

Research note

Forest Tending Materials as a Strategy for Ecological Compensation

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【 Summary 】

In Taiwan, the high cost of afforestation discourages private forest landowners from investing in forest management. As a result, negative impacts occur, such as forest degradation and a downturn of economic output. To facilitate proper forest management by private forest landowners, it is important to stimulate village economies, promote social stability, and improve environmental quality. The goal of the study was to activate farmers' resourcefulness in utilizing juvenile wood from forest thinning and growth operations such as small-dimension wood as a more-stable source of income. This study investigated the profitability of promoting the use of assembly kits of small-dimension wood as curricular teaching resources in public elementary school classrooms. It was estimated that the market would be worth NT\$260 million, equivalent to 20 years of current afforestation subsidies covering 8647 ha in Taiwan. In view of the estimated worth of NT\$600,000/ha for private forest landowners to manufacture assembly kits with forest thinning materials, results of this research recommend this desirable practice to be used as an alternative for ecological compensation approaches. In addition, this practice is expected to enhance plantation management, facilitate effective public involvement, and increase forest landowners' income.

Key words: small-dimension wood (SDW), ecological compensation, non-timber forest products (NTFPs).

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研究簡報

以森林撫育資材做為生態補償之策略應用

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摘 要

在台灣，造林成本高造成私有林主無意投入森林經營工作，結果造成森林衰退和經濟產出下滑等負面影響。而私有林主入適當森林管理，對刺激山村經濟、促進社會穩定及提升環境品質極其重要。本研究目的即為善用從森林疏伐之未成熟材，如小徑材作為林主穩定的收入來源。本研究調查使用小徑材做為國民小學校課程的組裝材料包之可行性。據估計，此一產品約有新台幣2.6億元的產值，約相當於政府補貼8647 ha造林面積20年的造林獎勵金，即私有林主可從製作疏伐材料的組裝材料包獲得NT\$600,000/ha，研究建議此方案可做為生態補償之可行選項之一。此外，此策略可望能提高人工林管理、促進有效的公民參與，並提高私有林主之收入。

關鍵詞：小徑材、生態補償、非木材林產物。

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The main goal of forest management was timber yield in the period of traditional forestry. Calculating the environmental value of forests which included water, air, flora and fauna habitats, carbon sequestration, and so on became popular after the 1970s. In the beginning of this century, national and international organizations were increasingly appreciating the value of non-timber forest products (NTFPs). Costanza et al. (1997) calculated the current economic value of the world's ecosystem services that was estimated to be in the range of US\$16~54 trillion, and an average was US\$33 trillion which is 1.8-times the global gross national product (GNP) per year. The Food and Agriculture Organization's (FAOs) Global Forest Resources Assessment (FRA) reported that the global NTFP value was estimated to be US\$16.839 billion in 2005 (FAO 2010), but this report also pointed out that the estimated value was lower than the actual value. Two main

problems of underestimation were identified in country statistics. First, many countries reported the value of only a portion of their total NTFPs. Second, values reported were sometimes the value of exports only or of the income from license fees to remove products (FAO 2005). Therefore, NTFPs provide greater economic and environmental values to private forests and communities.

On the other hand, the International Union for Conservation of Nature (IUCN) and the United Nations Environment Programme (UNEP) are promoting the concept of paying for ecosystem services (PES) that supports sustainable ecosystems, provides stable financing for conservation, and is the approach of eco-compensation (Landdell-Mills and Porras 2002). PES not only includes payments for environmental services but also offers incentives to farmers or landowners in exchange for managing their land to provide some sort of ecological service. Therefore,

PES is similar to a subsidy and tax that encourages farmers or landowners to provide ecosystem services to achieve sustainable conservation of natural resources (Landell-Mills and Porras 2002). In fact, international organizations have taken several ecological finance instruments to elucidate the concept of PES such as the Global Environment Facility (GEF) and the global carbon fund, which are designed to slow climate change and reduce deforestation. However, there is still a fairness question about PES, which indicates that the beneficiaries are not undereducated, economically disabled, elderly, female, or other social vulnerable groups (Bull et al. 2008). Traditional economics considers the approach of eco-compensation as a subsidy policy that results in market distortions change current market principles.

Although international organizations and financial institutions do not provide products of ecological finance in Taiwan, there are many similar products such as fair trade-certified coffee, forest-certified products, and organic agricultural products. The environmental value is connected to the commercial value of green products that have the concept of green consumption which attracts consumers to identify and purchase them. This research attempted to apply the concept of NTFPs and PES to elucidate a strategy of ecological compensation. In other words, NTFPs have an environmentally friendly image that increases original timber products' added value, which results in afforestation subsidies being transferred to products from farmers which implies that afforestation subsidies are not equally unearned. Small-dimension wood (SDW) is used as art products that blend into the public in order to expand different consumer groups.

The research considered that SDW can be constituted in "do it yourself (DIY)" material packages that could replace existing

teaching materials of art crafts in schools. The main purpose of the research was to estimate the potential market size of SDW material packages.

The government provides incentives to carry out policies of reforestation on the lowland plains, which regards the concept of PES as a pattern of environmental compensation. This study addressed an alternative approach to PES of marketing intermediate products. Schools could become a potential market in Taiwan if all students would use DIY packing that includes SDW, branches, and top wood produced during the late phase of afforestation. According to online data of the Ministry of Education, there were 1,297,120 elementary school students during the 2014 academic year in Taiwan.

