regional-scale ecosystem operation

- Regional scale valuation does not address connectivity or reliance of global-scale ecosystem operation
Scale Perspective: Example

Adapted from FISRWG 1998
Scale Perspective: Example

Local – within site
Regional – downstream to estuary or gulf/ocean

1st & 2nd Order
Water Quality
Local & Regional

3rd & 4th Order
Channel Stabilization
Local & Regional

5th Order
Flood Attenuation
Local & Regional
Feedback Loop Approach

Ensure good and services can be produced or consumed without long-term impact to the resilience of the ecosystem.