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WEALTH ACCOUNTING AND THE VALUATION OF ECOSYSTEM SERVICES

VALUATION OF ECOSYSTEM SERVICES IN AN ACCOUNTING CONTEXT

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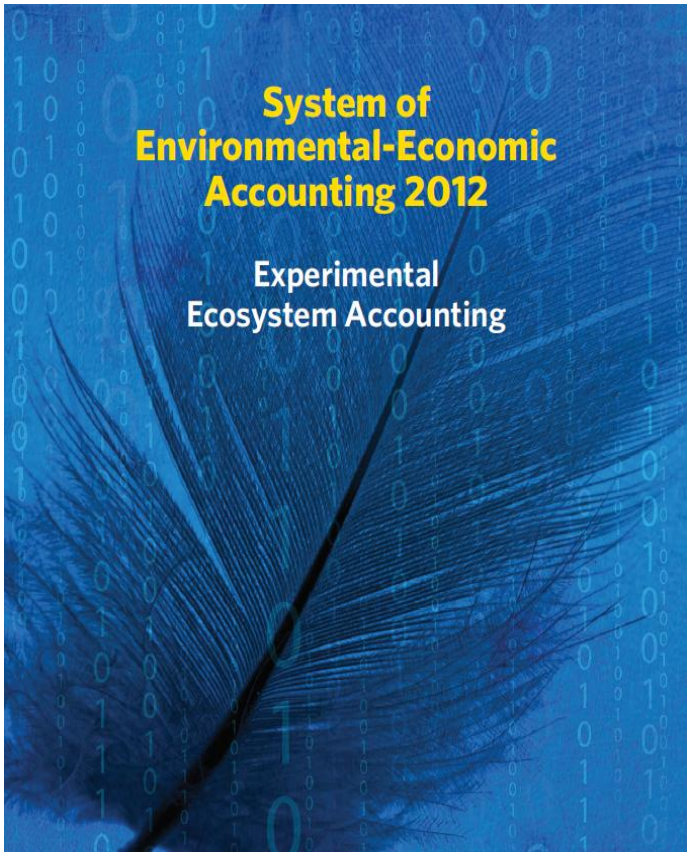
- This session focuses on valuing ecosystem assets and services (stocks and flows)

- Emphasis on services



Outline of the presentation

- Introduction
- Valuation in an accounting context
- A tiny bit of theory
- Scope of valuation methods
- Valuation of services
- Valuation of assets
- Policy analysis

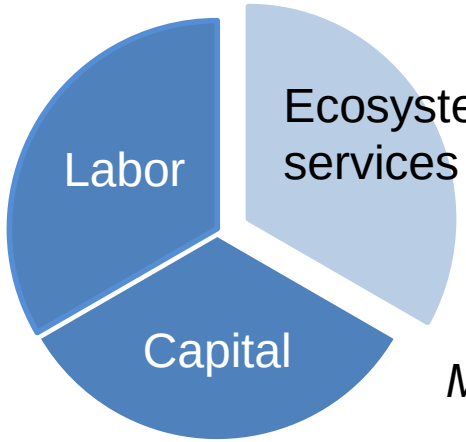
Why value?

To integrate environmental issues in economic decision making and development planning

Why value?

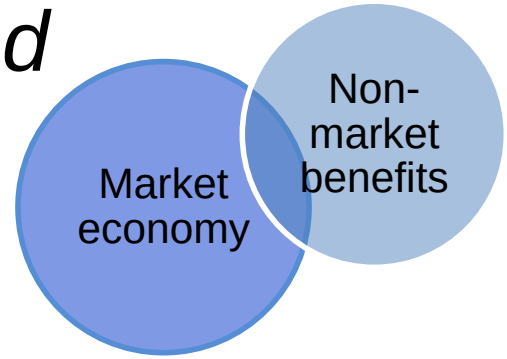
To integrate environmental issues in economic decision making and development planning

- *Show how ecosystems contribute to the economy*



Market economy

- *Make non-marketed benefits visible*



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Valuation in an accounting context

- Valuation can capture different types of values, depending on valuation method

- In the national accounts, the prices only measure marginal values in the current market

- In welfare economics, you want to capture the value that people get out of different goods and services over an above the price they pay in the market, e.g. the pleasure we derive from drinking a well-made cup of coffee may be much higher than the price of the coffee – and one person may derive a much higher pleasure than another…

Valuation in an accounting context

- For comparing with existing national accounting values, we need to use a consistent valuation basis for all goods and services
- In accounting, exchange value/market prices are used
- Market price is the marginal price at *current supply and demand*
- But not all prices in SNA are market prices – e.g. public sector goods & services valued at cost of production

