Part II Some theoretical issues on environment and natural resource accounts : 6 Forest resource accounts and their use

6

Forest Resource Accounts and Their Use

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1. INTRODUCTION

This paper discusses the important considerations when setting about to design and draw up forest resource accounts. It is based on the findings I obtained during a survey tour of Europe (Finland, France, and Luxembourg) in September 1994, and on information and literature collected subsequently.

2. THE PURPOSE OF DRAWING UP ACCOUNTS

The experience of traditional economic accounts is suggestive when making up forest resource accounts.

A description (para. II.13) of purpose in the 1993 edition of the System of National Accounts (SNA) sets forth three points as the requirements imposed on account frameworks by users' needs:

(a) Provide a picture of the economy, but the picture, to be intelligible and manageable, must be simplified.
(b) Faithfully represent economic life by covering all important aspects in a balanced way without neglecting or giving too little emphasis to some aspects or giving others too much prominence.
(c) Portray all significant economic behaviour, interrelations and the results of economic activity.

In (b), the original meaning of the word "represent" is not simply ad hoc descriptions or expressions, but rather the act of allowing people an awareness (of things that do not exist or which cannot be grasped as concepts) — using means including symbols, graphs, and images.

From the descriptions of (a), (b) and (c), one can see that SNA attempts a balanced and comprehensive representation without emphasizing any certain part of the socioeconomic system or any certain aggregated total. In other words, SNA is an attempt to provide an overall view of the socioeconomic system, concerning especially the events, i.e., transactions flow within that system.

The role of "accounts" system as an essential means of representing the economy is not clear from these requirements of (a), (b) and (c). I would like to consider this matter in another section.

3. The Functions of Accounts

3.1 Accumulating Data

As one of the important role of social accounting system, Yanovsky (1965) pointed out that in the process of drawing up such accounts a "missing link" could be found among the statistics pertaining to the national economy, and that as a result it would be possible to provide a guideline of statistics framework.

Similar manner of thinking appeared in the 1968 SNA as the term "instrumental use" (para. 1.74). Perhaps the "event approach" (Sorter, 1969) regarding a business system as a complete data/information system can be considered an extension of this idea. To put it concisely, one could say that the form of accounts gives us a framework to accumulate a broad array of data without unevenness or waste, while continually making sure of statistical self-consistency.

3.2 Showing Flow and Stock

Accounting systems are structured so as to clearly show statistics for flow and stock while making sure of their consistency. I shall later discuss the significance to users of showing flow and stock, but an example I would like to give here is the importance to an automobile driver of the speedometer, which indicates flow, and the fuel gauge and odometer, which indicate stock. In relation to this example, I should like to point out one of the defects of the "green GDP" approach, which is subject to criticism from Norway's Aaheim and Nyborg (1995) and others, is that, using the automobile example to illustrate, it employs difficult-to-interpret calculations in which the decrease in fuel and the increase in distance traveled are subtracted from speed.

4. Possibilities for the Application of Accounts

Accounts have these functions because they are capable of building systems axiomatically based on quantitative laws of conservation in the real and financial cycles that are recorded in accounts.[1]

For example, the SNA's flow-of-funds accounts and the financial accounts in the French satellite accounts are balanced tables based on what one might simply call the law of money conservation, in which currency as the source is always used in some way somewhere

in society. SNA's central system (especially production accounts) and the production accounts in the French satellite accounts are accounts that base themselves on the law of value preservation while at the same time balancing, setting the balance item of "added value," the sources and uses of goods and services as based on their assessed values in the market. On the other hand, the material/energy balance table that constitutes the core of natural resource accounts is based on the law of conservation of matter and energy, which assumes that matter, i.e., the source, is always used somewhere in society in the form of other matter or energy.

If one looks for something that can be measured quantitatively, and for which there is some sort of workable conservation law, a variety of statistics could be expressed as accounts. Later I will discuss the types of accounts that might be used for forests.

5. The Simplest Use of Accounts: Disclosing Stock and Flow

As usual, environmental data are measured with methods of the natural sciences and they are instantaneous data (instantaneous values). Let's call such data "f" (for natural-science flow). When observing environmental states and their changes, values other than f are also sometimes important, such as $S = \int f dt$ (stock), $f' = df/dt$ (rate of change in the natural-science flow), and $f'' = df'/dt$ (the trend of the rate of change in flow).

