

*Small-scale Forest Economics, Management and Policy*, 1(1): 25–37, 2002

## **The Shrinking Profitability of Small-scale Forestry in Japan and Some Recent Policy Initiatives to Reverse the Trend <sup>1</sup>**

Ikuo Ota

Section of Forest Policy and Economics  
Graduate School of Agriculture, Kyoto University  
Kitashirakawa Sakyo, Kyoto 606-8502, Japan

About 80% of annual wood fiber consumption in Japan is imported. Even though most of the land surface is covered by forests in Japan, the domestic forestry and forest industry are threatened by such imports flooding the local market. Fragmented land ownership, steep terrain, rapid growth of weeds, and high labor costs have all contributed to the decline of domestic forestry. Further, the purchasing power of the Japanese Yen has become very strong in recent years, and the decreasing prices of imported timber have depressed the prices of domestic timber, eroding profitability and discouraging small-scale forestry. In spite of these difficult circumstances, there are several interesting new developments in Japanese forestry. One is the revision of the *Basic Forestry Law* of 1964, through which the Japanese government is steering forest policy from timber production towards environmental services. Because of this change, new ways to assist rural forestry activities will become available in the near future. Another change is the certification movement, where recent examples of Japanese companies acquiring ISO 14001 and Forest Stewardship Council (FSC) forest certifications provide hope to depressed domestic forestry activities. In particular, FSC group certification is useful in motivating small-scale forest owners to implement and maintain sustainable forestry practices.

### **INTRODUCTION**

Small-scale forest holdings dominate the Japanese forestry scene apart from national and municipal forests. Most of the domestic forest production comes from such private forestlands. Millions of hectares of softwood plantations have been grown by such

---

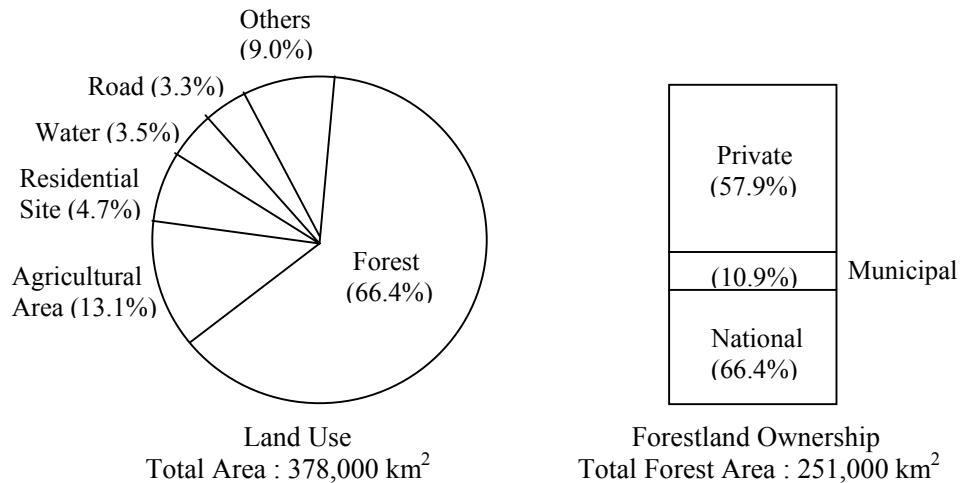
<sup>1</sup> This paper is based on the presentation at IUFRO Group 3.08.00 Symposium at Joensuu, Finland 2001. The original article, 'The economic situation of small-scale forestry in Japan', is in Niskanen and Vayrynen (2001).

small-scale forest owners since the 19th Century. Forestry has the potential to be one of the major economic activities in most of the rural area throughout the country. However, forestry and forest industry in Japan have been under pressure from abroad for decades, and production of timber has been decreasing since the late 1960s. Currently, consumption of foreign wood and fiber, including pulp and paper, is almost four times as high as that of domestic products. The share of sawn domestic timber supply for housing construction is slightly higher, but is still only about half that of imported timber. Under such market conditions, the prices of timber products are likely to be determined by prices of imports, and forest owners in Japan must unwillingly accept low prices.

This paper examines the general economic situation of Japanese forestry, in which most stakeholders are involved in small-scale forestry. Market structure for domestic logs and timber, and price and income trends, are then discussed, and production costs of construction timber are analysed. Finally, future prospects for Japan's small-scale forestry are considered.

### GENERAL STRUCTURE OF JAPANESE FORESTRY

As shown in Figure 1, 25 M ha or two thirds of the land surface of Japan is covered by dense closed forest. Because the islands are oriented north to south, and high mountains are found on the major islands, the climate varies from sub-alpine to sub-tropical. In addition, most of the islands are located in monsoon areas. These conditions make Japan rich in tree species, and a variety of types of forestry and forest industry activities have been practiced for centuries.