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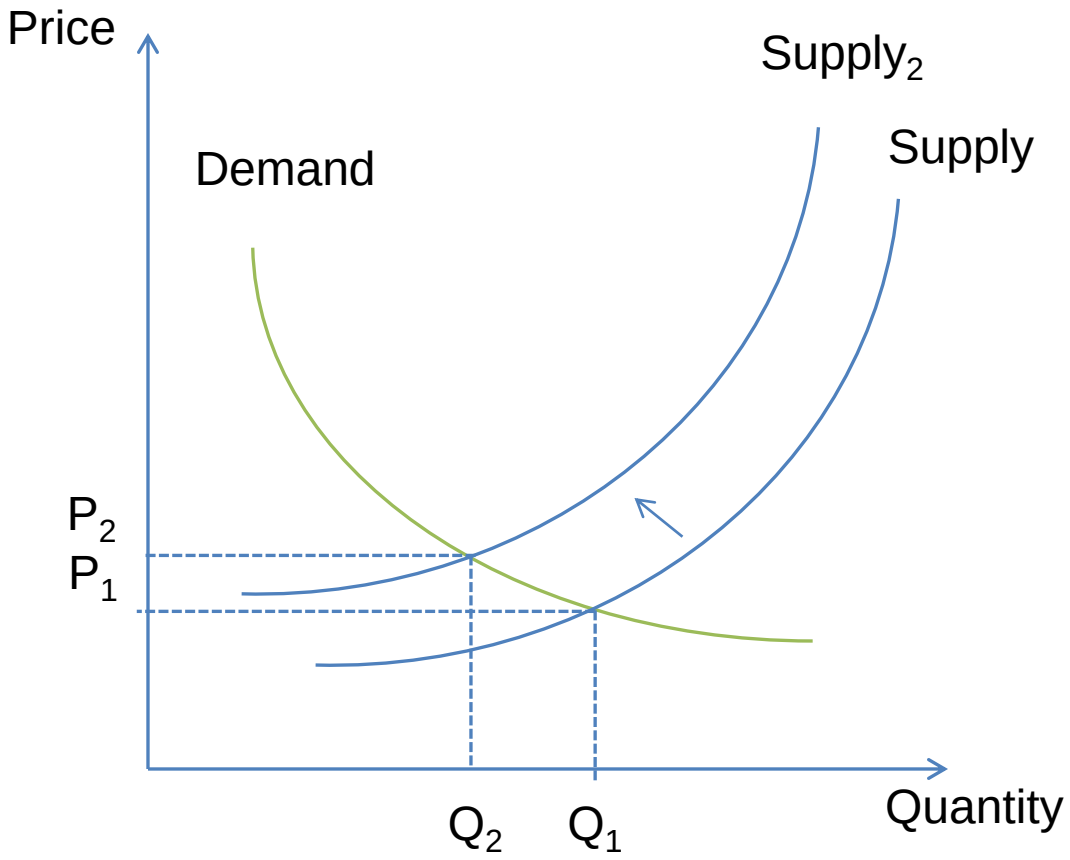
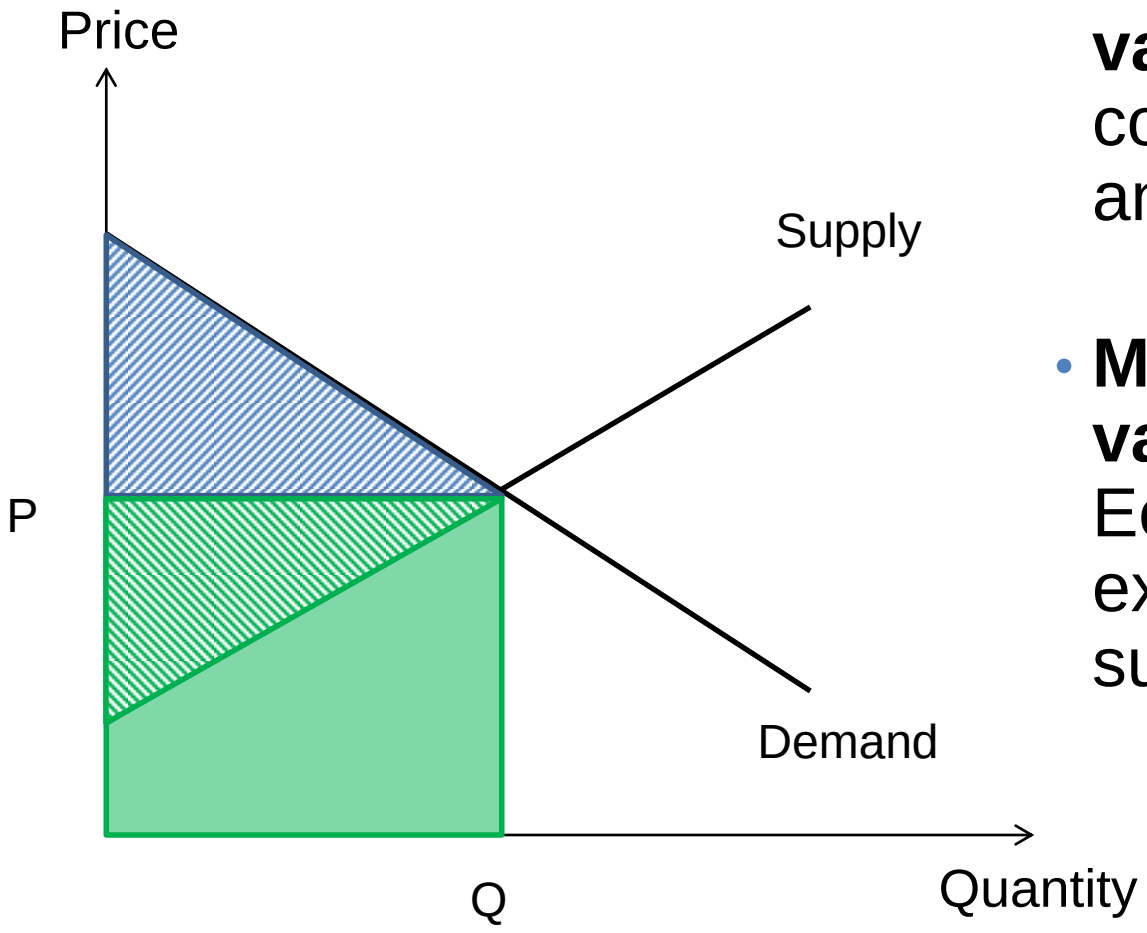
Market prices – supply equals demand



