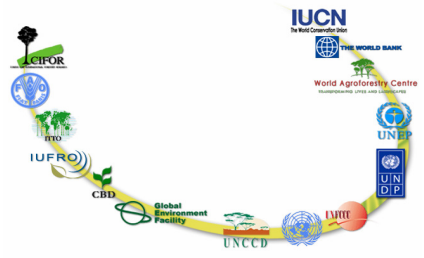
Forest Resources Assessment Working Paper 176



CASE STUDIES ON MEASURING AND ASSESSING FOREST DEGRADATION

FOREST RESOURCES DEGRADATION ACCOUNTING IN MONGOLIA

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December, 2009

Sustainably managed forests have multiple environmental and socio-economic functions which are important at the global, national and local scales, and they play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources - not only on area and area change, but also on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests' contribution to national economies - is crucial to support decision-making for policies and programmes in forestry and sustainable development at all levels.

Under the umbrella of the Global Forest Resources Assessment 2010 (FRA 2010) and together with members of the Collaborative Partnership on Forests (CPF) and other partners, FAO has initiated a special study to identify the elements of forest degradation and the best practices for assessing them. The objectives of the initiative are to help strengthen the capacity of countries to assess, monitor and report on forest degradation by:

- Identifying specific elements and indicators of forest degradation and degraded forests;
- Classifying elements and harmonizing definitions;
- Identifying and describing existing and promising assessment methodologies;
- Developing assessment tools and guidelines

Expected outcomes and benefits of the initiative include:

- Better understanding of the concept and components of forest degradation;
- An analysis of definitions of forest degradation and associated terms;
- Guidelines and effective, cost-efficient tools and techniques to help assess and monitor forest degradation; and
- Enhanced ability to meet current and future reporting requirements on forest degradation.

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Forest Resources Degradation Accounting in Mongolia

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Abstract

Mongolia is forest poor nation in ecological, economic and social terms. The causes of forest degradation are forest and steppe fire, insects and grazing of animals. Another reason is increased demand for timber consumption, which is supplied by both legal and illegal logging.

This case study outlines results of forest resources degradation accounting, covering a period of 30 years (1976-2006) of dynamics of change of forest resources in the country.

Forest resources accounting and valuation methodology, which we have used here, is similar to other natural resources accounts, but forests, as renewable resources intermediate stock will depend also on annual growth and closing stock, and from stock changes due to factors of degradation. In the case study we have implemented physical and monetary accounting of forest resources degradation, but accounting for depletion of forest environmental services has not been considered. In accounting for forest resources, it is important to determine the net value-added from the resource. The return to this factor of production is economic rent. That is, the value of the natural resource stock is the discounted present value of the net revenue. Total value of forest resources degradation in each year has been defined as the difference of total user cost at the beginning compared with the end of the year. In the integrated indicator at national level accounting data has been compared with the Net National Product to arrive at the environmentally adjusted green Net National Product, and with the Net National Savings to get Genuine Saving.

Results of degradation accounting have been adjusted with some macroeconomic indicators of development. The results of this study show that forest degradation has increased from year to year during the entire study period. This is due to expansion of economic activity and increased global climate change impact for the forest ecosystem. The changes of forest degradation have been integrated with macroeconomic indicators of socio-economic development of the country.

This study shows how degradation of resources can be analyzed in terms of future loss of goods and services in terms of indicators of monetary value. This may link physical degradation with economic indicators for sustainable development.

Key words: degradation, physical and monetary accounting, rent, macroeconomic adjustment

1. Introduction

This case study aims to collect information and review forest degradation accounting. It will contribute to a Special Study on Forest Degradation as part of the Global Forest Resources Assessment 2010, as well as part of the existing initiatives of the Collaborative Partnership on Forests (CPF) on harmonizing forest definitions and on streamlining forest-related reporting at national and international level.

Mongolia is traditionally an agricultural country dominated by pastoral herdsman. It is also a forest deficit nation in ecological, economic and social terms. The causes of deforestation and degradation are forest and steppe fire, insects and grazing of animals. Another reason is the demand for timber consumption.

