WORLD BANK INSTITUTE

Promoting knowledge and learning for a better world

Why Pay? Why Reward?

IW: Learn Regional Workshop on PES

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M.S. delos Angeles

WBI, The World Bank

Production : Output and environmental quality

$$Q_i = Q_i(x_{i1}..x_{iJ}, E_i,) \text{ all i}$$

$$C_i = C_x X_J + c_w E_i \text{ for all i}$$

$$P_i = P_i(Q_i)$$

where:

Q_i = the output of the i^{th} product

E_i = environmental quality input for the i^{th} product

x_J = vector of $x_1,...x_j$ = other variable inputs; j = i,...J

P_i = market price of Q_I

C_x = vector of $c_{xi},...c_{xJ}$, strictly positive input prices

= Output Price x Marginal Contribution of Input X

Consumption : goods, services

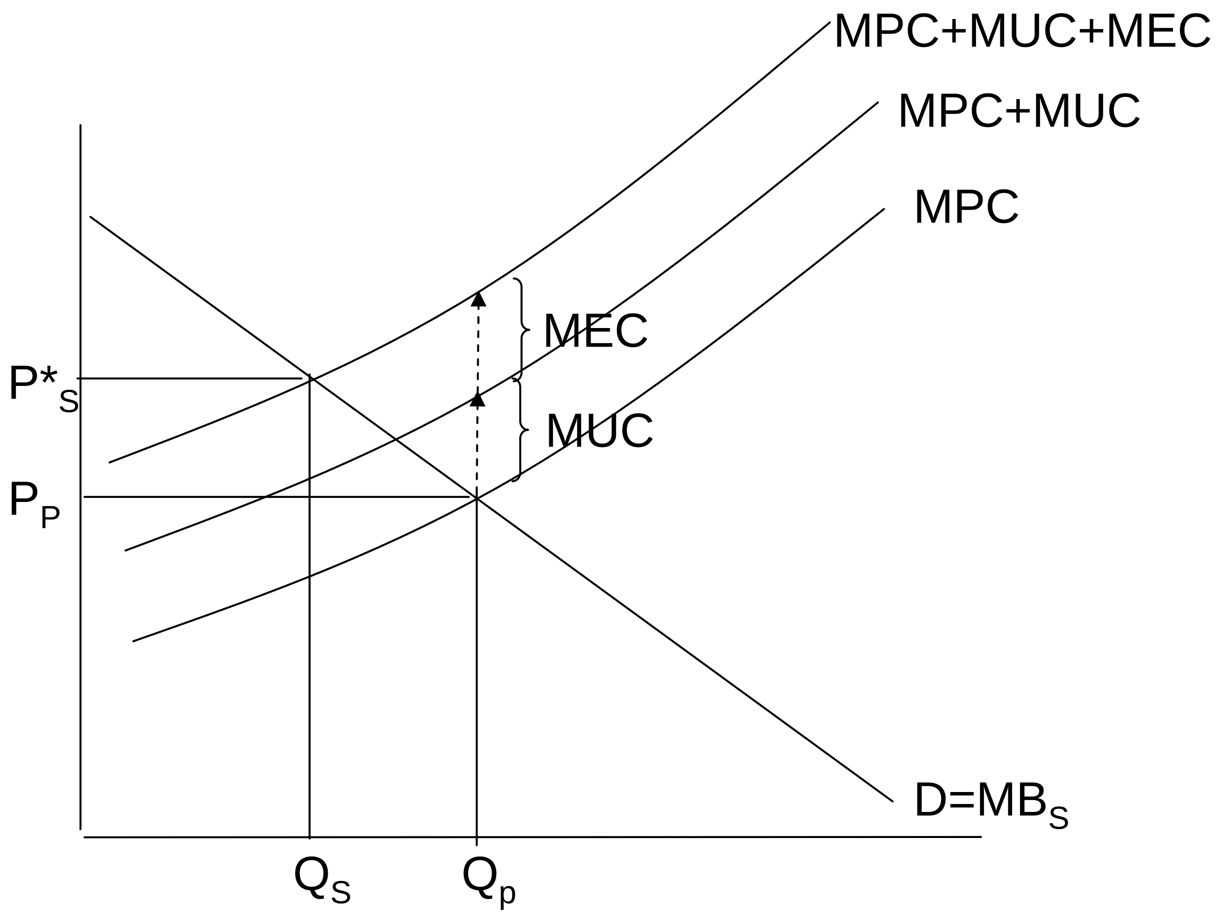
$$C_i = C_i(q_{i1}..q_{iJ}, E_i, Y, t) \text{ all i}$$

