

## Forest Resources Accounting in China

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### Abstract

Forest resources accounting is a hot research issue currently. According to the latest forest resources inventory data in the 7<sup>th</sup> and 8<sup>th</sup> ones, this paper established physical and monetary accounts, and preliminary carried out forest resources accounting from 2008 to 2013 in China on the basis of national economic accounting theory and the latest System of National Accounts (SNA2008) and the System of Environmental and Economic Accounting (SEEA2012) of United Nations. The results show that forest resources in physics are increased from 2008 to 2013, the average annual growth rate for standing timber and forestlands is about 0.44% and 2.01% respectively. Forest resources in monetary are also increased, the average annual increasing rate is about 2.10%, the asset-liability ratio is 20.86%, less than the safety warning line 75% of asset-liability ratio. The study also discussed some issues on forest resources accounting and management etc. according to the results of the study in China.

**Keywords:** Accounts; China; Forest Resources; Resources Management; SEEA; Value Accounting

### Introduction

In recent years, forest resources accounting has become a hot issue [1]. The international research on forest resources accounting began in 1991, and Bartelmus proposed The System for Integrated Environmental and Economic Accounting (SEEA), and he promoted the development and application of the SEEA framework initially [2]. Subsequently, the United Nations held its Earth Summit in Rio de Janeiro, Brazil in 1992 to promote the development of the integrated environmental and economic accounting [3]. In order to solve the increasingly prominent environmental problems in the course of economic operation, as a satellite account system of 1993 SNA (System of National Accounts), the environment accounting has been incorporated into the national economic accounting system. From 1993, the official release of integrated environmental and economic accounting system, the United Nations Statistics Division has released SEEA1993, SEEA2003, SEEA2012 and other different versions of environmental economic accounting system [4].

Forest resources and water accounting is currently mostly studied in international projects. Nikodinoska et al. studied the comprehensive environmental economic accounting system for

woody biomass and established a multi-method environmental accounting framework [5]. Canada, Australia, the United Kingdom and other countries have established forest resources accounting accounts and began to publish relevant statistical bulletins nationally. The research on the contents and methods of forest resources accounts relative to other resource accounts is mature. The United States, Russia, Japan, South Korea, India, Turkey, Norway, Italy and other countries studied the forest resources accounting in different extent to different degree.

The study of forest resources accounting in China began in the 1990s. In 1991, Li Jinchang raised the theory and method of natural resources assessment earlier, and his study mainly was conducted from three aspects: the classification of natural resources assets, the total accounting and how to integrate them into the national economic accounting system [6]. In 1997, He Weiren mentioned the value accounting of natural resources and has established a framework for analyzing economic and environmental issues and the relationship between them [7]. In 2000, Lei Ming constructed CSEEA according to SEEA framework and calculated green GDP of natural resources in 1995 in China [8]. In 2003, Gao Minxue put forward ideas and methods for environmental accounting in China [9,10]. In 2008, Li Jinhua designed a relatively complete system of Chinese environmental and economic accounting and made a detailed discussion and analysis of related issues according to the SEEA in China [11]. Recently, the research on forest resources

accounting methods has gradually been enriched. Some new contents are being added. Zhang Ying took the studies of Jilin Forest Industry Group and Zalantun City of Inner Mongolia as an example, and discussed the physical and monetary accounts, stock and flow accounts in details, and established the balance sheet of forest resources [12, 13]. Li Huixia et al. conducted an exploratory study on the establishment of China's forest resources balance sheet [14]. In a word, forest resources accounting in China is still developing, and in continuous improvement and enrichment.

## Data and Methods

### Data

According to the forest law in China, Forest resources included forests, trees, woodlands and wild animals, plants and microbes that live on forests [13]. Therefore, forest resource accounting is simply defined as forestland, standing timber (forests and trees) accounting.

According to the SEEA2012 of United Nations, forest resources accounting should carry out from the two ways, that is physical accounting and monetary accounting. Each of them also includes stock and flow accounting. Therefore, the data in this study are mainly coming from China Forest Resources Inventory [15], China Forestry Statistical Yearbook [16] and so on. Specifically, the area of forest land and the volume of standing timber etc. come from the eighth forest resources inventory. Data on woodland and timber prices derived from the China Forestry Statistical Yearbook and related research report [17].

The eighth forest resources inventory is the latest resources inventory, it completed in 2013 in China. Which provides abundant data and information for the forest resources accounting and management. Accounting period in this study is defined as the seventh to eighth national forest inventory period, that is 2008 to 2013. Specifically, the accounting beginning of the period (opening stock year) is 2008, that is the last year of the seventh forest inventory. The close stock year is 2013, and that is the last year of the eighth forest inventory in China.

### Methods

The evaluation of forest land and standing timber is the primary factor in forest resources accounting. In particular, their valuation method is key.

#### Forest land

Forest land evaluation method is used the land expected price approach. The formula for calculating is:

$$V = \frac{a}{1+r} + \frac{a}{(1+r)^2} + \frac{a}{(1+r)^3} + \dots + \frac{a}{(1+r)^n} \quad (1)$$

As  $n \rightarrow \infty$ , the formula is simplified as  $V = \frac{a}{r}$  (2)

In which,

V - forest land expected Value,

a - annual average expectation of forest land rent,

r - discount rate.

