

FOREST PUBLIC GOODS IN NATIONAL ACCOUNTS

V. Bergen

Department of Environmental and Timber Economics, Institute of Forest Economics,
Georg-August-University of Goettingen, Germany
vbergen@uni-forst.gwdg.de

SUMMARY

The consideration of forest public goods within national accounting requires a depiction of intersectoral relations characterized by market failure. These interrelations do not have monetary equivalents and, thus, are not yet considered in present national accounting. When interpreting these relations as flows of public goods between forestry and other sectors, monetary equivalents may be derived from market simulations. As a consequence, it is necessary to get to an extended definition of the term production including flows of public goods between institutional sectors as well as an extended definition of the term real estates including natural assets.

KEY WORDS: Public goods of forestry
National accounts
Monetary evaluation
Natural assets
Effects of forests
Performance of forestry

INTRODUCTION

The consideration of forest public goods within national accounts requires a depiction of intersectoral relations characterized by market failure. These interrelations do not have monetary equivalents and, thus, are not yet considered in present national accounting. When interpreting these relations as flows of public goods between forestry and other sectors, monetary equivalents may be derived from market simulations. As a consequence, it is necessary to get to an extended definition of the term production including flows of public goods between institutional sectors as well as an extended definition of the term real estates including natural assets.

The explanatory approaches on technological external effects and public goods can analyze market failure from a theoretical point of view. By using the factor forest as an input for the production of market-determined goods, forestry on the one hand causes technological external effects that influence the utility or production possibilities of other sectors without any consideration in a pricing system. On the other hand forest production

is strongly determined by technological external effects caused by other sectors. Moreover, forestry provides in addition to private goods numerous public goods, which are consumed or used as intermediate goods in other sectors.

A complete depiction of macroeconomic activities of forestry within national accounting, therefore, demands for a consideration and quantification of these flows. Only information about the complete extent of all relations to other sectors may facilitate decisions on the allocation of scarce resources. Thus, recently an increasing demand for information exists referring to dimensions and structures of non-market goods in an economy (Klaus, 1994).

The part of national assets that is owned by institutional units and provides financial advantages for its owners is already considered in national accounting since the revision of the System of National Accounts in 1993 (United Nations *et al.*, 1993). On the contrary, this paper concentrates on that part of natural assets that is not yet considered in national accounting. These are natural assets capable of providing public goods for institutional units.

In conceptions of environmental reporting systems within national accounting usually two different approaches for a consideration of public goods and natural assets can be identified. On the one hand the property of natural assets and, thus, the provision of public goods is attributed to present institutional sectors (Richter, 1994). On the other hand an institutional sector «nature» is proposed that is seen as the owner of natural assets and provides public goods to other sectors (Hampicke *et al.*, 1998). This paper analyzes both approaches by circular-flow analysis and elucidates the resulting consequences for sector-specific accounting.

A provision of different economic methods to measure monetary values of external effects and public goods is followed by a critical discussion of their position within circular-flow analysis. An analysis of the present consideration of public goods within a System of National Accounts is followed by an approach for an extension of a system of sectoral accounts by including the non-market production. Comparing both approaches integrating natural assets, it turns out, that the discussion about «effects of forests» versus «services of forestry» can be analyzed within the context of national accounting. As a result it is seen, that both approaches provided in this paper influence the macroeconomic picture of forestry in very different manners.

PUBLIC GOODS WITHIN CIRCULAR-FLOW ANALYSIS

The flows between forestry and other sectors characterized by market failure on the one hand can be interpreted as technological external effects and on the other hand as received and provided public goods. As a consequence there are two different approaches for a classification of these flows within circular-flow analysis.

The general technique within circular-flow analysis is based on the awareness that in a closed circulation each flow needs an inverse monetary flow that is equivalent in terms of value. In national accounting the convention exists to consider monetary flows only, due to missing ability to aggregate different real flows. In an analysis of flows between forestry and other sectors characterized by market failure this convention also forces to identify at least fictitious inverse flows. Thus, the quantity of received and provided pub-

lic goods can be depicted by monetary links between sectors without need for documentation of physical flows (Rettig and Voggenreiter, 1996).

Interpreting all market failure flows between forestry and other sectors as flows of public goods enables to derive inverse flows between the sectors by market-simulation. This technique means e. g. to interpret waste disposals in forests caused by other sectors (usually regarded as a negative technological external effect) as a public service provided by forest firms. Forest firms, therefore, receive inverse fictitious monetary flows. This means, that in this section the definition of «public goods» is interpreted in a wider sense, which enables us to consider them within circular-flow analysis. As a consequence, the definition of the term «production» must also be interpreted in a wider sense within the System of National Accounts.

Figure 1 shows the general flows of public goods between institutional sectors in a circular-flow of closed economy.