By authors' previous survey showed that the craft package price is about NT\$50~100 in elementary schools, and 87.3% of parents were willing to pay more than NT\$100. Assuming each student has an average payment of NT\$100 per semester to buy a DIY material package of local SDW, this would create a potential market size of NT\$259.42 million per year. If the DIY material kits could be one of the materials for the arts and craft curriculum during elementary school, it could provide a stable market and encourage other forest landowners to become involved in forest tending work. Moreover, if the government sectors such as the Council of Agriculture and the Ministry of Education could offer extra compensation as PES, forest land owners could receive higher returns.

In the view of policy, the Forestry Bureau provides on NT\$0.6 million/ha incentive to land farmers or owners to implement reforestation on the plains during 20 years, excluding NT\$1.8 million compensation for a degraded land use. Reforestation derives environmental value that is replaced by DIY

materials paid for by parents of elementary school students. The value is equal to a reforestation subsidy for 8647 ha on the plains. In order to increase forest farmers' incomes, the authorities have to extend the markets to museums, nature centers, leisure farms, and forest recreation areas.

This study inferred earnings from SDW products that use the result of a looping system for *Pistacia chinensis* afforestation in Gaoshu Township, Pingtung in 2013. The report of the looping system showed 0.9 ha of 12-yr-old *Pistacia chinensis* subjected to a looping and tending system produced approximately 1297 kg which was equal to 1440 kg of waste wood sticks per hectare. After deducting the weight of thin branches and leaves, the available branches accounted for 60% of all pruned branches. The data estimated that forest land could annually produce 864 kg of SDW per hectare.

The labor required for nurturance production per hectare were 4 laborers/day \times 2 days = 8 laborers. The expense of production was about NT\$1200/laborer \times 8 laborers = NT\$9600. The volume of the 1440 kg of branches and tops wood could be carried by a 15-ton truck. It would need to be carried once from the forest to the workshop, and then carried to schools, farms, or outdoor classroom. The expense of transportation would be about NT\$6000/vehicle \times 2 vehicles = NT\$12,000.

The existing DIY material of SDW is very different, so we assumed that a material package would weigh about 0.8 kg. The annual waste of SDW could make about 1080 DIY material kits which is a rough estimate per hectare. The amount produced by forest farmers or forestry production cooperatives would depend on the demands of consumers and the markets. The manufacturing cost of each package averages NT\$80, and the total manu-

facturing cost would be about NT\$80 \times 1080 packages = NT\$86,400.

The cost of a package would be about NT\$(86,400 + 12,000 + 9600)/1080 packages = NT\$100.

There are many other costs, including managing and marketing, warehousing and labor for selling the products. Referring to the existing business model, the selling price should be 3~5 times the cost, so a reasonable selling price of the DIY material kit would be setting NT\$300~500.

According to the current standard expenses of art and craft materials in schools, the DIY material kit of SDW is only sold for NT\$100 which is just equal the cost that would result in a zero net income for forest farmers. The net income of the DIY material kit depends on the forest size, amount of production, costs of production, costs of labor and costs of transportation. If a strategy of a low price for wood toys is applied, the difference in price would be made up through government subsidies (ecological compensation price) between the price and consumers' payments.

There are 2 patterns of subsidy for forest farmers and owners. First, if the policy of pruning materials' value-added application is from a subsidy or reward from the government, it can contribute to market formation. Forest farmers would be a supplier of environmental benefits and would also promote forest growth and health by implementing afforestation and nurturance. Second, the consumers' payments for forest mid-products would be regarded as another subsidy resource. Therefore, the policy enhances linkages among forestry management, environmental education, and marketing, and also increases the correct knowledge by the public of forest and environmental conservation through the use of forest mid-products.

According to the above discussion, the government does not need to terminate the policy because of financial difficulties which afforestation subsidies. Otherwise, it can utilize the payment of eco-beneficiaries to enhance the process of forest management, intermediate products could be designed to diversify forest products, and the products would create a marketing chain that enhances customer's concepts of afforestation to reduce carbon and enhance environmental protection which have important relationships with wood application. It can establish friendly attitudes towards the environment based on wood culture.

Although forest management provides greater contributions to the environment, forest properties which the government provide are public. However, most managing costs are assumed by small forest owners, which is unfair environmental justice. This research considered how to maintain ecological compensation for forest quality, and simplify the kind of SDW material packaging, which would reward small forest farmers to respect afforestation, nurturance, and production. Results of the calculations predicted the feasibility of the research model that combines carbon forestry, community forestry, village revitalization, community conservation plans, and so on.

LITERATURE CITED

- Bull GQ, Hegde R, Gong Y, Han K. 2008.** Impacts of forest carbon markets on local livelihoods in developing countries: a study of China, Mozambique and Afghanistan. In: International Conference on Rights, Forests and Climate Change, Oslo, Norway. 13-15 October 2008.
- Costanza R, d'Arge R, deGroot R, Farber S, Grasso M, Hannon B, et al. 1997.** The value of the world's ecosystem services and natural capital. *Nature* 387:253-260.
- FAO. 2005.** Global forest resources assessment 2005: progress towards sustainable forest management. FAO Forestry Paper 163. Rome: Food and Agriculture of Organization (FAO) of the United Nations.
- FAO. 2010.** Global forest resources assessment 2010: main report. FAO Forestry Paper 163. Rome: Food and Agriculture of Organization (FAO) of the United Nations.
- Landell-Mills N, Porras IT. 2002.** Silver bullet or fools' gold? A global review of markets for forest environmental services and their impacts on the poor. Instruments for Sustainable Private Sector Forestry Series. London: International Institute for Environment and Development.