The natural regeneration of Mongolian forests is slow, due to the Central Asian harsh continental climate and fires and insects. The forests in Mongolia play an important role in the maintenance of naturally balanced water conditions in rivers and streams, in the prevention of soil deterioration, in the control of green house gasses, in the reduction of harmful emissions and in the preservation of the permafrost.

This study was undertaken initially by the author, in 1998-1999, with the involvement of specialists and scientists from Ministry of Nature and the Environment, Ministry of Finance, National Statistical Office and from related research institutions of Mongolian Academy of Science. During the preparation of this case study it was revised and extended to cover the extended time frame by the author in consultation with specialists from the National Statistical Office and the Ministry of Finance of Mongolia.

The total forest area of Mongolia is 17.5 million ha, of which 12.7 million ha is forest area (2006). The total growing stock is 1.27 billion cubic meters and the volume of commercial forest about 301.9 million cubic meters (2006). The average tree size in exploitable forests varies between 0.45 and 0.58 cubic meters. According to species, the amounts are: Siberian Larch 971.6 mln m^3, Siberian Pine 70 mln m^3, Cedar 161 mln m^3, Siberian Spruce 3.6 mln m^3, Siberian Fir 0.4 mln m^3, Birch 66 mln. m^3, Aspen 1.5 mln m^3, Poplar 1.1 l mln m^3 and Willow 0.2 mln m^3.

17.5 million ha is total forest area (Ref: State of Environment of Mongolia, 2006) including areas which are not covered by forest and areas under shrubs and wooded land. In FRA 2005 we included the figure 10,252,000 ha (from 2002), and in FRA 2010 we included the figure 10,628,000 ha. This is forest area under coniferous and hardwood forest. However in the Mongolian classification it is defined as forest area covered by main forest species.

The volume amounts of commercial forest species, which we have according to the forest law Commercial forest, i.e. where annual allowable cut volume was calculated. But for other forest, or non commercial forest, which in under protected area and green zones, industrial timber harvesting is not allowed. However the forest species can be similar for both parts of the forest. In page 12 the species composition includes both parts of the forest area.

The case study describes a methodology for forest degradation accounting, which is linked to the thematic elements of sustainable forest management. Value of the changes of extent of forest resources, changes of forest health and reduction and changes of productive functions of forests and its potential resources by adjustments of forest degradation value are linked with economic development indicators of the country.

2. Methodology

Forest resources accounting and valuation methodology is similar to other natural resources accounts, but it has some specific areas in so far as forest resources intermediate stock will depend also on annual growth and closing stock, and from stock changes due to deforestation, fire and insects, which have gradually increased in recent decades due to global climate change and negative human impacts to the forest.

2.1 Physical accounting

For the successful forest resources degradation accounting and its monetary valuation, balanced physical accounting of resources should be carried out.

In our case study physical accounting of forest by area is defined as:

OPENING STOCK + quantity of reforestation - quantity harvested- quantity destroyed by deforestation -reductions due to fire/insects = CLOSING STOCK

Physical accounting by stock is defined as:

OPENING STOCK - quantity harvested+ timber growth- quantity destroyed by deforestation - reductions in stock due to fire / insects = CLOSING STOCK

The physical account of the forest resources was calculated for two types: total forest resources physical accounts, and commercial forest resources physical accounts, as in terms of sustainable forest management principles they are different. The natural growth rate averaged by main species (larch and pine) and reforestation data included in physical accounts by area and volume measure, through adjusted indicators.

2.2 Monetary accounting

As we have learned during the study there are three leading forest (natural) resources accounting methodologies that exist in most countries. They are:

i. Depreciation (degradation) method
ii. Total rent approach
iii. User cost method

After the comparative analysis, in our case study we have used methods of depreciation, as it is more suitable for the forest resources accounting objectives and principles.

The depreciation (degradation) method utilizes economic techniques similar to those used to value the decline in productivity of fixed capital in valuing natural capital depreciation.