Consumer and producer surplus

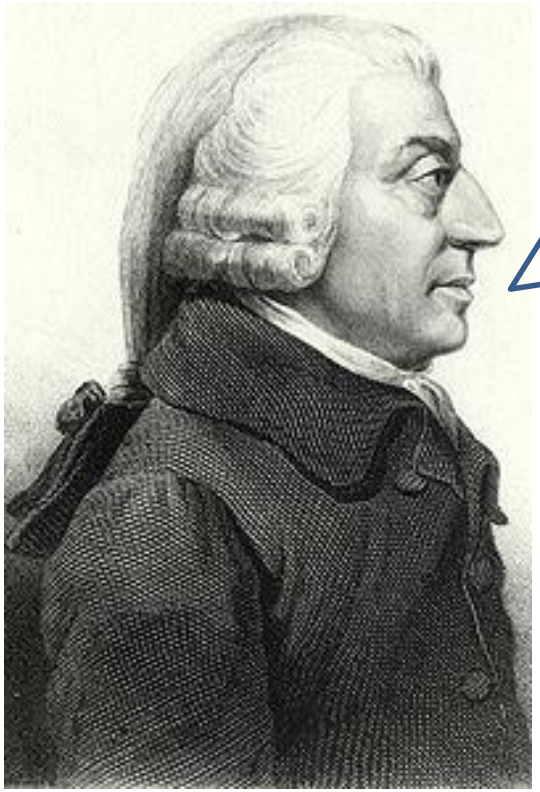


- **Welfare based valuation**: (MA, TEEB) considers producers and consumers surplus
- **Market based valuation** (SNA and Ecosystem Accounting) excludes consumer surplus

Welfare vs market values

- The choice of valuation method determines what you will capture
- Welfare estimates capturing consumer surplus are often used in cost-benefit analyses
- This is also the difference between e.g. WAVES and TEEB
- ENRAP/PENRA used various methods including consumer surplus
- Need to choose method according to purpose

The single most important thing to remember!



The things which have the greatest value in use have frequently little or no value in exchange; on the contrary, those which have the greatest value in exchange have frequently little or no value in use. Nothing is more useful than water: but it will purchase scarce anything; scarce anything can be had in exchange for it. A diamond, on the contrary, has scarce any use-value; but a very great quantity of other goods may frequently be had in exchange for it.

Exchange value = scarcity!

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Scarcity is always relative

- You'd pay a lot for water after a day without it!
- Time, place, and conditions always matter.
  - In some places and time water *provision* is a valuable ecosystem service
  - At other places and times water *disposal* is a valuable ecosystem service
- Economic value is determined *on the margin*
  - The question is not "what would you pay for water?" but
  - "What would you pay for another liter of water?"

