



System of
Environmental
Economic
Accounting

Session 3 accounting for ecosystem assets



United Nations



Overall framing

- Asset value = NPV of ES flows
- Should these flows be based on actual/current use of the asset or sustainable use?
 - > Glen Cove: actual use, sustainable use (coined as 'capacity') only functions as sustainability check
- Monetary ecosystem asset account:
 - > assess changes in value over time, and
 - > decompose these changes into relevant classes (e.g. degradation; revaluation etc.)
- While this framework seems generally agreed, it is quite different from cost-based approaches:
 - > cost to return/maintain to previous state (Maintenance Cost approach) or



Topics

- Degradation
 - Capacity / sustainable use
 - Integration in sectoral accounts (Model A,B,C)
 - Liabilities
 - Asset valuation
- (reversed topic 8 and 7 in our note)

Degradation 1 – main findings

- Proposed definition(s) of degradation (DP 5.4), got lots of criticism:

Ecosystem deterioration is the reduction in ecosystem condition over an accounting period that is due to human activity.

Ecosystem degradation is the decrease in the expected ecosystem services flows over an accounting period arising from ecosystem deterioration.

- Agreement that reduction in (physical) condition is necessary condition (e.g. reduction in ES flows can also be due to lower demand)
- Doubt whether we need two different terms (“keep it simple”). Ecosystem degradation has both physical and monetary aspects.
- Terminology: many are fine with degradation, some prefer CNC (“less normative”)
- Enhancement: some prefer ecological sound concepts (restoration, rehabilitation, reclamation)
- Distinction between human and natural causes is contested
- What to do with ecosystem conversions (changes in extent)? Keep separate or integrate in the definition? Need to link to UNCCD 15.3.1 land degradation

Proposal made in DP 5.4

Table 2: Combinations of changes in ecosystem assets

		Rise in expected ES flows	Fall in expected ES flows
Decline in ecosystem condition	Due to human activity (deterioration)	Other change in volume	Degradation
	Due to natural influences	Other change in volume	Catastrophic loss, Disappearance
Rise in ecosystem condition	Due to human activity	Enhancement	Other change in volume
	Due to natural influences	Appearance	Other change in volume
No change in ecosystem condition		Other change in volume	Other change in volume

Degradation 2 – issues and options

- Human vs natural, some options:
 - > By default all is human, except seismic activity + volcanoes
 - > Distinguish direct or indirect pressures/drivers
 - > All ecosystems have natural variation, how to go about this?
- Link with condition? Made at the EA level, at ET level, or should we assess this on a per ES basis (e.g. link to production functions)?

Back to SEEA EEA / TR:

- *Ecosystem degradation is the decrease in the **expected** ecosystem services flows **over an accounting period** arising from a reduction in ecosystem condition that is **due to human activity**.*
- *Ecosystem degradation is the **decrease in asset value during the** accounting period arising from a **permanent** reduction in ecosystem extent and/or condition due to (in)direct human pressures.*

Integrate in SNA sectoral accounts

	SNA 2008			Model A				Model B			Model C			
	Farmer	Household	Total	Farmer	Household	Ecosystems (public sector)	Total	Farmer	Household	Total	Farmer	Household	Ecosystems (public sector)	Total
<i>Production and generation of income accounts</i>														
Output—products	200		200	200			200	200		200	200			200
Output—ecosystem services						110	110	30		30	80		30	110
Total output	200		200	200		110	310	230		230	280			310
Intermediate consumption—products	0		0	0			0	0		0	0			0
Intermediate consumption—ecosystem services				80			80	0		0	80			80
Gross value added	200		200	120		110	230	230		230	200		30	230
Less consumption of fixed capital (SNA)	10		10	10			10	10		10	10			10
Less ecosystem degradation (non-SNA)						15	15	15		15	10		5	15
(Degradation-adjusted) net value added	190		190	110		95	205	205		205	180		25	205
Less compensation of employees—SNA	50		50	50			50	50		50	50			50
(Degradation-adjusted) net operating surplus	140		140	60		95	155	155		155	130		25	155
<i>Allocation/use of income accounts</i>														
(Degradation-adjusted) net operating surplus	140		140	60		95	155	155		155	130		25	155
Compensation of employees		50	50		50		50		50	50		50		50
Ecosystem transfers				80	30	-110	0	-30	30	30		30	-30	0
(Degradation-adjusted) disposable income	140	50	140	140	80	-15	205	125	80	205	130	80	-5	205
Less final consumption—products		200	200		200		200		200	200		200		200
Less final consumption—ecosystem services (non-SNA)					30		30		30	30		30		30
(Degradation-adjusted) net saving	140	-150	-10	140	-150	-15	-25	125	-150	-25	130	-150	-5	-25

