Economic Valuation of Protected Area Benefits and its Role in Financing Conservation

Stefano Pagiola  Gunars Platais
Environment Department, World Bank

I. Introduction: Why Value?
- Understand benefits of protected areas
- Build political support
- Design financing mechanisms
- Understand incentives of stakeholders

II. Valuation techniques

III. Applications
- Valuing reforestation in Croatia
- Financing Bolivia’s protected areas
Design of financing mechanisms

1. Who will pay?
2. How much will they pay?
3. How will they pay?
4. Who will be paid?
5. How will they be paid?

1. Who will pay?

- Old approach: Government pays
  - Limited funding
  - Unreliable
- New approach: Get beneficiaries to pay
  - Protected area visitors
  - Downstream water users
  - Global community

Who will pay?

- Who are the beneficiaries?
- What will they pay for?
Who will pay?

Total Economic Value (TEV)
- Use Value
  - Direct Use Value
    - Consumptive use: local communities
  - Indirect Use Value
  - Option Value
- Non-Use Value
  - Existence Value

Who will pay?

Total Economic Value (TEV)
- Use Value
  - Direct Use Value
  - Indirect Use Value
- Non-Use Value
  - Option Value
  - Existence Value

Who will pay?

Total Economic Value (TEV)
- Use Value
  - Direct Use Value
  - Option Value
- Non-Use Value
  - Existence Value

Who will pay?

Total Economic Value (TEV)
- Use Value
  - Direct Use Value
  - Indirect Use Value
  - Option Value
- Non-Use Value
  - Existence Value

Pharmaceutical industry
Crop breeders

Downstream water users

“Greens”
Example: Water services

Supply of services:
Upstream land uses affect the **Quantity**, **Quality**, and **Timing** of water flows

Demand for services:
Possible downstream beneficiaries:
- Domestic water use
- Irrigated agriculture
- HEP
- Fisheries
- Recreation
- Downstream ecosystems

NB: Upstream-downstream links are often poorly understood

---

Example: Water services

- All water users don’t want the same thing…
- Domestic water users want
  - High quality
  - Consistent flow
- HEP producers want
  - Maximum volume
  - Low quality OK, but sediment harmful

The logic of payments for environmental services

<table>
<thead>
<tr>
<th>Benefits to land users</th>
<th>Costs to downstream populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation and use for pasture</td>
<td>Payment</td>
</tr>
<tr>
<td>Conservation with payment for service</td>
<td></td>
</tr>
</tbody>
</table>

Key Issues:

- Identify benefits being provided by ecosystem
- Identify beneficiaries
- Quantify/value benefits received
- And how they would change with/without conservation
2. How much will they pay?

Visitors

Consumer surplus is
- A benefit to society
- If the visitors are foreigners, not a benefit to the country
- Not a benefit to the PA

How much will they pay?

Visitors

Increasing fees affects
- PA revenues
- Level of visitation

Revenue = P'V'

How much will they pay?

Downstream service users

Why value?
- Value of benefits (maximum payment)
- Opportunity cost (minimum payment)

Benefits to land users

Deforestation and use for pasture

Conservation

Conservation with payment for service

Payment

Costs to downstream populations

Minimum payment

Maximum payment

Valuation
3. How will they pay?

- Need to capture part of benefit received
  - Easy if can control access (direct uses)
    - eg Entry fees
  - Difficult if cannot control access (indirect uses)
    - eg Payments for environmental services
  - Very difficult if beneficiaries receive nothing tangible (existence value)
    - eg Premium for shade-grown coffee

3. Who will be paid?

- Old approach: Protected area system
  - Omits large areas that need conservation
  - Expansion possibilities limited
  - Institutionally weak
  - Local communities don’t benefit, continue encroaching
- New approach: Pay service providers
  - Protected area system
  - Private land owners in the ecosystem
  - Other local communities whose actions can affect the ecosystem

4. How will they be paid?

- Protected area system
  - Ensure funds go to specified use
  - Finance long-term maintenance costs
    - Trust Funds