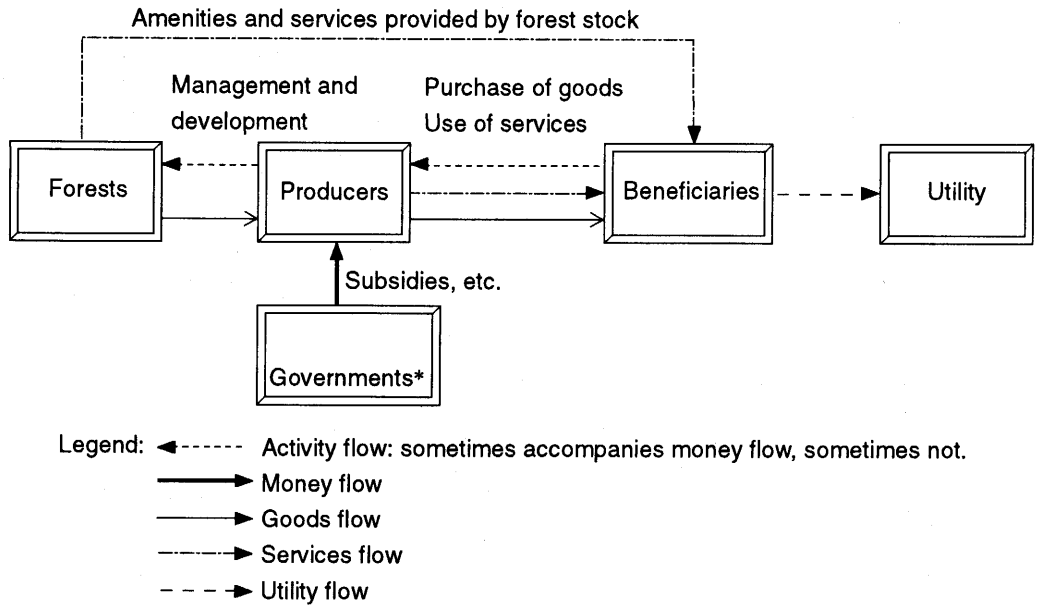
Generally when considering the social-scientific implications of classifying environmental data in this manner, it is f', not S or f, that is most easily perceived by people, and one can point out that only when the speed of environmental deterioration has accelerated do people tend to readily notice that the environment is deteriorating. This makes for at least two problems. First, social decision-making always tends to be delayed on environmental problems that become apparent only when S exceeds a certain threshold value. Second, when $f' = 0$ (i.e., when f is constant), people get used to it, so that it generally becomes difficult for people — economic agents — to correctly estimate the marginal substitution rates of economic goods for environmental goods. This problem would be more fundamental than any other problem such as "free rider problem."

As decision-makers need to deal properly with these problems, it would be necessary to statistically arrange environmental data including not only f', but also data such as S and f, in order to keep a conscious and constant monitoring on them.

Flow in economic statistics differs somewhat from that in the natural sciences. Specifically, while the natural-science instantaneous flow f is the precise differential/micro value S' of stock S, flow in economic statistics (which I will call F here) is a periodic concept, so it is equal to the difference between the opening stock and the closing stock, or $\Delta S = S(T)-S(T-1)$.

Thus flow in economic statistics, F, differs from the concept of flow in the natural sciences, f, but in connection with decision-making one can generally discern similar problems. That is to say, economic agents might react most sensitively to none other than the amount of increase or decrease, from the previous year, of flow in terms of economic statistics, expressed as $\Delta F\{ = F(T)-F(T-1)\}$. For example, the perception of "(the extent to which) the economy is better than last year" could be shown. In contrast, economic agents are perhaps not very sensitive to of course S (national wealth in this example), or even to F (GDP in this example) itself. In the present instance, one significant point in showing F and S for businesses' accounts and national accounts is perhaps to disclose figures that are surprisingly dif-

Figure 1 Interaction between Forests and Economic Agents



Note: * Both national and local governments. As with national forests, the government too is sometimes a producer.Waste flow has been ignored for the sake of simplification.

ficult for economic agents to notice. In the same way, in environmental accounting it is probably meaningful to show the economic statistical flow F (f is also all right, but it's difficult to compare with socioeconomic data) and S.

6. Problems in Forest Accounts

In light of the foregoing discussion, let's consider the problems that arise in making up accounts for forests.