In order to calculate natural capital depreciation, physical accounts must be created. It is therefore: the real value as an input in the production process minus the average cost incurred (including a normal profit) in extracting the resource.

Net changes in the value of stocks are attributed to the current year's additions minus deductions plus any price changes of the resource during the year.

In accounting for forest resources, it is important to determine the net value-added from the resource. The return to this factor of production is economic rent. It is also important to distinguish the value added from the resource from that value added associated with the physical (man-made) capital used to extract the resource. The value added from the resource is defined as the net revenue from the resource less all factor payments including a normal return to capital. That is, the value of the natural resource stock is the discounted present value of the net revenue.

The concept of economic rent is central to forest resources degradation accounting. Economic rent (R) is defined as the return to any production input, its market price (p) over and above the minimum amount required to retain it in present use or cost of production (C).

The total rent for forest resources in the beginning of the year can be defined as:

$$Rt = p*H - C(h) \qquad (1)$$

Where

p - world market price per m^3 of resources harvested

H - volume of timber harvest, including illegal logging

C(h) - cost of harvesting (logging, hauling, transportation and processing production of timber and roundwood), including depreciation of assets and normal return of rate, excluding the stumpage price;

The value of the resources at the beginning of the accounting period is defined as:

$$Vso = \Sigma \frac{Rt}{(1+r)^t} \qquad (2)$$

Where t - cutting cycle;

Intermediate cost of resources:

$$VSi = Vso - \sum \frac{Rt}{(1+r)^t} * g - \sum \frac{Rt}{(1+r)^t} * H +/- \sum \frac{Rt}{(1+r)^t} * L - \sum \frac{Rt}{(1+r)^t} * D \quad (3)$$

Where: g - annual growth of forests,

D - Deforestation (deforestation, forest insects and fire),

L- timber of transferred land or reforestation

r- discount rate (for initial case studies planning: on forestry activity, including reforestation 2-3 %, for timber logging and wood industry 5 %-8% , in average 5 %)

Forest land use value by non-timber benefits can be defined as:

$$L = +/- Ufr +/- Uws +/- Uot = Rt' * L \quad (4)$$

Where

L- value of transferred land or forest land use value by non-timber forest resources benefits

Rt' - total value of non-timber benefits

Ufr - non-timber material products value

Uws - watershed protection value

Uot - value of other benefits of forest resources used, which are not valued in conventional national accounts

Ufr - use of fruits and other non timber material products is defined by their market prices;

Uws - the changes of volume and prices of agriculture outputs is defined by market prices;

Uot - changes in the value by using other benefits of forest resources;

Forest resources degradation value will be:

$$FDV = VSi - VSo \quad (5)$$

Detailed analysis for deflated price, cost and unit rent calculation for forest resources accounting and correlation coefficients of accounting of useful functions of the forest was carried out according to the above methodology and the literature (8, 16, 23, 24).

One of most important part of environmental accounting is an adjustment of its results into an economic accounting system.

2. 3 Macroeconomic adjustment

Macroeconomic adjustments in the practice of natural resources and environmental accounting, which have been developed in other countries, have two kinds of methodological versions. The first is a totally integrated system, with a complete inventory of environmental assets with the balance sheet of all assets at the end of the accounting period adjusted for GDP or GNP. The second version is a conventionally calculated GDP revised with the natural resources degradation accounting, and with no adjustment needed for a totally integrated system of National accounts.

The traditional calculation of GNP or GDP in a National accounting system underestimates the true value of natural resources and essentially ignores the value of natural resources while neglecting environmental costs of development.

The aim of national income accounting is to provide an information framework suitable for analysing the performance of the economic system. Man-made assets, buildings and equipment, for example – are valued as productive assets, and are written off against the value of production as they depreciate. Natural resource assets are not so valued, particularly in the case of Mongolia, and their loss entails no change in the accounts against current income that would reflect the decrease in potential future production.

If current development trends continue, then Mongolia could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would rise steadily as these assets disappeared.

