

# The economics of payment for ecosystem services

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# What are we talking about? Categories of Ecosystem (Environmental) Services (ES)

- *Conservation & Preservation*
- *Storage and stabilization ( e.g water, carbon )*
- *Risk reduction ( flood control, protection form fire)*
- *Natural resources quality enhancement ( soil, water)*
- *Amenity creation-Restoration, Enhancement*

# Categories of Environmental Services (ES)

- *Pollution Prevention*. Producers may be paid to modify environmental damaging activities.
  - Payment to give up rights to pollute
- *Conservation*. Payment for changing activities to preserve natural resources, ecosystems etc.
  - Forest resources ( old growth tropical) and wetlands
  - Farming practices, varieties, rural communities
- *Amenity creation*-restoration and built up of NR
  - Wetlands and bodies of water
  - Forests, parks green lungs

# PES and environmental policies

- Environmental policy tool have part of the evolving regulatory arsenal which also includes
  - Command and control
  - Polluter fee
  - Cap and trade
  - Voluntary agreement
  - Verification and certification

# The reasons for correcting market outcome include

- Externalities
- Public good
- Income distribution
- PES are introduced to address these problems
- Tool choices reflect political economy considerations

# Problems of designing effective environmental policies

- Direct controls are costly
- Industry opposes taxation
- Property rights- polluters have rights to pollute
  - Makes pollution pay principle difficult to introduce

# Cap and trade: an emerging solution

- No transfer of funds outside the industry
- Cap may be determined based on political consideration
- Kyoto targets may be attained by CO<sub>2</sub> Sequestration
- Good Solution when industry is well to do (monopoly power) and can survive the extra cost of pollution
- But what about small holders that face fixed prices and minimal capacity to adjust, or
- Industries that have very much political muscle and established pollution rights
- CAP and trade is implemented by markets for ES

# Drivers of PES

# Caps leads to PES

- Government polices create markets for PES
- Policies use caps and polluters buy PES as offsets
  - Policies like “No Net Wetland lose” create market for new wetlands- “wetland banking”.
  - Caps on groundwater pumping lead to payment for water conservation that release water rights
  - Global ceilings on GHG emission create market for sequestration

# Government policy wants to achieve an environmental objective

Create environmental amenity-forests (China),  
national park

Protect against soil erosion

Sometimes there is a distributional policies

- US reduced farm subsidies and increased CRP budget since it is in the “Green box”-
- CES can be used as part of public work policies to reduce unemployment

# PES are used when polluters are too weak or strong

- Payment for ES is a response to a “de facto” property right assignment.
  - when you can not make Agents ( polluters, farmers) change their behavior you pay them to do it
  - But PES aim to establish more than one objective
  - First we will see the performance of PES addressing environmental objectives and then we will deal wiith distributional effects

# Private sector will pay for ES if it will reduce cost or generate profits

- PES can reduce pollution control costs
- Needed to allow activities like Tourism or recreation (Bird watching or hunting)
- Needed to meet regulatory constraints
- People and institutions may want to get recognition for providing public goods
  - Private sector can pay and is paying for some ES but government is the major driver through finance and regulation

# The evolution of PES as a concept- returns to natural capital

- PES was introduced as the returns for natural capital (Heal, Dailey, Perrings)
  - Catskill Watershed- pay farmer not to graze cows to maintain water quality
  - Wet lands as buffers against floods ( Mississippi)
  - Biodiversity conservation
  - Climate change CDM- carbon farmers
- PES was introduced as means to improve public environmental conservation programs
  - Biodiversity preservation

# A related literature- managing purchasing funds

- Programs-
  - CRP
  - Debt for nature
  - Nature conservancy
  - Forest conservation programs- Costa rica
- Concepts
  - Targeting
  - Correlations
  - Working lands vs diversion program
  - GIS indecies
- Babcock, WU, DZ ,Alix, Shogren, Antle, Horan, Pagiola, Bulte

# Multi-dimensionality of PES



# PES for land use change vs. modification of production system

- **Diversion programs** pay for changing resource use from current production activities to greener ones
  - CRP- from farming to wetland,trees,native grasses
- **Working land programs** require modification
  - Planting native varieties
  - Reduce use of chemicals
  - No tillage