6.1 The Relationship between Stock and Flow with Respect to Forests

First of all, it is important to imagine a rough sketch of stock and flow in relation to forest resources, and their use and management. Figure 1 was produced by taking into consideration not only wood production, but also environmental benefit, while referring to Pearce and Turner (1990). (See Figure 1.)

Environmental benefit includes two benefit flows: One is realized only in conjunction with active use by users, such as the function of forests as a place for recreation; the other, such as soil conservation by forests, does not directly depend on the activities of users (i.e., beneficiaries). In either case, the activities and investment of people as managers are involved. Human activities like these and the changes in the states of forests themselves are

mutually related in terms of both real and financial aspects, and the whole of such relationships leads to human utility.

6.2 Types of Forest Resource Accounts in the Broad Sense

Let us consider the applicability of accounts as discussed in Section 4 in relation to forests. Begin by assuming we are going to draw up a forest account for an upstream timber stand in terms of volume (cubic meters), and that we then use what might be called a law of land area conservation, which includes forested land, to prepare an account of forested land by area (ha) and thereby ascertain increases or decreases in area. We then make up a forest products account by weight (t) based on the law of matter conservation for the process extending from the extraction and processing of forest products (including paper and pulp) to final consumption. It is also possible to use what might be called the law of currency conservation to prepare, as a supplementary measure, an account expressing the flow of funds for managing forests in monetary units (yen). It is trees that are measured in this forest account, while in the forest land account it is forested land, in the forest products account it is forest products, and in the forest management account it is the funds used in managing the forests.

There might also be accounts based on the number of people and on time. Making up an account for the number of people based on what might be called a "law of population conservation" and/or "law of time conservation" would allow us to represent things such as the input of labor in forest management and the amount of time people spend in forests. In making up such accounts, the so-called "time budget" approach will perhaps be of particular interest in the future when working on "Sunday forestry," or forest management by volunteers. Table 1 presents these account types.

Table 1 Types of Forest Resource Accounts and Their Expanding Use

Type of account	*Unit of Measurement*	*What is Measured*	*Underlying "law"*	*Necessary data sources*
Forest account	m^3	Trees	Law of matter conservation	Forest resource inventory, forest register
Forested land account	ha	Forested land	Law of land conservation	Forested land development statistics, land use statistics
Forest products account	t (m^3)	Wood materials	Law of matter conservation	Input-output tables for timber-related industries, ect.
Forest management account	Yen	Forest management funds	Law of currency conservation	Forest economic survey and subsidy data, etc.
Forestry labor account	Persons	Forestry labor	Law of population conservation	*
Forest time account	Time	Amount of time spent in forest	Law of time conservation	*

Important here are the relations among these accounts. For instance, the "amount of decrease in timber stock caused by logging" in the forest account is equal to the "number of logs extracted from domestic forests" in the forest products account.

Because the forest balance is especially important among these accounts, I will devote a section to discussing it.

The reason the forest account is considered important is that, in Table 1, it is the only account that records the stock of forest resources themselves, and because the information on forest resource stock represented by the forest account is most directly related to the sustainability of timber production and to environmental benefit.

6.3 Structure and Qualitative Classification of the Forest Balance

While it goes without saying, the forest account's structure can be simplified as in Table 2, which constitutes an "account" because its left side is arranged to describe with consistency the opening stock, the period flow, and the closing stock. It does not matter how the table's top is categorized, but its material categorization is of great importance as an information of stock. A look at the account created for France's Lozère Province described in "*les Comptes du Patrimoine Naturel*" (CPN) shows that, elaborating detailed categorizations of tree species and biota, a cross-matrix of these two categorizations yields a "relation account" (Table 3).

Table 2 Basic Structure of a Physical Forest Account

ΔYears* account for "a." Unit: Physical amount

	Total $a=\Sigma a_i=\Sigma a_j$	*Category 1* $a_1 \dots a_n$	*Category 2* $a^1 \dots a^m$
Opening stock (19xx)			
Period flow			
Increase/decrease caused by human activities			
Natural increase/decrease			
Reconciliation			
Closing stock (19xx + Δ)			

Note: * The accounting period is not necessarily one year.