**Figure 1.** Land use and forestland ownership pattern of Japan, 1999

Source: Ministry of Land and Traffic (2001), Forestry Agency (2001).

Timber production is concentrated in private forests, which make up 57.9% of the total forested area. Over 76% (14.3 M m<sup>3</sup>) of the total timber harvested (18.9 M m<sup>3</sup>) in 1999 was from private forestlands. In recent years, the private sector has become increasingly important in forestry, because of drastically decreased timber production in national forests.

A special feature of Japanese forests is the large stock of plantations, which comprise 10 M out of 25 M ha of total forestland. Most of these plantations are even-aged conifer stands, planted after the initial harvest of hardwoods following the energy revolution in the 1950s, when the household energy source changed from charcoal to coal or oil. The total timber stock is about 3.5 B m<sup>3</sup>, of which 1.9 B m<sup>3</sup> are held in conifer plantations, and another 450 M m<sup>3</sup> are held in natural conifer stands. Two of the most common species in plantations are Japanese cedar (*Cryptomeria japonica*) and Japanese cypress (*Chamaecyparis obtusa*). The average rotation length for Japanese cedar is between 40 and 70 years, and that for Japanese cypress is slightly longer.

Most private forest holdings are small. Table 1 presents the area distribution of forest ownership by private households. Of the total of 2.5 M forest households, 1.5 M hold less than 1 ha, and another 780,000 hold 1-5 ha. Nearly 90% of forest holdings are thus categorized in the less than 5 ha class, and the national average for the area of forest owned is 2.7 ha. The other major types of private ownership are 'company' and 'communal' land, but these are also small in scale; the average forest area of company holdings is 34.6 ha and that of communal holdings is 19.3 ha. No large forestland holding companies are currently active in Japan.

**Table 1.** Distribution of forest ownership by private households in Japan, 1990

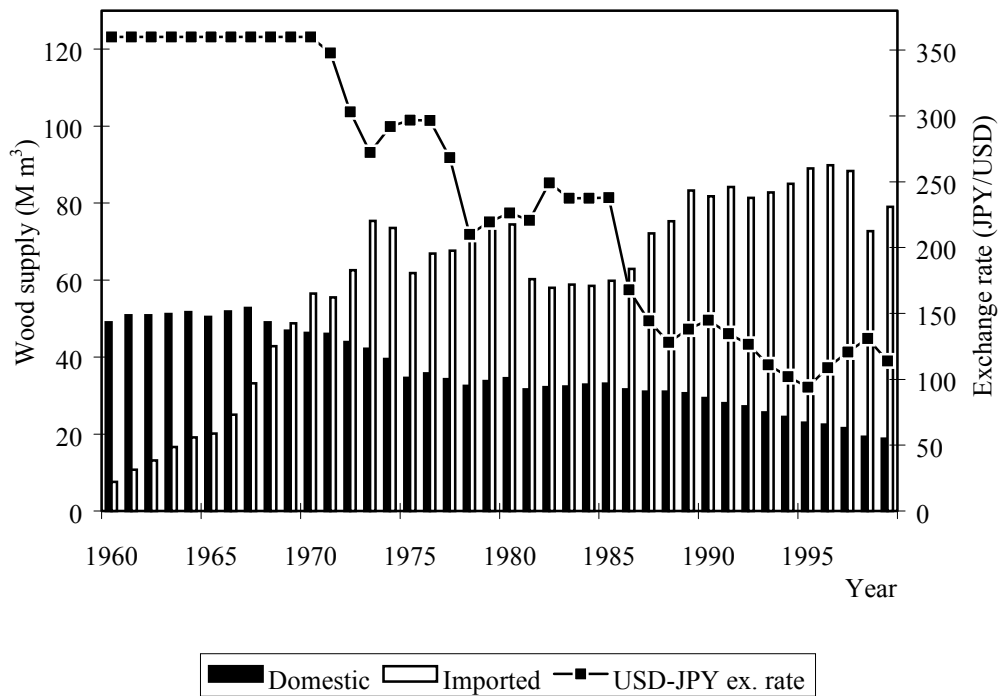
Class	Number of households		Area	
	(houses)	(%)	(ha)	(%)
0.1-1 ha	1,452,255	57.89	560,797	8.31
1-5 ha	777,207	30.98	1,624,273	24.06
5-10 ha	150,661	6.01	973,948	14.42
10-20 ha	79,281	3.16	1,014,582	15.03
20-30 ha	23,294	0.93	527,311	7.81
30-50 ha	14,664	0.58	520,710	7.71
50-100 ha	7,490	0.30	478,931	7.09
100-500 ha	3,376	0.13	612,095	9.07
500-ha	377	0.02	439,474	6.51
Total	2,508,605	100.00	6,752,121	100.00

Source: Ministry of Agriculture, Forestry and Fishery (1992).