II. Valuation Techniques
Valuation tools: direct use value

- Total Economic Value (TEV)
  - Use Value
  - Non-Use Value
  - **Direct Use Value**
    - Indirect Use Value
    - Contingent valuation
    - Travel cost
    - Hedonic prices
    - Change in productivity

Valuation tools: indirect use value

- Total Economic Value (TEV)
  - Use Value
  - Non-Use Value
  - **Indirect Use Value**
    - Direct Use Value
    - Contingent valuation
    - Cost-based approaches
    - Change in productivity

Valuation tools: option value

- Total Economic Value (TEV)
  - Use Value
  - Non-Use Value
  - **Option Value**
    - Direct Use Value
    - Indirect Use Value
    - Contingent valuation
    - Travel cost
    - Hedonic prices
    - Change in productivity

Valuation tools: existence value

- Total Economic Value (TEV)
  - Use Value
  - Non-Use Value
  - **Existence Value**
    - Direct Use Value
    - Indirect Use Value
    - Option Value
    - Contingent valuation
Valuation techniques

1. Charging visitors
   a. Travel Cost
   b. Contingent Valuation

2. Charging service users
   a. Change in productivity
   b. Cost-based approaches

3. Charging non-users
   a. Contingent Valuation again

4. And for everybody…
   a. Benefits transfer

Travel cost

Approach: Uses information on total expenditure to visit a site to trace out the demand curve for that site

- Important: Travel Cost itself is not the estimated benefit

Travel cost:
Monteverde Cloud Forest Reserve, Costa Rica
- One of Costa Rica’s major ecotourism destinations
- 4 hour drive from San José
- 88% of visitors are international (73% US)
- Private reserve
Travel cost:
Monteverde Cloud Forest Reserve, Costa Rica

- Travel cost survey
  - 320 international visitors
  - Randomly selected
  - Interviewed in person
- Questions on
  - Cost of travel to Costa Rica
  - Costs in Costa Rica
  - Socio-economic information
  - Other visits on same trip

Travel cost:
Monteverde Cloud Forest Reserve, Costa Rica

Results for US visitors to Costa Rica:
- Estimated Consumer Surplus: $1,150 /visitor
- Total consumer surplus: $68 million /yr
- Specifically from Monteverde: $4.5 million /yr
  (pro-rated by % of time spent in Monteverde)
- Per hectare: $50 /yr

Travel cost:
Pros and cons

- Pros:
  - Based on observed behavior
- Cons:
  - Only applicable to a single issue
  - Hard to apply to multi destination international trips
  - Better at estimating total value than marginal value
  - Measures *potential* benefits, not actual benefits to country

Contingent Valuation

**Approach:** Ask survey respondents directly their willingness to pay for specific level of good or service

- Can be used for any type of value
- Only way to measure non-use value
- Considered most reliable when used to estimate use value
Contingent valuation: WTP vs WTA

- CV relies on direct questioning of
  - **Willingness to Pay (WTP)** for specified benefits or
  - **Willingness to Accept (WTA)** compensation for loss of benefits
- Which is correct?
  - Use **Willingness to Pay** if change will _increase_ benefits
  - Use **Willingness to Accept** if change would _reduce_ benefits
- Almost always: WTP < WTA
- Some use WTP as ‘more conservative’

Contingent valuation: Blue Ribbon Panel guidelines

- Carry out survey in person, not by mail or telephone
- Provide an accurate description of the expected effects of the choice being proposed
- Remind respondents of alternatives and of their budget constraint
- Use referendum, or dichotomous choice, format