Tabel 3 Structure of CPN Relation Account

Stock 19xx		*Total* $a=\Sigma a_j$	*Category 1* $a_1 \dots a_n$
Total		$a=\Sigma a^j$	
Category 2	a^1		
	.		
	.		
	.		
	a^m		

Stock 19xx + Δ		*Total* $a=\Sigma a_j$	*Category 1* $a_1 \dots a_n$
Total		$a=\Sigma a^j$	
Category 2	a^1		
	.		
	.		
	.		
	a^m		

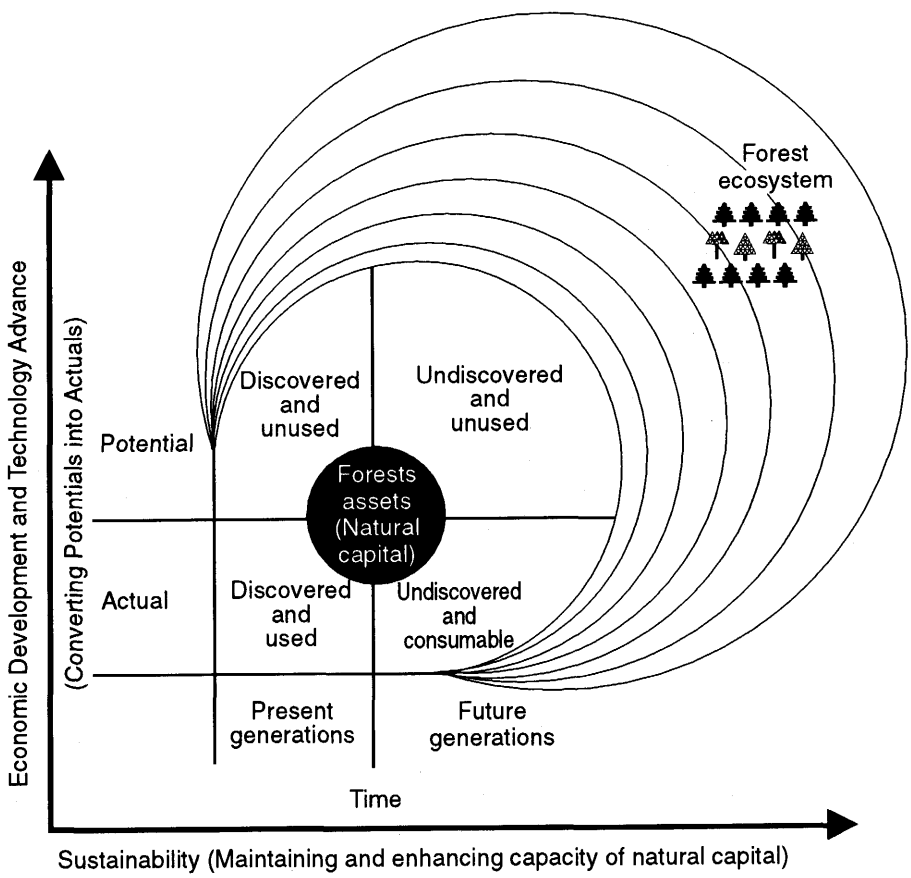
6.4 Forest Accounts and McKelvy's Box

Categorization at the table's top will probably differ according to a government's policy requirements and other considerations. The detailed categorizations of tree species and biota for Lozère Province imply a strong awareness of nature conservation policy requirements.

As another way of thinking, perhaps one could try a different table-top categorization that focuses on what is called sustainability. It is difficult to propose something specific, but McKelvy's box might offer a hint. Bradley and Xu (1994) show McKelvy's box as regards forests (Figure 2).

If forest resources can be divided into four areas as shown here,[2] one can understand the importance of using them in the table-top categories on forest balance. Some specific categories would be old-growth forests and plantation forests, village forests and hinterland forests, and juvenile forests and full-grown forests, as well as categories based on age class. It appears that by using such categorizations, accounts created using physical quantities as the units make it possible to express forest sustainability far better than scalar values such as the

Figure 2 Relating Forest Ecosystems to the Concepts of Forest Capital



present value and the net price of forest resources, which are obtained as monetary values (Bravel, G., et al., 1995). Only the "discovered and used" section in Figure 2 is directly linked to use balance, which is the flow account.

6.5 The Missing Link of Forest Statistics: Discovering Japan's Problems

In Japan there have been experimental attempts at accounts based on existing statistics and researchers' independent surveys, examples being Koike's use balance and forest balance, and the forest management account for forested areas managed for recreational purposes by Oishi and Tsuchiya, but there have been no officially prepared forest resource accounts. Such accounts in Japan are still at the research stage, in which people are carefully checking for statistical problems and gathering reliable data before setting to work.

