Agroforestry and Carbon Sink Activities in Gunung Walat Educational Forest of Bogor Agricultural University, Indonesia[1]

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Abstract

Gunung Walat Educational Forest (GWEF) is managed by Faculty of Forestry of Bogor Agricultural University in Indonesia. The total forest area is 359 ha, which is mostly covered by agathis (*Agathis loranthifolia*) and pine (*Pinus merkusii*) stands. The plantation was established in 1959 by a state-owned enterprise followed by the university students, and recently enrichment planting was also conducted under management of forest administrator. The forest is surrounded by villages in which villagers collaborates with the forest administrator for agroforestry activity and resin extraction of agathis and pine trees. Agroforestry activities cover about 100 hectares and involving about 200 villagers who plant rice, cassava, banana, coffee, and medicinal trees under stands. The GWEF is also used by pupils, students, and people who love nature for various forestry educational activities. Besides domestic visitors (either individuals or organizations), many visitors also came from abroad (e.g. Gottingen University Germany, Technical University of Munich Germany, Juensuu University Finland, Swedish Agricultural University Sweden, Texas University USA, Kangwon National University South Korea, Nagoya University Japan). All expenses of GWEF can be covered from self income generating activities, especially resin production and public services, which provides a unique example on how a small scale forest management can survive without cutting the trees.

Keywords: Agroforesty, educational forest, self finance, resin extraction

1. Introduction

For decades, forest management in Indonesia has focused on managing natural forests and developing plantation forests. Economic benefits have been a main concern on managing the forests, especially to generate national incomes. However, a shift from large scales forest management to small scales forest management has been emerging recently in response to a proper forest management, especially empowering community to manage the forest.

Gunung Walat Educational Forest is an example for reforestation area with the total of 359 hectares, since 1959 the bare land has been planted with *Agathis* sp, *Pinus* sp and other trees species, and right now the area is completely covered with the forest stand. The policy of forest manegement is not cutting the tree, and the income is generated from resin of pine and agathis, eco-tourism service, and other activities without forest destruction.

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Agro-forestry activities are conducted by the people from arround the forest, they plant agricultural plantation, e.g. banana, cassava, rice, coffee and other species. They are allowed to plant and harvest the plants regulerly according to the season, and bring the materials to their homes. Beside the agricultural activities they also keep the forest safely from enchrocement and other destroying forest, because they have to maintant the area. This method has mutual benefit for the management and also the involved people.

On the other aspect, the forest is also used for carbon sink activities. Some companies join the program with planting the trees in some areas. The areas were bareland caused by fire or natural disaster e.g. cyclon, huge rain with big wind, or other damage. This activity becomes intensive because arround the area is already covered with the tree stand. As out comes of all activities, Gunung Walat Educational Forest becomes one place for recreation for local people, and also becomes a place for field practice for forestry students from domestic and abroad as well.

2. An Overview of Gunung Walat Educational Forest (GWEF)

Gunung Walat Educational Forest (GWEF), located in Sukabumi district, West Java, Indonesia (6°54'23"–6°55'35" S, 106°48'27"–106°50'29" E; Fig. 1), is a state-owned university forest that fully managed by Faculty of Forestry, Bogor Agricultural University, Indonesia. Total area of GWEF is 359 ha with elevation of 450–715 m (above sea level) and annual rainfall of 1600–4000 mm.