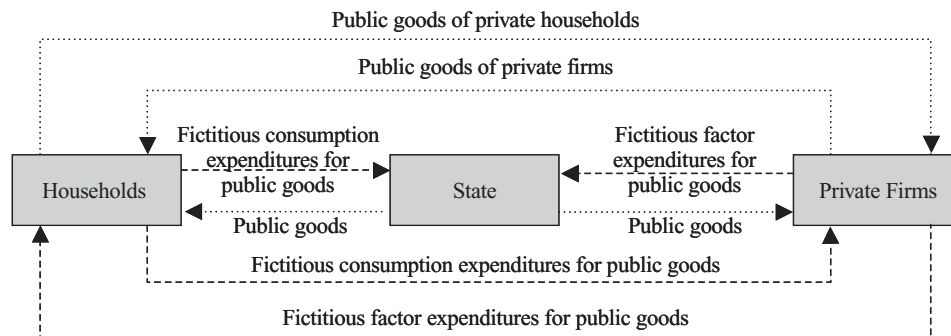


Fig. 1.—Public goods in a circular-flow of a closed economy

The dotted lines mark real flows of public goods. They face fictitious monetary flows of equivalent value marked by broken lines. A consideration of a sector of «changes in assets» is neglected in order to simplify the analysis. It is assumed here that the economic transactions related to public goods do not concern any assets. Later this simplifying assumption will be dropped.

Analyzing public goods of forestry requires to isolate forestry from other private firms to be able to regard flows of public goods between forestry and other sectors. Figure 2 shows the most important flows of public goods and inverse monetary flows in a four-pole circular-flow of a closed economy. In this figure public goods provided by private households are not considered any longer, because according to the definition of the European System of Accounts - ESA 1995 (European Commission, 1996) households do not carry out production activities. Therefore and for reasons of simplification these public goods are neglected. Referring to forestry, this means that potential public goods provided by private households and used as inputs in forestry are no longer considered in this analysis.

For an identification of recipients of the public goods provided by the sector state it is necessary to record inverse monetary flows in all mentioned sectors as documented in

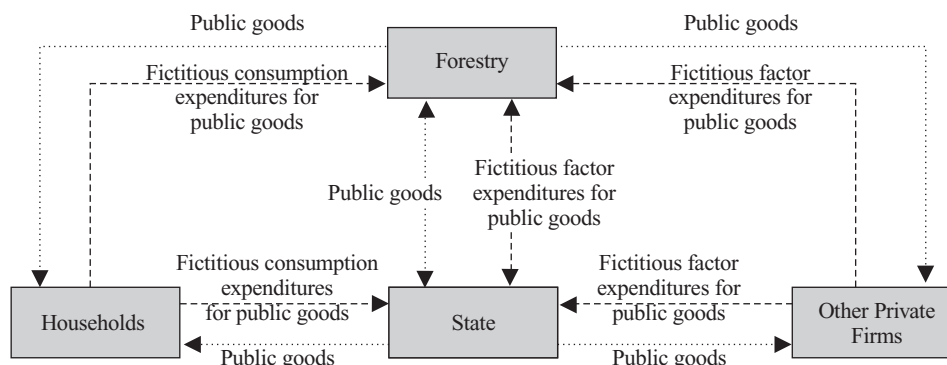


Fig. 2.—Public goods of forestry in a circular-flow of a closed economy

Figure 2. In contrast, it is mentioned in the Systems of National Accounts that no inverse intersectoral monetary flow exists for public goods provided by the sector state. They are interpreted as public consumption and, thus, are calculated at factor costs as intrasectoral flows within the public sector. In the following, due to reasons of simplification it is stuck to this convention. But, as a consequence, recipients of public goods provided by the public sector cannot be identified. Referring to forestry, this means, that the amount of public intermediates used in the production process and provided by the public sector cannot be recorded. These restrictions cause that further analysis is limited to intersectoral flows between forestry and other firms as well as flows of forest public goods provided for households and their respective inverse monetary flows.

Figure 2 implies that an extension of the circular-flow analysis by public goods forbids to draw a closed monetary circular-flow. The necessary identity of in- and out-coming flows is not fulfilled, because fictitious expenditures of households and other firms do not affect the income accounts of the sectors. In present Systems of National Accounts this problem is already considered for public goods provided by the sector state. It is faced by intrasectoral inverse flows as public consumption in the income accounts of the sector state. This method is called integration approach (Cansier, 1996, p. 303) and tries to consider flows of public goods in present national accounting. Nevertheless, this approach for closing the monetary circular-flow again cannot provide information about recipients of public goods of the sector state. Thus, it cannot give any statement about whether these goods are consumed or used as intermediates in production processes. Moreover, this method leads to a falsification of the sectors share of the national value added. Public goods used as inputs in the business sector are not accounted as intermediates and, thus, do not affect the value added in this sector. A correct accounting of public goods in the mentioned sector is only attainable, if the balance of flows of indirect taxes and subsidies from private firms to the state equals the monetary value of public intermediates. Applying an integration approach on forestry means, that those forest public goods provided for other sectors would have to be accounted as consumption in the sector forestry. The consequences would be analogous to the statements mentioned for the public sector.

The integration approach is confronted with a separation approach (Cansier, 1996, p. 303). This approach enables to account public goods in monetary terms by using an ad-

ditional satellite system. The advantage is, that the closed circular-flow of present national accounts is not affected by considering public goods (Bergen, 1999, p. 388). In the satellite fictitious equivalents in the above mentioned form are not necessary, because consistency is not required.