Table 4 Data Coverage, Quality, Comparability, and Frequency for Forest Accounts in Japan

Field/Problem	*Main data source*	*Evaluation of data*		*Notes*
Forest resources	Forest register	Cover:	good	* Inventory has not been executed since 1961
		Quality:	poor*	
		Compar:	poor	
		Freq:	every 5 years	
Forested land area	Cadastral map	Cover:	good	* Dizitisation has been needed
		Quality:	n.g.*	
		Compar:	good	
		Freq:	every time	
	Statistics of permission on land conversion	Cover:	n.g.*	* Small-scale conversion left out
		Quality:	good	
		Compar:	good	
		Freq:	every year	
Forestry management (Forest management for timber production)				
Output	Mokuzai Jukyu Hokokusho	Cover:	good	* Not equal to volume of harvesting
		Quality:	n.g.*	
		Compar:	good	
		Freq:	every year	
Input	Rinka Keizai Chosa Hokoku	Cover:	good	* Short of samples
		Quality:	n.g.*	
		Compar:	poor*	
		Freq:	every year	
	Forestry Census	Cover:	poor*	* Lack of data on capital goods
		Quality:	good	
		Compar:	poor	
		Freq: every 10 years		
Wood processing	Mokuzai Jukyu Hokokusho	Cover:	n.g.*	* Lack of stock data in the factories nor energy data
		Quality:	good	
		Compar:	good	
		Freq:	every year	

I should like to refer to Scherp (1994) and Damrongsak, C. (1996) in interpreting the present state of Japanese statistics pertaining to forest accounts. They are shown here for the reader's consideration (Table 4). The assessment is my personal and tentative one, and does not represent any official judgment.

Table 4 Data coverage, quality, comparability, and frequency for forest accounts in Japan (continued)

Field/Problem	*Main data source*	*Evaluation of data*		*Notes*
Intermediate inputs to other industries	Mokuzai Jukyu Hokokusho	Cover:	good	
		Quality:	good	
		Compar:	good	
		Freq:	every year	
Household consumption	Household survey (Kakei Chosa)	Cover:	n.g.*	* Confined to paper and wood charcoal
		Quality:	good	
		Compar:	good	
		Freq:	every year	
Forest management for non-timber use				
Recreational use	Special survey (by Oishi & Tsuchiya)	Cover:	n.g.*	* Lack of data on supply side in private sector
		Quality:	–	
		Compar:	–	
		Freq:	–	
Watershed management	–	Cover:	poor*	* Available in some forested watersheds only
		Quality:	–	
		Compar:	–	
		Freq:	–	
Relation between forest resources & forestry management	Experimental study using GIS (by Yamamoto)*	Cover:	–	* ID of owners can link different attributes
		Quality:	–	
		Compar:	–	
		Freq:	–	
Relation between forest resources and environment				
Relation between forest resources & water resources	–	Cover:	–	'Tank model' might be applicable
		Quality:	–	
		Compar:	–	
		Freq:	–	

Cover: How complete is the description of the field/problem?

Quality: How accurate is the description statistically?

Compar: How would the data be compared adequately with the data on developed countries? General method is adopted to attain the data?)

Freq: How often are statistical surveys carried out?

Scale: good > n. g. (not good) > poor

7. SUMMATION

If one considers the instrumental use of forest resource accounts to provide guidelines for the continuous collection of forest statistics, the very process of careful drawing up forest accounts is very important, but if one considers representing forests, it is probably not enough just to prepare highly aggregated accounts. P. Bazire, who is an author of the 4th chapter of CPN, has used much space in a historical description on French forest and society. It will in addition be necessary to supplement by means such as showing detailed information through material categorization, conversion to indicators by some means, or modeling. But such supplementary modules are needed as a response to the ad hoc demands of the times, while I feel that, by contrast, forest resource accounts themselves must be rigid so that they are not easily influenced by the demands of the times.

Notes

1. I might also mention that the difference between macro accounts and macro models is that while macro accounts are identity systems, macro models are equation systems. The Dutch NAMEA combines the features of both systems. See Keuning and Timmerman (1995).
2. There may presently be many unused forests in the world, but since there are in fact hardly any undiscovered forests, that actually leaves three sections minus the top-right part.

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