### PROFITABILITY OF PRIVATE FORESTRY

Production of domestic timber has been decreasing steadily since the late 1960s. The current level of production is only about 40% of its historical maximum. In contrast, the volume of imported wood has been increasing. Figure 2 shows the trend of domestic production and imported wood volumes over the past 4 decades. The Japanese consume about 100 M m<sup>3</sup> of wood fiber annually, and this decrease of domestic production is caused by the increase in imports. Self-sufficiency in timber has now fallen to just below 20%.

On the other hand, in the past 30 years, the Japanese yen (JPY) has gained in strength (Figure 2). Until 1971, the US dollar (USD) was worth 360 JPY, whereas in 2000 it was valued around 110 JPY. This was primarily a result of strong domestic industries, such as automobiles and electronics; as a consequence, foreign goods, including timber, wood chips, and other forest products, have become less expensive in Japan. The JPY has also appreciated relative to European currencies. One Euro was equivalent to 183 JPY in 1990, but only 133 JPY in 1998.



**Figure 2.** Trend of Japanese domestic production and imported wood volumes and USD-JPY exchange rate, 1960-1999

Source: Forestry Agency (various years), Ministry of Finance (2001).

The timber market situation in the 1980s and 1990s was very different from that 20 years earlier, when timber was in short supply and the government requested trading companies to urgently import more wood to support expanding economic growth, causing the volume of wood imported to increase dramatically. Since the late 1970s, the Japanese have been able to purchase wood either from domestic or foreign sources, and price has thus become the driving market force. Imports have continued to increase with the increased strength of the JPY.

The following regression equation was derived by using the data for Figure 2 to explain the relationship between exchange rate and imported wood volume.

$$\text{IMP} = 102.639 - 0.179 \text{ EXC} + 154.947 \text{ DUM81}$$

$$(t) \quad (34.580^*) \quad (-10.074^*) \quad (5.178^*)$$

where IMP is volume of imported wood (M m<sup>3</sup>);  
 EXC is the exchange rate between USD and JPY (JPY/USD);  
 DUM81 is a dummy variable for the oil shock periods;  
 (1970-80: 1, and 1981-99: 0); and  
 the data period is 1970 to 1999 (30 years).

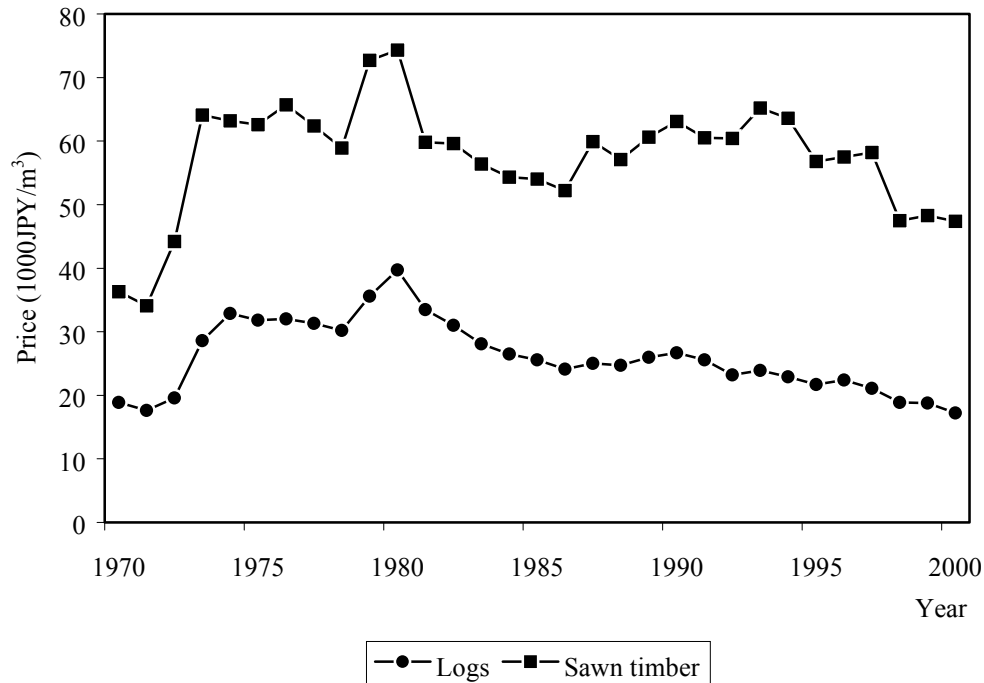
The equation has an adjusted  $R^2$  value of 0.801, and an  $F$ -statistic of 59.242 (significant at the 0.01% level). A high correlation is found between these two variables. A decrease in JPY/USD exchange rate of one unit is associated with an increase in import volume of about 180,000 m<sup>3</sup>.