David Simpson, US EPA

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An ecological example: Pollination services

- Without pollination, we wouldn't have many important crops.
- What is the value associated with losing habitat that shelters pollinators?
- The "value of the marginal pollinator" =
  - Price of the product to which it contributes
  - X Number of seeds it can fertilize
  - X The likelihood that those seeds would not be fertilized by any other pollinator (or by wind, or by imported honeybees, or by hand, or . . .)

If you already have a lot of bees, adding more would add very little to expected production!

David Simpson, US EPA

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Scope of valuation and recommended methods

Scope	Valuation method
Disentangle SNA values	Unit resource rent Production function methods Revealed preference methods
Value goods and services outside the SNA	Market prices – PES Proxy market prices Replacement cost method Damage costs avoided

Not recommended methods

Restoration costs

- Often pertain to an ecosystem as a whole
- Difficult to verify that there is a corresponding willingness to pay
- Need to assess that it is indeed more worth to restore ecosystem than to keep the current land use

Stated preference methods (estimates of hypothetical individual willingness to pay)

- Includes consumer surplus
- All sorts of caveats with the measuring methods

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Valuation methods for different services

Type of ecosystem service	Method
Provisioning	Unit resource rent
	Proxy market prices
Regulating	Market prices – PES
	Production function methods
	Avoided damage cost
	Replacement cost methods 
Cultural	Revealed preference methods (hedonic pricing, travel costs)

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Valuation of provisioning services

Basic approach: Unit Resource Rent

RR = TR – (IC + LC + CC)

where

- RR = resource rent
- TR = total revenue
- IC = intermediate consumption
- LC = labor costs
- CC = consumption of fix capital

Non-marketed provisioning services

- Approximate by resource rents of similar products

Valuation methods for different services

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Method	
Production function method	Production function approaches estimate the contribution of ecosystem services to the value of the final product being traded on the market
Replacement costs	Hypothetical costs for replacing services from an ecosystem. Should not be used unless there is solid evidence that there is actually demand equaling the cost of supply!
Damage costs avoided	The costs that would be incurred on society in the absence of the ecosystem service.

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Production function method

- Estimates contribution of an ecosystem service to a final commodity
- Improvement in resource base or environmental quality, i.e. enhanced ecosystem services, lowers costs and prices or increases quantity of goods
- Requires knowledge of relationships between ecosystems services and valued end points

Example – production function

$y = f(K, L, N)$

y = production
K = capital
L = labor
N = ecosystem service

Impact of a change in mangrove area on fishery

$$X = mE^a A^b$$

X = fish harvest (kg)
E = fishing effort (fishing boats*time)
a,b = parameters estimated on data from 5 fishing zones, 10-year period

Average economic value for changes in Mangrove area:

20-70 US$ per ha
(depending on elasticity of demand)

(Sathirathai and Barbier, 2001)

Example – Replacement costs

Value of coastline protection and erosion prevention

Average cost of constructing breakwaters: $ 875 per m

75-m-width mangroves protecting the shoreline would yield per hectar for a 20-year period (at a discount rate of 10 %) **$ 12,300**

But this is an over-estimation!

Taking into account that around 30 % of the coastal areas would actually be worthwhile such an investment, the amount reduces to **$ 3,700**

(Sathirathai and Barbier, 2001)

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Example – Replacement costs

New York: the Catskills watershed

- Together, the costs of building and operating the filtration system were estimated to be in the range of $6 billion to $8 billion
- Overall, New York City projected that it would invest $1 billion to $1.5 billion in protecting and restoring natural ecosystem processes in the watershed

(Chichilnisky&Heal, Nature 1998)

Valuation methods for different services

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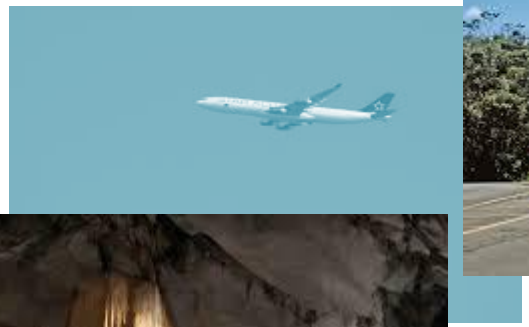
Revealed preferences

- Travel cost method – the value of the ecosystem and its attributes can be disentangled from the amount that consumers pay for goods and services related to visits to recreational sites



Revealed preferences

- Hedonic pricing - This involves disentangling the part of the price that people pay for marketed products or assets that can be attributed to the local ecosystem services.