Within this domain, there is good reason for resource-based economies to pay special attention to the depletion issue. Natural resources contribute significantly to the national wealth of such countries, especially in the developing world, and particularly Mongolia. From an economic accounting perspective, the depletion of these resources through use (exploitation) or misuse (degradation) represents a real economic cost and a diminution in national wealth which is equivalent to the wearing out (depreciation) of physical structures and equipment. Conventional national income measurement techniques recognise neither the contribution of natural resources to a nation's net wealth, nor any reduction in income to reflect depletion of these resources through extraction of imputing a zero cost to the consumption of resources upon which an economy may depend in order to meet economic targets, finance imports, and sustain its population. At the same time, useful adjustments to the national accounts to reflect changes in the asset position for at least some of the most important natural resources is feasible without inordinate investment in new data collection or methodological development

Currently, the environmental concerns generally fall into 3 categories (3, 4, 5, 10,18):

i. Depletion of natural resources;

ii. Conservation of natural state of environment;

iii. Pollution and its control;

In resource dependent countries, like Mongolia, more attention should be given to the depletion of natural resources.

Resource dependency is also manifest in the more traditional nomadic and herding sector with dependence on pastures and forest products.

Degradation of forest resources and conservation of the environment also increasingly impacts global climate change and deforestation in many parts of the world.

In most cases (4, 5, 15) at national level natural resources accounting data has compared with the Net National Product to arrive at the environmentally adjusted green Net National Product, and with the Net National Savings to get Genuine Saving. Other indicators can also be adjusted easily using these main indicators (green Net National Product and Genuine Savings). Macroeconomic adjustment by all indicators is possible in the framework of the extended or integrated Environmental and Economic Accounting system which was suggested by UNSTAD in their 1993 and 2003 Guidebooks (13).

The basic methodology of the calculation of environmentally adjusted green Net National Product (gNNP) is as follows:

$$g\,NNP = GNP - Dc - Dn \qquad (6)$$

Where:

GNP - Gross National Product

NNP - Net National Product

Dc - Conventional depreciation (Depreciation of man-made capital or fixed assets)

Dn - Depreciation of Natural resources

In our study results of the natural resources degradation accounting have been adjusted with the amount of Gross National Saving, consumption and depreciation of man-made capital of that period, for the purpose to calculate the "genuine saving" indicator for Mongolia, defined as:

$$GrS = GNP - C - G \qquad (7)$$

where: GrS- Gross National Saving

C- Consumption

G - Government expenses

$$NS = GrS - D \qquad (8)$$

where:

NS- Net Saving

D- Depreciation of fixed assets

$$GS = NS - Dn \quad (9)$$

Where:

GS - Genuine Saving

In this case study we have implemented macroeconomic adjustments with the results of Forest resources degradation accounting by the above explained methodology.

3. Results

Physical accounting of total forest resources by area and physical accounting of commercial forests by volume are shown in Tables 1 and 2.

Table 1. Physical accounting of total forest resources by area

Year	Opening stock	Harvesting	Reforestation	Fire/ insect	Deforestation	Closing stock	Net changes
1976	13913.5	23.33	0.34	173.9	8.97	13878	-35.53
1980	13675.3	29.4	1.1	107.2	8.77	13643.7	-31.64
1985	13547.2	22.67	4.2	3.4	8.63	13533.1	-14.06
1990	13465	14.79	8.08	55	8.53	13454.4	-10.56
1995	13357.3	6.6	3.85	130	8.44	13340	-17.33
2000	12875.1	10.1	6	411.5	8.43	12826.7	-48.41
2005	12826.7	16.8	8	480	11.3	12767	-59.7
2006	12767	18.2	8	491.3	11.5	12705.5	-61.5

In the last 30 years, from 1976 to 2006, some 1208.0 thousand ha forest was depleted in Mongolia, due to above mentioned factors.