# Alternative buying strategies

- Some programs aim to buy the cheapest lands
- Others buy the lands with the best amenities
- Some combine benefits and costs in targeting purchases

# Other dimension of variation among PES programs

- The same land may provide a multitude of ES
- Some ES are provided simultaneously others are not
  - Growing Wetland conflicts with native plants
  - Soil erosion and wind erosion are complementary
- ES may provide regional, national & global benefits
- Benefits of ES vary across individuals & groups
  - Bird watchers & hunters benefit from better bird habitat
  - All gain from flood control- gains vary by location

# The Dimensions of Wetland Services

	Local	National	International
Wildlife habitat	Public Private	Public	Public
Flood control	Public Private	Public Private	Public Private
Water purification	Private Public	Public Private	
Aesthetic value	Public Private	Public	Public
Recreation	Private	Private	Private
Existence	Public	Public	Public

# Theory can evaluate Targeting and Performance of PES

- Who is gaining and losing from PES??
- What are the conditions under which various targeting are optimal?
- When Can PES harm the environment?



# Targeting

# The impacts of Targeting

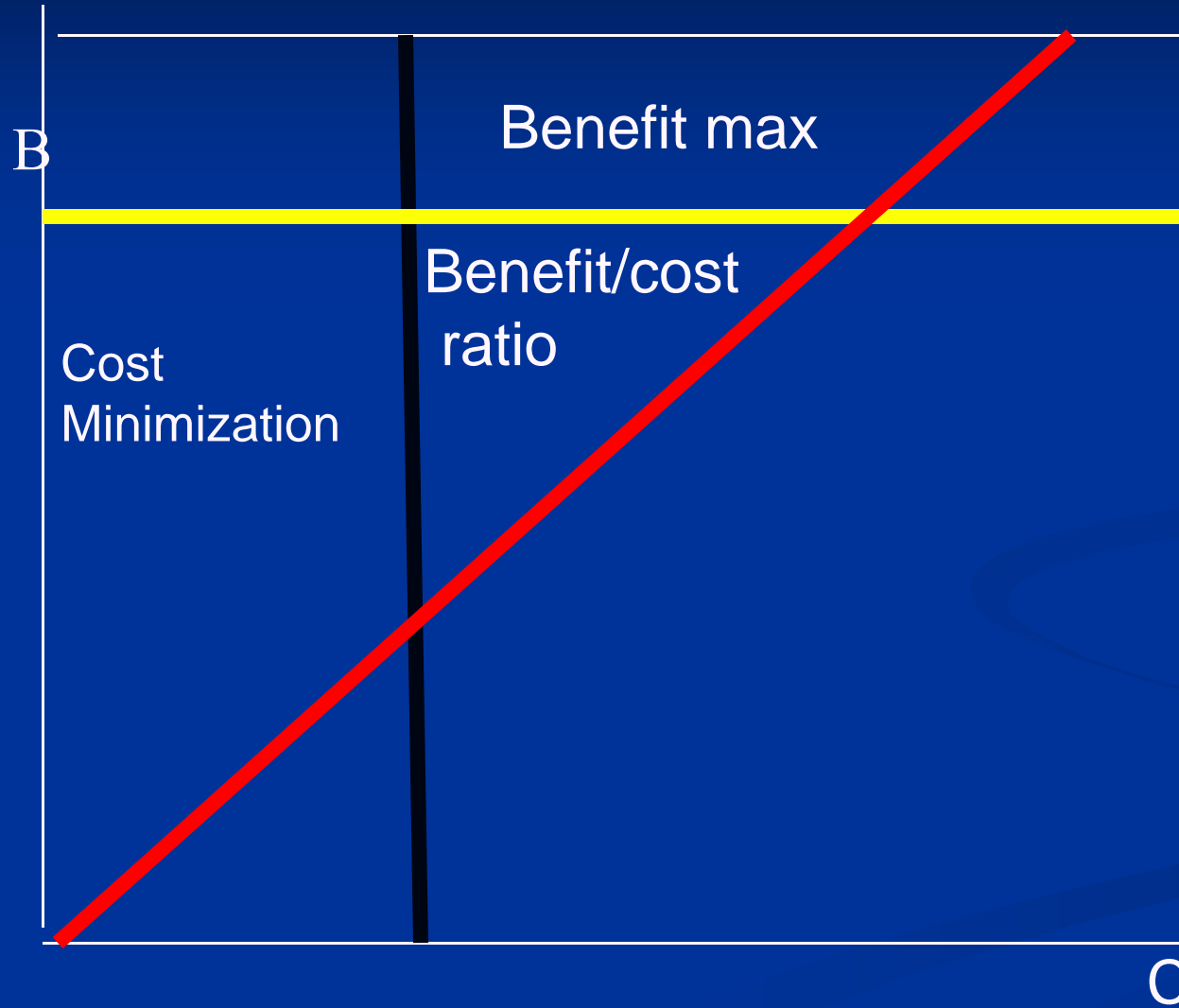
Based on WU et-AL

- They Consider the case with the No Scale effects
- Assume Heterogeneity -ES benefit & cost per acre vary
- There are N locations, identified by  $n=1, N$  .
  - $A_n$  = Land of location n,
  - $B_n$  = Benefits per acre of location n.
  - $C_n$  = Costs per acre( value of land in alternative use)

# Targeting criteria

- Acreage maximization Buy the lands with the lowest  $C_n$  (regardless of benefits) given the budget
- Benefits targeting Purchase the highest quality lands (lands with highest  $B_n$ ) within budget
- Benefit /cost Targeting Purchase lands with the highest  $B_n/C_n$  (highest benefit cost ratio) given the budget

# targeting



# The implication of targeting

- Benefit cost targeting is optimal-  
Maximizing ES given budget
- Cost targeting maximize acreage & preferred by land owners.
- Benefit maximizing result in lowest acreage reduction- best for consumers

# Correlation and variability

- The importance of correlation when low cost lands has high ES (negative correlation of  $B_n$  and  $C_n$ ) the welfare loss of cost targeting is small. It is big in case of positive correlation.