This paper follows a combined integration and separation approach. The production account of forestry in present national accounting is extended by the production of public goods. The monetary equivalents in the income accounts, necessary for a complete integration approach are neglected, but the satellite contains all flows determined by private and public goods. Thus, for this account the mentioned technique may be regarded as a complete integration of public goods into a System of National Accounts. The consequence is an extended computing of the national product including the value of public goods.

Figure 3 shows an extended production account of forestry. The net value added computed in this production account reveals the contribution of forestry to the amount of goods positively valued by society (Bergen, 1998, p. 109). It must be characterized as an extended interpretation of national product, which contains both, uses of natural resources and produced public goods. An extension like this enables to interpret the national product as an indicator for social welfare (Richter, 1994; Weitzman and Löfgren, 1997). The items to be supplemented to ESA 1995 in a satellite system can be specified as follows:

Production Account			
Uses		Resources	
Private Intermediates	ESA 905	Output of Raw Wood	ESA 95
Public Intermediates	Satellite	Output of By-Products	ESA 95
Depreciation on Capital Assets	ESA 95	Net Increase of Standing Timber	ESA 95
Depreciation on Natural Assets	Satellite	Output of Public Consumption Goods	Satellite
Net Value Added	Satellite	Output of Public Intermediates for other Sectors	Satellite

Fig. 3.—Extended Production Account of Forestry

Public Intermediates: This is the monetary value of those public goods used as factor inputs in forestry for the production of private goods and other public goods. They also include uses of national resources that are not property of forestry.

Depreciation on Natural Assets: This position captures the depletion of natural assets of forestry due to the production of private and public goods. Depreciation documents restrictions on natural assets for future production activities. In an additional extension of national accounts by accounting natural assets following Juster (1973) depreciation depicts disposals on natural resources (Frenkel and John, 1996, p. 155).

Output of Public Goods: This is the extension of the output of forestry by the value of public goods provided for other sectors in the above mentioned wide interpretation. These goods either benefit the sector households directly or are transformed into goods

utilized in later production processes. Thus, they increase the share of forestry on consumption possibilities of society and, therefore, have to be included in an extended national product.

The exposition shows that from a theoretical point of view it seems possible to depict flows of public goods in a society within a System of National Accounts. To keep up consistency of closed circular-flows in present national accounts, it is preferable to illustrate fictitious monetary flows of public goods within a satellite system, where a strong consistency of closed circular-flows is not required. In an extended production account three positions can be identified that depict inverse monetary flows of real flows of public goods. Thus, in the next chapter attention is focussed on the conceptual development of an approach to record forest output of public goods.

MONETARY EVALUATION OF PUBLIC GOODS

Economic entities benefit from public goods. Considering public goods within national accounts enables to depict comprehensively the welfare-increasing consumption possibilities of society. To commonly include different public goods and private goods in a single system of accounts it is necessary to transform them into a monetary scale. Fictitious amounts have to be calculated in monetary terms. The monetary evaluation may be carried out by using different approaches. In the following, several concepts are discussed and proved for their suitability within national accountings.

Evaluation by production costs: The provision of public goods causes costs in institutional sectors. Using the concept of evaluation by production costs, the monetary value of public goods is inferred from average costs of their provision. Thus, this approach supposes a strong linkage between production decisions of firms and resulting costs on the one hand and preferences of households and benefits of consumption on the other hand. From a theoretical point of view this linkage is problematic, for the provision and costs of goods do not necessarily reflect benefits for consumers (Bergen, 1993, p. 52). Nevertheless, due to its practicability and in spite of these theoretical objections it is agreed in national accountings to evaluate public forest goods by costs of the imputed factors.

Evaluation by maximum marginal willingness to pay: Market goods can be evaluated by market prices. They represent maximum marginal willingness to pay for the last consumed unit of this good. If households' willingness to pay reflects the utility generated by these goods, there is a strong correlation between revealed willingness to pay on a market and the benefit generated by the good (Bergen, 1993, p. 52). But this approach omits the depiction of additional consumers surplus for the traded quantity and, thus, leads to an underestimation of the maximum total willingness to pay for that quantity. Nevertheless, in national accountings it is agreed, that the market value is a suitable scale to record values of market goods due to its high practicability. Referring to the evaluation of public goods the problem of missing market prices for public goods has to be considered.

Evaluation by maximum total willingness to pay: An evaluation by maximum total willingness to pay deals with exactly this problem. The maximum total willingness to pay is computed as the area below the demand curve for a public good, which is to be derived by suitable environmental economic methods. The idea of capturing values of public

goods by total consumers surplus is also based on the assumption that households orientate their willingness to pay to the utility generated by a good. The maximum willingness to pay may then be regarded as an approximation to the benefit from consumption of the total quantity of a public good (Bergen, 1993, pp. 52-53).