Figure 3 shows the trend of log and sawn timber prices of Japanese cedar. The log price here is the average sawmill price of medium-sized logs (14-22 cm diameter, 3.65-4.00 m long), and the sawn timber price is the average price of typical construction timber lengths (10.5 cm x 10.5 cm, 3.00 m long) at retail. Disregarding the influence of the second oil shock in 1979, log prices fell constantly, while sawn timber prices increased between 1986 and 1994. However, because of sharp fall in timber prices since 1997, the difference between the price of timber and the price of logs is becoming smaller. As a result, sawmillers as well as forest owners have increasing difficulty in continuing their business.

To illustrate the declining values of wood production during this period, Table 2 lists real and nominal log prices of Japanese cedar, as well as the Wholesale Price Index (WPI). Increases of nominal prices in the 1970s were mostly offset by increases in the WPI. The real price was relatively stable during this decade, but began decreasing rapidly thereafter. The nominal price in 2000 was slightly below of that in 1970, but the real price decreased nearly 50%, from 32,530 JPY/m<sup>3</sup> to 17,805 JPY/m<sup>3</sup>.

Table 3 shows the average annual profit of forest owner households in three size classes: 20-50 ha, 50-100 ha, and 100-500 ha. Almost all of the owners in the 20-50 ha class and most in the 50-100 ha class do not consider forestry their principal occupation. Typically, these owners are farmers who also have off-farm employment. In all size classes, profits have fallen by more than 50% in the past 10 to 15 years, and forest owners have been unwilling to harvest their timber under such unfavorable market

conditions. Overall, the share of income from forestry within total household income has dropped from 27% in 1985 to 13% in 1998.



**Figure 3.** Average log and sawn timber prices of Japanese cedar, 1970-2000

Source: Forestry Agency (various years).

**Table 2.** Nominal and real log prices of Japanese cedar, 1970-2000

Year	Nominal price (Yen/m <sup>3</sup> )	Real price (Yen/m <sup>3</sup> )	WPI
1970	18,900	32,530	58.1
1975	31,800	34,868	91.2
1980	39,700	33,001	120.3
1985	25,600	21,387	119.7
1990	26,700	24,608	108.5
1995	21,700	21,700	100.0
2000	17,200	17,805	96.6

Source: Forestry Agency (various years), Ministry of Finance (2001).

Of course, the exchange rate is not the sole cause of the slump in Japanese forestry. The small and fragmented holdings, unbalanced age distribution of plantations, high planting and logging costs on steep terrain, technological improvements of logging and sawing abroad, development of engineered wood products in North America and Europe, and many other factors have all contributed to this market situation. However, the main reason for the recent rapid rise in sawn timber imports from northern Europe (mainly spruce for laminated lumber) has been the strong relationship with the exchange rate between the JPY and the Euro. The tremendous increase in purchasing ability has aggravated the problems of domestic industries, including forestry. Whereas a company such as Toyota can transfer its automobile factory to anywhere that has convenient market access and less costly labor, small-scale forest owners have no such opportunities.

**Table 3.** Average annual profit of forest ownership in three different classes in Japan, 1975-1999 (1000 JPY)

Year	Size class		
	20-50ha	50-100ha	100-500ha
1975	521	1,185	3,585
1980	708	1,508	4,719
1985	542	1,372	4,370
1990	574	627	4,115
1995	477	723	2,181
1999	247	585	1,109

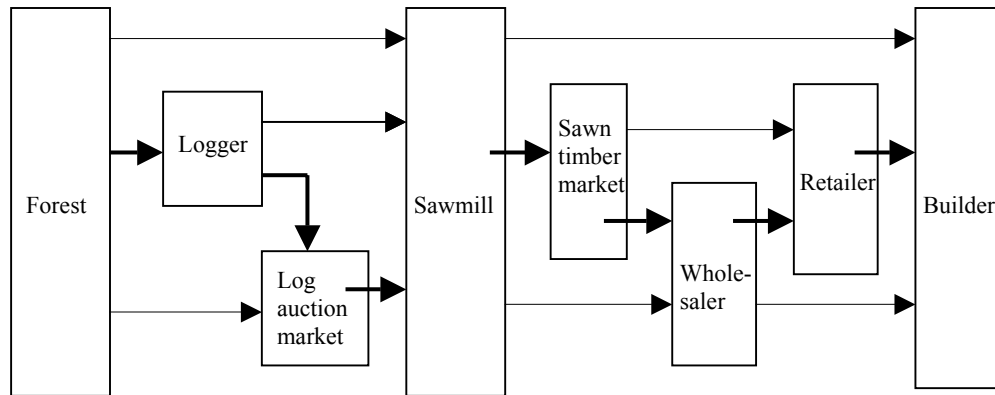
Source: Ministry of Agriculture, Forestry and Fishery (various years).