Models – main findings

Sectors:

- > Stewardship Model A: extra ecosystem sector (as in PSUTs)
 - > SNA Model B: no sector (close to SNA)
 - > Split asset Model C: attribute based on nature of ES (pro: keeps aggregates intact, but at the cost of splitting ecosystem assets going against ecological notions)
 - > Alternative proposals
- Models A and C obtained most support during expert consultation
 - Need to assess ownership of ecosystem assets when introducing degradation costs in the accounts
 - Costs borne by owner of asset is the starting point for sequence of accounts, but some support to also show polluter pays perspective (either in supplementary accounts or by a degradation transfer)

Degradation transfer

	Degradation transfer				
	Factory	Farmer	Household	Ecosystems (public sector)	Total
Production and generation of income accounts					
Output—products	100	200			300
Output—ecosystem services		80		30	110
Total output	100	280			310
Intermediate consumption—products		0			0
Intermediate consumption—ecosystem services		80			80
Gross value added	100	200		30	330
Less consumption of fixed capital (SNA)	20	10			30
Less ecosystem degradation (non-SNA)	15				15
(Degradation-adjusted) net value added	65	190		30	285
Less compensation of employees—SNA	20	50			70
(Degradation-adjusted) net operating surplus	40	140		30	210
Allocation/use of income accounts					
(Degradation-adjusted) net operating surplus	40	140		30	210
Compensation of employees	10		50		60
Ecosystem transfers			30	-30	0
Degradation transfer	15	-10		-5	0
(Degradation-adjusted) disposable income	45	130	80	-5	205
Less final consumption—products			300		300
Less final consumption—ecosystem services (non-SNA)			30		30
(Degradation-adjusted) net saving	45	130	-250	-5	-80



Capacity – main findings

- Agree in Glen Cove: reduced role of capacity in the system
 - > Should not try to link capacity and degradation
 - > Check on future service flows
- While many see the need for a concept of capacity, few liked the proposed definition of the DP:
 - > Predicated of assets or individual flows
 - > Issues with definition, too weak and too strong:
 - Capacity set is undetermined
 - Provide a different basket of services in case of other use (e.g. capability a la Amartya Sen)
- Linkages to explore; with sustainable use, but also with ‘potential’ supply

Liabilities – main findings

Intuition - environmental degradation is accumulating (e.g. global warming; acidification of Oceans), which is not recognized in SNA (e.g. because global commons or damages lie in future).

- Liability itself not a good term (as they have a clear SNA meaning as being financial in nature), it assumes there exists a legal obligation
 - > perhaps unpaid ecological costs (Vanoli) or ecological debt
- Policy relevant (for determining env. compensation (used in Swedish law))
- Distinguish current and future liabilities
- Avoid double counting:
 - > Should not have a degradation costs + liability
- More clarity needed on how this links to the notion of externalities (e.g. societal GHG emissions).