This brief discussion of different concepts to evaluate goods results in an evaluation of private goods by market prices as a practicable method that is also suitable from a theoretical point of view. Due to missing market prices this method does not seem to be practicable for public goods. Due to theoretical problems an evaluation by production costs seems unsuitable for the depiction of public goods within a satellite system. In systems of national accounts this approach is only used for recording public goods provided by the public sector when following an integration approach, because here the consistency of closed circular-flows is most important. Theoretical problems are accepted due to the high practicability of this approach. Following the separation approach in a satellite system it seems better to use the theoretically correct concept of evaluation by maximum total willingness to pay. Nevertheless, when combining and comparing monetary values of private and public goods, consequences of different theoretical measures have to be considered. Evaluation of private goods by maximum marginal willingness to pay implies an underestimation of their total value measured by consumers surplus. A common depiction of public goods valued by total willingness to pay neglects the differences in theoretical measures.

Environmental economics have developed several methods to determine the willingness to pay for public goods. In the following, the most important of them are briefly characterized:

Travel Cost Method (TCM): This method is based on the assumption that households react similarly on changes of prices on substitutional markets for private goods as on changes of fictitious prices for a public good. By regression analysis a reaction function is estimated and in a second step a demand curve for a public good is derived. The area under this demand curve can be identified as Marshall's consumers' surplus and reflects maximum total willingness to pay for the quantity of the public good. Data on substitutional markets can be obtained from present statistics or by own measurements. TCM is mainly used to determine recreation values of recreation-areas. On substitutional markets travel costs of households to join recreation benefits are regarded. Several empirical studies in Germany could prove monetary values for recreation possibilities of forests on statistical significant level (Bergen, 1999, pp. 389-391).

Hedonic Price Method (HPM): This method derives the evaluation for public goods from consumers' market behavior on markets for private goods, where the provision of public goods is relevant. The method is based on the Lancaster approach (1966), regarding goods as vehicles of characteristic features. By valuing several features of a good the household indirectly values the good as a bundle of all features. This approach allows to break down the market price of a good into its hedonic prices for all features. The evaluation of the public goods by HPM also requires for the identification of substitutional markets. Data on substitutional markets can be obtained from present statistics or by own measurements. The private good traded on a substitutional market is regarded as a vehicle of valued features based on the provision of a public good. Explaining the market price of the private good by regression analysis, the isolation of the hedonic price for the public good provides information about maximum marginal willingness to pay for the public good. In opposite to Travel Cost Method HPM is able to derive assessments of several

public goods. In Germany, studies using HPM already exist in the context of the monetary evaluation of protecting forests (Bergen and Pfister, 1995).

Hedonic Consumers' Surplus Method (HSM): This approach measures the share of total consumers' surplus generated by the existence of a public good. Based on market analysis for a private good, the change in consumers' surplus is ascertained due to changes in the market price caused by alternative quantities of a public good. That means, we isolate that part of consumers' surplus from consumption of a private good that is caused by the existence of a public good. The method is based on the assumption that the input of a public good in a production process may cause decreasing operating costs. Assuming competitive markets with normal behavior of all participants, decreases of operating costs, if variable, will be passed on to the consumers. Moreover, a quantitative reaction will take place depending on the price elasticity of demand. As a result the consumers' surplus increases in the new market equilibrium. Thus, parts of the consumers' surplus generated by consumption of a private good may be attributed to the input of public goods in the production process. In Germany, this method was used to assess monetary values of forests for the protection of drinking water (Olschewski, 1997; Gutow and Schröder, 2000a).

Contingent Valuation Method (CVM): This method is a direct evaluation method based on experiences that economic units have made on other markets. By interviewing households, a market for a public good is simulated. The good to be evaluated is described in all its features and the possibility of exclusion from consumption is suggested to simulate the consequences of the households' behavior. For this, consumers are informed that the provided quantity of the public good depends on the expressed willingness to pay. Using this scenario technique, the monetary evaluation of the public good by consumers takes place. This approach is also based on the assumption that households orientate their willingness to pay for a good to the generated utility. In contrast to indirect methods the expressed willingness to pay using this approach does not represent the Marshallian but the Hicksian consumers' surplus. Depending on the simulation four different Hicksian measures can be distinguished. From a theoretical point of view the Hicksian consumers' surplus seems advantageous in comparison with the Marshallian one, for the income effect of a variation in prices is eliminated and, thus, the derived demand curve represents a constant level of utility for the household. CVM fits for the evaluation of all kinds of public goods. Moreover, in contrast to the above mentioned methods it enables to estimate existence and option values. But it has to be mentioned that the results of CVM may depend on strategic behavior of interviewees. Moreover, the evaluation of several public goods leads to difficulties when simulating markets and possibilities of exclusion. In Germany, this method has often been used for the evaluation of social functions of forests. Case studies exist for recreation values and several protection functions of forests (Bergen, 1999, pp. 389-391).

The listing clarifies that several theoretically founded methods exist to estimate the willingness to pay for public goods. In Germany monetary values of forest public goods have been proved in numerous case studies. An extension of the production account of forestry by output of public goods requires an extrapolation of case study results to the whole sector. Thus, a quantity frame, recording the total quantity of provided public goods is needed. The analysis of forest function maps allows for extrapolating results from case studies to the sum total of public goods in a forest office and computing their monetary value (Gutow and Schröder, 2000b, Part III). The method is based on the as-

sumption that the information documented in forest function maps is strongly correlated with the quality and use of these functions as public goods by households.