Contingent valuation: CV estimates of visitor WTP in Costa Rica

<table>
<thead>
<tr>
<th>Protected area</th>
<th>Mean WTP (US$)</th>
<th>Scenario</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poas, Manuel Antonio, Cahuita National Parks</td>
<td>Residents: 0.6 Non-residents: 1.3</td>
<td>Willingness to pay “fair” entrance fee</td>
<td>Baldares and Laarman (1990)</td>
</tr>
<tr>
<td>Monteverde Cloud Forest Reserve</td>
<td>Residents: 1.5 Non-residents: 3.7</td>
<td>Willingness to pay “fair” entrance fee</td>
<td>Baldares and Laarman (1990)</td>
</tr>
<tr>
<td>Monteverde Cloud Forest Reserve</td>
<td>Costa Ricans: 137 Foreigners: 119</td>
<td>One-time donation to a conservation fund</td>
<td>Echeverria et al. (1995)</td>
</tr>
<tr>
<td>Manuel Antonio National Park</td>
<td>Residents: 13 Non-residents: 14</td>
<td>Per visit with future improved park services</td>
<td>Shultz, Pinazzo, and Cifuentes (1998)</td>
</tr>
<tr>
<td>Poas National Park</td>
<td>Residents: 11 Non-residents: 24</td>
<td>Per visit with future improved park services</td>
<td>Shultz, Pinazzo and Cifuentes (1998)</td>
</tr>
</tbody>
</table>

Contingent valuation: Pros and cons

- **Pros:**
  - Applicable to broad range of issues
  - Can be targeted to specific question of interest
- **Cons:**
  - Easy to do wrong
  - Based on hypothetical, not actual behavior
  - Many have little confidence in it
2. Charging service users

a. Change in productivity
b. Cost-based approaches

Change in productivity:

**Damage to irrigation systems**

- Damage to irrigation infrastructure (diversion dams, distribution canals)
- Affects water availability
- Economic consequences
  - Irrigated areas reverting to rainfed production
  - Lower yields, because water not available on a timely basis
  - Forced switch to lower-valued crops
  ➔ Lower income

**Bio-physical relationships**

**Valuation begins here!**

Need multidisciplinary work
Change in productivity: Damage to irrigation systems

Haiti’s Plaine des Cayes:
- Returns from rainfed production are 200-800US$/ha/year lower than for irrigated production
- Initial irrigated area: 2,000ha
- Half has reduced productivity (10% lower) because of irregular water availability
  - Loss of potential income: 1,000ha x 10% x $1000/ha = $100,000 /yr
- 100ha of irrigated land are abandoned annually (revert to rainfed production)
  - Annual damage: 100ha x $200-$800 = $20,000-80,000 /yr

NB: This estimates impact of cumulative past damage, not future marginal damage

Change in productivity: Damage to hydroelectric power generation

- Land use
- Hydrological effects
- Hydroelectric production
- Irrigation
- Agricultural income
- Producer’s income
- Consumer welfare
- Domestic water supply
- Impact on electricity production
- Value of electricity

- Quantity and quality of water flows, and their distribution over time
- Water availability, reservoir sedimentation

Change in productivity: Damage to domestic water supply

- Land use
- Hydrological effects
- Irrigation
- Agricultural income
- Producer’s income
- Consumer welfare
- Domestic water supply

- Quantity and quality of water flows, and their distribution over time
- Water availability (is there a reservoir?); water quality

- Value of water
  - Willingness to pay
  - Replacement cost
  - Health costs

Change in productivity: Common mistakes

- Assuming productivity completely lost (or gained)
- Need to compare With and Without cases
- With and Without ≠ Before and After
- Assuming all productivity changes are negative (or positive)
  - Need to look at net effect of all changes – some uses interfere with others
- Assuming high levels of use are sustainable
- Either use sustainable harvest level in calculations, or use actual harvest level and project how it evolves over time
Change in productivity:  
Pros and cons

- **Pro:**
  - Applicable to broad range of issues
  - Based on observed behavior and market prices

- **Con:**
  - Scientific information to trace impacts often lacking/incomplete

Cost-based approaches

Cost of obtaining the same service in another way

- Replacement cost
- Restoration cost
- Relocation cost

Use the *lowest* of these costs

Cost-based approaches:  
Examples

- **New York State:** Replacing water purification service of Catskills watershed would have cost US$8 billion; conservation cost US$2 billion
- **Shanghai:** Relocating potable water intake from lower Huangpu River cheaper than clean up
- **Haiti Plaine des Cayes:** Cleaning and repair of irrigation canals costs $2,500/km  
  - Maintaining 100km of canals costs $250,000/yr