Liabilities – options / issues

- Some options have been proposed.
 - > Vanoli: record these costs as final hh consumption (measure of overconsumption)
 - Original form
 - Reduced form to cover costs not already reflected in balance sheets (e.g. because in future, or outside EEZ, or of assets not recognized)
 - > CNCA see liability as NPV of costs required to receive benefits from an ecosystem asset
- Unpaid ecological costs, wouldn't there be unpaid ecological benefits?
- Can we introduce a liability without an underlying asset (e.g. atmosphere)

Integrate in SNA sectoral accounts

	Model D			
	Farmer	Household	Ecosystems (public sector)	Total
<i>Production and generation of income accounts</i>				
Output—products	200			200
Output—ecosystem services	80		30	110
Total output	280			310
Intermediate consumption—products	0			0
Intermediate consumption—ecosystem services	80			80
Gross value added	200		30	230
Less consumption of fixed capital (SNA)	10			10
Less ecosystem degradation (non-SNA)				
(Degradation-adjusted) net value added	190		30	220
Less compensation of employees—SNA	50			50
(Degradation-adjusted) net operating surplus	140		30	170
<i>Allocation/use of income accounts</i>				
(Degradation-adjusted) net operating surplus	140		30	170
Compensation of employees		50		50
Ecosystem transfers		30	-30	0
Degradation transfer				
(Degradation-adjusted) disposable income	140	80	0	220
Less final consumption—products		200		200
Less final consumption—ecosystem services (non-SNA)		30		30
Less final consumption - unpaid ecological costs		15		15
(Degradation-adjusted) net saving	140	-165	0	-25

Valuation of assets – main findings

- Asset value (V) = NPV of expected service flows
- **Asset price:** the change in the net present value of a stock, conditional on a specific management program, with respect to a change in quantity of the stock.
- Problem: in case of low resource rents, asset value may be 0
- Glen Cove: support for assessing unrealized values (e.g. optimal values)
- Future flows -> identify most likely pattern, many assumptions:
 - > assess impacts of condition (through capacity) to see whether the current pattern is sustainable
 - > assume same management regime
 - > how to deal with changes in demand (e.g. recreation near growing cities)
 - > price path assumptions? Capital gains?

Valuation of assets – questions

- Same discount rate for all ES?
- Illegal flows (poaching)?
- What is the “change in the quantity of stock” (hectares) ?
- How does this price definition relate to SEEA CF:
 - > Price of the asset in situ $P1 = V1/S1$
 - > Depletion: $(P2+P1)(S2-S1)/2$; Revaluation $(P2-P1)(S2+S1)/2$
- In case ES are assessed as welfare values based on shadow prices
 - > What does their NPV signify?
- Shadow prices
 - > Prices in which all externalities have been internalized?
 - > Or, simply imputed prices in case of non-market phenomena
- What to do with maintenance costs ? Input into the generation of ecosystem services (and hence need to reallocate those costs)

Questions

- 7.1 In accounting, the future flow of benefits and the associated prices will result in the value of the future stream of income reflecting exchange values. This future stream may be applied in nominal terms ($p \times q$) or in volume terms (constant prices). The choice will impact on the selection of the discount rate. How does this logic play out in other contexts?
 - > Does the future stream of income under an optimal institutional arrangement reflect a time series of social welfare values - quantities multiplied by appropriate marginal social benefits?
 - > Will this future income stream necessarily be in volume/real terms?
 - > What is the relationship between the future stream of income and the selection of discount rate in these circumstances?

Questions

- 7.2 Can we reach an agreement, for the purposes of discussion of ecosystem accounting, about what is intended when the term shadow prices is used?
- 7.3 Within the core ecosystem accounting framing it is intended that the entity to be accounted for/asset to be valued is an ecosystem reflecting an ecological unit which supplies ecosystem services but has no direct input costs. A common alternative framing is that the focus of valuation is a spatial area incorporating all activities and associated incomes and costs within that area. The second framing can lead to quite different valuation results if the costs to maintain the ecosystem assets (incurred by, for example, the ecosystem manager) are deducted to estimate the future stream of income of the asset. Is there agreement that the entity that is to be the focus of valuation for ecosystem accounting is the ecologically defined unit?