ALTERNATIVE APPROACHES INTEGRATING NATURAL ASSETS

According to the definition of United Nations SNA natural assets are that part of natural environments which are already affected or can be affected by human activities in the future. If institutional sectors own natural assets, then the circular-flow of public goods and changes of natural assets can be described in the following way. Figure 4 shows a circular-flow of a closed economy without transactions of the state. The institutional sectors «Households», «Forestry» and «Other Firms» are supplemented by the functional sector «Changes in Assets». The functional sector records all transactions which change the assets or liabilities of the institutional sectors, thus documenting changes of the wealth position in the ownership of the institutional sectors. Transactions of Forestry which change the natural assets can be shown by the distinction between «Changes in Capital Assets» and «Changes in Forest Natural Assets». Now the interrelation between the sectors can be divided into asset-relevant and non-asset-relevant flows.

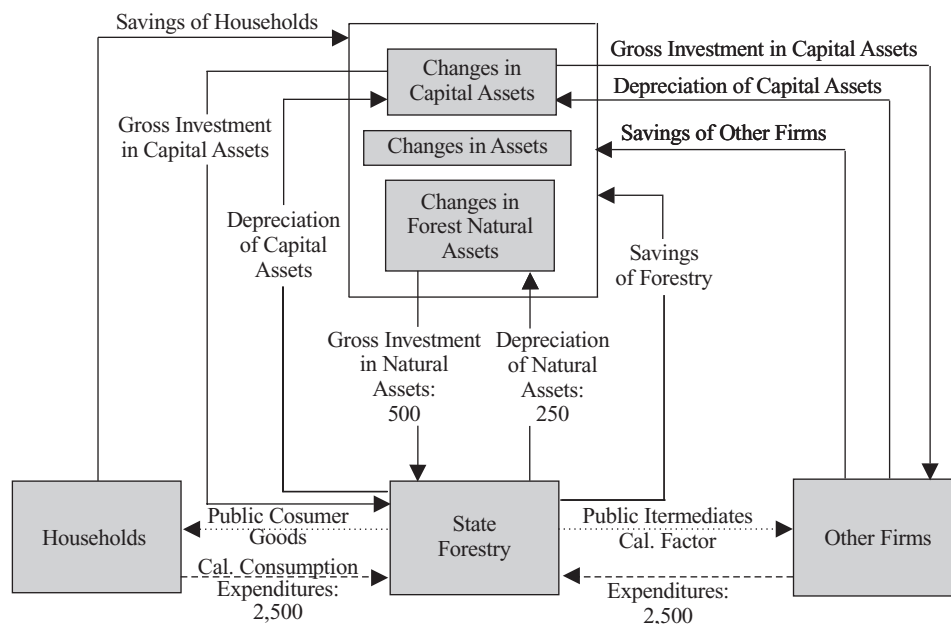


Fig. 4.–Natural Assets in the ownership of the institutional sectors

The asset-relevant transactions between the institutional sectors and the changes in assets sector are described completely and according to gross budgeting. There are the following five flows:

Gross investment in capital assets: The economy produces investment goods which are used for several time periods. Net accumulation of inventories is included as well. In national accounts gross investment is a flow from the sector «Changes in Assets» to the sectors «Forestry» and «Other Firms». This means an accumulation of capital assets.

Depreciation of capital assets: Depreciation means a loss of value due to the use and attrition of the capital stock during the production process. This is a flow from the sectors «Forestry» and «Other Firms» to the sector «Changes in Capital Assets». Depreciation is used as reinvestment, therefore the difference between gross investment and depreciation is called net investment and means the periodical accumulation of capital assets.

Gross investment in natural assets: Forest firms own natural assets. The production processes of forestry generate an increase of natural assets which can be interpreted as gross investment in natural assets. The corresponding flow goes from the sector «Changes in Forest Natural Assets» to the sector «Forestry».

Depreciation of Natural Assets: The production of public goods of Forestry demands for the input of natural assets. It is realized by a value loss of the natural asset. This is shown by the flow from the sector «Forestry» to the sector «Changes in Forest Natural Assets». If there is a positive difference between gross investment and depreciation, then the circular-flow shows a periodical net investment in natural assets.

Savings: Ex post total gross investment and the sum of total depreciation and savings must be equal. The net accumulation of assets equals savings at the same level. Savings mean that households and the other institutional sectors renounce consumption of goods produced. This part of the income is available for investment in order to increase the future consumption. By integrating the forest natural assets the meaning of the term savings is extended in an appropriate way.

The transactions of Figure 4 are reflected in the production and accumulation accounts of forestry and the total economy. Using data of Germany in 1995 we can show the consequences of the forest natural assets owned by the institutional sector «Forestry» in Figure 5 (Bergen, 1998, p. 109):

Production Account of Forestry: This account shows the transactions needed to produce the forest goods in the period. On the resource side the extended production covers the public goods of forestry provided for households and other firms and the net increase of standing timber as a sort of self-produced forest natural asset.

This extension of the term forest goods demands for depreciation in forest natural assets on the use side of the account. As a result the net value added of the forest sector increases from 2,000 to 7,000 Mio. DM.

