Using markets to preserve forests and the services they provide

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Integrative Science for Integrative Management
Saariselkä, Finland, 17.8.2007
Forests are more than just timber

Annual flow of benefits from Mediterranean forests
Mean: US$148/ha

- Passive use values
- Carbon sequestration
- Watershed protection
- Recreation and hunting
- NTFPs
- Grazing
- Timber and fuelwood

Source: Croitoru and Merlo, 2005
Who benefits from forests?

Source: Croitoru and Merlo, 2005
Why are forests mismanaged?

- Global externalities
- Externalities
- Insecure property rights
- Policy distortions

Source: Croitoru and Merlo, 2005
The Costa Rica Striptease

Benefits of forest land to landowners, Costa Rica

- Clearing and use for pasture
- Sustainable forest management

Source: Based on Kishor and Constantino, 1993

Source: Costa Rica Ministry of Energy and Environment

1940
1987

Using markets to preserve forests
Need to address both policy distortions and externalities

Benefits of forest land to landowners, Costa Rica

Clearing and use for pasture
Sustainable forest management
Eliminating policy distortions
Internalizing externalities
Eliminating distortions and Internalizing externalities

Source: Based on Kishor and Constantino, 1993

How do we do this?
Using markets to preserve forests and the services they provide

Benefits of forest land to landowners

- Clearing and use for pasture
- Sustainable forest management + ecotourism and/or certification

Prior conditions:
- Secure property rights
- Eliminate policy distortions

Market-based instruments:
- Increase direct income
- Ecotourism
- Eco-certification
- Internalize externalities
Externalities caused by loss of forests
Sasumua water treatment plant, Kenya
Externalities caused by loss of forests
Sasumua water treatment plant, Kenya
Externalities caused by loss of forests
Sasumua water treatment plant, Kenya

Clearing silt from water intakes: $50,000/year
Treating for contamination: $100,000/year
Using markets to preserve forests

The logic of payments for environmental services

Benefits to land users
- Water
- Biodiversity
- Carbon
- Landscape

Costs to downstream populations

Deforestation and use for pasture

Conservation with payment for service

Payment

Important!
This logic is repeated every year
- Need annual payments
- Need sustained financing
Definition of PES

A mechanism to improve the provision of indirect environmental services in which

- Those who provide environmental services get paid for doing so (‘provider gets’)
- Those who benefit from environmental services pay for their provision (‘user pays’)
- Payments are conditional
- Participation is voluntary
What makes payments for environmental services attractive?

- Generates it’s own financing:
  - Brings new financing not previously available for conservation

- Efficient:
  - Focuses efforts where benefits of conservation highest and costs lowest

- Potentially very sustainable:
  - Not based on whims of governments, donors, NGOs, but self-interest of service users and providers

- For this to work, need to:
  - Base payments to providers on payments by users
  - Actually deliver services: getting the science right is critical
  - Tailor mechanism to specific local conditions
A mechanism to improve the provision of indirect environmental services in which:

- Those who provide environmental services get paid for doing so ('provider gets')
- The government (or another third party) pays for their provision
- Payments are conditional
- Participation is voluntary
What makes supply-side PES attractive?

- Generates its own financing:
  - Brings new financing not previously available for conservation
- Efficient: ?
  - Focuses efforts where benefits of conservation highest and costs lowest
- Potentially very sustainable:
  - Not based on whims of governments, donors, NGOs, but self-interest of service users and providers
- For this to work, need to:
  - Base payments to providers on payments by users
  - Actually deliver services: getting the science right is critical
  - Tailor mechanism to specific local conditions
Examples of PES mechanisms

