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

Timm Kroeger, Ph.D.
The Nature Conservancy

Payments for Ecosystem Services and their Institutional Dimensions
10-12 November 2011, Berlin, Germany

Outline

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

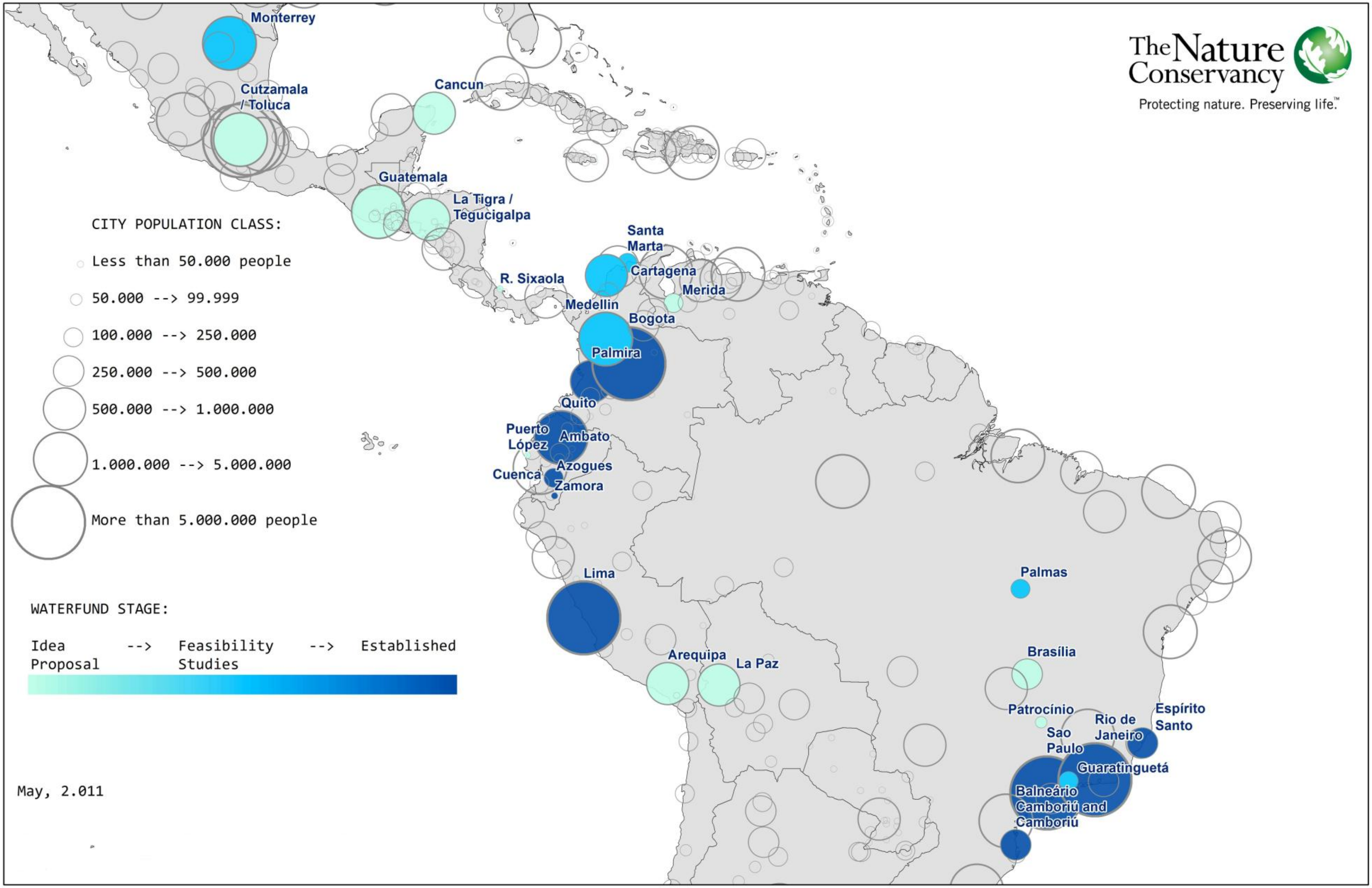
TNC's interest in PES design

- 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: ≡ that which maximizes human well-being (service ***values***) s.t. budget

- ***all*** ES, not just target ES

B) PES literature: ≡ that which maximizes ***target*** ES ***flows*** s.t. budget