#### Standing timber

Standing timber evaluation is commonly conducted according to age group and forest management types, among which Cost Replacement (CR), Current Market Price (CMP), and Net Present Value (NPV) are usually adopted for young aged forests, middle-aged forests and matured forests. The calculation formula for Cost Replacement (CR) and Net Present Value (NPV) is respectively:

$$V_n = k \cdot \sum_{i=0}^n c_i \cdot (1+p)^{n-i+1} \quad (3)$$

$$V_{npv} = \sum_{i=0}^n \left[ \frac{R_i - C_i}{(1+P)^i} \right] \quad (4)$$

In which,

V<sub>n</sub> - The value of young aged forests,

C<sub>i</sub> - The production cost of the i year

P - Rate of interest,

K - Adjustment coefficient,

n - Age of forest stand,

V<sub>npv</sub> - The value of middle-aged forests and matured forests,

R<sub>i</sub> - The revenues in i year,

C<sub>i</sub> - The costs in i year.

In the broadest sense, the Net Present Value method is usually used to evaluate the value of forest resources, it can be obtained a satisfaction result.

## Results

### Physical Accounting

Based on above data and methods, the physical accounting is shown in Table 1.

| Items   | Opening stock (2008) | Changes (2008-2013) | Closing stock (2013) |
|---|----------------------|---------------------|----------------------|
| Total forestland (10000 hm <sup>2</sup> )   | 30378.19             | 667.99              | 31046.18             |
| Woodlands   | 18138.09             | 979.41              | 19117.5              |
| Open forestland   | 482.22               | -81.54              | 400.68               |
| Shrub land  | 5365.34              | 224.88              | 5590.22              |
| Non-woodlands   | 1132.63              | -421.88             | 710.75               |
| Nursery land  | 45.4                 | 5.24                | 50.64                |
| Unstocked forestland  | 709.61               | 315.14              | 1024.75              |
| Suitable land for forest  | 4403.54              | -445.93             | 3957.61              |
| Auxiliary production of forestland  | 101.36               | 92.67               | 194.03               |
| Standing timber (10000m <sup>3</sup> )  | 1455393.79           | 152012.43           | 1607406.22           |
| Forest stock  | 1336259.46           |                     | 1477908.82           |
| Young-aged forest   | 148777.11            | 14263.19            | 163040.3             |
| Middle-aged forest  | 386141.65            | 24458.71            | 410600.36            |
| Nearly-matured forest   | 264983.39            | 38461.4             | 303444.79            |
| Matured forest  | 315872.22            | 40490.6             | 356362.82            |
| Over-matured forest   | 220485.09            | 23975.46            | 244460.55            |
| Open forestland stock   | 11423.77             | -853.74             | 10570.03             |
| Scattered trees' stock  | 74468.12             | 4390.91             | 78856.03             |
| Stock of trees on the "Four Sides"  | 33242.44             | 6825.9              | 40068.34             |
| Total stock   | 1485771.98           | 152680.42           | 1638452.4            |
| * Trees planted next to village, house, road and water.   |                      |                     |                      |
| <b>Source:</b> State Forestry Administration, P. R. China. 2014. Forest Resources in China - The 8 <sup>th</sup> National Forest Inventory. |                      |                     |                      |

**Table 1:** Physical Accounting of Forest Resources from 2008 to 2013 in China.

As shown in Table 1, from 2008 to 2013, total forest resources increased in China. The forestland was 303.781 million hm<sup>2</sup> in 2008 and in 2010 it was 310.4618 million hm<sup>2</sup>, an average annual increase rate of 0.44%. About standing timber, the stock in 2008 was about 14.554 billion m<sup>3</sup> and 16.074 billion m<sup>3</sup> in 2013, which increased about 2.01% annually. In addition, during the accounting period, the stock volume of all ages of forests increased and reflects an increasing trend.

### Monetary Accounting

According to the formula (1) to (4) and the China Forestry Statistical Yearbook 2009 and 2014, calculated price of forestland and forest stock in 2008 and 2013 are respectively 18225.00 RMB yuan/hm<sup>2</sup>, 217.17 RMB yuan/m<sup>3</sup> and 24774.00 RMB yuan/hm<sup>2</sup> and 281.50 RMB yuan/m<sup>3</sup>. On this basis, further monetary accounting is shown in Table 2.