Ci = the consumption of the product q
Ei = environmental amenity
Y = income
t = time

Effects of "Zero" Price

- Producers:
  - It costs to supply goods and services
  - Over use of zero-priced inputs, over-production
  - High producers' surplus,
  - Excessive profits (above normal profit, or economic rent)
  - Too many producers
- Users, consumers
  - It costs to consume goods and services
  - Over-use of zero priced goods, services, amenities
  - High consumer's surplus
  - Too many users
  - High externalities:residuals (garbage); congestion

UNDERPRICING OF SCARCE NATURAL RESOURCES AND ENVIRONMENTAL ASSETS CAUSES DEPLETION AND DEGRADATION



Full Cost Pricing

MUC = depletion cost = user cost

= internalized through secure property rights (if private discount rate = social discount rate; or use output taxes or tradable production quotas

MEC = internalized via taxes, charges, tradable permits, user fees or other instruments.

WHY Payments for Ecosystem Services (PES)?

- **Uneven benefits and costs of conservation**
  - free benefits to users
  - costly to suppliers: specially poor, disadvantaged, groups

- **Users Pay, Beneficiaries Pay, Principle**
- **Producers Get Paid**

WHY Payments for Environmental Services (PES)?

For many developing country cases with some form of conservation payments (in-kind subsidies, cash):

1. **not sustainable: post project backsliding**
   - **integrated conservation development projects financed by**
     - » **Loans**
     - » **Bilateral assistance**
     - » **NGO assistance**
     - » **Governments**
2. **not earned by the poor providers**

WHY PES?

Previous subsidies for conservation…

3. were not effective: no critical mass of ES

- remained at pilot scale, and at experimental stage
- no scaling up, no sustainability

4. caused unexpected negative impacts

- other environmental problems
- strategic behavior effects
- need correction, redesign
- impoverishment due to displacement from large scale reforestation/carbon sequestration

WHY PES?

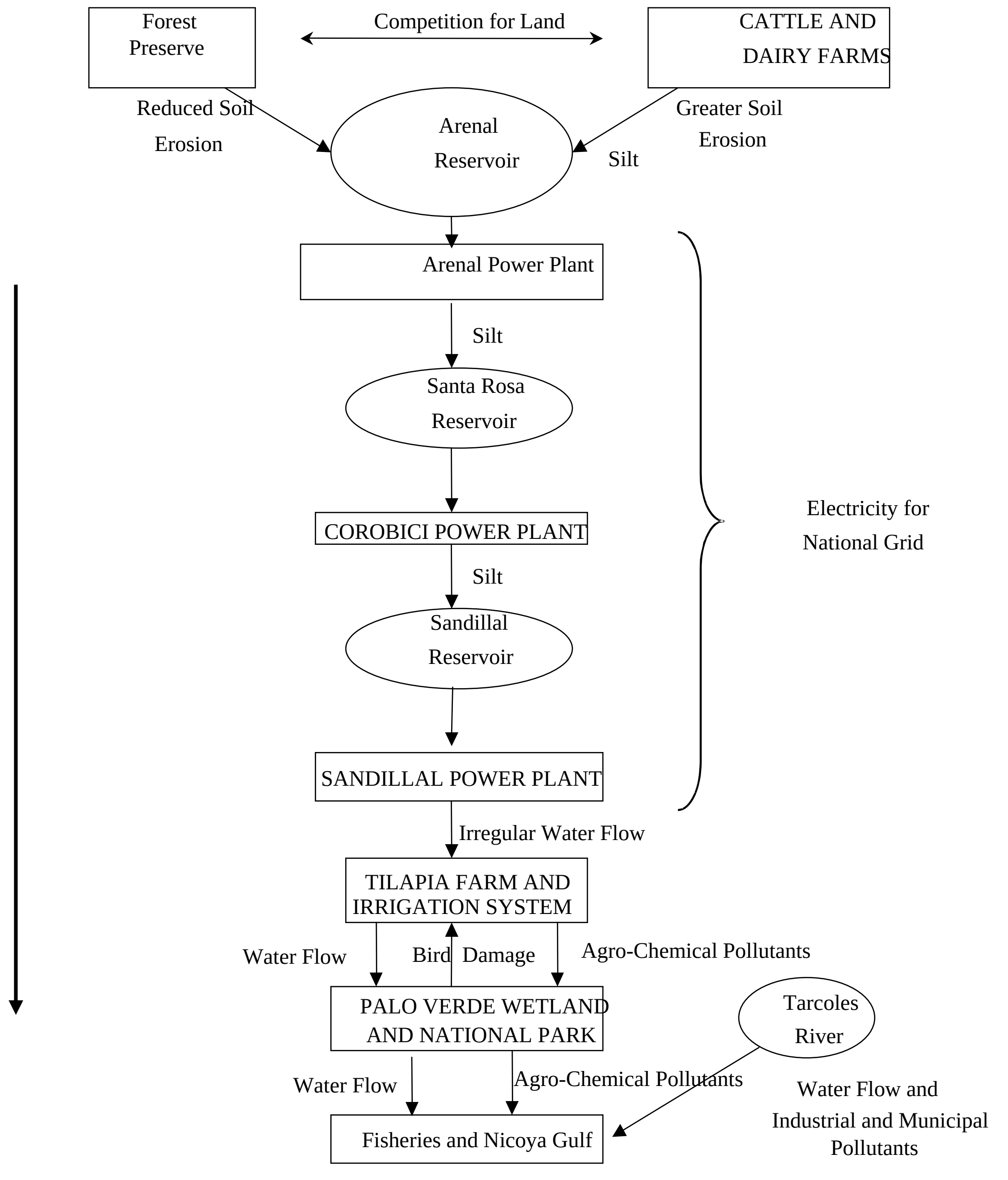
- **Lessons:**
  - **identification, attribution and measurement problems**
  - **beneficiaries and providers were not linked**
  - **absent preconditions: functioning institutions, clear property rights**
  - **Inadequate attention to transactions costs:**
    - **Information needed for sounde decision-making**
    - **Joint decision-making processes**
    - **Compliance and enforcement**
    -
  - **short-lived sources of support**
  - **dominance of policies that penalized conservationists**