→ cost-effective (at best), not optimal

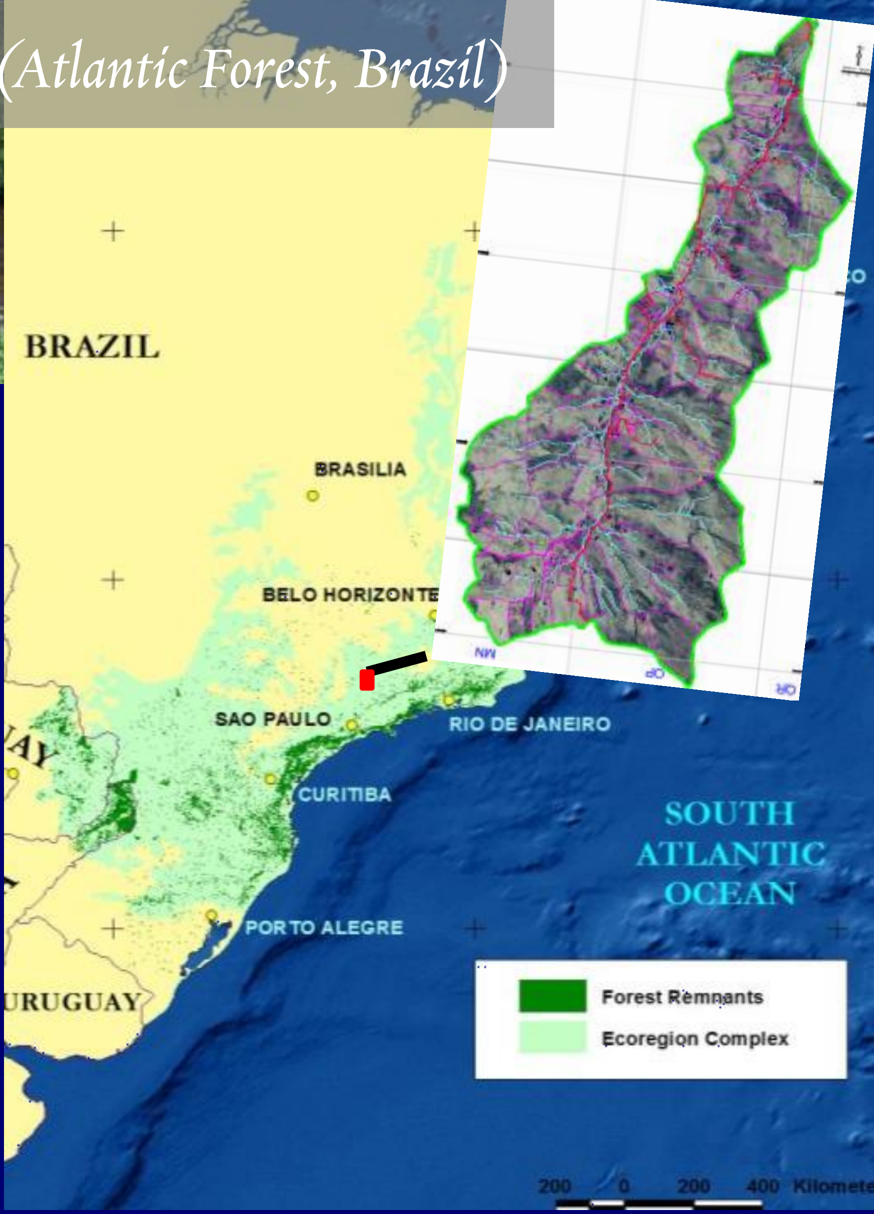
How to make PES cost-effective

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)

The Nature Conservancy
Protecting nature. Preserving life.™

CONSERVADOR DAS ÁGUAS

How to make PES cost-effective (contd.)

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

Problem:

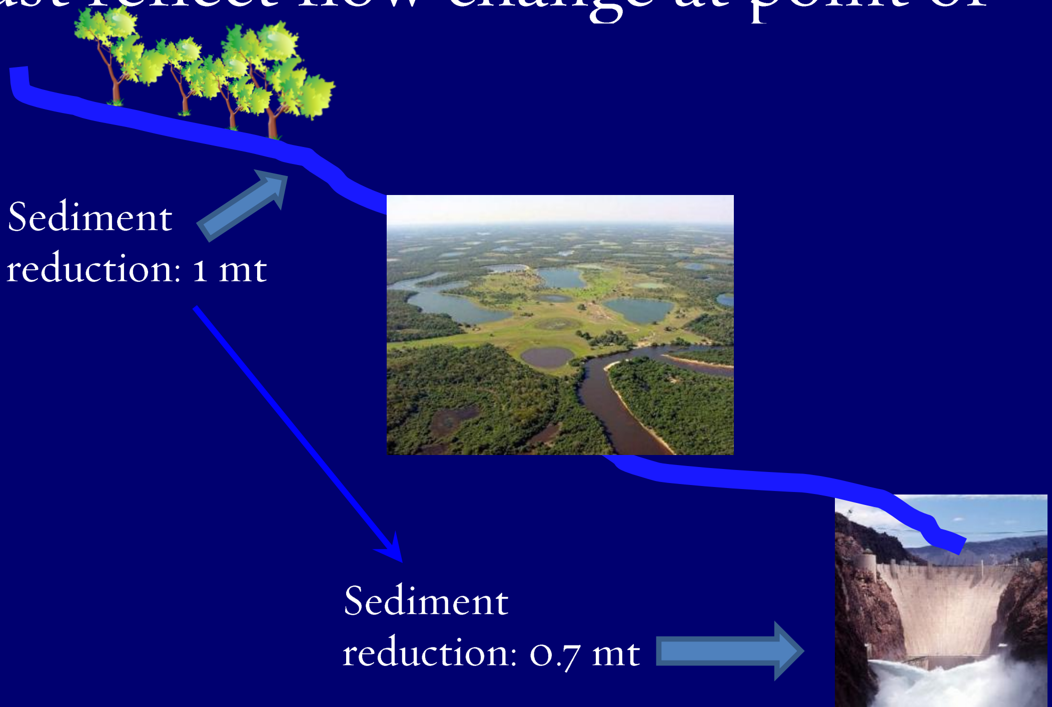
For most ES, these two will NOT achieve cost-effective allocation of PES resources across landscape

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

- 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

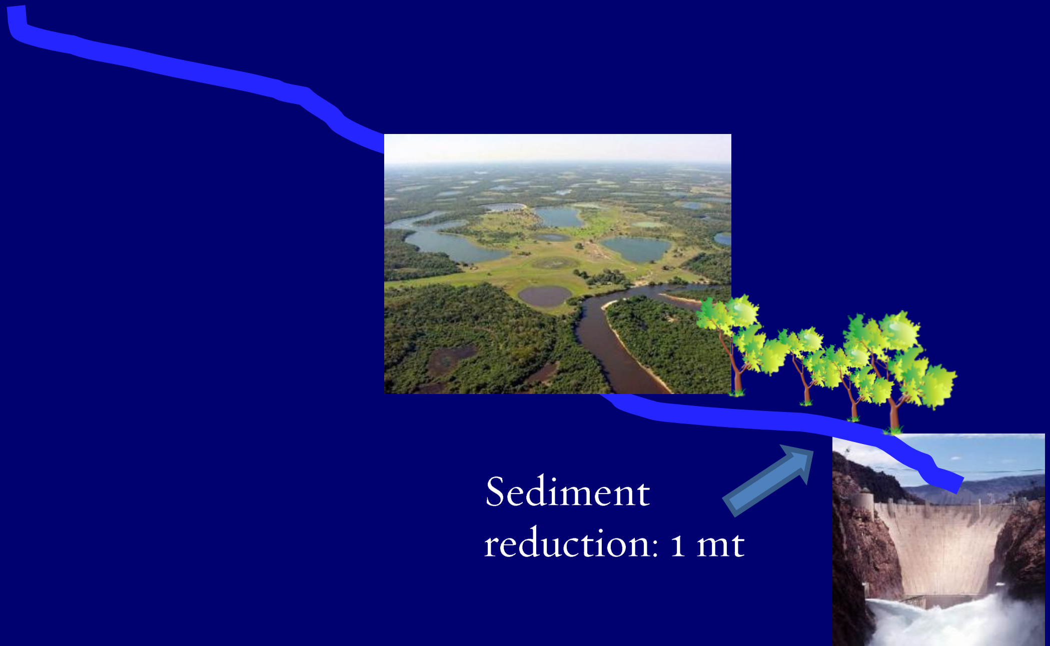


Sediment reduction: 1 mt

Sediment reduction: 0.7 mt

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



How to make PES cost-effective

→ Use final ES, defined in *benefit-specific* terms

“~~ES = Reduced sediment load~~”

Benefit	Final ES	Intermediate ES
Avoided drinking water filtration costs	Reduced sediment load in drinking water (village *x*, water utility *y*)	Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel
Avoided dredging costs/reduction in useful life of dam	Reduced sediment input in hydro reservoir *z*	Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel
Avoided farmer dredging costs/ avoided loss in ag. productivity	Reduced sedimentation of irrigation canals	Riparian vegetation buffers; intact natural land cover; intact floodplain; undisturbed river channel
…	…	…

= 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)

→ 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.