| Items                                      | Opening stock (2008) | Changes (2008-2013) | Closing stock (2013) |
|--|----------------------|---------------------|----------------------|
| Total forestland<br>(100 million RMB Yuan) | 55364.26             | 2560.85             | 57925.11             |
| Woodlands                                  | 41940.05             | 3060.24             | 45000.29             |

|   |           |          |           |
|---|-----------|----------|-----------|
| Open forestland                           | 570.92    | -126.47  | 444.02    |
| Shrub land                                | 4115.83   | 230.19   | 4346.02   |
| Non-woodlands                             | 1393.14   | -712.87  | 680.27    |
| Nursery land                              | 573.08    | 88.74    | 661.82    |
| Unstocked forestland                      | 848.64    | 483.04   | 1331.68   |
| Suitable land for forest                  | 5737.87   | -758     | 4979.87   |
| Auxiliary production of forestland        | 184.73    | 295.96   | 480.69    |
| Standing timber<br>(100 million RMB Yuan) | 94733.72  | 13913.78 | 108647.5  |
| Forest stock                              | 89832.25  | 13338.92 | 103171.17 |
| Young-aged forest                         | 3243.34   | 402.22   | 3645.56   |
| Middle-aged forest                        | 16604.09  | 1408.82  | 18012.91  |
| Nearly-matured forest                     | 23053.55  | 4307.68  | 27361.23  |
| Matured forest                            | 27638.82  | 4534.95  | 32173.77  |
| Over-matured forest                       | 19292.45  | 2685.25  | 21977.7   |
| Open forestland stock                     | 465.24    | -44.59   | 420.65    |
| Scattered trees' stock                    | 2973.72   | 231.91   | 3205.63   |
| Stock of trees on the "Four Sides"        | 1462.51   | 387.54   | 1850.05   |
| Total                                     | 150097.98 | 16474.63 | 166572.61 |

**Table 2:** Monetary Accounting of Forest Resources from 2008 to 2013 in China.

As shown in Table 2, the value of forest resources in China is about 15.010 trillion RMB yuan in 2008 and 16.657 trillion RMB Yuan in 2013, with an average annual growth of about 2.10%. During the accounting period, the value of forestland and standing timber all indicated an increasing trend with an average annual growth of 0.91% and 2.78% respectively. There's also some value going down, such as the value of open forestland, non-woodlands, suitable land for forest and open forestland stock, the value reduced by 4.99%, 13.36%, 2.79% and 1.20% respectively annually. A non-wood land has the greatest reduction in value.

In addition, we also calculated the assets-liability ratio of forest resources. We defined the whole forest resources as the total forest assets, according to the China Forestry Statistical Yearbook 2009 and 2014 as well as Zhang Ying et al. study [13], the assets-liability ratio = total liabilities / total assets × 100% [14]. It calculated is about 20.86%, much lower than the international alert level of 75% [17]. This shows that the debt ratio of forest resources in China is relatively low from the perspective of forest management. on the other hand, it also shows that the harvesting and utilization levels of forest resources are still relatively low. It needs to be gradually strengthened and improved.

## Discussion

Based on the conclusions above, we can also discuss the related issues:

- The forest resources accounting is closely related to the pricing of resources. Therefore, the method of forest resources evaluation directly affects the value of resources. At present, most of the international accounting of forest resources adopt the net present value method and the direct market transaction price method [1]. Therefore, how to determine a set of normative and unified theoretical system of forest resources accounting from the economic theory is an urgent problem to be solved in China.
- Stock and flow accounting is necessary. Stock accounting reflects wealth condition, and flow accounting reflects production of a country. Both reflect different aspects of accounting. The main purpose of it is to reflect the wealth and management situation of national forest resources. Therefore, both are indispensable and cannot be biased.
- In forest resources accounting, the loss due to economic reasons and natural causes should be distinguished. Because the loss of economic reasons can be taken into the SNA, natural causes cannot. This should attract attention in future forest resources accounting.

## Conclusions

Through the forest resources accounting in China from 2008 to 2013, we can see that:

- It is feasible and possible to carry out the forest resources accounting based on the available data and the existing research results. In particular, the System of Integrated Environmental Economic Accounting (SEEA), published by five UN departments, provides the standard basis and technical support for accounting. Chinese forestry inventory data and related forestry statistics has also become an important basis for forest resources accounting. Therefore, it is of great significance to include the accounting of forest resources in the System of National Accounts (SNA), so as to fully reflect the value of forest resources and make better services for management and decision-making.
  - The total amount of forest resources in China increased continuously from 2008 to 2013, with an increase of about 6.68 million hm<sup>2</sup> of forest land and an increase of about 1520.12 million m<sup>3</sup> of forest stock. This shows that the effect of forest resources protection in China is obvious. In terms of the value of forest resources, it was about 150098.00 billion RMB yuan in 2008 and 166572.66 billion in 2013, the average annual increase is about 2.10%. During the accounting period, the value of forestland and standing timber all showed an increasing trend, with an average annual growth rate of 0.91% and 2.78% respectively. As can be seen, the value of forest land increased slowly, and the value of standing timber increased rapidly. In fact, China is still in the process of the forest tenure reform, and the market of forestland transfer has not yet been fully established which affect the growth of price and value of forestland. Also, due to the impact of natural forest protection policies, decreasing forest consumption is another reason for the increase in the value of forest resources.
  - From 2008 to 2013, the assets-liability ratio of forest resources in China is calculated about 20.86%, far below the international warning level of 75%. On the one hand shows that Chinese resource protection policy is successful; on the other hand, also shows that besides protecting forest resources, its level of development and utilization also needs to be improved.
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