Policy Instruments

USING MARKETS *(economic instruments)*	CREATING MARKETS (RIGHTS) *(economic instruments)*	DIRECT REGULATION *(command and control)*	ENGAGING THE PUCLIC *(transactions costs concerns)*
Subsidy	Property rights	Standards (technological, product, performance)	Public participation
Taxes & Charges	Tradable permits & rights	Permit, quotas	Information disclosure
User Fees	Tradable quotas	Ban	Voluntary agreement
Deposit-refund schemes	Int'l offsets	Zoning	Liability Rules
	Common Property Resource Mngt.		

Example 1. Arenal-Tempisque Watershed

A Flowchart of the Watershed – the physical system



Baseline payoff matrix –Unresponsive ICE Manager (NPV, $ million)

	Forest Reserves	Dairy/Cattle Farms	ICE	Irrigated Farms	Wetland	Fishermen	Realized Benefits
Forest Reserves	Maximize forest area (39.7)						(39.7)
Dairy Cattle Farms	-	Maximize dairy & cattle income (38)					(38.0)
ICE	-	Siltation of reservoirs (-703.1)	Optimize electricity production ((1,821.6)				(1,118.5)
Irrigated Farms	-	-	-	Maximize crop income (195)	Bird damage to crops (-20.1)		(174.9)
Wetland	-	-	-	Agro-chemical pollution and soil runoff (-51.6)	Maximize conservation (70.7)		(19.1)
Fishermen	-	-	-	Agro-chemical pollution and soil runoff (-111.6)	Reduced Agro-chemical and soil runoff (16.9)	Maximize fish income (121.2)	(26.5)
Net Benefits	(39.7)	(-665.1)	(1,821.6)	(31.8)	(67.5)	(121.2)	(1,416.7)

Diagonal:
users' own net returns, without externalities

Off-diagonal:
Inter-sectoral externalities

Social welfare measure:
final column (realized benefits) and final row (net benefits)

Payoff matrix-2 –Responsive ICE Manager (NPV, $ million)