Valuation of assets

- The value of an asset equals the discounted value of the flow of services from the asset:

$$NPV = \sum_{t=0}^{T} \frac{C_t}{(1+r)_t} = C_0 + \frac{C_1}{(1+r)_1} + \frac{C_2}{(1+r)_2} + \ \ldots \ + \frac{C_T}{(1+r)_T}$$

NPV = Net Present Value

C = Net benefits in year t

T = Discount period (e.g. 20 year)

r = Discount rate

How to go about it?

- Identify beneficiaries of the ecosystem service
- Relate the beneficiaries to classification of the accounts (business sectors, household categories)
- Identify the type of benefits they reap
- Choose valuation method
- Compute and aggregate values for the relevant unit – ha, specific ecosystem, ecosystem service, beneficiary…

Policy analysis

- Compare values under different land use or management rules
- Analyze policy impacts on the environment, businesses and households – e.g. tax on resource use or emissions
- Assessment of compensation claims or PES schemes
- ….but you don’t always have to value, sometimes linking physical data to economic data is enough!

Cost-benefit analysis of converting mangroves into shrimp farm

Benefit of mangroves	US $ per hectare
Direct provisioning services (wood, seafood)	90
Regulating service – nursery ground for fishery	20-70
Regulating services - coastline protection	3,800
Total	≈ 3,950

NPV for 20 yrs, 10 % discount rate

NPV = $ 35,000

Returns to commercial shrimp farming	US $ per hectare
Benefits (gross returns)	17,900
Costs (variable + annualized fixed costs)	17,650
Costs of pollution	230
Total	20

Mangrove forest rehabilitation 8,200

NPV without mangrove rehab = $ 209
NPV with mangrove rehab = $ -5450

(Sathirathai and Barbier, 2001)

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Values per hectare of ecosystem services benefits

Ecosystem Services	Unit of Measure	Unit Values, PhP
Carbon Sequestration Old Growth	PhP/ha	1,204
Carbon Sequestration Residual	PhP/ha	1,472
Carbon Sequestration Mossy	PhP/ha	1,204
Carbon Sequestration Mangrove	PhP/ha	1,204
Carbon Sequestration Tree Plantation	PhP/ha	5,621
Carbon Sequestration Ag		
Carbon Sequestration Br		
Carbon Sequestration Gr		
Carbon Storage Old Gro		
Carbon Storage Residual		
Carbon Storage Mossy		
Carbon Storage Mangro		
Carbon Storage Tree Pla		
Carbon Storage Agrofor		
Carbon Storage Brushlar		
Carbon Storage Grasslar		

Ecosystem Services	Unit of Measure	Unit Values, PhP
Existence/Bequest Values Local comm	PhP/area	9
Existence/Bequest Values National cor	PhP/area	4,948
Existence/Bequest Values Global Com	PhP/area	41,136
Depletion of soil	PhP/ha	38,825
Mineral (Extraction)	PhP/ha	1,000,000
Water Pollution (Lost fishing income fr	PhP/area	6,717
Soil Erosion from Upland Farming	PhP/ha	4,965
Forest Fire	PhP/ha	935
Timber harvest in natural forests	PhP/ha	34,630
Biodiversity	PhP/ha	1,413
Tourism	PhP/Area	37,883
Vines	PhP/ha	
Mining Damage Remediation	PhP/ha	3,259
Watershed Management Cost	PhP/ha	12,231
Soil Erosion from Infrastructure Develc	PhP/ha	
Surface reclamation (dirt-moving, reco	PhP/ha	372,315

Ecosystem Services	Unit of Measure	Unit Values, PhP
Abaca	PhP/ha	4,487
Banana	PhP/ha	148,562
Coconut	PhP/ha	693
Rattan	PhP/ha	859
Almaciga	PhP/ha	440
Pilinut	PhP/ha	698
Fuelwood	PhP/ha	3,850
Irrigation water	PhP/cum	49,815
Recreation	PhP/Area/ Person	295
Bioprospecting	PhP/ha	548
Pollination	PhP/ha	-
Watershed Protection	PhP/Unit	855

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Remember:

- Input of labor and capital needs to be taken into account when valuing ecosystem services – e.g. provisioning services like crops, timber

- The criterion for using replacement costs of damage costs avoided is that you can show that the ecosystem and its services would actually be replaced, or that the damages would affect an actor in the economy - **need to identify beneficiaries and their WTP**

- Beware of double counting – values that are already in the SNA should be reallocated between sectors, not added

Maraming Salamat!

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