Ecosystem Services and Human Use and Nonuse Losses in NRDA

Dr. Ted Tomasi
Environmental Resources Management
Philadelphia, PA
Questions

• What is the economic relationship between NRDA and ES?
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• Is current NRDA practice (HEA/REA) consistent with an ES perspective?
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- To what extent should ES principles be brought into NRDA?
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• Is current NRDA practice (HEA/REA) consistent with an ES perspective?
• To what extent should ES principles be brought into NRDA?
• What should ES analysts learn from NRDA practice?
<table>
<thead>
<tr>
<th>NRDA</th>
<th>ES</th>
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</thead>
<tbody>
<tr>
<td><strong>Structure, function, services</strong></td>
<td><strong>Final goods and services</strong></td>
</tr>
<tr>
<td>– Media to organisms</td>
<td>– Directly valued by people</td>
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<tr>
<td>– Organism to organism</td>
<td>– Use values emphasized</td>
</tr>
<tr>
<td>– Organism/habitat to people</td>
<td>– Non-use recognized</td>
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<tr>
<td><strong>Restoration</strong></td>
<td>– Community/social</td>
</tr>
<tr>
<td>– Compensation paid in services</td>
<td><strong>Benefit-cost tradition</strong></td>
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<tr>
<td>– Nexus is important</td>
<td>– Wide scope for compensation</td>
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<td><strong>Legal process</strong></td>
<td>– $ values</td>
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<tr>
<td>– Causality</td>
<td><strong>Policy/program evaluation context</strong></td>
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<tr>
<td>– Measurable adverse effect</td>
<td>– Planning perspective</td>
</tr>
<tr>
<td>Restoration Steps</td>
<td>Valuation Steps</td>
</tr>
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<tr>
<td>1. Determine impacts on habitat structure and function relative to baseline</td>
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<tr>
<td>2. Quantify ecological services changes</td>
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<tr>
<td>3. If you have reliable information, measure the change in economic value of services</td>
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</tr>
<tr>
<td>4. Find restoration that provides PV benefit equivalent to PV loss</td>
<td>4. Compare PV benefit to PV costs</td>
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</tbody>
</table>
Is HEA/REA Consistent with ES and Economics?

Sometimes
(Restricted Situations)

- Small enough effects
- Small enough changes in baseline over time
- Affected people have similar preferences
- Restoration is "Like for Like"
Economic Scaling

\[
\text{Added over People Added over Time} \quad \text{Value of Injured Services} = \quad \text{Added over People Added over Time} \quad \text{Value of Restored Services}
\]

- Injury Debit
- Restoration Credit
Effect of Restrictions

Added over People
(Same Preferences)

Added over Time
(Small & Constant)

Value per Unit
(Like-for-Like)

X
Units of Injured Services

= (Same Preferences)

Added over People
(Small & Constant)

Added over Time
(Like-for-Like)

Value per Unit
(Like-for-Like)

X
Units of Restored Services

Injury Debit

Restoration Credit
HEA/REA

\[ \text{Added over Time} \quad \text{Units of Injured Services} \quad = \quad \text{Added over Time} \quad \text{Units of Restored Services} \]

Injury Debit

Restoration Credit
Like-for-Like What?

• Same resource structure or function?
• Same services provided?
  – All Intermediate and final services?
  – Only final services?
• Economic values?

*Required Degree of Match Between Restoration and Injury is Key Factor in Restoration Cost*
Functions, Services, and Values

• **Ecosystem Structure and Function**
  – Biological, chemical, physical, ecological descriptions and processes

• **Ecological Services**
  – Beneficial outcomes to people
  – Ecological production function relates structural and function (inputs) to services (outputs)

• **Service Values**
  – Economic concept of Willingness-to-Pay (WTP) to have more services
  – Maximal fungibility/substitution
## 1. Structure/Function
- Marsh:
  - Area
  - Stem density & height
  - Channels
  - Sediments
  - Area
  - Biological communities
  - Numbers of fish/birds

## 2. Services
- Catching fish
  - (Catch rate)
- Storm surge protection (Houses protected)
- Bird watching
- Knowing about birds??

## 3. Value
Utility/$$$$

![Marsh Life](image1.png)

![Channels](image2.png)

![Services](image3.png)
Like-for-Like – What?

**LfL: Structure and Function**
- Limited/no substitution
- Double/under counting
  - Intermediate -v- final services
  - Marsh for fish + marsh for birds + marsh for plants = too much marsh

**LfL: Services**
- Basis for substitution
- Basis for eliminating double and under counting

**LfL: Values**
- Done all the time for use values (e.g. recreation)
- Non-use values – mega-problems
Step 1

Structural Metrics

Simplest HEA/REA

Restoration Match Injury?

Yes

Ad Hoc Adjustments

No

Step 1 Restrictions

Rigorously Consistently with Economics
Step 1
Structural Metrics

Simplest HEA/REA

Restoration Match Injury?

Yes
Ad Hoc Adjustments

No
Step 1 Restrictions

Step 2
Services Metrics

Service-Based HEA/REA

Restoration Match Injury?

Yes
Ad Hoc Adjustments

No
Step 2 Restrictions

Ecological Production Function

Rigorously Consistent with Economics
Step 1
Structural Metrics

Simplest HEA/REA

Restoration Match Injury?

Yes
No

Ad Hoc Adjustments

Step 1 Restrictions

Step 2
Service-Based HEA/REA

Restoration Match Injury?

Yes
No

Ad Hoc Adjustments

Step 2 Restrictions

Step 3
Economic Metrics

Value to Value Scaling

Human Use Impacts?

Ecological Impacts

Biases from SP Data

Rigorously Consistent with Economics
Human Use Services

- Injury/Response Actions
- Restoration Actions
- Fishing Closures
- Catch Rate
- Anglers
- Fishing Pier
- Catch Rate
Blended Approach

Injury/Response Actions

Restoration Actions

Fishing Closures

Catch Rate

Anglers

Catch Rate

HEA REA

Fish Populations

Bird Populations

Non Users

Fish Populations

Bird Populations

Marsh Restoration
We Don’t Know *Exactly* What a HEA DSAY is

BUT

We May Know *Enough* to Resolve NRD Cases

AND

We May be Minimizing Errors *relative to* Valuations for Non-Use Values

USING

In-Kind Compensation
Not Monetization
Complex Measurement Needs a Coherent Conceptual Framework

“He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may be cast.”

Leonardo da Vinci