	Forest Reserves	Dairy/Cattle Farms	ICE	Irrigated Farms	Wetland	Fishermen	Realized Benefit
Forest Reserves	Maximize forest area (39.7)						(39.7)
Dairy Cattle Farms	-	Maximize dairy & cattle income (38)					(38.0)
ICE	-	Siltation of reservoirs (-5.4)	Optimize electricity production (1,123.9)				(1,118.5)
Irrigated Farms	-	-	-	Maximize crop income (195)	Bird damage to crops (-20.1)		(174.9)
Wetland	-	-	-	Agro-chemical pollution and soil runoff (-51.6)	Maximize conservation (70.7)		(19.1)
Fishermen	-	-	-	Agro-chemical pollution and soil runoff (-111.6)	Reduced Agro-chemical and soil runoff (16.9)	Maximize fish income (121.2)	(26.5)
Net Benefit	(39.7)	(32.6)	(1,123.9)	(31.8)	(67.5)	(121.2)	(1,416.7)

- **Responsive ICE Manager scenario, takes own in-situ action to remove sediment by closing reservoirs and dredging sediment, thereby incurring additional management costs but avoiding major power losses. No change in Total NPV**

Payoff matrix-3 –Proactive ICE Manager (NPV,$ million)

	Forest Reserves	Dairy/Cattle Farms	ICE	Irrigated Farms	Wetland	Fishermen	Realized Benefit
Forest Reserves	Maximize forest area (39.7)						(39.7)
Dairy Cattle Farms	-	Maximize dairy & cattle income (0)					(0.0)
ICE	-	Siltation of reservoirs (0)	Optimize electricity production (1,821.6-57)				(1,764.6)
Irrigated Farms	-	-	-	Maximize crop income (195)	Bird damage to crops (-20.1)		(174.9)
Wetland	-	-	-	Agro-chemical pollution and soil runoff (-51.6)	Maximize conservation (70.7)		(19.1)
Fishermen	-	-	-	Agro-chemical pollution and soil runoff (-111.6)	Reduced Agro-chemical and soil runoff (16.9)	Maximize fish income (121.2)	(26.5)
Net Benefit	(39.7)	(0)	(1,764.6)	(31.8)	(67.5)	(121.2)	(2,024.8)

Proactive ICE Manager avoids the sedimentation problem by "buying out" the dairy sector with a 50% premium ($ 38m x 1.5 = $ 57 m). New total Net Benefits = $ 2024.8 M > baseline and Scenario 2 = $ 1416.7

Insights

- Most externalities (off-diagonal elements) are negative; Electricity and irrigation provide 90% of the benefits in the AT system
- As originally measured, dairy operations and ranching provide negative benefits worth $665 million. They should probably not be undertaken or severely modified
- Irrigation produces high negative downstream impacts on the wetlands and fishermen
- Under the Baseline scenario externality costs are equal to as much as 38% of potential benefits; Major losers are the electricity authority, fishermen and the wetlands

