Introduction: Evolution and Valuation of Ecosystem Services

Prepared for:
A Conference on Ecosystem Services

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Objective

- Provide an overview and understanding of:
  - the evolving "ecosystem services" field and;
  - how ecosystem services are quantified and can be applied in evaluating actions that affect the environment.
Agenda

- Introductions
- What are Ecosystem Services?
- Historical Perspective and Evolution
- Environmental Economic Methods for Ecosystem Service Valuation and Quantification
- Understanding Net Environmental Benefit Analysis (NEBA)
- Case Studies
- Group Exercise
- Discussion
Introductions

- Joe Nicolette, CH2M HILL EcoValuation Practice Director
- Tom Campbell, Pillsbury Winthrop Shaw Pittman
- Bruce Peacock, Department of the Interior, Natural Resource Economist
- Mark Rockel, CH2M HILL Natural Resource Economist
- David Nicholas, OSWER, Policy Analysis and Regulatory Staff
What Are Ecosystem Services?
An “ecosystem” is defined as the complex of a community of organisms and its environment functioning as an ecological unit.


Ecosystem “functions” or “processes” are the characteristic physical, chemical, and biological activities that influence the flows, storage, and transformation of materials and energy within and through ecosystems (U.S Environmental Protection Agency).
Why Ecosystem Services?

- Ecosystems provide resources and functions that we value
  - these resources and functions are valued because they provide benefits to people in a variety of forms (e.g., clean water, habitat for wildlife, aesthetics, timber, recreation opportunities)

- Because we value these benefits, we recognize that ecosystems provide a service to people
  - hence the term “Ecosystem Services”
As such, the term “Ecosystem Services” is an anthropocentric concept (human-oriented perspective of the environment) denoting the contributions that ecosystems make to people either directly or indirectly.

These contributions are sometimes referred to as the “benefits” that humans derive from ecosystems.

Multiple Definitions of Ecosystem Services Exist
Millennium Ecosystem Assessment

- Largest Assessment of the Health of Earth’s Ecosystems
- Governance
  - Called for by UN Secretary General in 2000
  - Partnership of UN agencies, conventions, business, non-governmental organizations with a multi-stakeholder board of directors
- Experts and Review Process
  - Prepared by 1360 experts from 95 countries
  - 80-person independent board of review editors
  - Review comments from 850 experts and governments
Focus: Ecosystem Services
The benefits people obtain from ecosystems

ECOSYSTEM SERVICES

Provisioning
- FOOD
- FRESHWATER
- WOOD AND FIBER
- FUEL
- ...

Regulating
- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

Supporting
- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

Cultural
- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

Millennium Ecosystem Assessment *Ecosystems and Human Well Being* (2005)
Example: Millennium Assessment (2005)
Typology of Ecosystem Goods and Services

• **Provisioning**
  - Provisioning services *(products obtained from ecosystems).* These include food, fuel wood, fiber, biochemicals, genetic resources and fresh water. Generally these services are traded in the open marketplace.

• **Regulating**
  - Regulating services *(benefits received from regulation of ecosystem processes).* This category includes a host of pathways that stem from the presence and functioning of ecosystems and influence people in positive ways, both direct and indirect. These include flood protection, human disease regulation, water purification, air quality maintenance, pollination, pest control and climate control. These services are generally not marketed but many have clear value to society.

• **Cultural**
  - Cultural services *(the nonmaterial benefits people obtain from ecosystems).* Ecosystems contribute to the cultural, spiritual and aesthetic dimensions of people’s well-being. They also contribute to establishing a sense of place.

• **Supporting**
  - Supporting services. These are the processes that maintain ecosystem functioning such as: soil formation, primary productivity, biogeochemistry, and provisioning of habitat. They all affect human wellbeing, but generally indirectly through their support of the provisioning, regulating and cultural service functions.