Table 2. Physical accounting by volume by commercial forests, 1976-2006

Opening stock	Harvesting	Reforestation	Growth	Deforestation	Fire/ insect	Illegal logging	Closing stock	Net changes
341400	2232	0.32	1442.5	276.5	863.94	0	339470	-1929.62
332835.1	2812	1.3	1417.4	270.5	332.57	0	330839	-1996.37
324391.6	2169	3.95	1405.4	266.1	16.89	0	323349	-1042.64
319926.7	1415	7.61	1385.5	263.2	273.24	0	319368	-558.33
319429.6	631	3.62	1376.4	260.2	120.5	500	319298	-131.68
317093	679	3.36	1129.5	260	836.6	800	315650	-1442.74
307022	609.9	6.8	1129.5	330	1400	1000	304818	-2203.6
304818	638	6.9	1129.5	350	2025	1000	301941	-2876.6

In terms of physical accounting reduction of Mongolian forest in timber resources in last 30 years was about 39 459.0 thousand m^3.

Table 3. Value of forest resources degradation in Mongolia, 1976 - 2006

Year	Net changes, 1000 m^3	Net rent, m^3/MNT	Degradation factor	Value of forest degradation, mln. MNT
1976	-1929,62	1070,799	0,002866	-5921,8
1980	-2196,37	3282,815	0,003384	-19475,5
1985	-1042,64	1469,24	0.004446	-6809,8
1990	-558,33	643,671	0.005675	-2039,5
1995	-131,68	10524,69	0.007242	-10036,6
2000	-1442,74	17644,8	0,009336	-214114,1
2005	-2203,6	20489,15	0.008416	-379981,5
2006	-2876,6	21500,65	0.008417	-520581,1

Table 4. Comparison of NNP of Mongolia with gNNP in terms of its forest degradation

Years	GNP	Depreciation	NNP	Forest degradation	green NNP	Ratio gNNP/NNP
1976	75790,9	3276,8	72514,1	-5921,8	66592,3	91,83359
1980	103923,6	4616,8	99306,8	-19475,5	79831,3	80,38855
1985	149235,3	7380,4	141854,9	-6809,8	135045,1	95,19946
1990	186802,4	8528,4	178274	-2039,5	176234,5	98,85597
1995	169797,1	15655,3	154141,8	-10036,6	144105,2	93,48872
2000	1167094,4	106525,5	1060568,9	-214114,1	846454,8	79,81139
2005	2878393,0	270102,8	2608290,2	-379981,5	2228308,7	85,43178
2006	3755521,6	304554,7	3450966,9	-520581,1	2930385,8	84,91492

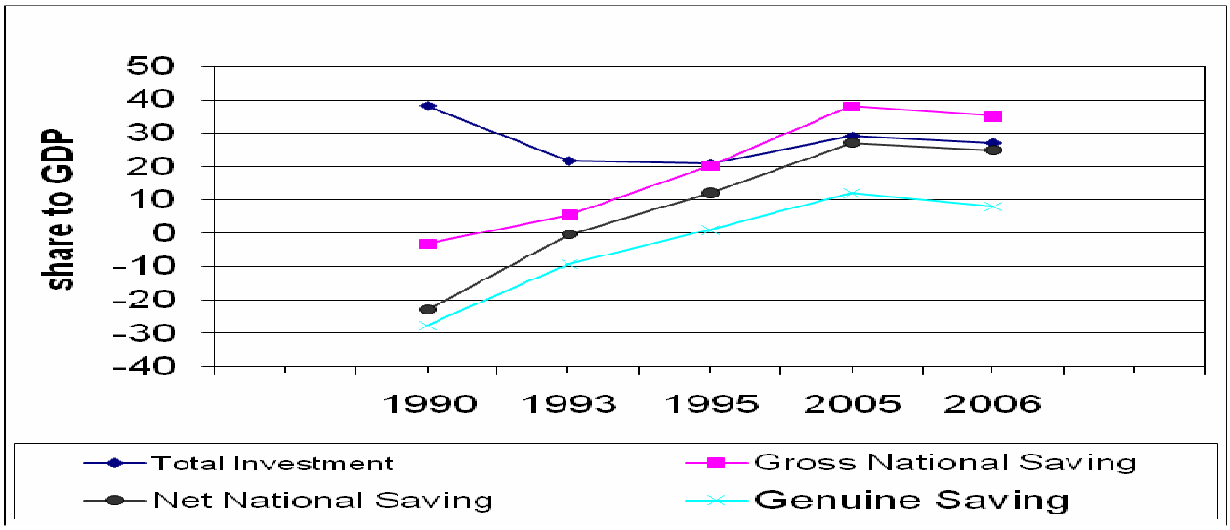
The results of this study show that degradation and depletion of forest resources have increased from year to year during the entire study period. This is due to expansion of forest fire and insects, the legal and illegal harvesting, and the quick growth of numbers of livestock.

