Designing the optimal PES: Theory, reality and the challenge of measuring biophysical and welfare returns on conservation investments

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Outline

1. Basics: What constitutes an “optimal” PES?
2. How to achieve “optimality”: Theory and reality
   - Targeting
   - Conditionality
3. Outlook
TNC’s interest in PES design

- PES as important new conservation tool
- New focus on human wellbeing (alongside biodiversity) → ES
- Drive to improve project effectiveness assessment generally

→ New hydro-PES project monitoring framework
→ “Return on Investment” Partnership (TNC, Resources for the Future)
TNC’s hydro PES projects (May 2011)
What makes a PES “optimal”?

“Optimal” project
A) Strictly: $\equiv$ that which maximizes human well-being (service values) s.t. budget
   - all ES, not just target ES

B) PES literature: $\equiv$ that which maximizes target ES flows s.t. budget
   $\rightarrow$ cost-effective (at best), not optimal
How to make PES cost-effective

Literature suggests:

1. Targeting (cost, ES flows, threat/additionality)

2. Strong conditionality
Example: TNC’s PES in Extrema municipality (Atlantic Forest, Brazil)

Forest conservation and restoration (~1,200 ha) for sediment reduction

Targeting:
– Conversion threat
– Opportunity cost
– ES provision (riparian areas & steep slopes; forest cover)

Conditionality:
– Payments tied to quality of restored forest (hi-res. satellite imagery; site visits)
How to make PES cost-effective (contd.)

- Targeting (cost, ES flows, threat/additionality)
- Strong conditionality

Problem:
For most ES, these two will NOT achieve cost-effective allocation of PES resources across landscape
1. Why targeting is not enough: Use of wrong ES metrics

- Targeting of ES flows *per se* is not enough
- Unless ES are spatially fungible w.r.t. benefits, ES metrics used must reflect flow change at point of service use
1. Why targeting is not enough: Use of wrong ES metrics

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- Unless ES are spatially fungible w.r.t. benefits, ES metrics used must reflect flow change at point of service use
Use final ES, defined in *benefit-specific* terms

“ES — Reduced sediment load”

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Final ES</th>
<th>Intermediate ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided drinking water filtration costs</td>
<td>Reduced sediment load in drinking water (village (x), water utility (y))</td>
<td>Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel</td>
</tr>
<tr>
<td>Avoided dredging costs/reduction in useful life of dam</td>
<td>Reduced sediment input in hydro reservoir (z)</td>
<td>Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel</td>
</tr>
<tr>
<td>Avoided farmer dredging costs/ avoided loss in ag. productivity</td>
<td>Reduced sedimentation of irrigation canals</td>
<td>Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel</td>
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ES defined w.r.t. specific benefit and point of use (service delivery)
Challenge: Need to know ES production functions

Q: How does change in variable $x$ in location $y$ impact sediment load at point $z$?

Empirical problem:
- Many target ES have several key drivers
- High natural variability
- Time lags (e.g., sediment can take years to move through system)

$\rightarrow$ Long time series data; well-designed, BACI experimental setup (counterfactuals)
Challenge: Need to know ES production functions (contd.)

But necessary to test if program is effective. Key questions monitoring must be designed to answer:

1. Does an intervention work? *Are we affecting ecosystem function* — e.g., *stream sedimentation*? *By how much?*

2. Does the intervention result in ES? *Do changes in functions translate into changes in ES* (i.e., *at point of use*)?

3. Are scale and location of interventions appropriate? *Are we achieving ES objectives* (e.g., *20% reduction of sediment at point x*)?
2. Conditionality: Yes, but how strict?

- Important to ensure compliance (no “money for nothing”)

- But: carries opportunity costs: Optimize, not maximize compliance!

- Optimal conditionality: point at which further increase in stringency reduces overall ES gains of PES
Countervailing effects of conditionality stringency on ES gains from PES program; with increasing stringency:

<table>
<thead>
<tr>
<th>Demand side (ES buyers)</th>
<th>Supply side (ES sellers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased need for accuracy &amp; precision</td>
<td>Opportunity costs ↑ (higher risk of non-payment) *</td>
</tr>
<tr>
<td>Monitoring costs ↑</td>
<td>TAC ↑</td>
</tr>
<tr>
<td>Available payment budget ↓</td>
<td>Conservation costs ↑ (extra actions to avoid non-compliance)</td>
</tr>
<tr>
<td>Acreage ↓</td>
<td>Participation costs ↑</td>
</tr>
<tr>
<td>ES ↓</td>
<td>Payment levels ↑ *</td>
</tr>
</tbody>
</table>

* Risk premiums demanded unless risk aversion-weighted $E(I)_{\text{PES, Cond.}} \geq E(I)_{\text{Alt. Land Use}}$

Mean ES/ha ↑

ES ↑↓ ??

ES ↑↓ ??
So where does that leave us?

- Without appropriate ES metrics ("final, benefit-specific");
- without ES flow monitoring; and
- without counterfactual scenarios based on validated, locally calibrated ES flow models...

...we cannot reliably assess the performance of a PES project.
Where to from here?

- Develop production functions of key final ES ("sediment at point x") (→Research)

- Build validated final ES models and calibrate them to field sites (e.g., InVEST, ARIES)

- Identify and deploy lowest-cost, sufficiently accurate & precise monitoring options for specific ES

- Develop counterfactuals (additionality); monitoring is not enough ("after project" ≠ "with project")
Thank you!

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