### **A DETAILED ACCOUNT OF STUMPAGE AND SAWN TIMBER SALES: A SERIES OF CASE STUDIES**

Illustrating the flow of logs and sawn timber distribution in Japan is not a simple task. Traditionally, there are many intermediate agencies and complex routes to and from these agencies, because consumers prefer a variety of species from particular areas, and special features of wood quality. Figure 4 is a simplified chart of the distribution of logs and sawn timber in Japan. The most popular route from the forest to house builders is indicated by the thick arrow. Logs are harvested and yarded by loggers, transported to log auction markets, and purchased by sawmills. Sawn timber is priced at sawn timber markets and distributed to builders through wholesalers and retailers. The prices of logs and sawn timber, especially construction lengths, are determined by species, tree ring density, surface color, texture, number of visible knots, and several other factors.

Although there is sufficient supply and demand at log auction markets and sawn timber markets to create competitive market conditions, the price of domestic logs and sawn timber is strongly influenced by the price of imported substitutes. For example, the

retail price of Japanese cedar construction lengths cannot much exceed the price of western hemlock construction lengths from north America. Significantly higher domestic prices are only possible for particular specialized products, such as the decorative poles that are used in traditional Japanese features.



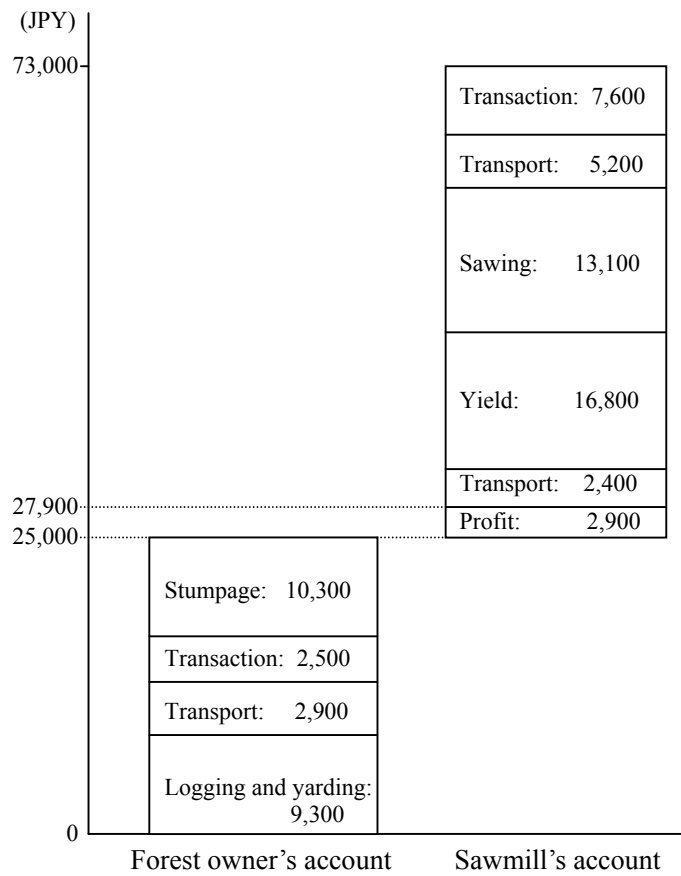
**Figure 4.** Typical supply chain of domestic logs and sawn timber in Japan

To reveal the real economic situation of small-scale forestry, the author conducted a series of surveys for sales accounts of stumpage and sawn timber. The surveys were conducted in a small sawmill located in Wakayama Prefecture, which is one of the advanced forestry regions in western part of Japan. Japanese cedar construction lengths (10.5 cm x 10.5 cm x 3 m) were chosen as an example, and details of transactions were recorded.

