On the Interchange of Subsistence Agriculture and Rainforest: An Indonesian Case

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ABSTRACT: The rainforest role as agent in maintaining the ecosystem balance is constantly under threat. Forest conversions have occurred in all over the world on a very rapid progress. Most of the conversion associated with rural farmers practicing subsistence farming. Part of slash and burning farming system particularly in South Sulawesi has been shifted to land clearing for cereal and state crops (ie. Cocoa) by the rural farmers. This study conducted to trace the rate of forested land conversion into subsistence farming and the driving factors behind this process. The multi temporal Image analysis together with field survey been conducted to find out the rate of conversion and the perception of the rural farmers on land conversion. The study shows that the basic need for survival and the desire to get better life style has driving the people to further convert the forested area into farming land and some of the converted land was abandoned back to forested land

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Introduction

Indonesian forest statistics (2011) shows that the rainforest in Indonesia consisted of 99.6 million ha covered 52% of the country. Indonesian rainforest plays an important role in preserving biodiversity of endemic flora and fauna. The rain forest in Indonesia is constantly under threat of deforeatation with rate of more than 610 thousand ha per year considered as the third largest rate in the world.

A growing dilemma on tropical rainforests and the people who depends their lifelihood on the forest where the needs for protecting the remain of forest standing and the needs for the local people to secure their livelihoods, and such dilemma exists in almost all of the tropical rainforests such as in Amazonian (Marquadt et al. 2013), in tropical Africa, Southeast Asia (Rerkasem et al. 2009), and in Mexico (Schmook 2013). Swiddening or shifting cultivation is one of the farming practice usually balmed for the spreading of deforestation of the rainforest world wide.

Subsistence agriculture (shifting cultivation or slash and burn) is a farming system that developed on people's experiences in preparing the land and normally passed through generations. The swidden farming has been practiced since ancient time from low-land of mesoamerica (Borejsza et al. 2011; Ohl., 2008; Vien et al. 2006) and in other part of the world. In addition, the systems have a great impact on agricultural land use in terms of ecology structure and people lifelihood (McHale, 2011).

Shifting cultivation (swidden agriculture) has been widely found throughout the highlands of Southeast Asia. The use of satellite imagery in studying the dynamics of forested area have advatages in studying the large area. Even though, complexity and dynamics in land cover makes it difficult to accurately describeing and montoring the change due to limitation in digital image processing or visual interpretation techniques unless it carried out in conjunction with high resolution aerial photos (Merts, 2009). Swidden agriculture is one of the traditional practices of forest management and land by people in the tropics and compatible with the existing social typology as a form of interdependence between humans and the environment. In addition, maintaining that traditional forms of agriculture reflect the optimum strategy to serve the needs of humans and the efforts to maintain the ecological balance in the tropics. These practices can be improved through agroforestry technologies to adapt to the dynamics of the local socio - economic and environmental changes. Conceptually, swidden agriculture has a close relationship with the social forestry, for example, defines social forestry as any close business conditions and involve local communities in forestry activities to ensure the benefits of economic, ecological, social and at the same time maintaining the resources (Padoch, 1998).

Material and methods

This research conducted in the District of Matangga West Sulawesi Indonesia, using Landsat 5 images data acquired on Sept. 28, 2002 and SPOT 4 Acquired on August 18, 2011. The vector file of administrative boundaries were also overlaid on the images.
The analysis performed by analyzing changes of forested land into agricultural land by communities living nearby the forest area. The sequence of the study presented in the following figure.

Figure 1 The sequence of the study process

Supervised classification (Lillesan et al. 2004) were applied on both images to study the land use change between these two different images. We also analyze the social factors that influence the desire of the local resident to convert the forest into agriculture.For social issues, we surveyed the local farmers who live near the forest to find outthe driving factorsfor them to convert the forest.

Result and discussions

From the image analysis on two different images (10 years apart) shows significant shifting of land use (forested land and cultivated) during the time period of 2002 to 2011 (Fig.2).