<table>
<thead>
<tr>
<th>Country</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>Cauca Valley water user associations</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>FONAFIFO/Pagos por Servicios Ambientales (PSA)</td>
</tr>
<tr>
<td></td>
<td>Heredia: Environmentally adjusted water tariff</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Quito: FONAG</td>
</tr>
<tr>
<td></td>
<td>Cuenca: ETAPA</td>
</tr>
<tr>
<td></td>
<td>Pimampiro</td>
</tr>
<tr>
<td></td>
<td>Capital city</td>
</tr>
<tr>
<td></td>
<td>Mid-size town</td>
</tr>
<tr>
<td></td>
<td>Small rural town</td>
</tr>
<tr>
<td>El Salvador</td>
<td>Tacuba, San Francisco de Menéndez, Yamabal</td>
</tr>
<tr>
<td>Mexico</td>
<td>Pago por Servicios Ambientales del Bosque (PSAB)</td>
</tr>
<tr>
<td></td>
<td>Coatepec</td>
</tr>
<tr>
<td>Venezuela</td>
<td>CVG-Edelca payments for conservation of Río Caroní</td>
</tr>
<tr>
<td>South Africa</td>
<td>Working for Water Program: payments from Hermanus and George</td>
</tr>
</tbody>
</table>
### Costa Rica: Payments by water users

#### (US$/ha/yr):

<table>
<thead>
<tr>
<th>Hydropower producer</th>
<th>Bottler</th>
<th>Domestic water supply</th>
<th>Irrigated agriculture</th>
<th>Hotel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energía Global</strong></td>
<td><strong>Platanar S.A.</strong></td>
<td><strong>CNFL/Río Aranjuez</strong></td>
<td><strong>CNFL/Río Balsa</strong></td>
<td><strong>Florida Ice &amp; Farm y Heredia ESPH</strong></td>
</tr>
<tr>
<td><strong>Azucarera El Viejo</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hidroeléctrica Agua Zarcas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Misc</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total 18,000 ha**
ca **US$500,000/year**

- **Renewed!**

- **Renewed!**

- **Renewed!**

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Stefano Pagiola, World Bank, 2007
World Bank support to PES

Completed projects:
- **Costa Rica**: Ecomarkets Project (US$33 million WB + US$8 million GEF)

Projects under implementation:
- **Colombia/Costa Rica/Nicaragua**: Regional Integrated Silvopastoral Ecosystem Management Project (US$4.5 million GEF)
- **South Africa**: Cape Action Plan for the Environment (US$9 million GEF)
- **Mexico**: Environmental Services Project (US$83 million WB + US$15 million GEF)
- **Costa Rica**: Mainstreaming Market-Based Instruments for Environmental Management Project (US$30 million WB + US$10 million GEF)

Projects under preparation:
- **Brazil**: Forests for Life Project
- **Colombia**: Sustainable Livestock Management Project
- **Ecuador**: Management of Chimborazo’s Natural Resources Project
- **Venezuela**: Canaima National Park Project
- **Kenya**: Agricultural Productivity and Sustainable Land Management Project
- **Worldwide**: LULUCF carbon projects (US$30 million BioCarbon Fund)

Capacity building: Courses in Colombia, Dominican Republic, Ecuador, El Salvador, Kenya, Mexico, Panama, Peru, Senegal, South Africa, Venezuela

Research: Case studies; Hydrological aspects; Poverty links; Valuation
Using markets to preserve forests

1. Understanding the science...

2. Charging service users

3. Paying service providers

4. Establishing the institutional framework

... and the economics

From theory to practice

Land users → Hydrological effects → Irrigation → Water users association → Farmers

Hydropower production → Farmers

Domestic water supply → Water company → Water users

Hydropower producer → Electricity users

Payment
Water flows downhill
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Irrigation

Low potential payments

High potential payments

Hydroelectric production

Río Nizao

98MW

52MW

64MW

Potable water 6 m³ s⁻¹

Río Ocoa

Dominican Republic

Water services vary substantially
Where are the services?
Guatemala: Watersheds with hydropower plants

Source: Pagiola, Zhang, and Colom, 2007

Higher potential payments

Lower potential payments

Generating capacity per hectare of upstream area (kW/ha)
- 0.04 - 0.20
- 0.20 - 0.80
- 0.80 - 1.50
- 1.50 - 3.45

Source: Pagiola, Zhang, and Colom, 2007
Where are the services?
Guatemala: Watersheds with irrigation (>500ha)

Source: Pagiola, Zhang, and Colom, 2007
Where are the services?