Questions

- 7.4 The treatment of capital gains is a common area of confusion. From an accounting perspective, capital gains are excluded from measures of production and income as recorded in the relevant flow accounts. However, for the purposes of valuing assets based on future flows, it seems plausible that expected capital gains should be considered. What is the appropriate treatment for accounting purposes and how does this align with the approaches in the economics literature?
- 7.5 Generally, present value approaches are applied to individual benefit or income streams which in effect suggests that a single ecosystem service can be given an asset value. However, in the ecosystem accounting framing, it is intended that an ecosystem asset would be regarded as supplying a basket of ecosystem services such that the value of the ecosystem asset would reflect multiple future income streams. A compromise approach might be to estimate the present value of each individual ecosystem service and then aggregate. However, it is accepted that in reality, for any given ecosystem asset, there will be strong connections among the supply of different ecosystem services – some competing and some complementary – thus the future patterns of flows for individual ecosystem services will be connected. Given this reality, what are the options and



implications for measuring the overall value of an ecosystem asset (for example

Questions

- 8.1 Ecosystem degradation has been associated with a loss in condition due to human activity... Feedback has suggested both conceptual and practical concerns in making this distinction between human and naturally induced changes, especially as the boundary may be very blurred in some cases.
What is the appropriate approach for ecosystem accounting? *(NB: the total change in asset value will still be recorded in the asset account, this is a question of whether and how far to isolate the changes)*
- 8.2 As noted above, degradation has both physical and monetary aspects. The physical aspects are linked to declines in condition and the monetary aspects are linked to declines in expected ecosystem service flows. Discussion has observed that it may not always be the case that declines in condition (considered a pre-requisite for recording degradation) will lead to declines in expected ecosystem service flows. What is the appropriate treatment and what factors should be considered when this issue arises?
- (definition of degradation?)

Questions

- 8.3 Generally, the accounting treatments presume that an ecosystem asset remains largely in place over an accounting period, perhaps changing slightly in size. In cases where an ecosystem asset changes to another ecosystem type during an accounting period (e.g. from forest to agricultural land) how should this ecosystem conversion be recorded in the accounts? Should ecosystem conversion be recorded distinctly from other additions and reductions and if so, what considerations are appropriate?
- 8.4 The framing of ecosystem degradation describe here suggests that, in general, ecosystem degradation will reflect a change in present value of ecosystem services. This approach therefore requires estimation of ecosystem asset values in the first instance. Alternative approaches based on restoration costs and damage costs have been proposed in the accounting literature. How should these cost based approaches be considered within the ecosystem accounting framework as described?

Questions

- 8.5 Determining the economic ownership of environmental assets following SNA principles is challenging when the assets and the benefits they supply are public goods and not subject to clear property rights. A range of considerations have been examined, including consideration of the treatment of other “public” assets such as natural resources, resources on the high seas, research and development, intellectual property type assets; as well as the treatment of leases and joint ventures. Given the range of possibilities, what considerations and treatments are most appropriate for ecosystem assets and their integration into economic accounts?
- 8.6 Three models (listed below) for an extended sequence of economic accounts have been proposed each with various pros and cons. The consultation on DP 5.3 gave most support for either Model A or C. Which model is preferred/most appropriate for integrated accounting?

Questions

- 8.7 Following standard national accounting principles, degradation should be allocated/attributed to the economic unit whose future flow of ecosystem services is reduced. This is considered a costs borne approach. While this approach does align with national accounting tradition, the fact that a loss of ecosystem condition can arise through no fault of the economic unit losing the services, suggests that an alternative approach is to attribute degradation to the economic unit that causes the loss of condition. This is known as a polluter pays approach and is a common framing from a policy and user perspective. Both treatments are possible in the accounts using various accounting entries. Which approach is most appropriate for ecosystem accounting purposes?