



System of
Environmental
Economic
Accounting

Integrated accounting treatments and recording degradation for ecosystem accounting

Glen Cove

Bram Edens, Ph.D.

Senior statistician

United Nations Statistics Division



Link to valuation research agenda

- **Issue 4: Valuation concepts for ecosystem services and ecosystem assets**
- **Issue 5: Valuation methods for key ecosystem services**
- **Issue 6: Accounting for ecosystem capacity, degradation and enhancement**

Key issues for accounting treatments

- Recording of ES in PSUT -> solved
- **Definition of degradation of ecosystems**
 - > **Vis a vis physical descriptions**
 - > **Role of “capacity”**
- **Recording ecosystems as separate institutional unit (Model A and Model B)**
 - > **Integration of Ecosystem asset values with balance sheet**
 - > **Allocation of degradation to units (cost-caused vs. borne)**
- **Treatment of restoration costs**
 - > **Links to defensive expenditures / Env. Protection Expenditure Accounts**
 - > **Liabilities / environmental debt**
- Other recording issues e.g. disservices (*not treated here*)
- Developing a complementary table for broader ranges of values (*not treated here*)

Extended PSUT

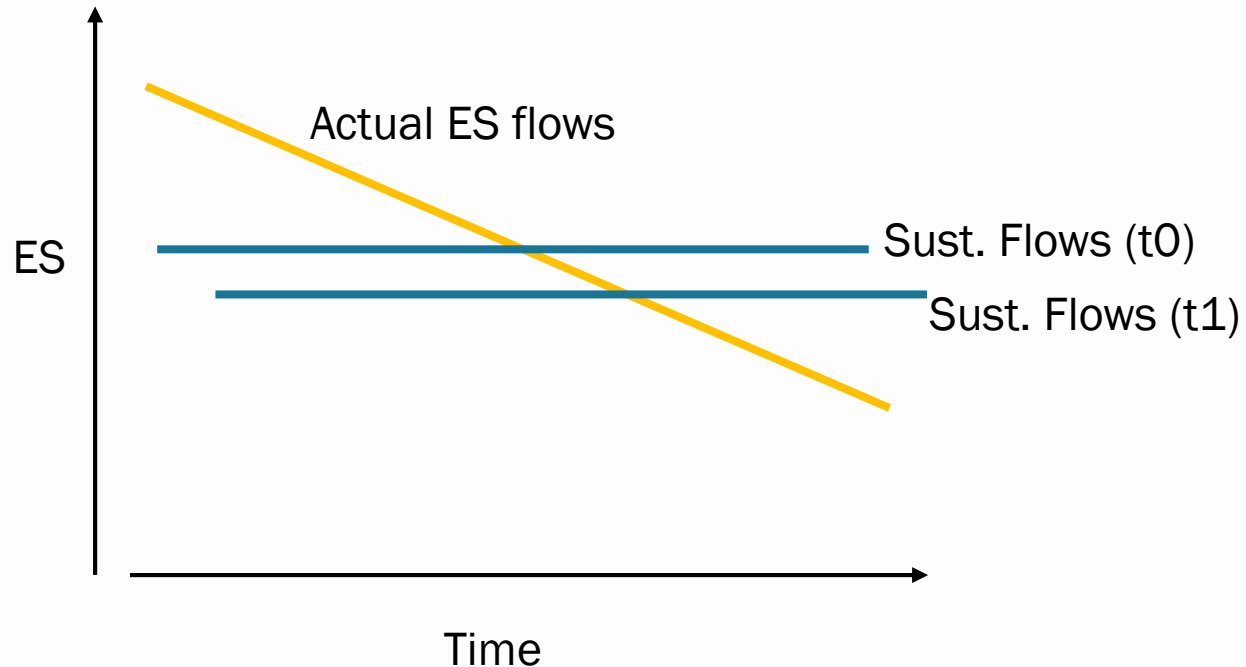
ECOSYSTEM SERVICES SUPPLY TABLE																							
	Measurement Units	Type of economic unit						Proxy ecosystem type (based on land cover)							TOTAL SUPPLY								
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Governments	Households	Accumulation	Rest of the world - Imports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland		Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies
								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ecosystem services		A						B															
Provisioning services																							
Biomass accumulation																							
- Timber																							
- Crops																							
- Grass / fodder																							
- Fish																							
Water abstraction																							
Regulating services																							
Carbon sequestration																							
Water regulation																							
Water purification																							
Air filtration																							
Nutrient/waste remediation																							
Pest & disease control																							
Soil retention																							
Cultural services																							
Enabling tourism and recreation																							
Enabling nature based education and research																							
Enabling nature based religious and spiritual experiences																							
Products		C						D															



Definition of degradation ecosystems

- Degradation is not simply the change in value of the asset in two points in time
- In an asset account, change in value is decomposed in various elements
 - > Important to identify the part that is due to using up of the asset -> exclude changes in value due to price changes
 - > Distinguish between human and non-human induced degradation
- Link also to physical measures :
 - > Deterioration of condition of the ecosystem
 - > Link to the capacity of the ecosystem to supply services