Accumulation Accounts of Forestry and Total Economy: These accounts show all asset-relevant transactions documenting the changes of national wealth. The «Changes of Natural Assets Account of Forestry» is part of the overall «Accumulation Account of the Total Economy». The forestry accumulation account informs about the changes of the forest natural assets and their financing. The accumulation account of the total economy deals with the forest natural assets in the same way as with the other sorts of assets due to the concept of ownership of institutional sectors.

Environmental accounting is dominated by another view on natural assets. Nature is considered as an institutional sector of its own. There is no ownership of other institu-

Production Account of Forestry			
Uses	in Mio. DM for Germany 1995		Resources
Private Intermediates	1,500	3,400	Output of Raw Wood
Public Intermediates	not cal.	100	Output of By-Products
Depreciation of Forest Capital Assets	250	500	Output of Self-Produced Forest Natural Assets
Depreciation of Forest Natural Assets	250	2,500	Output of Public Consumption Goods
Net Value Added	7,000	2,500	Output of Public Intermediates for other Sectors

Changes in Natural Assets Account of Forestry			
Changes in Assets	in Mio. DM for Germany 1995		Changes in Liabilities
Gross Investment in Forest Natural Assets	500	250	Depreciation of Forest Natural Assets
		250	Savings in Forest Natural Assets

Accumulation Account of the Total Economy			
Changes in Assets	in Mio. DM for Germany 1995		Changes in Liabilities
Gross Investment in Capital Assets	700,000	450,000	Depreciation of Capital Assets
Gross Investment in Forest Natural Assets	500	250	Depreciation of Forest Natural Assets
		250,000	Savings of Households and Other Firms
		250	Savings of Forestry

Fig. 5.—Extended Accounts of Forestry and Total Economy

tional sectors on natural assets. The supply of nature goods to the other sectors of the economy is the result of the production activities of nature as an institutional sector (Peskin, 1989; United Nations, 1993).

With respect to forestry this means that forestry is not seen as the owner of the natural resource forests. The public goods of forests are no longer the product of forestry. The public goods of forests are production factors which are «bought» from the sector forest. Combined with other factors of production forestry produces the private and public goods of forestry. The production value of forestry contents the public goods of forests as intermediate goods. Figure 6 shows the circular-flow of this approach. Here it is also possible to differentiate between asset-relevant and non-asset-relevant transactions. The non-asset-relevant transactions are restricted to public goods and their monetary equivalents in the same way as in Figure 4. The asset-relevant flows are divided into change of capital assets and change of natural assets. With respect to change of capital assets there is no difference to the normal procedure of national accounts. Differences occur referring to changes of natural assets, because they are the only flows concerning the institutional sector «Nature».

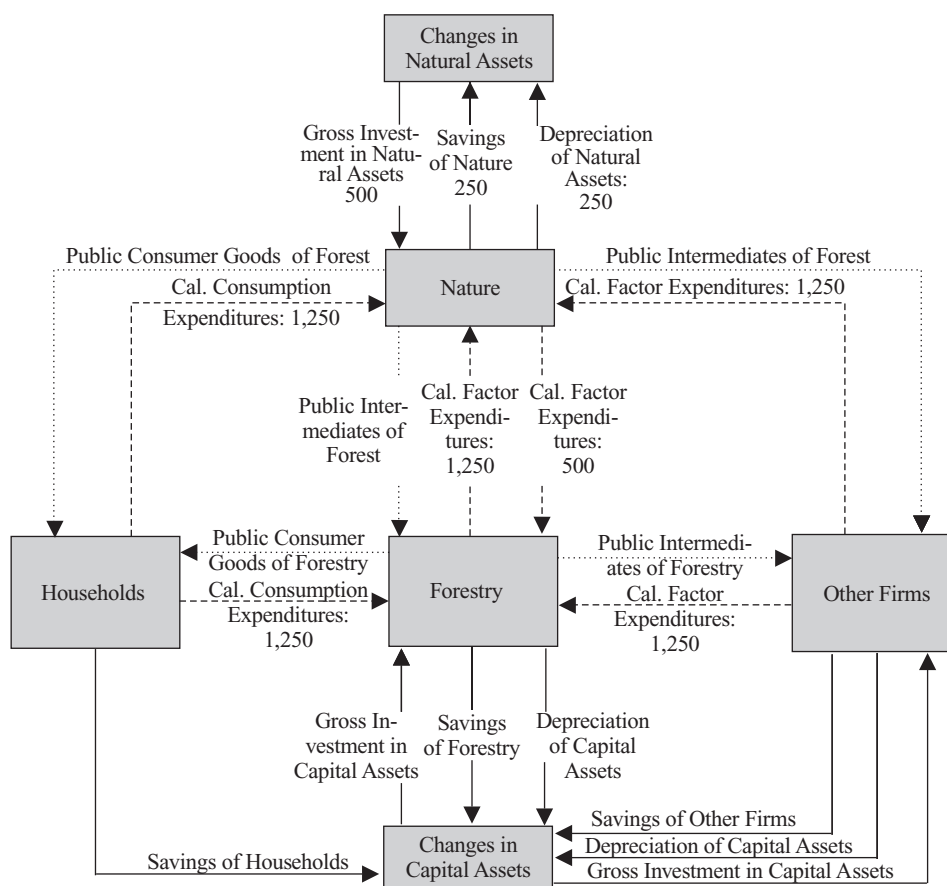


Fig. 6.—Nature as an institutional sector

Defining nature as an institutional sector has consequences for the production and accumulation accounts which is shown in the Figure 7.