Accordingly, the ratio of gNNP to NNP was 91.8 % in 1976 and 84.9 % in 2006. This means that the annual NNP of Mongolia will be reduced to 15.1 % in 2006 only by its forest resources degradation.

Figure 1 shows a Genuine savings comparison between the Net investment and the Gross National Saving in the percent share to GDP of Mongolia for the period 1990-2006, with the Forest resources degradation accounting. In some years there was a genuine savings with minus sign or its decreasing, which shows the unsustainablity of forest resources management in the country.

Figure 1. Genuine savings comparison of Net investment and the Gross National Saving

1990-2006



Forest resources degradation has increased in the last decade, which can be explained by the illegal logging and loss of forest resources by forest fire and disease.

4. Discussion

Mongolia is a country currently in transition from a centrally planned to a market economy. Therefore one complicating factor comes from the statistical basis of growth reported in former centrally planned economic systems. Specifically, the Material Product System is not the same as the accounting structure, which has been the basis for much of the existing literature on accounts adjustments in other market economy countries. Mongolia's differing treatment of capital depreciation and non-material sectors means that existing Mongolian data may have to be reorganized to achieve consistency with aggregates used under the conventional UN SNA accounting system.

The value of forest resources degradation of by this method is more acceptable and the lower level of interest rate (5%) is more comparable with discounted income value of forest growth. The results of this study can be incorporated with the development of Forest Resources Management policies for the future sustainable development of the Mongolian economy.

The other weakness of this forest resources degradation accounting is its inability to capture all the environmental benefits of the forest, including carbon statistics. Perhaps much of these services escape official statistics. The results of some surveys among the stakeholders and literature shows that it could add as much as 4-5 times more than material resources accounts. Another factor is the informal sector connected with illegal logging of the forest, which has significantly increased in recent years.

High inflation rates and the devaluation of the national currency in 1991-1998, due to economic reform, means some economic indicators need to be adjusted, including Forest resources exploitation cost - benefit analysis, with the adequate prices, using special deflators. Therefore this situation is specific for Mongolia and other countries in socio-economic transition.

The existing scheme of rent capture by natural resources uses taxes or royalties and is comparatively lower than it should be and was equal to only 3-5 % of the actual rent in case of forest resources. It shows that most of the rent income is earned by private companies, logging industries and illegal loggers. Therefore, a forest resources taxation system should be improved on the basis of its degradation accounting.

In future sectoral studies it should be possible to compare forest resources degradation with the forestry sector's economic development indicators, if it is developed separately.

5. Conclusions

This study is the first effort to apply forest resources and environmental accounting in Mongolia. Future actions need to be followed by the institutionalization and adoption of the green accounting procedure in the country. The proposed methodology of Forest resources degradation accounting is more suitable for the specific case of Mongolia, but in the future it needs improvements in terms of including ecological and social benefits of the forest. It can be improved through the experience of sharing with other countries and researchers in regard to global sustainable forest management objectives.

The ratio of forest resources degradation based Green Net National Product to NNP (79.8-91.3%) is comparatively high, so it indicates a need for more sustainable forest management approaches.

Future improvement of economic incentives and instruments for sustainable forest resources management are recommended, particularly for community based forest resources management, to reduce illegal logging and losses from forest and steppe fire.

We recommend future specific case studies of forest resources degradation at local and community level, including depletion of all the economic, ecological and social benefits of the forest.

It is also suggested that the results of this case study be used for the collaborative learning and university level training, with the involvement of forest management stakeholders, students, teachers and researchers on participatory action research on forests.

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