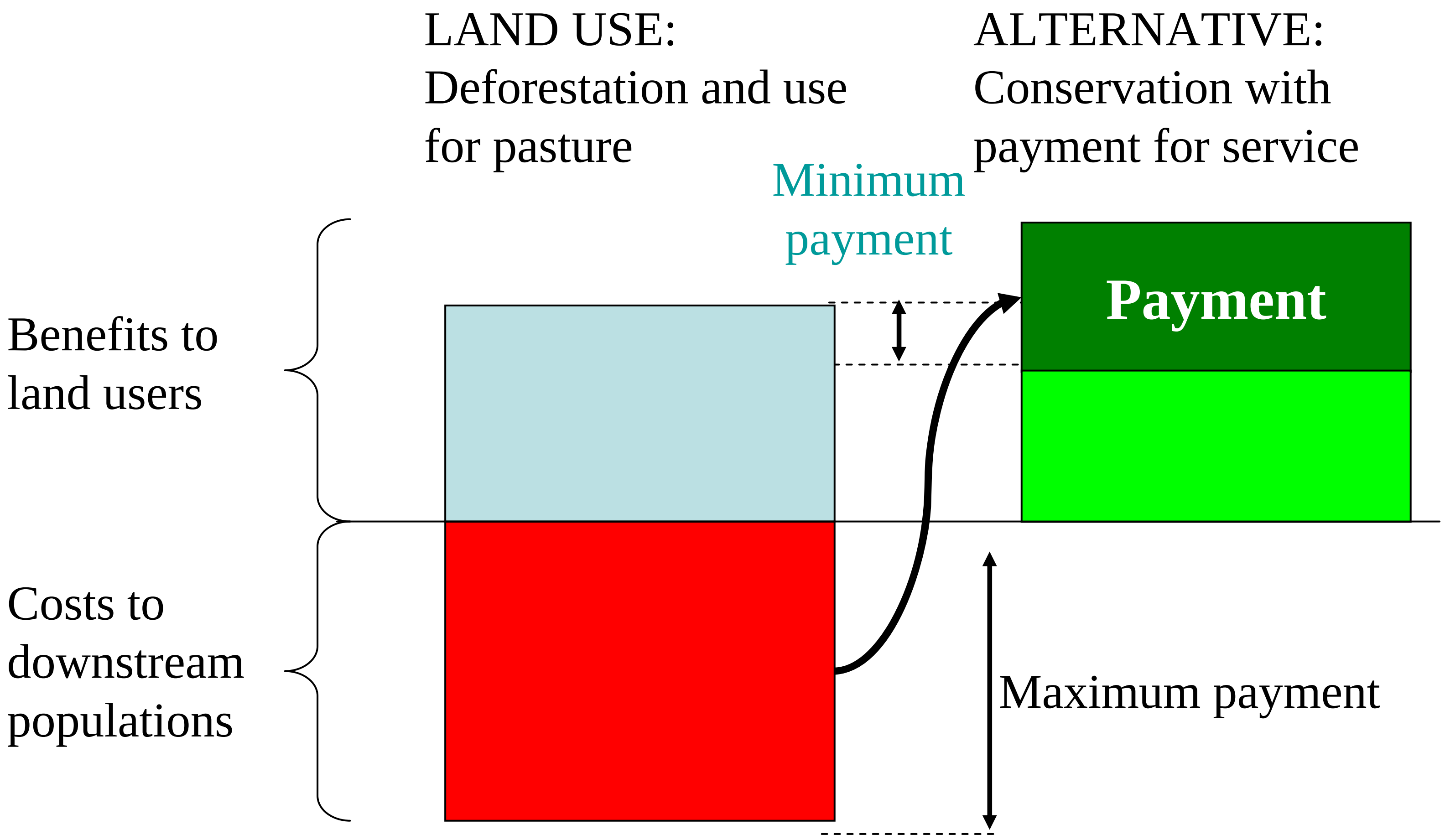
Insights (cont.)

- Rapid siltation of the low cost Corobici (Santa Rosa) reservoir drives the upstream impacts
- Dredging of the Santa Rosa reservoir may be an economical option and should be considered (and costed) – see Scenario 2. Interventions in the upper watershed also look attractive – see Scenario3.
- Downstream, system benefits are larger with increased irrigated acreage, however demand side effects may lower this benefit
- The major impact of chemicals is on the estimated life of the wetlands and fisheries (however, valuation of wetlands at $200 per hectare per year may be high)

Valuation as a basis for watershed protection payments by downstream, irrigated farmers to upstream pasturalists