The account «Changes in Natural Assets in Forestry» is replaced by «Changes in Natural Assets in Nature» with the same figures as in Figure 5. Forestry has to «buy» public intermediates from nature. There is no depreciation of natural assets to forestry, because it is not the owner of natural assets any longer. The net increase of standing timber is now an intermediate output of forestry supplied to nature. The forest public goods have now to be divided into a part supplied by nature and the other part by forestry. In the production account it is assumed that half of the forest public goods are provided by forestry. The net value added of forestry is reduced to 3,500 Mio. DM due to the definition of nature as an own institutional sector. Savings of the total economy are the same as before, because nature is counted as an additional sector of the economy.

Production Account of Forestry			
Uses	in Mio. DM for Germany 1995		Resources
Private Intermediates	1,500	3,400	Output of Raw Wood
Public Intermediates	1,250	100	Output of By-Products
Depreciation of Forest Capital Assets	250	500	Output of Intermediates for Nature
		1,250	Output of Public Consumption Goods
Net Value Added	3,500	1,250	Output of Public Intermediates for other Firms

Changes in Natural Assets Account of Nature			
Changes in Assets	in Mio. DM for Germany 1995		Changes in Liabilities
Gross Investment in Forest Natural Assets	500	250	Depreciation of Forest Natural Assets
		250	Savings in Forest Natural Assets

Accumulation Account of the Total Economy			
Changes in Assets	in Mio. DM for Germany 1995		Changes in Liabilities
Gross Investment in Capital Assets	700,000	450,000	Depreciation of Capital Assets
Gross Investment in Forest Natural Assets	500	250	Depreciation of Forest Natural Assets
		250,000	Savings of Households
		250	Savings of Nature

Fig. 7.—Extended Accounts of Forestry, Nature and the Total Economy

The comparison between the two approaches to integrate natural assets into national accounting shows that there are important differences documenting the macroeconomic picture of the economy and their sectors.

DISCUSSION

Forestry is linked with other sectors of the economy by market and non market production. The explanatory approaches on technological external effects and public goods provide possibilities to classify forest non market production in circular-flow analysis theoretically. Thus, circular-flow linkages between sectors have to be extended, if public goods are considered. Literature on environmental economic national accounts provides two general approaches to consider non market production. The integration approach is on the one hand able to integrate public goods in present systems of national accounts.

But on the other hand the necessary unity of circular flows requires counterparts in the same institutional sector, so that recipients of public goods cannot be identified. The opposite of the integration approach is the separation approach, where public goods are considered within a separate satellite system. Here the consistency of circular flows is not required, so that it is easier to identify the recipients of forest public goods. The approach of an extended production account of forestry suggested in this paper contains a combination of integration and separation approach, aimed at a complete documentation of the net value added of forestry, without disturbing the consistency of present national accountings.

The monetary value of public goods may be depicted by several evaluation methods. From a theoretical point of view a utility-orientated evaluation by households seems preferable. To compare public and private goods, an evaluation at market prices is to be preferred according to ESA 95. But because of missing market prices an evaluation at market prices does not seem practicable for public goods. The best approximation to utility is an evaluation at maximum total willingness to pay. Environmental economic methods to estimate Marshallian and Hicksian consumers' surpluses have been tested on their theoretical consistency and practicability for an evaluation of forest public goods in numerous studies. In Germany numerous case studies exist to depict maximum total willingness to pay for protection and recreation services of forestry. An approach has been developed to extrapolate results from case studies on the evaluation of forest public goods area-wide using forest function maps. This approach is based on the assumption, that mapped recreation and protection zones reflect the use and evaluation of forest public goods by households.

The extended presentation of forestry in a sectoral account has to show a correct picture of the macroeconomic transactions dealing with forest public goods and forest natural assets. Therefore a broad understanding the different approaches for integrating natural assets into national accounts is indispensable. Both approaches interpret forest public goods in a different way. If nature is seen as an institutional sector of its own, then two sorts of forest public goods have to be distinguished. There are public goods of forests and public goods of forestry. Different production activities serve as the distinctive criterion. If only natural production factors provide the output, then nature is the institution to produce the public goods of forests. In the forest literature this is sometimes called «effects of forests» (Blum *et al.*, 1996). If in contrast natural production factors are combined with human and man-made production factors, forestry is the institution to produce the public goods of forestry. This is called «performance of forestry». It is recognized that this distinction demands for nature as an institutional sector. The present system of national accounts does not differentiate between the forest public goods. This idea refers to an integrated environmental and economic accounting which is built up at present. Further research is needed to realize a correct picture of the macroeconomic relations.