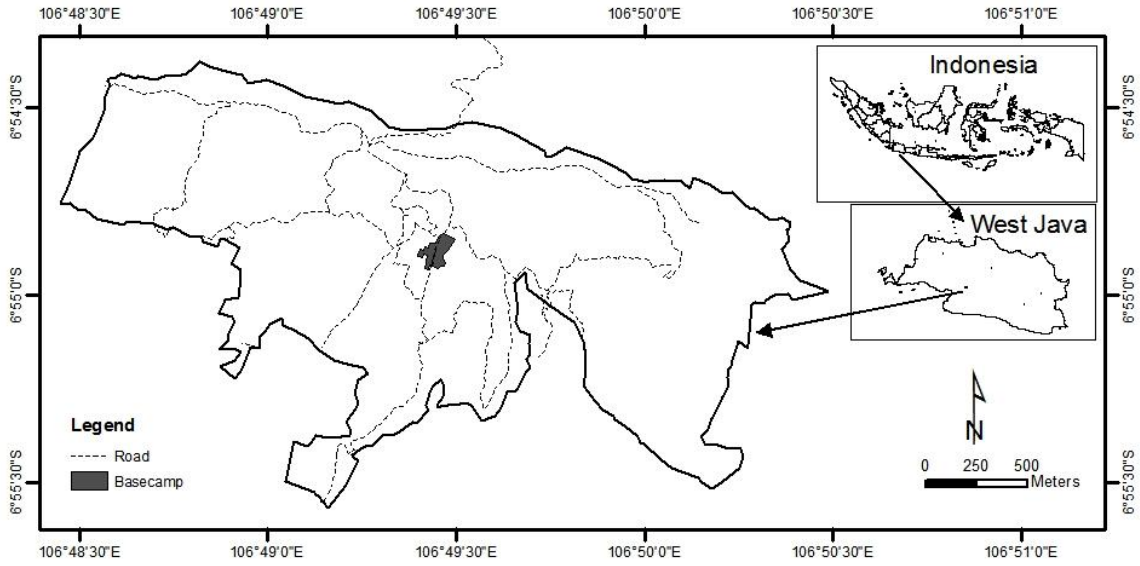

Figure 1. Gunung Walat Educational Forest (GWEF) in Sukabumi district, West Java, Indonesia.

In the beginning, the GWEF was almost bare-lands dominated by wild-grasses (e.g., *Imperata cylindrica*). Plantation forest establishment of GWEF was first conducted by students and local people in 1959 by planting *Agathis loranthifolia* trees, which was then gradually continued until 1980

by planting other plantation species, e.g., pine (*Pinus merkusii*), *Schima wallichii*, *Maesopsis eminii*, *Swietenia macrophylla*, *Altingia excelsa*, and rose wood (*Dalbergia latifolia*). At present, the forest condition of GWEF is approaching the structure of a semi natural forest with forest cover about 95%. Such a good forest condition provides suitable habitats for various faunas (see Himakova, 2007), such as long tailed macaque (*Macaca fascicularis*), wild boar (*Sus scrofa*), wild rabbit (*Nesolagus* sp.), jungle cat (*Felis bengalensis*), squirrel (*Callociurus* sp.J), trenggiling (*Manis javanica*), and civet (*Paradoxurus hermaphroditic*).

While most of the plantation forests in Indonesia are managed for timber production, the GWEF is managed mainly for producing non-timber forest products (i.e., pine and agathis resins), supporting education and researches, and enhancing environmental services (e.g., water reserve, carbon sequestration, and ecotourism). Until now, the GWEF implements a zero-cutting policy, meaning that there is no cutting of standing trees to produce timbers. A small amount of timber, however, could be obtained from naturally fallen trees (due to windstorms, diseases, etc.). This policy was a result of a public agreement with local communities living surrounding the GWEF areas, who considered that non-timber forest products and environmental benefits (especially water reserves) are more important than timber benefits to support their livelihood. Roslinda (2002) confirmed that timber value only contributed about 15.3 – 22.7% to the total economic value of GWEF.

To support various activities in managing GWEF, a base-camp was established in the center of GWEF area (Fig.1). The base-camp is equipped with an administration office, guest-houses, meeting rooms, class rooms, a mosque, and a kitchen. These facilities can accommodate various purposes of visitors, e.g., field practices of both domestic and international students, researchers who study various topics of GWEF, companies who conduct trainings for their staffs, and other visitors who spend their holidays in the close to nature forest of GWEF. During the last five years, GWEF is used for field practices and summer schools by many international students came from Gottingen University (Germany), Technical University of Munich (Germany), Juensuu University (Finland), Swedish Agricultural University (Sweden), Texas University (USA, Kangwoon National University (South Korea), and Nagoya University (Japan).

3. Agroforestry Activity

GWEF exists in a mountainous area that is surrounded by five villages (i.e., Hegarmanah, Cicantayam, Cikembar, Bojongkembang, and Bojong). Such situation often creates social problems in managing the GWEF. Most noticeable problems are land encroachments and illegal-cuttings. Some local peoples illegally used the GWEF areas to plant agricultural crops, leading to the decrease of forested lands of GWEF. In addition, illegal-cuttings conducted by local peoples have contributed to the decrease of standing trees. These problems were rampant in the period of 1998–2000, which were also occurred in many parts of Indonesia.