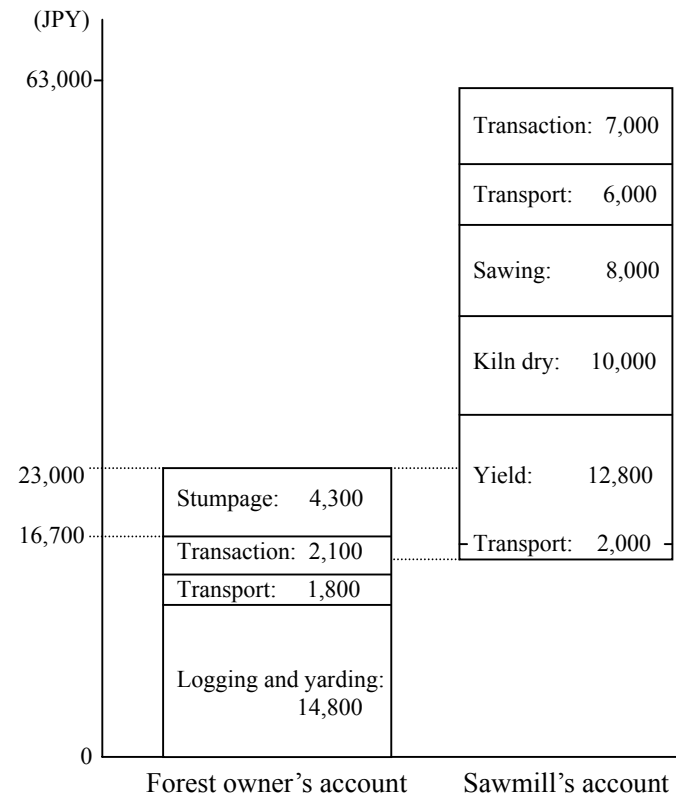
Figure 5 summarizes the results of the first survey, conducted in 1994. A log was purchased at a local auction market for 25,000 JPY/m<sup>3</sup>. The log, cut from a 55-year-old plantation tree, was sawn and planed without kiln drying. The timber was then sent to a timber market in Tokyo and realized a price of 73,000 JPY/m<sup>3</sup>. The detailed account was as follows: 2400 JPY/m<sup>3</sup> for transportation costs (including the cost of the transaction at the log auction); 16,800 JPY/m<sup>3</sup> for the yield when converting from log to sawn lengths; 13,100 JPY/m<sup>3</sup> for sawing; 5200 JPY/m<sup>3</sup> for transportation to the timber market in Tokyo; and 7600 JPY/m<sup>3</sup> for the transaction cost at the market. These costs amount to 45,100 JPY/m<sup>3</sup>; subtracting this amount and the purchase price of the log (25,000 JPY/m<sup>3</sup>) from the sales price (73,000 JPY/m<sup>3</sup>), the sawmill made a profit of 2900 JPY/m<sup>3</sup>.

The survey was continued at the auction and with the contract logger. In this example, trees were harvested by the crew of the forestry cooperative that supervised the auction market. Transaction costs were therefore very low compared to those of other private loggers. The log was harvested from a small-scale forest in the same village as the auction. The logging and yarding cost was 9300 JPY/m<sup>3</sup>, transportation to the auction





**Figure 5.** Accounts of a forest owner and a sawmill for construction lengths from 55 years old Japanese cedar in 1994



**Figure 6.** Accounts of a forest owner and a sawmill for construction lengths from 70 years old Japanese cedar in 2000

was 2900 JPY/m<sup>3</sup>, and the market transaction cost was 2500 JPY/m<sup>3</sup>. Subtracting these costs from the sale price, the final stumpage price collected by the forest owner was 10,300 JPY/m<sup>3</sup>. In this case, the logging cost was relatively low because of the location of the site. The average logging and yarding cost in this area was nearly 15,000 JPY/m<sup>3</sup>, and the average stumpage price was approximately 5000 JPY/m<sup>3</sup>.

Figure 6 shows the results of the second survey, conducted in 2000. The data shows the cost and price of typical example during the period between September and October 2000. The market price of a 70-year-old Japanese cedar log was 23,000 JPY/m<sup>3</sup>. By subtracting the costs of logging and yarding, transportation, and transactions, the stumpage price was calculated to be 4300 JPY/m<sup>3</sup>. Forest owners can only gain some profit from stumpage if the trees are old enough; in other words, trees under 55 years old would not be profitable at all now.

The sawmill account is more complicated. The market price for construction lengths was 63,000 JPY/m<sup>3</sup>, and the sum of costs was 46,300/m<sup>3</sup>: 7000 JPY/m<sup>3</sup> in transaction costs; 6000 JPY/m<sup>3</sup> for transportation to Tokyo; 8000 JPY/m<sup>3</sup> for sawing; 10,000 JPY/m<sup>3</sup> for kiln drying; 12,800 JPY/m<sup>3</sup> for yield; and 2000 JPY/m<sup>3</sup> for transactions in and transportation from the log auction. Subtracting these costs from the price of construction lengths, the acceptable purchasing price for a log should be below 16,700 JPY/m<sup>3</sup>. However, the log fetched 23,000 JPY/m<sup>3</sup> at the log auction market. In other words, the sawmill did not make any profit from this operation, and this calculation implies a further decrease of log prices in the near future. Construction lengths are one of the main products of many small sawmills in this area, but the business is in a difficult financial situation.