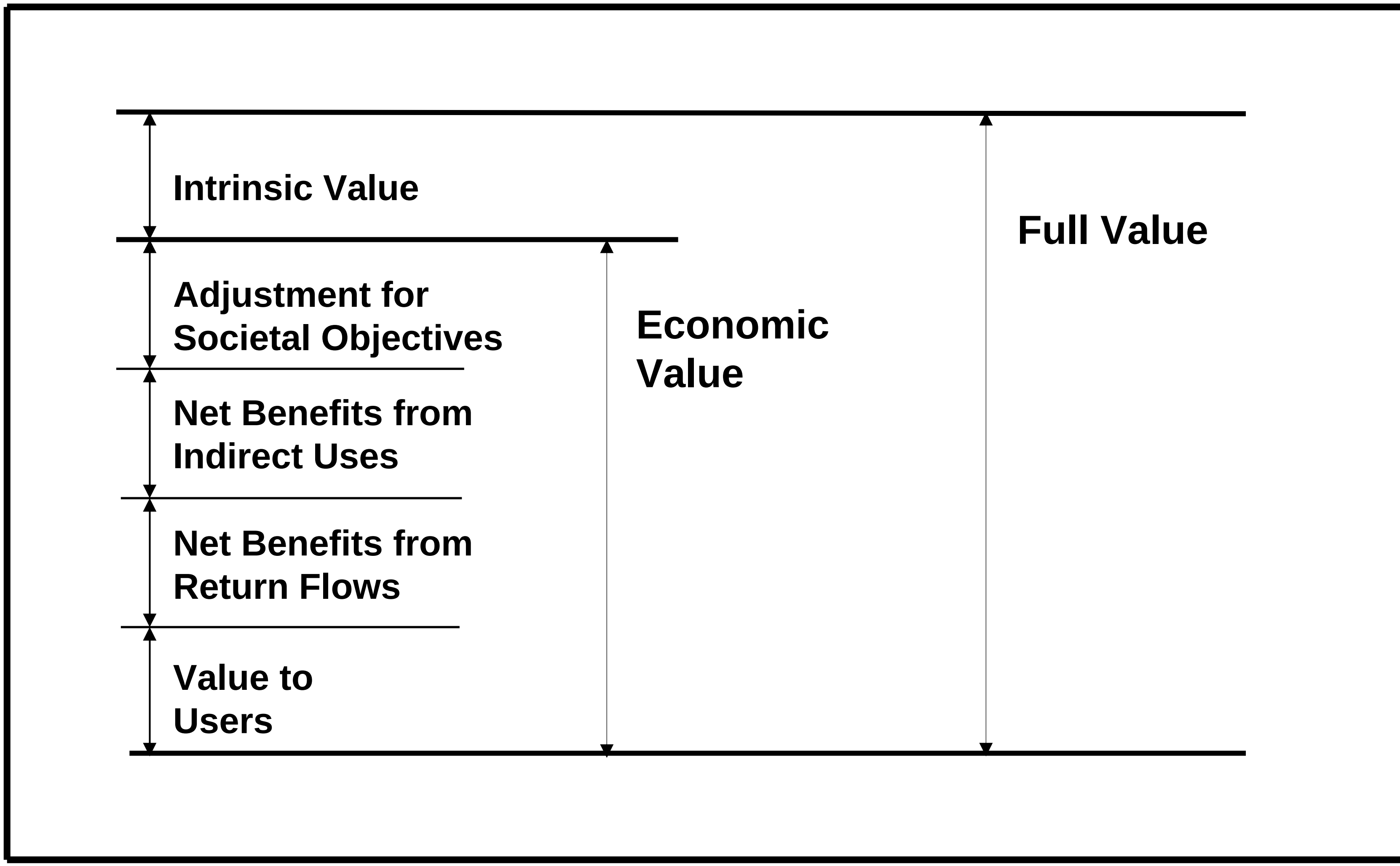
How much are downstream beneficiaries likely to pay?

How much are pasturalists likely to accept?

