Economic Valuation of Conserving Soyang Lake and Its Catchment

Presentation @ TERRECO Workshop

April 12, 2010

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I. Introduction
   1. Soyang Lake Catchment and the Communities
   2. Water Conservation Levy
   3. Objectives

II. Nonmarket Valuation
   1. Public Goods
   2. Choice Models
   3. Random Utility Models

III. Nexus
   1. TERRECO & This Proposal
   2. Future Discussion
I. Introduction

1. Soyang Lake Catchment and the Communities

- Han River Catchment

<table>
<thead>
<tr>
<th>Regions</th>
<th>Area (㎢)</th>
<th>Population (1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seoul</td>
<td>289</td>
<td>10,026</td>
</tr>
<tr>
<td>Incheon</td>
<td>188</td>
<td>1,331</td>
</tr>
<tr>
<td>Kyonggi</td>
<td>7,503</td>
<td>8,284</td>
</tr>
<tr>
<td><strong>Gangwon</strong></td>
<td><strong>12,377</strong></td>
<td><strong>888</strong></td>
</tr>
<tr>
<td>Chungbuk</td>
<td>4,043</td>
<td>484</td>
</tr>
<tr>
<td>Kyongbuk</td>
<td>181</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24,581</strong></td>
<td><strong>21,014</strong></td>
</tr>
</tbody>
</table>
I. Introduction

2. Water Conservation Levy (1/3)

- Upstream vs. downstream

- The Han River Act
  ➔ Han River Catchment Mgmt Fund, 1999)

- Water Conservation Levy
  ➔ $0.13/ton in 2008
I. Introduction

2. Water Conservation Levy (2/3)

<table>
<thead>
<tr>
<th>Region</th>
<th>Population (1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seoul</td>
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<tr>
<td>Incheon</td>
<td>2,596</td>
</tr>
<tr>
<td>Kyeonggi</td>
<td>8,284</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Levy rate ($/ton)</th>
<th>Revenue ($, Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.07</td>
<td>147.43</td>
</tr>
<tr>
<td>2001</td>
<td>0.09</td>
<td>197.49</td>
</tr>
<tr>
<td>2002</td>
<td>0.09</td>
<td>212.02</td>
</tr>
<tr>
<td>2003</td>
<td>0.10</td>
<td>230.01</td>
</tr>
<tr>
<td>2004</td>
<td>0.10</td>
<td>240.51</td>
</tr>
<tr>
<td>2005</td>
<td>0.11</td>
<td>261.34</td>
</tr>
<tr>
<td>2006</td>
<td>0.12</td>
<td>287.10</td>
</tr>
<tr>
<td>2007</td>
<td>0.13</td>
<td>311.14</td>
</tr>
<tr>
<td>2008</td>
<td><strong>0.13</strong></td>
<td><strong>333.82</strong></td>
</tr>
</tbody>
</table>

Levy Area
## 2. Water Conservation Levy (3/3)

<table>
<thead>
<tr>
<th>Yearly Allocation (2008)</th>
<th>Amount ($, Million)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents Support</td>
<td>0.53</td>
<td>24.43</td>
</tr>
<tr>
<td>Env. Treatment Facilities</td>
<td>0.96</td>
<td>44.26</td>
</tr>
<tr>
<td>Water Quality</td>
<td>0.22</td>
<td>9.96</td>
</tr>
<tr>
<td>Land Mgmt</td>
<td>0.41</td>
<td>19.02</td>
</tr>
<tr>
<td>Nonpoint Sources</td>
<td>0.01</td>
<td>0.65</td>
</tr>
<tr>
<td>Total Quantity Control</td>
<td>0.00</td>
<td>0.22</td>
</tr>
<tr>
<td>Operation</td>
<td>0.03</td>
<td>1.45</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2.17</strong></td>
<td></td>
</tr>
</tbody>
</table>
I. Introduction

3. Objectives

- To estimate economic values of ecosystem services and water quality gained or lost in the Soyang Lake Catchment
- To identify socially acceptable level of the levy rate
- To find out appropriate allocations of the Fund

Communities’ Preferences?
II. Nonmarket Values

1. Public Goods
   - Nonrivalry
   - Nonexcludability

Source: Modified from Figure 1.4 of Bateman et al. (2002:30).
II. Nonmarket Values

2. Choice Modeling

- Target goods as a bundle of attributes
- Respondents make choices, expressing ‘trade-offs’
- Willingness-to-pay estimated using RUM
II. Nonmarket Values

3. Random Utility Maximization Models (RUM)

\[ U_{iq} = V_{iq} + \varepsilon_{iq} \]

\[ U_{iq} > U_{jq} \quad j \neq i \in A \]

\[ (V_{iq} + \varepsilon_{iq}) > (V_{jq} + \varepsilon_{jq}) \]

\[ (V_{iq} - V_{jq}) > (\varepsilon_{jq} - \varepsilon_{iq}) \]

\[ P_{iq} = P(i|j, j \in A) = P[(V_{iq} - V_{jq}) > (\varepsilon_{jq} - \varepsilon_{iq})] \]

\[ P(\varepsilon_j \leq \varepsilon) = \exp(- \exp(- \varepsilon)) = e^{-e^{-\varepsilon}} \]
1. TERRECO & This Proposal (1/2)

Complex Terrain and Ecological Heterogeneity (TERRECO)

- **Landscape Processes**
  - Atmospheric coupling
  - Plant production
  - Biogeochemistry
  - Hydrology and transport

- **Climate Change**
- **Social-Ecological Scenario Evaluations**
- **Social Response**

- **Desired Ecosystem Services**
  - Agency discourse
    - Land use decisions

- **Sustainable Ecosystem Services**

**Bio-Economic Modeling**
- **Social Framework**
  - Demography
  - Regulatory policy
  - Economic analysis
  - Land management
  - Land use decisions

**Source:** Tenhunen, John (2010)

**Figure 1. Information flows**
III. Nexus

1. TERRECO & This Proposal (2/2)

Source: Tenhunen, John (2010)

Figure 2. Conceptual relationships
2. Future Discussion

1. Proposal evaluation and decision making (This workshop)
2. Project team formation (This workshop)
3. Detailed project plan (April ~ June, 2010)
4. Project implementation (As planned)

- The impact of socio-economic land-use decisions on ecosystem services in small catchments (Patrick Poppenborg and Thomas Koellner)
- Quantifying and evaluating trade-offs between multiple ecosystem services in Haean Catchment (Thomas Koellner et al.)
THANK YOU