According to a governmental survey of silvicultural costs for plantation forestry, sum of the costs in real term is about 2.30 M JPY/ha for 50 years rotation length of Japanese cedar growing (Ministry of Agriculture, Forestry and Fishery, 1993). Supposing the interest rate as 2% and 4%, total cost would be equivalent of 5.14 M JPY and 7.76 M JPY respectively. Because stumpage volume of Japanese cedar plantation at age 50 is roughly 300 m<sup>3</sup>/ha, the stumpage price revealed in the survey is not be sufficient to cover the costs of silvicultural activities. High rate of subsidies for various practices are required to make plantation forestry profitable for small-scale forestry in Japan.

## DISCUSSION

The economic situation of small-scale forestry is growing more precarious in Japan. It will be difficult for the industry to break this 'vicious cycle' of low prices and reduced production. To revitalize domestic forestry, a strong trade policy would be desirable. However, this is almost out of the question, given the worldwide trend of free trade and globalism. The Japanese government is therefore seeking another solution. The direction of current forest policy in Japan is changing. The *Basic Forestry Law* of 1964 was intended to promote timber production as the primary objective of national forest policy, but the situation today is far from the ideal foreseen by the law. Therefore, a new law named *The Basic Forest and Forestry Law* was implemented on July 11, 2001.

Small-scale forestry has traditionally survived with the help of government subsidies based on the policy of the *Basic Forestry Law* of 1964. For example, forest owners could be subsidized up to 68% of the cost of new planting and pre-commercial thinning. In addition, every year the government pays large sums to support roads or machinery to enhance rural forestry. In the 1960s and 1970s, when forestry was strong, forestry practices realized both timber production and environmental services, which was referred to as 'reestablished harmony' in forestry. However, harmony has since disappeared, because appropriate practices are now lacking. Abandoned plantations on steep terrain can easily cause environmental disasters such as wind throws, soil erosion and landslides. Unfortunately, the number of such abandoned forests is gradually increasing because small-scale owners can no longer afford to maintain their forestland.

The primary objective of forest policy under the new law is to implement various environmental services. In addition to the above-mentioned domestic reasons, the law is influenced by an international movement for sustainable forest management practices following the 1992 Earth Summit in Rio de Janeiro. Timber production will thus officially have to relinquish its position of primary importance, although in reality it has not held this position for some time. Forestry will continue to play an important role in land stewardship and will no longer be concerned merely with timber production.

The role of small-scale forestry may or may not change. Because forestry practices are necessary in maturing plantations, government assistance to forest owners must not be discontinued. Although integration of forest management by accumulating dispersed holdings is planned, in most cases small-scale owners will continue to manage their own forestland for as long as possible. Direct income compensation or similar public support systems for forest owners are under consideration. With this kind of help, small-scale forestry may have a chance to continue to play a leading role, as before.

Another new movement is towards forest certification. Just before the turn of this century, several Japanese forestry enterprises acquired international forest certification. In 1999, Sumitomo Forestry Co. successfully acquired ISO 14001 certification for their 40,000 ha of forest land. Even though ISO 14000 series have been highly popular among Japanese industries, this was the first example of the forest sector having obtained environmental certification. Forest certification has since become quite popular.

In 2000, Hayami Forestry and the Yusuhara Forest Owners Cooperative were both certified by the Forest Stewardship Council (FSC). The former is a company run by a single large forest owner with about 1000 ha of forestland holdings in Mie Prefecture. It is also one of the country's leaders in sustainable forest practices, and this first trial of FSC certification has received much attention from the forestry sector. The Yusuhara Forest Owners Cooperative in Kochi Prefecture was the first forest management group to obtain FSC certification in Japan. It manages about 3300 ha of forestland belonging to 200 different, primarily small-scale, owners. The Yusuhara Forestry Cooperative is one of 1100 forestry cooperatives in Japan, but this new challenge brought with it sudden fame. This cooperative proved that even small-scale forest owners can be internationally certified, providing hope for domestic forestry. Two other forestry organizations followed to obtain FSC forest certification in 2001, and many others are preparing to be assessed all over the country.

Forest certification may be advantageous to domestic forestry, because a large volume of timber is still imported from countries that have unsustainable production methods. If Japanese people become more conscious of sustainability issues in forest resources and forestry, then domestic forest products may become preferred, in spite of higher prices.