# The Importance of variability

- Benefits are positively correlated to costs & variability of benefit is much larger than of costs
  - Simulations and reality suggest that with high variability of ES small fraction ( 80% of ES land) provide 80% of benefits, Thus targeting is crucial and there is increasing marginal benefits to ES funds

# Unintended consequences

Designers of ES programs need to be aware of

- Slippage- if output demand is inelastic, PES program increase ag prices leading to farming of previously idle lands (slippage)- This may lead sometimes to reduction of benefits thus PES may need to pay for keeping lands with high ES out of production
- Purchasing funds that are sole buyer may pay monopolistic pricing and short change the landowner
- Landowners may gain from ES but operators and other lose, including government if lower production reduce taxes revenue to government.

# Importance of space

- Agglomeration effects- There are extra benefits from larger piece of land pooled together
- Some times need lanes that allow connectivity and movement
- Some amenities needs being near body of water
- Other far away

# Other considerations



# Selling ES in markets vs. special trades

## Markets

Low transaction cost

Standard product

Large number of buyers

Minimal contact of buyer and seller

May be Better for poor

Best application- carbon markets

## Special deal

Tailor product to buyers' needs

Local small number of potential partner

Needs a way to link buyer to seller green E-bay

That's is the way the Nature Conservancy operates

# Elements of implementation

Measurement

Specific instrument design

bidding

trading

ES output meeting well defined standards

Monitoring and enforcement

Unbundling

Heterogeneity

Correlation

Targeting

Role of government

Third party

# Measurement

- Buyers and sellers need to know
  - What is delivered - when - for what price
  - Deliverables can be outcomes or actions
  - Must be easily measurable
  - Simplicity and common sense are essential
    - ES is controlled by the worker in the field
    - Not the scientist in the lab.

Clever use of new IT can improve measurement accounting and monitoring

Complexity of measurement will not favor the poor

# The reasons for ES product standards ( Being commodities not unique products)

- Buyers want

- to know what they buy
- To sell it when they want ( liquidity)
- Certification by trusted agency

All associated with having ES meeting standards.