Capacity and degradation



- Situation over overuse: actual ES flows $>$ Sust. ES flows (capacity flows)
- NPV act. \neq NPV cap. (e.g. larger when discount rate high)
- Degradation: Δ NPV_{act} or Δ NPV_{sust}
- **NB: Capacity has benefit of not needing projections of future flows**

Capacity and degradation

- Q1: Which value do we want to show in the accounts (as opening stock)? NPV_act or NPV_sust?
- Q2: how do we record degradation?
 - > Δ NPV_act
 - > Δ NPV_sust
 - > Physical concept (change in condition)
- NPV_act is in line with accounting practices .
- NPV_sust: hypothetical, but more intuitive ->
 - > degrading the capacity of the asset to provide sustained services over time
 - > Linked to change in condition of the asset
- Mixed recording? -> introduce a liability in the accounts.

Sequence of accounts

- Focus on the institutional sector level (i.e. corporations, governments, households) and measures of income, saving, investment and wealth.
- One of the main functions demonstrate linkages between incomes, investment and balance sheets
 - > a key feature of the standard SNA sequence of accounts is the attribution of consumption of fixed capital (depreciation) to economic activities and institutional sectors as a cost against income
 - > In the SNA, only depreciation is deducted to provide a measurement of net domestic product (NDP).
- A choice is required whether (i) ecosystems should be treated as producing units in their own right - Model A; or (ii) treated as assets owned and managed by existing economic units – Model B.

Table 8.2: Simplified sequence of accounts for ecosystem accounting

	Model A				Model B		
	Farmer	Household	Ecosystem	Total	Farmer	Household	Total
<u>Production and generation of income accounts</u>							
Output – Products	200			200	200		200
Output – Ecosystem services			110	110	30		30
Total Output	200		110	310	230		230
Int. consumption – Products	0		0	0	0		0
Int. consumption –Ecosystem services	80		0	80	0		0
Gross value added	120		110	230	230		230
Less Consumption of fixed capital (SNA)	10			10	10		10
Less Ecosystem degradation (non-SNA)			15	15	15		15
Degradation adjusted Net Value Added	110		95	205	205		205
Less Compensation of employees – SNA	50			50	50		50
Degradation adj. Net Operating Surplus	60		95	155	155		155
<u>Allocation and use of income accounts</u>							
Degradation adj. Net Operating Surplus	60		95	155	155		155
Compensation of employees		50		50		50	50
Ecosystem transfers	80	30	-110	0	-30	30	0
Disposable income	140	80	-15	205	125	80	205
Less Final consumption – Products		200		200		200	200
Final consumption – Eco. serv.		30		30		30	30
Degradation adjusted net saving	140	-150	-15	-25	125	-150	-25

Allocation of degradation to units

- Caused: “polluter pay’s principle”
- Impact: (costs borne)
- Issue 1: allocation to multiple economic units
 - > apart in time
 - > apart in space
 (goes back to SEEA 1993)
- Possible solution?
 - > “Cause based” recording in production account (Bonn)
 - > Record “transfers” (income accounts) to ensure impacts are allocated to correct assets
 - > Apart in time?? Liability?

Table 4.1 Imputed and actual environmental costs of economic activities in the SEEA: numerical example
(Monetary units)

		Imputed environmental costs		Actual environmental costs	
		Production activities of industries	Household consumption activities	Production activities	Household consumption activities
		1	2	3	4
	Costs caused ^{a/}	59.9	17.1	54.1	8.8
1	Depletion costs	17.5	0.7	0.0	0.0
	Degradation costs ^{a/}				
	Prevention costs ^{a/}				
2	Use of land etc.	9.0	0.8	0.0	0.0
	Discharge of residuals				
3	Current activities	33.3	13.3	47.7	7.7
4	Use of produced assets	5.1	2.3	6.4	1.1
5	Restoration costs ^{b/}	-5.0	0.0		
	Costs borne	20.5	75.6	78.7	21.5
6	Depletion costs ^{a/}	11.3	0.3	0.0	0.0
	Degradation costs				
	Prevention costs ^{b/}				
7	Use of land etc.			0.0	0.0
	Discharge of residuals				
8	Current activities			47.7	7.7
9	Use of produced assets			6.4	1.1
	Repercussion costs ^{b/}				
10	Use of land etc.	1.1	12.3	0.0	0.0
11	Discharge of residuals ^{a/}	10.1	63.0	19.6	12.7
	Restoration costs ^{a/}				
12	Non-market producers	0.0		5.0	
13	Others	-2.0		0.0	0.0