## CONCLUDING COMMENTS

The inventory of domestic timber in Japan is large and increasing. However, imports are high, not because of a positive policy to seek foreign resources, but rather due to lack of appropriate trade and domestic forest policies. The profitability of Japanese private forestry is decreasing rapidly, which is easily explained by comparative advantage theory. However, such an interpretation is not useful to struggling small-scale forest owners. A responsible policy is necessary to maintain both forest health and timber production in the future.

The new *Basic Forest and Forestry Law* of 2001 as well as the forest certification movement are examples of constructive actions toward sustaining domestic forests and forestry. Efficient use of domestic resources with environmentally sound practices is one of the key actions that developed countries can implement to solve global environmental problems. In the 21st century, forest policy and environmental policy will converge, and the author sincerely hope that Japan will set an example in enhancing environmentally sustainable small-scale forest production.

## REFERENCES

- Forestry Agency (various years), Table for demand and supply of forest products, Tokyo.
- Forestry Agency (2000), Fundamental principles of forest policy reform, Forestry Agency, Tokyo.
- Forestry Agency (2001), Summary statistics in forestry, Tokyo.
- Hata, T. and Masuo, D. (1997), 'Forestry in Japan (II): Forest and rural development policy', in Y. Murashima, ed., Sustainable Management of Small Scale Forestry, Proceedings of IUFRO Symposium in Kyoto 1997, IUFRO Group 3.08.00 and 6.11.02, Kyoto University, Kyoto, pp. 252-257.
- Ministry of Finance (2001), White paper for economy and finance, Tokyo.
- Ministry of Agriculture, Forestry and Fishery (various years), Report on economy of forestry households, Tokyo.
- Ministry of Agriculture, Forestry and Fishery (1992), International agricultural and forestry census in 1990, Tokyo
- Ministry of Agriculture, Forestry and Fishery (1993), Report on silvicultural costs in 1991, Tokyo.
- Ministry of Land and Traffic (2001), White paper for land use, Tokyo.
- Murashima, Y. (1993), 'The current state of private forests in Japan.', in C. Simpson, ed., *Forestry and Rural Development in Industrialized Countries: Where Are We Going?*, Proceedings of IUFRO Fredericton Symposium, IUFRO Group 6.11.02, Fredericton, Natural Resource Canada, pp. 147-154.
- Niskanen, A. and Vayrynen, J., eds. (2001), *Economic Sustainability of Small-Scale Forestry*, EFI Proceedings No. 36, Joensuu, Finland.
- Nose, M. and Ito, K. (1997), 'Forestry in Japan (III): Production and consumption of timber', in Y.

- Murashima, ed., *Sustainable Management of Small Scale Forestry*, Proceedings of IUFRO Symposium in Kyoto 1997, IUFRO Group 3.08.00 and 6.11.02, Kyoto University, Kyoto, pp. 258-262.
- Ota, I. (1993), 'Depopulation in rural areas and the increasing role of forestry cooperatives in Japan', in C. Simpson, ed., *Forestry and Rural Development in Industrialized Countries: Where Are We Going?* Proceedings of IUFRO Fredericton Symposium, IUFRO Group 6.11.02, Fredericton, Natural Resource Canada, pp. 246-252.
- Ota, I., and Murashima, Y. (1996), 'Domestic log marketing in Japan', in IUFRO Project Group 3.04-00, *Forestliche Versuchs- und Forschungsanstalt Baden-Württemberg*, Proceedings from World Congress held in Tampere, Finland 1995, pp. 171-179.
- Ota, I. (1997), 'Regenerating forestry workers in Japan', in Y. Murashima, ed., *Sustainable Management of Small Scale Forestry*, Proceedings of IUFRO Symposium in Kyoto 1997, IUFRO Group 3.08.00 and 6.11.02, Kyoto University, Kyoto, pp. 72-79.
- Ota, I. (1999), 'Declining situation of Japanese forestry today and its challenges toward the 21st Century', *The Natural Resource Economic Review*, 5:103-124.
- Ota, I. and Murashima, Y. (2001), 'Afforestation policy in Japan : Its trend in the last half of the 20th Century and present status', in J. L. Herbohn, S. R. Harrison, K. F. Herbohn, and D. B. Smorffitt, eds., *Developing Policies to Encourage Small-scale Forestry*, Proceedings of international symposium in Kuranda, Australia 2000, pp. 212-219.
- Shinohara, H. (1995), 'Studies for timber distribution costs', Graduation thesis (Baccalaureate), Kyoto University, Kyoto.
- Tanaka, W. and Otsuka, M. (1997), 'Forestry in Japan (I): Resource, management and planning', in Y. Murashima, ed., *Sustainable Management of Small Scale Forestry*, Proceedings of IUFRO Symposium in Kyoto 1997, IUFRO Group 3.08.00 and 6.11.02, Kyoto University, Kyoto, pp. 245-251.