

The Strategy of Upland Tropical Agriculture Development Towards Sustainable Environmental Management: Case Study at Ngebel, Ponorogo District, East Java, Indonesia

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Abstract

Ngebel Sub District is located at the upland of Wilis Mountain which is a conservation area at Ponorogo Regency East Java, Indonesia, Ngebel Sub District has large springs accumulated at the Ngebel Lake. The water is used for Hydroelectric Power Plant (HEPP) and agricultural irrigation water source for surrounding areas that have a lower location. Beautiful panoramic of Ngebel Lake make it as a tourism destination. Most of people at Ngebel Village as farmers with dry land tenure with many varieties of annual crops and animal husbandry.

The objectives of the study were to: (1) analyze the feasibility of annual crops farming; (2) develop the strategy of upland tropical agriculture development at Ngebel Village towards sustainable environmental management. Survey method with purposive sampling method was used in this study. Primary and secondary data from many agencies were used. Primary data collecting was done by interviewing 30 farmers.

The results of the feasibility analysis showed that *durian*, mangosteen and various other tropical plants in the mixed farming system were feasible. SWOT analysis result indicates that the suitable strategy to apply is a strengths - opportunity (SO) strategy. This strategy is intended to maximize the strengths and use the opportunities that exist. The alternative of SO strategies are including: develop the agriculture and tourism potential at Ngebel Sub District by agro tourism; develop local commodities and give opportunity for farmers to cultivate the "Perhutani" land and support the financial aspect from the Indonesia Government Bank; develop the economic instruments for environmental management as an implementation of The Law number 32/2009 bay tax and subsidy mechanism; and designing The Payments for Environmental Services (PES) with charging cost for downstream population and for Hydroelectric Power Plant who receives the benefits for environmental services and give incentives for farmers who preserve the environment.

Keywords: Ngebel, Ponorogo, upland tropical agriculture, sustainable environmental management, payments for environmental services

1. Introduction

Ngebel Sub District is located on the slopes of the Wilis Mountain in Ponorogo District, East Java Province, Indonesia. Most of this region is the agricultural land plantations, forestry and agroforestry also. This upland agriculture and forestry area produces many environmental services such as oxygen production, carbon sink, erosion prevention, water storage, micro climate control, maintaining biodiversity, food production, fresh air, natural beauty and amenity. There are large springs which are accumulated at the Ngebel Lake which is used for Hydroelectric Power Plant (HEPP) and agricultural irrigation water source for surrounding areas that have a lower location. Beautiful panoramic of Ngebel Lake make it as a tourism destination. Many environmental services, water and Hydroelectric Power Plant give benefit for society.

Most of people in Ngebel Sub District are farmers with dry land tenure (dry fields or gardens fields) with varieties of annual crops such as *durian*, mangosteen, coconut, jackfruit, cloves, avocado, pepper, banana and so on. These farmers have well adapted to their environment. The problems that were faced by farmers are limited land tenure, limited capital, low education, low income and the scarcity of water irrigation for their dryland farming. Though there are large springs which accumulated at Ngebel Lake but there is not water irrigation for agricultural land which located above the lake. There are springs at the mountain but there is no irrigation infrastructure for agricultural land. The water irrigation for the agricultural land just comes from the rain in rainy season. This situation makes the limitation for farmers to increase their agricultural productivity and their

income. Most of farmers at Ngebel have animal husbandry those are goat and chicken. The farmers have been using the wastes from animal husbandry for fertilizer through composting process. The animal husbandry was integrated with farming system they have.

As reported by Tanner et al (1993) that ruminant livestock are an integral part of smallholder farming system in Indonesia. Manure-compost is ranked by farmers as one of the most important outputs from livestock production. In the upland regions of Java 90% of the fertilizer used on smallholdings is manure-compost. It is hypothesised that livestock are used to produce high-quality of compost and that their integration into Javanese Agriculture is essential to the sustainability of some of the most intensive cropping cycles in the world (Tanner et al, 1993)

To conserve the ecosystem in Ngebel, the farmers are very important subject, so that their welfare must be considered towards sustainable environmental management. Their activity in environmental conservation through practicing conservation agriculture have been resulting the environment services which are enjoyed by society, but until now there are not regulation about it. The Indonesian Government has The Law 32/2009 on environmental management. There are 19 kind of economic instruments for environmental management, including schemes that provide for payments for environmental services. This could revolutionize environment management throughout the archipelago (Finlayson, 2013). As knowing that Indonesia is the biggest archipelago in the world. Indonesia Government still preparing the government regulation for implementing The Law 32/2009. So that, now the implementation of economic instruments for environmental management is still limited in the country included at Ngebel, Ponorogo District. The research about sustainable environmental management is very important in Indonesia.

