

Expert Meeting on Ecosystem Accounts

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<http://unstats.un.org/unsd/envaccounting/seeaLES/egm2/lod.htm>

Two options for recording ecosystem services in sequence of account

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This note presents two options for the recording of ecosystem services based on a hypothetical example.

Suppose we have a closed economy that consists of a single farmer and a consumer, with the following specs:

Farmer

interest rate	10%.
produces corn	200
intermediate consumption	40
cfc	10
owns agricultural land	400
owns machines	200
causes degradation (soil erosion)	15

It follows:

gross value added	160
wages	50
operating surplus	110
user cost of fixed capital	30 (10 cfc + 10%* stock of fixed assets)
resource rent	80

Furthermore, let's assume that carbon sequestration occurs of 30 that is currently non-market.

The two recording options are illustrated Tables 1 and 2.

- Both options consider ecosystems as composite assets that produce a bundle of services;
 - NB: this is in contrast to the standard concept of a capital good as a producer of a single service (e.g. in which a truck only produces transport services).
 - NB2: the extension of the asset boundary and the production boundary occurs simultaneously!
- Key difference:
 - Option 1: assumes that the ecosystem as asset concurs with an actor (and hence as there is only 1 actor we need to introduce an additional quasi-sector 'ecosystems').
 - Option 2: assumes the ecosystem asset is owned by the farmer and there is no need for an additional sector ecosystems.

Table 1: Ecosystems as asset and sector

	Farmer			Consumers			Ecosystems			National Economy		
	S.11			S.13/S.14			S.xx					
Production account	R	U	BI	R	U	BI	R	U	BI	R	U	BI
Output												
Produced products	200									200		
Ecosystem products												
Provisioning of space							40			40		
Provisioning agri production							40			40		
Sequestration							30			30		
Intermediate consumption												
Produced products			40									40
Ecosystem products			80									80
(adjusted) Gross value added						80				110		190
Compensation of employees			50									50
Gross operating surplus						30				110		140
Consumption of fixed capital			10									10
Depletion / Degradation								15				15
Net operating surplus						20				95		115
Distribution of income account												
Compensation of employees					50						50	
Current transfers												
Ecosystem transfers	80			30				110		110	110	
Net disposable income			100			80				-15		165
Use of income account												
Final consumption												
Produced products					160							160
Ecosystem products					30							30
Net savings			100			-110				-15		-25
	280	180		80	190		110	125			470	495
Balance sheet												
Opening stock	200						1100			1300		
Consumption of fixed capital			10									10
Depletion / Degradation								15				15
Closing stock	190						1085			1275		

Table 2: Ecosystems as asset

	Farmer			Consumers			National Economy		
	S.11			S.13/S.14					
	<i>R</i>	<i>U</i>	<i>BI</i>	<i>R</i>	<i>U</i>	<i>BI</i>	<i>R</i>	<i>U</i>	<i>BI</i>
Production account									
Output									
SNA	200						200		
Non SNA	30						30		
Intermediate consumption									
Produced products		40					40		
(adjusted) Gross value added			190						190
Compensation of employees		50					50		
Gross operating surplus			140						140
of which <i>provisioning service</i>			80						
<i>sequestration</i>			30						
<i>capital services</i>			30						
Consumption of fixed capital		10					10		
Depletion / Degradation		15					15		
Net operating surplus			115						115
Distribution of income account									
Compensation of employees				50			50		
Current transfers									
Ecosystem transfers		30		30			30	30	
Net disposable income			85			80			165
Use of income account									
Final consumption									
Produced products				160			160		
Ecosystem products				30			30		
Net savings			85			-110			-25
	230	145		80	190		310	335	
Balance sheet									
Opening stock	1300						1300		
Consumption of fixed capital		10						10	
Depletion / Degradation		15						15	
Closing stock	1275						1275		

Results:

- Option 1: Additional sector
 - the ecosystem sector has an output of ecosystem products 110, where we have decomposed the resource rent into:
 - provisioning of space (calculated here as $10\% \cdot 400$)
 - provisioning of a agri production (remainder i.e. $80 - 40$)
 - ecosystem products are intermediately consumed by the farmer reducing his output; he obtains however an income transfer of 80, which leads to a disposable income equal to BAU (business as usual i.e. standard SNA recording)
 - ecosystem products in the form of carbon sequestration is assumed to be finally consumed by consumers (here we lump S13 and S14 together; most logical would be to consider this as collective consumption by the government sector): hence increasing its consumption compared to BAU).
 - Degradation of 15 caused by the farming activity to the ecosystem is recorded in the production account of the ecosystem.
 - We can check that income is a return to wealth:
 - the ecosystem as sector owns an ecosystem as asset worth 1100 and hence earns an income worth 10% i.e. 110. NB: due to the degradation borne by the ecosystem, the output that it will yield in the next period will be reduced towards 108,5;
 - Also for the farmer income (20) is a return to wealth: fixed assets (200).

- Option II: No additional sector
 - the farmer's output is now 230 (200 corn + carbon sequestration) that he produces
 - degradation costs are charged to the farmer, reducing his output in the next period
 - when we compare totals (right column) we see that total output of the economy is less in option 2 compared to option 1 (230 instead of 310); the remaining aggregates are however identical.

Comparing options:

- *Pro 2: Key intuition is ecological: it is incorrect as model 1 suggests to see ecosystems as autonomous actors, as all ecosystems are heavily influenced by humans.*
- *Pro 1: Key intuition is economic: option 2 implies imputing the production of services to actors (e.g. the farmer) who may not be aware of themselves as a producer of these services; if the actor would have been aware he may have made different decisions regarding what products to produce. Essentially, the description in model 2 is a mismatch with economic reality. NB: in case of payment for ecosystem services the farmer would be aware and the situation changes.*
- Whereas model 1 conceives of ecosystem products as capital services provided by ecosystems that are subsequently used by other units; in model 2 ecosystem services are conceived as outputs (e.g. agricultural products) that are the results of a combination of assets (fixed, human and ecosystem); choice of recording method has implications for the conception of ecosystem services.
- Pro 1: Whereas model 1 treats all services on an equal footing, in model 2 the non-SNA services are introduced within the production account while the marketed services are made explicit in the generation of income accounts. This is perhaps a bit murky.
- Pro 1: Recording the value of ecosystems in the balance sheet of the sector ecosystems may avoid issues of how to record sectoral ownership (e.g. does the farmer only own the value of the agricultural land or the whole ecosystem asset or should it be on the balance sheet of the government).
- Pro 2: We would want to charge the cost of degradation to the farmer (cost caused) not to the ecosystem. This may be achieved by means of a transfer (cf. the recording of depletion costs in case of extractor different from owner in case of subsoil assets), as the ecosystem eventually bears the costs. But in the absence of an ownership relation between the ecosystem and the farmer this is cumbersome according to standard accounting conventions.
- Pro 2: arguably better aligned with theoretical work on green accounting (e.g. production functions that produce outputs based on combination of assets)
- Pro 1: Introduction of an additional quasi-sector would be similar to Physical Supply Use Tables set-up. For instance the harvest of timber (from a natural forest) is recorded as a transfer of timber from the environment to the economy in MFA which would be parallel here with an ecosystem providing a service consumed by say a farmer.
- Pro 2: Suppose we draw an analogy e.g. consider a monumental historic site which produces amenity services to visitors in addition to housing services to its inhabitants. It is difficult to see who the actor would be for these amenity services: it cannot be the household.