Guatemala: Watersheds with significant domestic water use

Source: Pagiola, Zhang, and Colom, 2007
Identification and quantification of water services

Need to understand chain of cause and effect

- Land users → Hydrological effects
- Quantity, quality, and regularity of water flows
- Availability of water when needed (is there a dam?)
- Irrigation
- Hydropower production
- Domestic water supply
- Water users association → Farmers
- Water users association
- Hydropower producer → Electricity users
- Water company → Water users
- Value of production
- Impact on agricultural production
- Need to understand chain of cause and effect

Stefano Pagiola, World Bank, 2007
Identification and quantification of water services

Need to understand chain of cause and effect

- Land users
  - Hydrological effects
  - Quantity, quality, and regularity of water flows
- Irrigation
- Water users association
- Farmers
- Hydropower production
  - Volume of water available, sedimentation
- Water company
  - Water users
- Domestic water supply
- Water users
- Electricity users
- Impact on electricity production
  - Cost of production, value of sales
Identification and quantification of water services

Need to understand chain of cause and effect

- Land users → Hydrological effects
  - Quantity, quality, and regularity of water flows

- Land users → Volume and regularity of water availability

- Land users → Hydropower production
  - Impact on treatment and distribution

- Land users → Domestic water supply
  - Cost of treatment and distribution, value of sales

- Irrigation → Water users association
  - Farmers

- Hydropower production → Hydropower producer
  - Electricity users

- Water supply → Water company
  - Water users

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## Links between forests and water services: Myths and reality

<table>
<thead>
<tr>
<th>Myth:</th>
<th>Reality:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forests increase precipitation</td>
<td>Minor effect, except at continental scale</td>
</tr>
<tr>
<td>Forests slow runoff</td>
<td>True</td>
</tr>
</tbody>
</table>
| Forests increase total annual water flow | Because of increased evapotranspiration, forests usually *reduce* total annual water flow.  
*Exception:* Cloud forests |
| Forests increase water flow in the dry season | Unclear                                                                |
| Forests reduce flooding     | True at small scales, not at large scales                                |
| Forests reduce erosion      | Depends on use that is made of deforested areas                          |

*Important:* Relevant comparison is not forest vs non-forest but forest vs specific alternatives
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Links between forests and water services: How much do we know?

<table>
<thead>
<tr>
<th>Service</th>
<th>Qualitative understanding</th>
<th>Ability to quantify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total water quantity</td>
<td>Good</td>
<td>Medium</td>
</tr>
<tr>
<td>Dry season water flow</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>Flood risk</td>
<td>Medium</td>
<td>Poor</td>
</tr>
<tr>
<td>Water quality</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Sediment loads</td>
<td>Good</td>
<td>Medium/high</td>
</tr>
</tbody>
</table>
Using markets to preserve forests

Charging service providers: Sasumua Water Treatment Plant

• Must be worth their while
• Need to convince them that it is
  • Quantification is often vital

Additional costs due to upstream degradation:
• Desilting water intakes: ca US$50,000 yr\(^{-1}\)
• Increased water treatment costs: ca US$100,000 yr\(^{-1}\)

Maximum payment:
• US$150,000 yr\(^{-1}\) if reduce problems by 100%
• US$75,000 yr\(^{-1}\) if reduce problems by 50%

Including transaction costs!
Charging service users

Easiest when beneficiaries
- Are easy to identify
- Receive well-defined benefits
- Are already organized
  - Easier to negotiate agreements
  - Already have payment mechanisms
- Are few
## Who’s going to pay?

<table>
<thead>
<tr>
<th>Are service users…</th>
<th>Water services</th>
<th>Biodiversity services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to identify?</td>
<td>√</td>
<td>X</td>
</tr>
<tr>
<td>Receive well-defined benefits?</td>
<td>√</td>
<td>X</td>
</tr>
<tr>
<td>Already organized?</td>
<td>√</td>
<td>X</td>
</tr>
<tr>
<td>Few?</td>
<td>√</td>
<td>X</td>
</tr>
</tbody>
</table>
Main problems to establishing PES mechanisms

- Getting the science right
- Getting the institutions right
Costa Rica: A happy ending

- Distortions reduced
- Changes in legal framework
- Wide array of market-based instruments
  - Ecotourism
  - Certification
  - Payments for environmental services
For more information

www.worldbank.org/environmentaleconomics