The objectives of the study are to: (1) analyze the feasibility of annual crops farming (2) design the strategy of upland tropical agriculture development at Ngebel Village towards sustainable environmental management.

2. Method

Purposive sampling method was used in this research, The research location was in Ngebel Ponorogo Regency East Java Province Indonesia, Survey method was used in this research, In this study both primary and secondary data were used, The primary data collecting have done by interview to 30 farmers at that location, The main source of secondary data was from many agencies are Central Bureau of Statistic; Agricultural Agency of Ponorogo Regency; Sub District Office (Kecamatan); Villages Office (Desa),

Several research methods were applied in order to answer all of the two research objectives above namely qualitative and quantitative methods, Qualitative method was accomplished by using techniques of in-depth interview and focus-group discussion while quantitative method was conducted by developing formal questionnaire.

3. Results and Discussion

Mostly the farmers at Ngebel cultivate the annual crops in dry land (dry fields and also on forestry land) with a mixed farming garden. The annual crops such as *durian*, mangosteen, cacao, banana, avocado, jackfruit, pepper, coconut cloves, langsep and so on. Durian and mangosteen are the major crops which are cultivated by farmers. The feasibility analysis for durian, mangosteen and other commodities can be seen in Table 1. The interest rate which is used to calculate the present value of the benefit and cost analysis is 19.26%. That is the interest rate of government bank (BRI - Bank Rakyat Indonesia) loans to micro and small enterprises, including agriculture at the time the study was conducted.

The Net Present Value (NPV) for durian, mangoesteen and all other crops in mixed farming garden is positive (greater than 0), it is mean that the durian, mangoesteen and all other cops at the Ngebel Village are feasible to develop because it is profitable. The Net Benefit Cost Ratio (Net B/C) is the ratio between revenues and costs of the farming. The analysis showed that the Net B/C value of the durian, mangoesteen and all other crops is more than 1. The durian has the biggest Net B/C value, it is means that the durian is the most profitable commodity at Ngebel Village.

Table 1. The Feasibility Analysis of Commodities at Ngebel Village 2013

No.	Investment Criteria	Durian	Mangoesteen	All other crops
1	NPV (Net Present Value)	IDR 5,564,305.45	IDR 24,805.13	Rp 274.838,40
2	Net B/C (Net Benefit Cost Ratio)	4.15	1.03	1,08
3	IRR	56%	20.02%	22%

Source : The Primary Data Analysis 2013

Internal Rate of return (IRR) is the rate of return of a net investment in farming which showed that revenues and costs are calculated on a present value equal to zero, IRR can also be used to compare the percentage of profits if the investment costs is deposited in the bank. An attempt is successful if it has a value of IRR greater than implied interest rate which is 19.26%. The IRR value of durian with the interest rate of 19.26% is 56%. IRR value is greater than the interest rate implied, so the investment in a durian farm will provide greater benefits to 56% more than the bank interest rate.

The Strategy of Upland Tropical Agriculture Development Towards Sustainable Environmental Management

To design the strategy of upland tropical agriculture development towards sustainable environmental management using SWOT analysis. The Internal Strategic Factors (ISF) External Strategic Factors (EFE) shows at Table 1 and Table 2. The alternative strategy can be seen at table 3.