Recording of restoration and enhancement costs

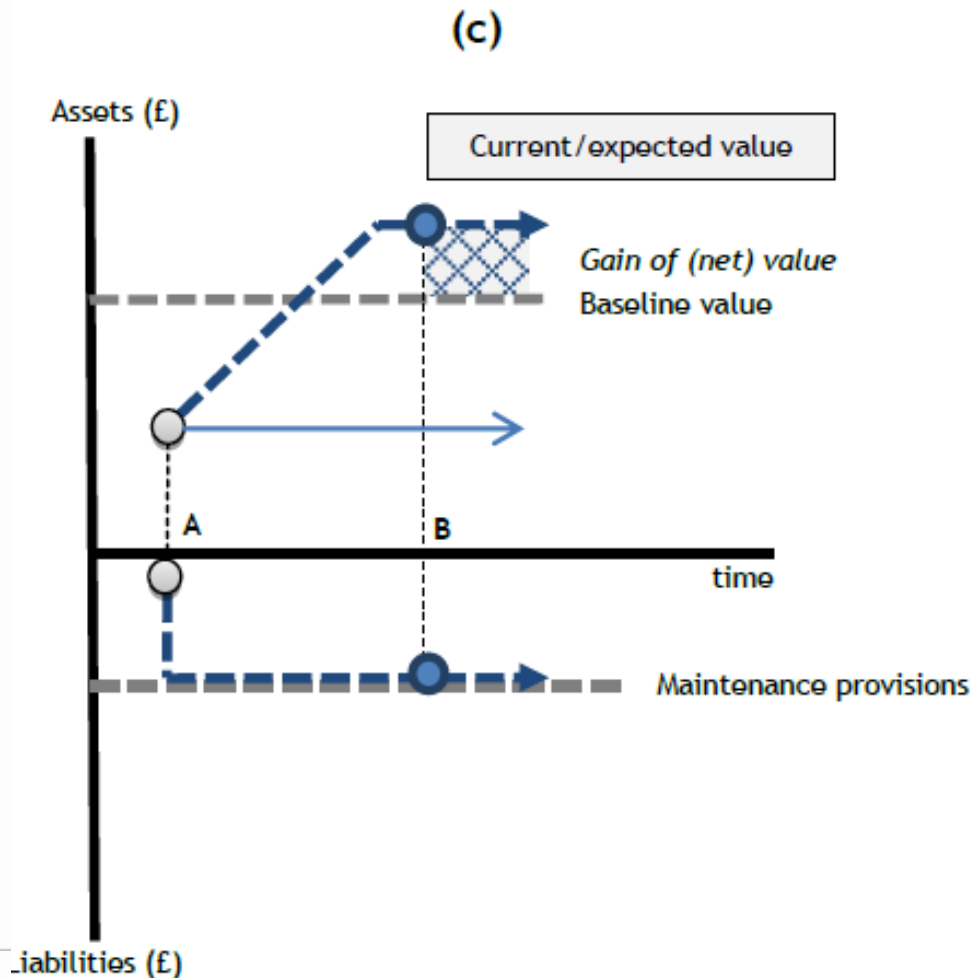
Reciprocal issue: treatment (recording) of activity that maintains, restores or enhances ecosystem condition (e.g. defensive expenditures)

- 2008 SNA: Cost of land improvements, affecting the parcel of land being considered directly, is treated as gross fixed capital formation, recorded as land improvements
- *Land improvements: result of actions lead to major improvements in quantity, quality or productivity of land, or prevent its deterioration (e.g. land clearance, land contouring, creation of wells that are integral to the land in question)*
- Q1: is that activity a good measure of the level of investment in the ecosystem asset? Or is the increase in NPV of the asset resulting from the expenditure a better measure of investment?

Maintenance costs as liability

- Corporate NCA Framework (EFTEC 2015)
- Maintenance costs (legal provision or EPEA) for specific environmental assets recorded as liability (NPV).

2. Target level of natural capital



Restoration and enhancement costs

- Option 1: Broader interpretation of SNA (land-> ecosystem) hence record all costs as investment (e.g. rather than as final government consumption)
 - > However, what type of asset?
 - > Not inconsistent with degradation approach where we look at the output side (NPV of ES)?
- Option 2: distinguish between investment costs and maintenance costs (defensive expenditures)
 - > NPV of maintenance costs as liability
- Option 3: no change / current treatment (e.g. other changes in volume)

Summary – key questions

- Q1: Defining degradation? NPV_Act, NPV_sust, physical measure(s)?
- Q2: Model A versus Model B? ecosystem as quasi-institutional sector?
- Q3: Cost allocation (caused versus borne)
- Q4: Enhancement as investment? If yes, based on NPV or actual costs ?
- Q5: If yes, all costs or differentiate maintenance costs and restoration costs?
- Q6: Environmental liability? (apart in time) other uses of liability?

Disservices

- Recorded as positive or negative contribution
- Cannot use welfare to make the distinction
- Example (elephant trampling maize):

	Ecosystem	Isic A	Isic B	Household	Total
Supply					
Ecosystem service A	70				70
Ecosystem service B	-20				-20
Product X		200			200
Product Y -> restoration					0
Use					
Ecosystem service A		70			70
Ecosystem service B		-20			-20
Product X				200	200
Product Y -> restoration					0
Value added (supply)	50	150	0		200
				200	