Also

- Low transaction cost
- High volume of trading
- Increased involvement of smaller farmers in ES market

# Monitoring and Enforcement

- ES are frequently generated on large parcels of land over long period of time
- Farmers can easily cut corners
- Inspection backed by action will lead to improved ES quality
- justify higher prices
- Can be part of certification program
- Monitoring allows establishing **buyers insurance plans** ( Guaranteeing delivery and compensation)
- **May Require regional cooperation for poor to participate**

# ES markets allow selling bundles of ES

- A field may generate various types of ES
- Potential buyer may be interested in only part of the package
- The Land owner's gain will increase If they can sell different types of ES to different buyers
- A well functioning ES market results in a pricing of individual ES that will increase the flexibility of the buyers and sellers

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# Important of technology

- Lower cost of monitoring and tracing will allow expanding ES that enter the market
- Better monitoring allow assigning responsibilities for stewardships-reduce need for direct controls and increase the potential of markets
- Improving tradability will make ES more liquid and enhance the trade in these products
- But new product should be developed with caution-Regulator make sure that PES work
- Instead of regulating activities regulate markets

# Creativity and opportunism

- Hotels pay farmers to allow elephants access to water
- Concern about climate change leads to PES for sequestration helping poor farmers
- Green house gases and depleted oil resources provide opportunities for greener fuels
- Draughts leads to introduce market solution and conservation-
- Environmentalists do not trust market-they buy them as solution of last resort
- Innovate with care- build the trust

# PES and distributional objectives



# PES and distributional objectives

- Agencies aim to use PES as new policy achieving distributional goals
- Timbergen emphasized the difficulty in obtaining multiple objectives with one tool
- Wu et-al showed that
  - Impacts depend on correlation between environmental benefits and wealth
  - IF poorer farmer own land with High amenity value they may gain

# Impacts on labor and consumers

- If conservation program reduce employment poor land owner may gain-but ( landless) workers may lose
- If PES takes land out of production – higher food prices may hit the poor
- Working land program where farming (forestry) continues but farmers are paid for green activities are better for the poor than land diversion programs

# Dynamic considerations

- Poor may be late adopters and ES payment excludes consideration of improved options.
- The benefits of ES program may vary in their dynamic profile.
  - Some ES effort aim to induce a sustainable change
  - Other aim to provide quick relief
  - Income may vary over time
- Contract should reflect the dynamic nature of benefits and income available to ES program
- ES design should consider impact of present performance on future earning

# Where can ES work for the poor

- Small number of landless
- Elastic demand of food
- Poor farmers with sufficient land of
  - Low ag productivity
  - High environmental amenities
- Working land programs that generate employment opportunity

# Projected funding for a Agricultural programs 2008-2012

- Land retirement programs (CRP) and the Wetlands Reserve Program) \$13 billion
- Working land programs :Environmental Quality Incentives Program (EOIP) and the Conservation Stewardship Program (CSP) \$12 billion.