Table 1. Internal Strategic Factors (ISF) for The Upland Agricultural Development towards Sustainable Environmental Management at Ngebel Ponorogo Regency

No,	Internal Factors	Weight	Rating	Score (weight x rating)
	Strengths :			
1	Ngebel Sub District is located in the upland slopes of Wilis Mountain which has great springs which accumulated at Ngebel Lake with the beautiful natural panoramic make it as a tourism destination	0.2	4	0.8
2	Ngebel Sub District has many tropical biodiversity with mixed garden system with local durian and mangosteen as major commodity and there are animal husbandry own by farmers.	0.15	4	0.6
3	Ngebel Sub District has a great potential for development of agriculture and tourism.	0.1	3	0.3
4	Indigenous farmers have adapted well to the environment and they are aware and willing to conserve the environment and most of them have join in farmer groups.	0.15	4	0.6
	Subtotal	0.6		2.3
No.	Internal Factors	Weight	Rating	Score (weight x rating)
	Weaknesses :			
1	Limitation of land ownership (dry land), capital and farmers' access to financial institutions	0.1	2	0.2
2	Low farmers' education and income, and they generally cultivate annual crops that were harvested only once a year	0.1	2	0.2
3	Irrigation for agriculture are not available yet	0.1	2	0.2
4	There is no local government regulations that provide incentive to farmers who conserve the environment.	0.1	2	0.2
	Subtotal	0.4		0.8
	S – W			1.5

Source : The Primary Data Analysis, 2013

Table 7.2. The External Strategic Factors (EFE) for Upland Agricultural Development Towards Sustainable Environmental Management in Ngebel Ponorogo Regency

No,	External Factors	Weight	Rating	Score (weight x rating)
	Opportunity			
1	Indonesia has The Law number 32/2009 of environmental protection and management	0.2	4	0.8
2	“Perhutani” land (government land) are available and could be cultivated by farmers	0.15	4	0.6
3	There are The Indonesia Government banks (BRI) at the sub district level	0.05	3	0.15
4	There are Hydroelectric Power Plant (HEPP) and water irrigation for the lower location which use water from Ngebel Lake	0.2	4	0.8
	Subtotal	0.6		2.35
	Threat			
1	Free Trade existence make the huge amount of imported agricultural products	0.1	1	0.1
2	The free trade system makes money as the only primary goal for the capitalists and sometimes free trade exist but is not fair trade	0.1	1	0.1
3	Indonesia Government policy is too liberal and less protection for the farmers.	0.1	1	0.1
4	Increasing in demand for water and energy.	0.1	1	0.1
	Subtotal	0.4		0.4
	(O – T)			1.95

Source : Primary Data (Processed) 2013

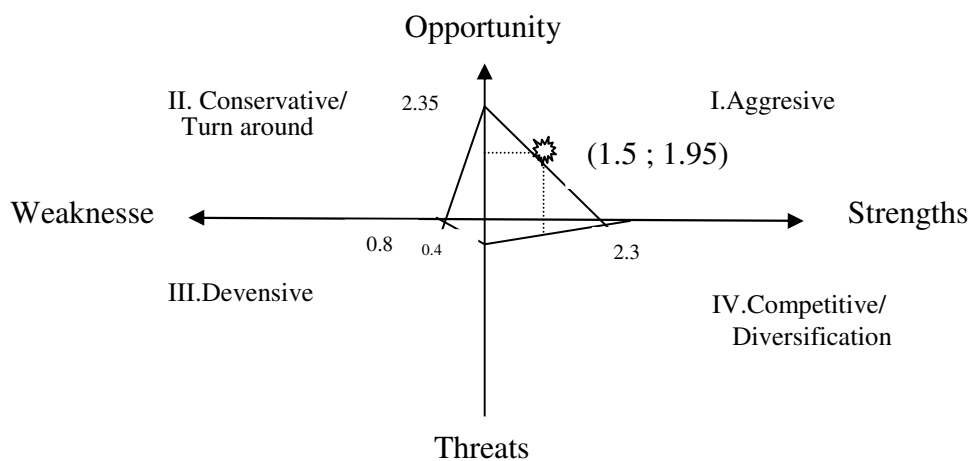


Figure 1. The Grand Strategy Matrix

The amount of each factors score both external and internal environment determines the position of strategy for upland agricultural development towards sustainable environmental management in Ngebel Ponorogo Regency those are at the S-O position with aggressive strategy which mapped on a matrix of grand strategy as shown in Figure 1. That strategy is to maximize the strengths and use the opportunities that exist. The S-O strategy and all alternative strategy can be seen at table 3.