Millennium Ecosystem Assessment *Ecosystems and Human Well Being* (2005)
Focus: Consequences of Ecosystem Change for Human Well-being

ECOSYSTEM SERVICES
- Provisioning
  - Food
  - Fresh water
  - Wood and fiber
  - Fuel
- Supporting
  - Nutrient cycling
  - Soil formation
  - Primary production
- Regulating
  - Climate regulation
  - Flood regulation
  - Disease regulation
  - Water purification
- Cultural
  - Aesthetic
  - Spiritual
  - Educational
  - Recreational

LIFE ON EARTH - BIODIVERSITY

CONSTITUENTS OF WELL-BEING
- Security
  - Personal safety
  - Secure resource access
  - Security from disasters
- Basic material for good life
  - Adequate livelihoods
  - Sufficient nutritious food
  - Shelter
  - Access to goods
- Freedom of choice and action
  - Opportunity to be able to achieve what an individual values doing and being
- Health
  - Strength
  - Feeling well
  - Access to clean air and water
- Good social relations
  - Social cohesion
  - Mutual respect
  - Ability to help others

Source: Millennium Ecosystem Assessment

Millennium Ecosystem Assessment Ecosystems and Human Well Being (2005)
Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history. The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs.
– The degradation of ecosystem services could grow significantly worse during the first half of this century
– The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices, that are not currently under way
<table>
<thead>
<tr>
<th>Active</th>
<th>Passive</th>
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<tr>
<td><strong>1. Commercial Uses</strong></td>
<td><strong>5. Property Damage Avoided</strong></td>
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<td>1.1 Agriculture</td>
<td>5.1 Flooding</td>
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<td>1.2 Trapping</td>
<td>5.2 Storm/Waves/Surge</td>
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<td>1.3 Mining (including genetic)</td>
<td>5.3 Siltation/Sedimentation</td>
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<td>1.4 Forestry</td>
<td>5.4 Overnutrification</td>
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<td>1.5 Fisheries</td>
<td>5.5 Noxious Weed Infestations</td>
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<td><strong>2. Recreational Uses</strong></td>
<td><strong>6. Human Health Risks/Costs Avoided</strong></td>
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<td>2.1 Fishing</td>
<td>6.1 Nutrient Cycling</td>
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<td>2.2 Swimming</td>
<td>6.2 Carbon Cycling</td>
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<td>2.3 Hiking</td>
<td>6.3 Chemical Cycling</td>
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<td>2.4 Nature Viewing</td>
<td>6.4 Oxygen Cycling</td>
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<td>2.5 Hunting</td>
<td><strong>7. Ecosystem Health Risks Avoided</strong></td>
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<td>2.6 Birding</td>
<td>7.1 Biodiversity Support</td>
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<td>2.7 Boating</td>
<td>7.2 Endangered Species Protection</td>
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<td><strong>3. Municipal Uses</strong></td>
<td>7.3 Protection of Ecological Infrastructure</td>
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<td>3.1 Groundwater Recharge/Discharge</td>
<td><strong>8. Climate Regulation</strong></td>
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<td>3.2 Drinking Water Purification</td>
<td>8.1 Global Climate Effects/Attenuation</td>
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<td>3.3 Pollution Prevention</td>
<td>8.2 Microclimate Effects/Attenuation</td>
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<td><strong>4. Other Active Uses</strong></td>
<td><strong>9. General Nonuse (Can be attached to</strong></td>
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<td>4.1 Aesthetics - visibility, odor, noise</td>
<td><strong>places, species, features, etc.)</strong></td>
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<td>4.2 Education/Learning Opportunities</td>
<td>9.1 Existence Values</td>
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<td>4.3 Research/Scientific Opportunities</td>
<td>9.2 Option Values</td>
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<td>4.4 Cultural/Spiritual Enrichment</td>
<td>9.3 Bequest Values</td>
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Ecological Service Valuation

- **Actions** and decisions that affect habitats/land, etc., can substantially affect ecosystem service values
- **Changes** to these values can be quantified and evaluated
  - Natural resource economics approaches
  - Litigation tested methodologies
Why Formal Quantification is Important?

- Enables you to:
  - Document the ecosystem value of a parcel of property;
  - Document the ecosystem cost/benefit of an action;
  - Compare ecosystem benefits/costs between actions (i.e., NEBA); and
  - Select/modify actions that maximize ecosystem benefits

- Subsequently, quantified values provide supporting information for decision-makers and other stakeholders
Need to Quantify Services

• Evolution of Ecosystem Services through NRDA
• Scaled using a service to service approach