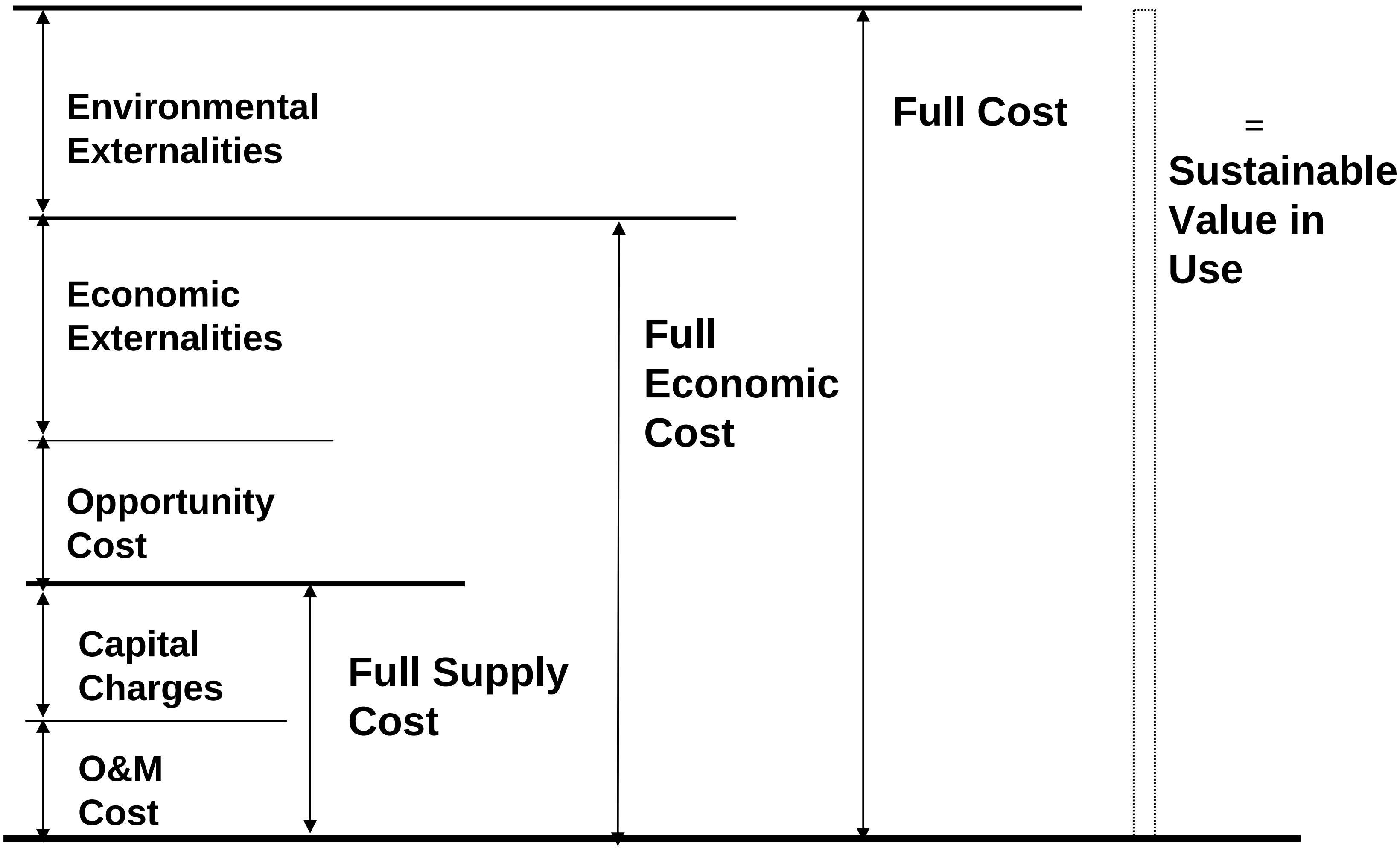


Source: S Pagiola

General Principles for Value-in-Use of Water



General Principles for Cost of Water

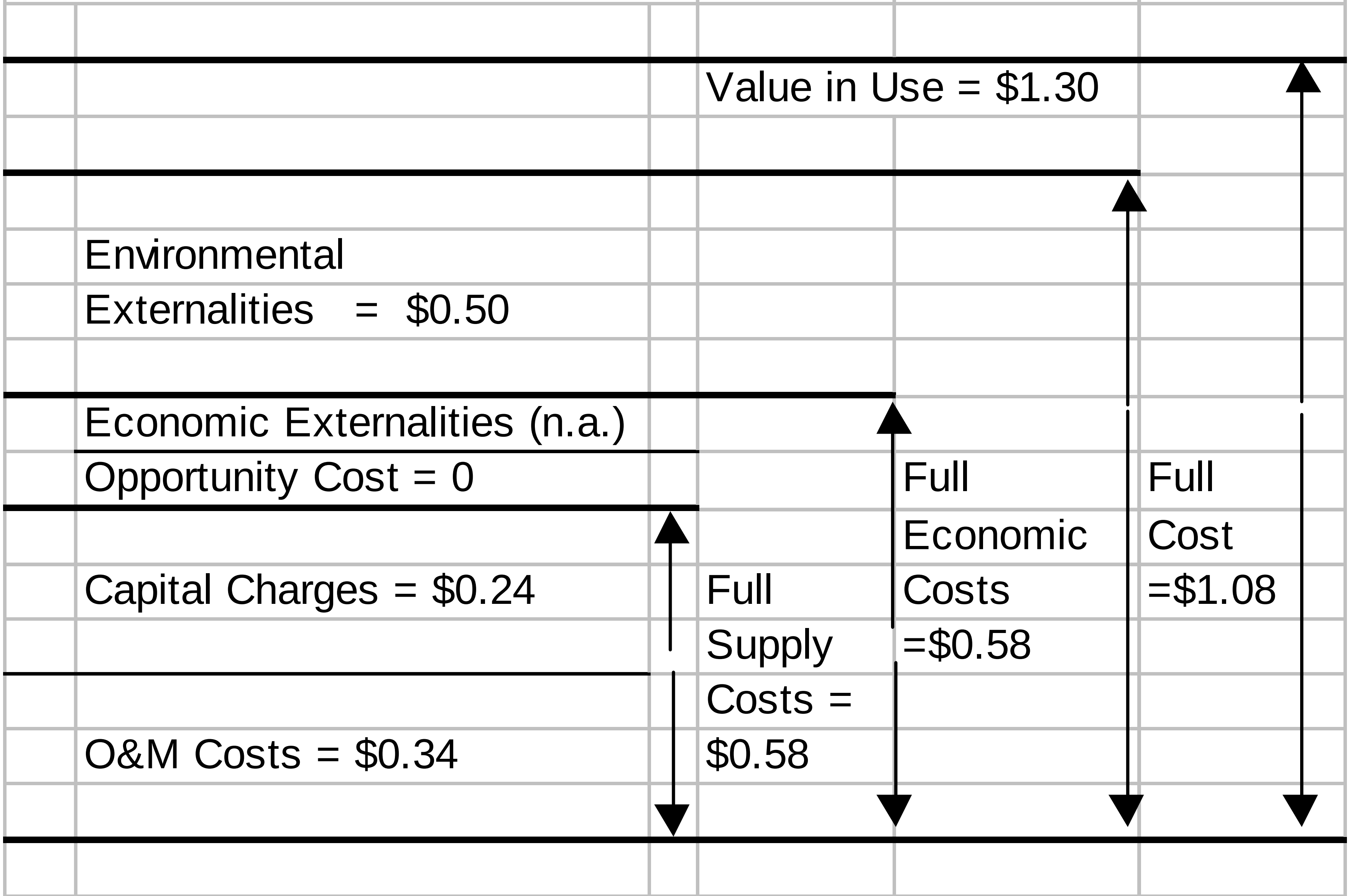


CHALLENGE: DO FOR COASTAL AND MARINE-BASED ECONOMIC ACTIVITIES?

Example 2

Costs and Values for Urban Water Supply in Phuket, Thailand

(per cu.m.) from Rogers et.al. 1997



Example 3: Valuing impacts on various sectors that rely on fisheries and aquatic ecosystems (from H. Cesar, 1996)

Total Net Benefits and Losses Due to Threats to Indonesian Coral Reefs

(Present value; 10% discount rate; 25 yr. Time-span; in U.S. $1000; per km^2)

	Net Benefits to Individuals	Net Losses to Society						
Function/Threat	Total Net Benefits	Fishery	Coastal Protection	Tourism	Food Security	Biodiversity	Others	Total Net Losses (quantifiable)
Poison Fishing	33.3	40.2	0.0	2.6 - 435.6	n.q.	n.q.	n.q.	42.8 - 475.6
Blast Fishing	14.6	86.3	8.9 - 193.0	2.9 - 481.9	n.q.	n.q.	n.q.	98.1 - 761.2
Coral Mining	121.0	93.6	12.0 - 260.0	2.9 - 481.9	n.q.	n.q.	> 67.0	175.5 - 902.5
Sediment - logging	98.0	81.0	-	192.0	n.q.	n.q.	n.q.	273.0
Sediment - urban	?	?	?	?	?	?	?	?
Overfishing	38.5	108.9	-	n.q.	n.q.	n.q.	n.q.	108.9

Source: Cesar (1996)

CHALLENGE: TRADE-OFF/PAY-OFF MATRIX FOR THIS?

W0RLD BANK PES: Initial Lessons

- Regular payments needed
  - Monitoring important
- Contracting with providers