Table 3. The Alternative Strategy for Upland Agricultural Development Towards Sustainable Environmental Management in Ngebel Village Ponorogo Regency

<p style="text-align: center;">Internal Factors</p> <p style="text-align: center;">External Factors</p>	<p style="text-align: center;">Strengths (S)</p> <ol style="list-style-type: none"> Ngebel Sub District is located in the upland slopes of Wilis Mountain which has great springs which accumulated at Ngebel Lake with the beautiful natural panoramic make it as a tourism destination Ngebel Sub District has many tropical biodiversity with mixed garden system with local durian and mangosteen as major commodity and there are animal husbandry own by farmers. Ngebel Sub District has a great potential for development of agriculture and tourism Indigenous farmers have adapted well to the environment and they are aware and willing to conserve the environment and most of them have join in farmer groups. 	<p style="text-align: center;">Weaknessess (W)</p> <ol style="list-style-type: none"> Limitation of land ownership (dry land), capital and farmers' access to financial institutions Low farmers' education and income, and they generally cultivate annual crops that were harvested only once a year Irrigation for agriculture are not available yet There is no local government regulations that provide incentive to farmers who conserve the environment.
	<p style="text-align: center;">Opportunities</p> <ol style="list-style-type: none"> Indonesia has The Law number 32/2009 of environmental protection and management "Perhutani" land (government land) are available and could be cultivated by farmers There are The Indonesia Government banks (BRI) at the sub district level There are Hydroelectric Power Plant (HEPP) and water irrigation for the lower location which use water from Ngebel Lake 	<p style="text-align: center;">SO Strategy</p> <ol style="list-style-type: none"> Develop the agriculture and tourism potential at Ngebel Sub District by agro tourism. Develop local commodities such as durian, mangoesteen and others, and give opportunity for farmers to cultivate the Perhutani land and support the financial aspect from the Indonesia Government Bank. Develop the economic instruments for environmental management as an implementation of The Law number 32/2009 bay tax and subsidy mechanism. The subsidy (insentive) can give for farmers such as for build the agriculture irrigation infrastructure and others. Designing The Payments for Environmental Services (PES) with charging cost for downstream population and for Hydroelectric Power Plant who receives the benefits for environmental services and give incentives for farmers who preserve the environment.
<p style="text-align: center;">Threats (T)</p> <ol style="list-style-type: none"> Free Trade existence make the huge amount of imported agricultural products The free trade system makes money as the only primary goal for the capitalists and sometimes free trade exist but is not fair trade Indonesia Government policy is too liberal and less protection for the farmers. Increasing in demand for water and energy. 	<p style="text-align: center;">ST Strategy</p> <ol style="list-style-type: none"> Develop local commodities such as durian, mangoesteen and others, and also the marketing strategy. Designing The Payments for Environmental Services (PES) system as insentive for farmers which have been doing environment conservation and for sustaining environmental management. 	<p style="text-align: center;">WT Strategy</p> <ol style="list-style-type: none"> Designing strategies to improve the farmers income such as develop the agriculture and tourism potential at Ngebel Sub District by agro tourism, build the irrigation infrastructure, give opportunity for farmers to cultivate the Perhutani land. Designing The Payments for Environmental Services (PES) system as insentive for farmers which have been doing environment conservation and for sustaining environmental management.

3. Conclusion

Ngebel Sub District at Ponorogo Regency is a conservation area have many strengths those are there are great springs which accumulated at Ngebel Lake with the beautiful natural panoramic make it as a tourism destination with many tropical biodiversity with mixed garden system and animal husbandry own by farmers. Indigenous farmers have adapted well to the environment and they are aware and willing to conserve the environment. SWOT analysis result indicates that the suitable strategy to apply is a strengths - opportunity (SO) strategy. The alternative of SO strategies are including: develop the agriculture and tourism potential at Ngebel Sub District by agro tourism; develop local commodities and give opportunity for farmers to cultivate the “Perhutani” land and support the financial aspect from the Indonesia Government Bank; develop the economic instruments for environmental management as an implementation of The Law number 32/2009 bay tax and subsidy mechanism; and designing The Payments for Environmental Services (PES) with charging cost for downstream population and for Hydroelectric Power Plant who receives the benefits for environmental services and give incentives for farmers who preserve the environment.

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