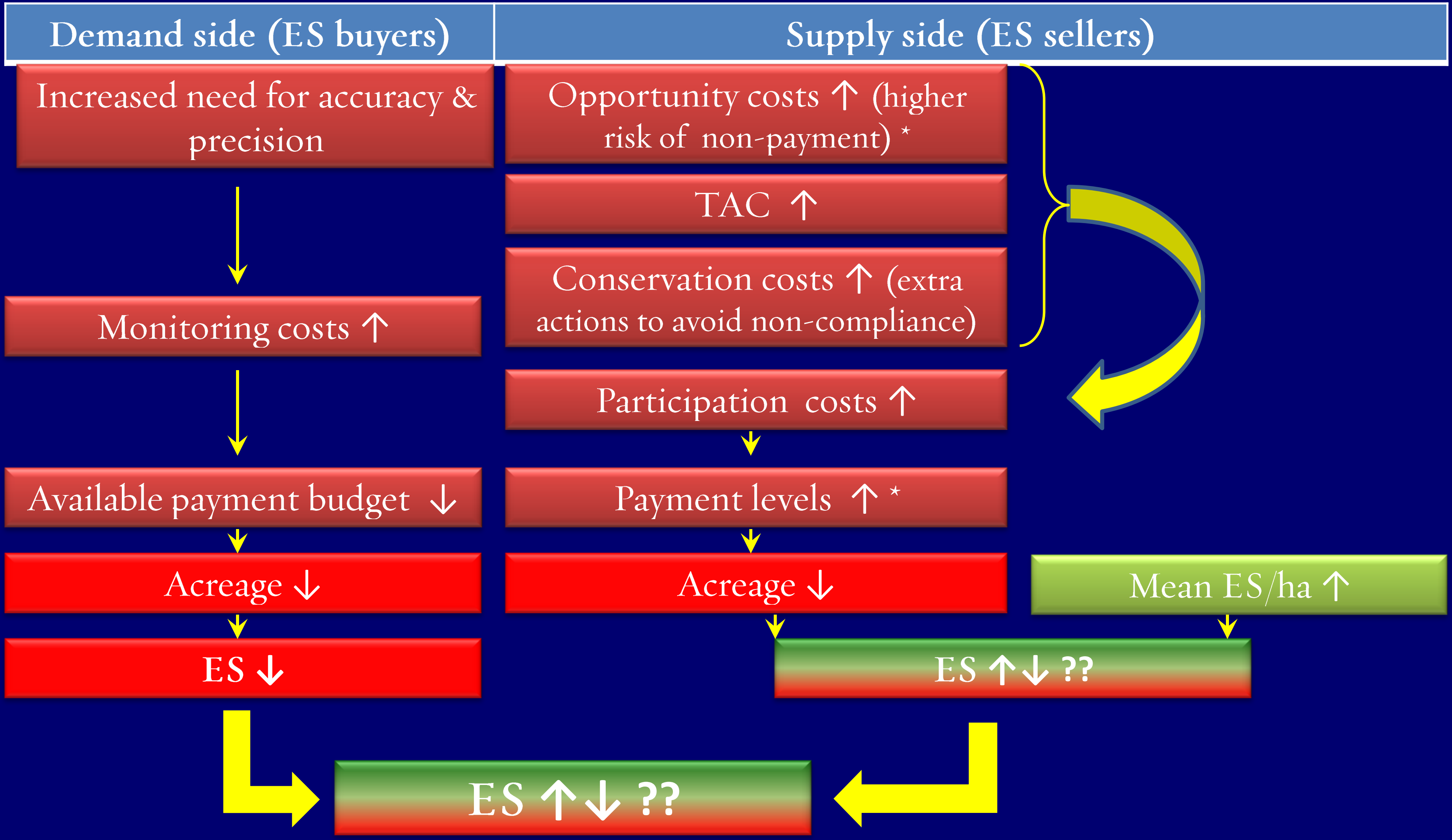
Key questions monitoring must be designed to answer:

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:



Demand side (ES buyers)

Increased need for accuracy & precision

Monitoring costs ↑

Available payment budget ↓

Acreage ↓

ES ↓

Supply side (ES sellers)

Opportunity costs ↑ (higher risk of non-payment) *

TAC ↑

Conservation costs ↑ (extra actions to avoid non-compliance)

Participation costs ↑

Payment levels ↑ *

Acreage ↓

Mean ES/ha ↑

ES ↑↓ ??

ES ↑↓ ??

---

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

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!

tkroeger@tnc.org