Considering such social problems, since 2000 the managers of GWEF have been implementing an agroforestry program. During the period of 2000–2005 this program was financially supported by ASEAN-Korea Environmental Cooperation Project (Lee, 2005). Similar to other areas, the agroforesty program of GWEF is aimed to accommodate the needs of local communities for cultivated lands. In this program, local communities are allowed to plant agricultural crops (i.e., banana, coffee, cassava, and maize) under forest stands, but they also have to plant and maintain *Agathis loranthifolia* and *Paraserianthes falcataria* trees (Darusman, 2006; Lee, 2005). There are three types of agroforestry programs implemented in GWEF (Lee, 2005): 1) agroforestry at spare stands (< 25 trees/ha, AF-1), 2) agroforestry at less dense stands (25–100 trees/ha, AF-2), and 3) agroforestry at dense stands (100–200 trees/ha, AF-3). These agroforestry activities are conducted by about 300 farmers with total area about 100 ha (mostly under *Agathis loranthifolia* stands).

The agroforestry program of GWEF provides mutual benefits for farmers and GWEF's managers. For farmers, the agroforestry programs generate additional incomes. Lee (2005) and Sundawati and Isnaini (2005) reported that the three types of agroforestry programs (AF-1, AF-2, and AF-3) were financially feasible with net present values (NPV) ranging from 2,138,953 to 8,465,179 IDR/ha (approximately 223–882 USD/ha). The highest financial benefits could be obtained if farmers conducted AF-1, because the growths of *P. falcataria* trees and agricultural crops under open canopy stands were better than those under close canopy stands (Lee, 2005; Sundawati and Isnaini, 2005). The agroforestry programs also provide benefits for the GWEF management, because such programs can increase the awareness of local communities to the sustainability of GWEF. Our field observations and interviews with some GWEF's staffs confirmed that currently there is no encroachment to forested lands or illegal-cutting, because local communities also involve in securing the GWEF areas through agroforestry activities.

4. Carbon Sink Activity

One of the management objectives of GWEF is to maintain and enhance environmental benefits. To achieve this objective, since 2009 the GWEF managers have been conducting forest rehabilitations on some degraded areas by implementing carbon sink projects through collaboration with some companies. Such carbon sink project is a voluntary-based scheme in which a company may invest some funding to GWEF for planting and maintaining a number of trees during a certain contract period. Currently, there are three carbon sink projects implemented in GWEF: Toso, ConocoPhillips, and NYK projects.

Toso's carbon sink project is a 30-year project funded by Toso Company Limited, which a Japanese company that develops and manufactures various interior products. During the first period of collaboration (2009–2015), the company provided funding to GWEF for planting and maintaining 4000 *Agathis loranthifolia* trees to increase carbon stocks of GWEF. Tree plantings were conducted

in 2009 and 2010 with total area of 10 ha. For the next 24 years of collaboration, GWEF has to maintain the planted trees with annual funding provided by the company.

The second carbon sink project was initiated by ConocoPhillips, an American multinational energy corporation. In 2009 and 2010, this company provided funding to GWEF for planting 5000 trees (consisting of *Agathis lorathifolia*, *Pinus merkusii*, *Altingia Excelsa*, *Arenga pinnata*, and *Coffea robusta*) with total area of 5 ha.

The third carbon sink project was funded by NYK, a Japanese shipping company. In 2009, the company provided funding to GWEF to plant 1500 trees. This project was not only aimed to increase carbon stocks of GWEF, but it also aimed to improve monkey habitats. Therefore, the degraded forest areas of this project were mostly planted by fruit trees that can be used to feed wild monkeys and increase carbon stocks.

All of the carbon sink projects, especially during trees planting, were conducted by GWEF through collaborations with local peoples, students (i.e., university students or junior/senior high school students), or guests who visit GWEF. Such collaborations provide mutual benefits among parties who interested in improving social and environmental conditions of GWEF. For example, tree planting activities would provide additional incomes for local peoples and enhance students' skills.

5. Financial Arrangement

Although GWEF is a state-owned university forest, the government of Indonesia has not provided fully financial supports for managing the GWEF. Since 2000, the GWEF has been struggling to generate its own incomes to cover all management costs (e.g., production cost, employee salary, workers meal, and facility maintenance cost). The main income of GWEF comes from resin productions, public services, and carbon sink projects.