Cost-based approaches:  
Pros and cons

- **Pro:**
  - Easy to explain

- **Con:**
  - Over-estimates benefits
Hedonic prices

**Approach:** Price of products embodies prices for different attributes: use statistical techniques to extract ‘price’ of environmental attribute

- Price of hotel room with ocean view greater than price of hotel room with ‘garden’ view
- Applied to housing: **Property Value Approach**
- Applied to wages: **Wage Differential Approach**

- **But:** Requires a *lot* of data

---

Benefits transfer

**Approach:** Use of estimates from one site (“study site”) for analysis of benefits at another site (“policy site”)

- Direct transfer
- Transfer of relationships

---

4. And for everybody…

a. Benefits transfer

---

Benefits transfer: **Direct transfer**

- Find ‘study site’ that is as similar as possible as ‘policy site’
- Apply the value of the benefit estimated at the ‘study site’ at the ‘policy site’
- Example:
  - Benefit of Haiti’s Pic Macaya National Park is about $1 million a year, or about $140/ha/year
  - Use this same $140/ha/year to estimate benefits of PA in Dominican Republic
Benefits transfer:
Direct transfers: Problems

- Depends on the quality of the original study
- Differences between sites
  - Differences in site conditions
  - Differences between beneficiary/user populations

Benefits transfer:
Origin of a data point

<table>
<thead>
<tr>
<th>Source</th>
<th>Erosion rate (t/ha/year)</th>
<th>Applies to, Source cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bollinne (1982)</td>
<td>Doesn’t say</td>
<td>12 experimental plots in Sauvenière, Belgium</td>
</tr>
</tbody>
</table>

Source: Boardman, 1998

Benefits transfer:
Origin of a data point (part 2)

"... the mean erosion rate in El Salvador is 137 t/ha/year ...

Erosion measurements in Metapán

<table>
<thead>
<tr>
<th>Year</th>
<th>Traditional Practices</th>
<th>With live barriers</th>
<th>With terraces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>137.01</td>
<td>129.04</td>
<td>58.11</td>
</tr>
<tr>
<td>1976</td>
<td>72.17</td>
<td>5.10</td>
<td>5.95</td>
</tr>
<tr>
<td>1977</td>
<td>12.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>4.50</td>
<td>6.89</td>
<td>3.25</td>
</tr>
<tr>
<td>1979</td>
<td>18.51</td>
<td>19.95</td>
<td>6.89</td>
</tr>
</tbody>
</table>

Source: Flores Zelaya, 1980

Benefits transfer:
Transfer of relationships

- Find 'study site' that is as similar as possible as 'policy site'
- Use some of the data used to estimate the value of the benefit estimated at the 'study site' to estimate the value of the benefit at the 'policy site'

Example:

- Use dose-response function of health impact of pollution measured in one town to estimate the health impact in another town
Benefits transfer:
Transfer of relationships: Problems
- Depends on the quality of the original study
- Differences between sites
  - Differences in site conditions
  - Differences between beneficiary/user populations
- Often need parameters that are not available at the policy site

Benefits transfer:
Pros and Cons
- Pro:
  - Cheap, quick
- Con:
  - Can be extremely unreliable

Benefits transfer:
Can it be used reliably?
In some cases, with extreme caution
- If study and policy sites are "sufficiently" similar
  - Site characteristics
  - Characteristics of beneficiary population (number, income, education, culture, etc)
  - Examples:
    - Benefits to international tourists from visiting a protected area
      - Reliable? Yes, if…
    - Benefits of water services to downstream users
      - Reliable? No, but…
    - Provides useful cross check of other estimates

III. Applications
Applications

1. Valuing reforestation in Croatia
2. Financing Bolivia’s protected areas

1. Valuing forest benefits in Croatia

- Reforestation project in coastal areas
  - Reforesting areas burned during war
- State land, but only some is formally protected
- Important tourism area
  - Tourism is mainly beach-focused
  - But forests important for landscape

Valuing forest benefits in Croatia

Valuing forest benefits in Croatia: Costs

Based on:
- Site-specific work plan
- Site characteristics (eg slope)
- Unit costs of activities
Valuing forest benefits in Croatia:

Landscape benefits

Based on tourist WTP for forest landscapes
- CV surveys
  - Carried out in Croatia and Italy
  - Mechanism: increase in tourism tax at hotel
  - WTP ca $3/tourist/day
  - Consistent with other data (e.g., hotel room prices)
- Used $1.5/tourist/day (conservative)
  - Adjusted for number of tourists at site (assumed pre-war levels reached in 5 years)
- Adjusted for visibility of site (crude)
- Landscape benefits assumed recovered in 5 years

Hunting benefits

Based on lease rates for hunting reserves
- Values from Sweden ($10/ha-$30/ha)
  - Adjusted for site characteristics (animal population, accessibility)
  - Assumed recovery of hunting benefits following reforestation in 5 years

Wood production benefits

Based on
- Mix of species planted
- Site-specific growth tables

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean annual yield (m³/ha)</th>
<th>Proportion of planting (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Halepensis</td>
<td>3.5</td>
<td>50</td>
</tr>
<tr>
<td>P. Pinus</td>
<td>3.2</td>
<td>20</td>
</tr>
<tr>
<td>P. Pinaster</td>
<td>3.3</td>
<td>10</td>
</tr>
<tr>
<td>C. Sempervirens</td>
<td>3.0</td>
<td>20</td>
</tr>
</tbody>
</table>

- Management plan
  - 58% of available volume harvested
  - Thinning at 20 yrs, harvest at 40, 80 yrs
- Expected long-term prices

Avoid loss of landscape benefits

Erosion protection benefits

Based on
- Avoided costs of sedimentation in urban areas (cleaning roads, unclogging drainage)
  - At other sites: avoided loss of HEP generation capacity, avoided damage to oyster beds
- Several sites have no erosion protection benefits
- Only part of sites contributes to erosion protection, because of location
- Assumed erosion benefits achieved in 5 years
Valuing forest benefits in Croatia

2. Financing Bolivia’s protected areas

- Bolivia’s SNAP
- Financing needs
- Charging visitors
- Selling services
  - Water
  - Carbon

Financing Bolivia’s protected areas:
Bolivia’s National Park System

- 21 PAs
- > 16% of area

Financing Bolivia’s protected areas:
Projected financing requirements 2003-10

Pagiola and Platais, World Bank, 2003
Financing Bolivia’s protected areas:
Projected financing requirements 2003-10

- Visitor numbers small but growing
  - 45,000 in 2000
  - 62,000 in 2002
  - 83% foreign
- Most PAs don’t charge for entry
  - Legal issue: Can SERNAP charge for entry?
  - Decided it could, 1999
- Reserva Eduardo Avaroa began charging 1999
  - B30/person (ca US$4)

Financing Bolivia’s protected areas:
Visitors: 2002

- 5% annual growth
- 10% annual growth
Financing Bolivia’s protected areas: Revenue in 2012 under different scenarios

- How much potential?
- Most PAs downstream of users, so no/limited potential
- Limited potential in specific cases

Water services

- Tunari NP (municipalities, HEP)
- Cordillera de Sama (irrigation, HEP)
- Aguarague NP (municipalities, irrigation)

Demand for carbon sequestration

- Kyoto Protocol/Clean Development Mechanism
  - Reforestation or afforestation in areas deforested by 1990
  - Limited quantities
  - Not yet ratified
  - Many implementation problems
    - Incrementality
    - Permanence
    - Avoiding leakage
- Non-Kyoto ‘retail’ demand
  - Eligible activities depend on what people are willing to pay for
  - Limited demand
  - eg Johannesburg Climate Legacy

Carbon sequestration

- Noel Kempff Mercado Climate Action Project
- One of first carbon sequestration projects
  - US$7 million from energy companies
  - US$2.5 million from TNC and FAN
- Benefits:
  - Bought out logging concessions, almost doubling size of PA
  - Improved management
  - 30-year income flow
Financing Bolivia’s protected areas: Carbon prices

(late 2002)

Source: World Bank Carbon Finance

Pagella and Platois, World Bank, 2003