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RESUMEN

Bienes públicos forestales en el sistema de contabilidad nacional

La consideración de los bienes públicos forestales dentro de la contabilidad nacional requiere de la descripción de las relaciones intersectoriales caracterizadas por fallos de mercado. Estas interrelaciones no poseen equivalentes monetarios, y por ello, aún no son consideradas dentro del actual sistema de contabilidad nacional. Si se interpretaran estas relaciones como flujos de bienes públicos entre el sector forestal y otros sectores, equivalentes monetarios se podrían determinar a partir de simulaciones de mercado. Como consecuencia es necesario contar con una definición ampliada de la producción, incluyendo flujos de bienes públicos entre los sectores institucionales, así como con una visión extendida de los bienes reales incluyendo los activos naturales.

PALABRAS CLAVE: Bienes públicos forestales
Contabilidad nacional
Evaluación monetaria
Activos naturales
Efectos de los bosques
Output forestal

REFERENCES

- BERGEN V., 1993. Towards the theory of monetary evaluation of social functions of forests. In: V. Bergen, H. D. Brabänder, A. W. Bitter and W. Löwenstein, eds. *Monetäre Bewertung landeskultureller leistungen der forstwirtschaft*. Schriften zur Forstökonomie, Band 1. 2. Auflage, J. D. Sauerländer's Verlag Frankfurt am Main. pp. 51-56.
- BERGEN V., 1998. Forestry as part of national accounts. In: G. Buttoud, ed. *Accounting and managerial economics for an environmentally-friendly forestry*. Economie et sociologie rurales, «Actes et Communications» nr. 15. Mission Publications Versailles. pp. 107-111.
- BERGEN V., 1999. Framework and empirical content of forestry reporting in Germany. In: C. St. Roper and A. Park, eds. *The living forest. Non-market benefits of forestry*. London: The Stationary Office. pp. 387-392.
- BERGEN V., PFISTER G., 1995. Die monetäre bewertung von umweltwirkungen einer aufforstung im landkreis Göttingen. In: V. Bergen, W. Löwenstein and G. Pfister, eds. *Studien zur monetären bewertung von externen effekten der forst- und holzwirtschaft*. Schriften zur Forstökonomie, Band 2. 2. Auflage, J. D. Sauerländer's Verlag Frankfurt am Main. pp. 59-89.
- BLUM A., BRANDL H., OESTEN G., RÄTZ T., SCHANZ H., SCHMIDT S., VOGEL G., 1996. Wirkungen des waldes und leistungen der forstwirtschaft. *Allgemeine Fortzeitschrift*, 51(1), pp. 22-26.
- CANSIER D., 1996. *Umweltökonomie*. 2. Auflage, Lucius & Lucius Stuttgart.
- EUROPEAN COMMISSION, 1996. *European system of accounts - ESA 1995*. Office for official publications of the European Communities Luxembourg.
- FRENKEL M., JOHN K.D., 1996. *Volkswirtschaftliche gesamtrechnung*. 3. Auflage, Verlag Vahlen München.
- GUTOW S., SCHRÖDER H., 2000a. Monetäre bewertung der trinkwasserschutzfunktion des waldes. In: V. Bergen, ed. *Ökonomische analysen von schutz-, erholungs- und rohholzleistungen des waldes in Rheinland-Pfalz*. Mitteilungen der Landesforstverwaltung Rheinland-Pfalz Nummer 17/2000. pp. 29-58.
- GUTOW S., SCHRÖDER H., 2000b. Die forstwirtschaft im volkswirtschaftlichen rechnungswesen. *Schriften zur Forstökonomie*, Band 22. J. D. Sauerländer's Verlag Frankfurt am Main.
- HAMPICKE U., GEISENDORF S., GRONEMANN S., IMMLER H., 1998. Die bedeutung des naturvermögens und der biodiversität für eine nachhaltige wirtschaftsweise. Möglichkeiten und grenzen ihrer erfaßbarkeit und wertmessung. *Berichte des Umweltbundesamts* 6/98, Berlin.
- KLAUS J., 1994. *Umweltökonomische berichterstattung*. Ziele, problemstellungen und praktische ansätze. Spektrum Bundesstatistik, Band 5, Wiesbaden.
- OLSCHESKI R., 1997. Nutzen-Kosten-Analyse des wasserschutzes durch eine Aufforstung. *Schriften zur Forstökonomie*, Band 15. J. D. Sauerländer's Verlag Frankfurt am Main.

- PESKIN H.M., 1989. A Proposed environmental accounts framework. In: Y. J. Ahmad *et al.*, eds. Environmental accounting for sustainable development. The World Bank, Washington.
- RETTICH R., VOGGENREITER D., 1996. Makroökonomische Theorie. 6. Auflage, Werner-Verlag Düsseldorf.
- RICHTER W., 1994. Monetäre makroindikatoren für eine nachhaltige umweltnutzung: eine diskussion theoretischer und praktischer aspekte des ökosozialproduktkonzeptes. Metropolis Verlag Marburg.
- UNITED NATIONS *et al.*, 1993. System of national accounts 1993. New York *et al.*
- UNITED NATIONS, 1993. Integrated environmental and economic accounting. Interim version. Department of economic and social information and policy analysis, Statistical Division, New York.
- WEITZMAN M.L., LÖFGREN K.-G., 1997. On the welfare significance of green accounting as taught by Parable. Journal of Environmental Economics and Management, 32 (2), pp. 139-153.