Production of pine and agathis resins is the main source of GWEF's income. In 2010, GWEF produced resins up to 13.7±4.7 tons/month, consisting of 7.8±2.6 tons/month of pine resins and 5.9±1.9 tons/month of agathis resins (Fig. 2). The resin production fluctuated over months due to weather conditions (Fig. 1), in which dry seasons (May to August) produced higher resins than rainy seasons. In total, during 2010 GWEF has produced resins about 165 tons, consisting of 93 tons pine resin and 72 tons agathis resin. Such a large resin production generated income about 49% of the total GWEF's income in 2010. The resin production does not only provide economic benefits to GWEF administrators, but it also provides economic benefits to local peoples who work as resin tappers. Such relatively high incomes from resin productions indicate that GWEF could survive without cutting the trees.

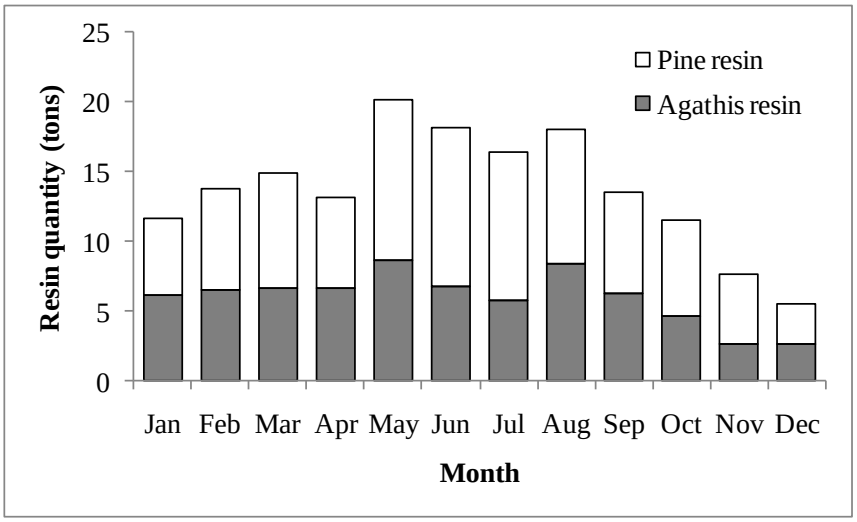

Figure 1. Resin production of GWEF in 2010

The unique forest condition of GWEF has motivated the administrators to develop public service programs. Ecotourism is a promising program implemented in GWEF, where visitors can enjoy various activities, such as camping, mountain bike tracking, exploring caves, enjoying water springs, and watching wild faunas (e.g., birds and monkeys). In addition, the GWEF with its excellent facilities provides a comfortable place for various training activities conducted by other institutions.

6. Remarks

The transformation of bare lands into the close to nature forest of GWEF could indicate a success story of a small scale forest management in Indonesia. The forest is not for wood production but getting income from resin, eco-tourism, carbon-sink, and other activity without destroying the forest. All expenses can be covered with these activities without extracting the tree or wood, and this method can be applied for the similar forest stand.

7. References

Darusman, D. 2006. Poverty alleviation program through people participation in improved agroforestry system in Gunung Walat Educational Forest. In Siregar,Z., Sundawati, L., Supriyanto, and Nurrochmat, D.N. Planning Workshop of the 2nd Phase of AKECOP. Faculty of Forestry of Bogor Agricultural University and ASEAN-Korea Environmental Cooperation Unit, Bogor.

Lee, D.K. 2005. Restoration of degraded forest ecosystem in the Southeast Asian tropical region: Annual report for year 2004–2005. ASEAN-Korea Environmental Cooperation Unit, Korea.

Roslinda, E. 2002. The economic value of Gunung Walat Educational Forest and its contribution to the surrounding community. MSc thesis, Bogor Agricultural University, Bogor (*in Bahasa Indonesia* with English summary).

Sundawati, L. and Isnaini, D.N. 2005. Benefit-cost analysis of agroforestry system in Gunung Walat Educational Forest. In Faculty of Forestry of Bogor Agricultural University. Annual report of fifth year AKECOP regional research in Indonesia. Faculty of Forestry of Bogor Agricultural University and ASEAN-Korea Environmental Cooperation Unit, Bogor.