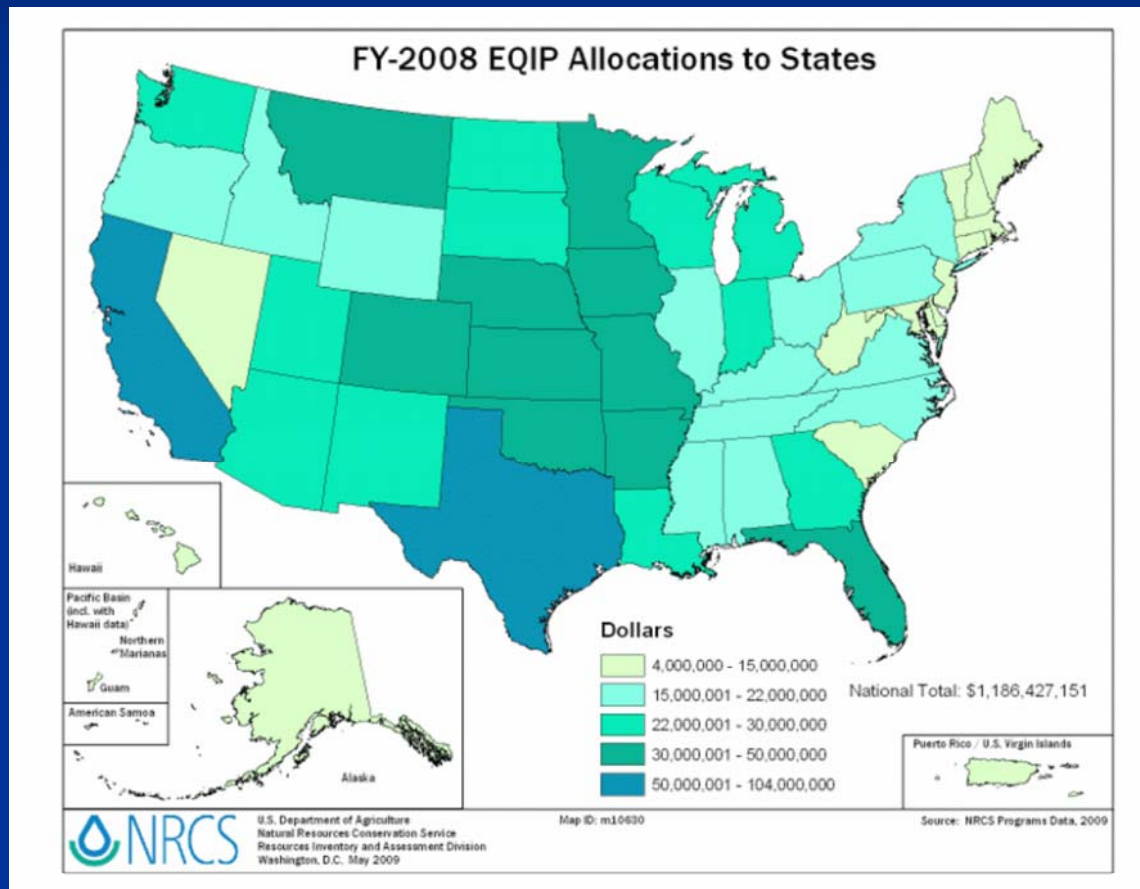
# Agricultural Programs:CRP

- Budget:FY2008 \$1,865,000 FY2009 \$2,012,000
- Uses an Environmental Benefits Index to rank producers' applications according to estimated environmental and cost performance.
- Reduced phosphorus applications by 100,000 Tons/annually
- About 450 million Tons of soil conserved
- Increased acres of riparian and grass by 2 million acres

# Wetland conservation :Three enrollment programs

- *Permanent Easement*- in addition to paying easement USDA pays 100 percent of the costs of restoring the wetland.
- *30-Year Easement*. Easement payments 75 percent of permanent easement. USDA also pays up to 75 percent of restoration costs.
- *Restoration Cost-Share Agreement*. for a minimum of 10 years to restore wetland USDA pays up to 75 percent of the restoration costs

# Environmental Quality Incentives Program (EQIP)



Απολυνταρχ χοστ σηα  
Προγραμ.

Παψσ το ιμπροπε:

Ανιμαλ ωαστε μνγτ,  
Ιρριγατιον ωατερ μνγτ,  
Γραζινγ λανδ,  
Σοιλ εροσιον

Σεδιμεντ χοντρολ,

,Ξ1.2 βιλλιον φορ 2008;

,Ξ1.337 βιλλιον φορ 2009;

,Ξ1.45 βιλλιον φορ 2010;

,Ξ1.588 βιλλιον φορ 2011;

,Ξ1.75 βιλλιον φορ 2012

# Conservation Stewardship Program (CSP)

- The CSP is a paying to
  - Undertaking additional conservation activities;
  - Improving, maintaining, and managing existing conservation activities.
- CSP payments will compensate for:
  - Installing and adopting additional conservation;
  - Improving, and managing conservation
  - Adopting resource-conserving crop
  - CSP payments to an individual or legal entity may not exceed \$200,000 for all contracts entered into during any 5-year period.

# Wishful thinking and the constraints of reality

- Economists bearer of bad news
- You can not get rid of all the bad problems in one swoop
  - Sometimes there is a real conflict between development and environment goals
  - Preferences of policy makers to address several concerns simultaneously can not materialize unless there are real synergies-
  - **we need to find them**

## Short conclusion

- Financial incentives are cost effective tools to achieve environmental objectives
- Choice of incentive depend on political economy
- Cap and trade is not costing the treasury funds
- PES can use to
  - Implement Cap and trade
  - address distributional and property right concerns
- It may have negative distributional impacts
- Require government fundings or initiative

Thank you