- Most biodiversity mechanisms not set up for long term payments
- Institutionalization important:
  - Contracting services
- Oftentimes:
  - Too enthusiastic action too early with little basis

W0RLD BANK PES: Initial Lessons

- Potentially applicable to a subset of wildlife conservation cases
- Developing effective payments to providers have lots of implementation problems but not insurmountable
- Who pays remains to be the main problem

ECOSYSTEMS SERVICES PAYMENTS MECHANISMS

WHY SHOULD USERS PAY
FOR ENVIRONMENTAL SERVICES?

- **Surplus earned by producers and consumers should be shared by society**
  - Higher net earnings from irrigation
  - Benefits from secure water supplies, recreation

- **Sustain ES to avoid higher cost of next best alternatives: encourage good use**

- **Enhance ES to lower maintenance and avoid replacement cost**

ECOSYSTEMS SERVICES PAYMENTS MECHANISMS

- **ES REWARD TO PROVIDERS**
  - **cash payments, ecolabelling, credit access, priority access to social services and infrastructure, property rights, etc.**

- **ES PAYMENT BY BENEFICIARIES**
  - **Water fees, park fees, payments to conservation funds, budget allocation, carbon payments, etc.**

- **MATCHING SUPPLY AND DEMAND**
  - ***By administrative fiat,***
  - ***By market creation,***
  - ***By brokering***

TARGET: Institutionalized mechanisms