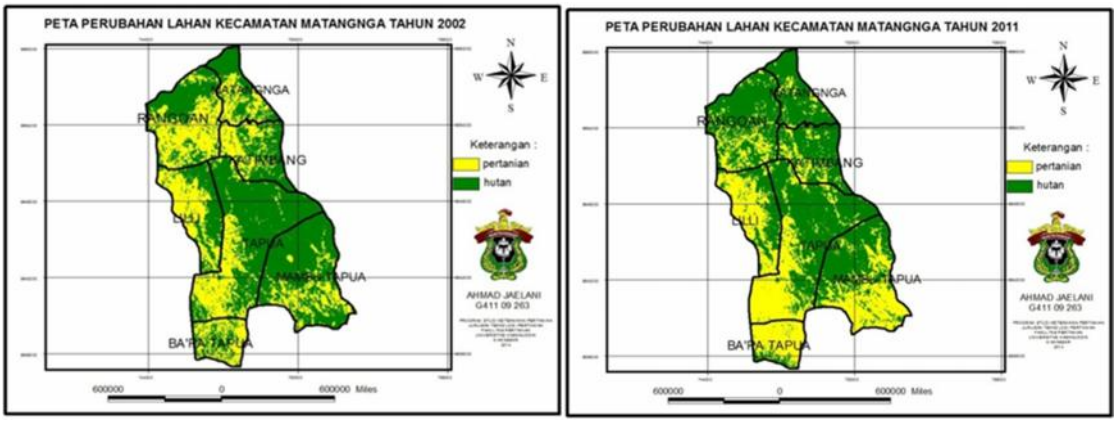

Figure 2 The land use of the study area on 2002 (left) and 2011 (right)

The area of forested land converted into farming land are mostly occurs on the southern part of the region (Ba'pa Tapua and Mambu Tapua village) while in the northern part the previously cultivated land was being converted back in to forest even though the remaining farm crops are still found. Although some of the culticated area has been returned to forested land, conversion into the agricultural land is still dominant (236 ha – Table 1)

Table 1The area of forested and cultivated land of study region

Land Use	**Area (ha)**		**Difference (ha)**
	2002	**2011**	
Forest	13,131	12,895	-236
Agriculture	8,170	8,406	+236
Total	21,301	21,301	

The dynamics of forest-agricultural shifting (Table 2) shows the remaining forested land and converted to agriculture between these two different dates are 10,440 ha and 2,761 ha respectively. While the agricultural land that claimed back to the forest and the remaining agricultural land are 2,437 ha and 5,663 ha respectively, and the spatial distribution of these land use dynamics shows in Figure 3.

Table 2 Cross tabulation of land use change in study area (2002-2011)

Land use change		year 2011	
		Forest (ha)	Agriculture (ha)
year 2002	Forest (ha)	10,440	2,761
	Agriculture (ha)	2,437	5,663

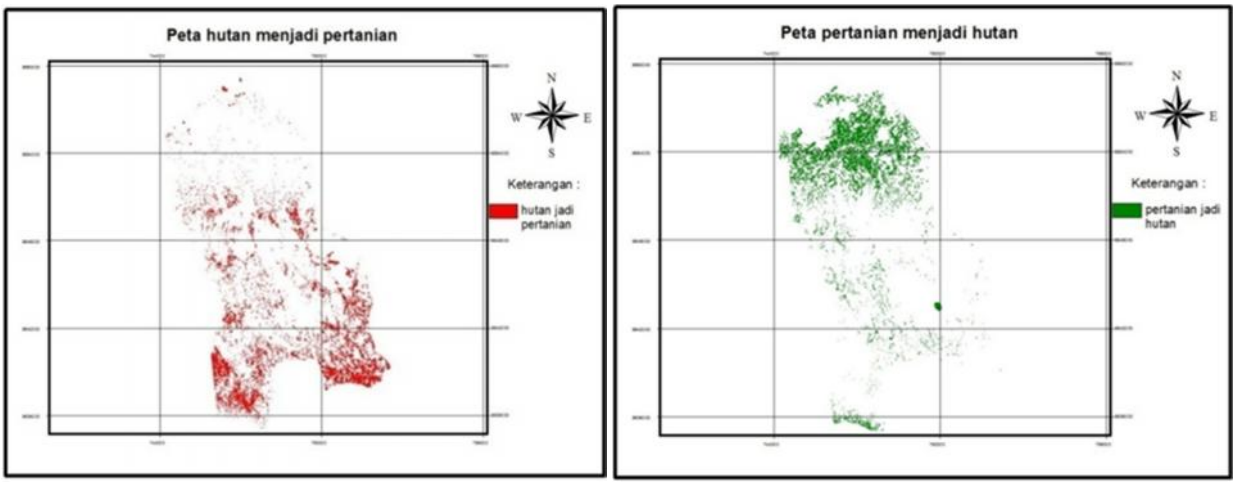

Figure 3 the area of converted forest to agriculture (left) and from agriculture to forest within 2002-2011

Social aspect

The swidden agricultural practices for the Matangga people has lasted for several generations (personal communication with locals).The swiddening practice are mainly slashed and burned the forest to get an opening for foodcrops plantation. They normally planting mixed crops such as corn and cassava as the first crop after opening the land and following by a permanent crop (mostly cocoa trees). After cultivating the land for several years the land abandoned for 3 to 5 years before its recultivated (Figure 4).

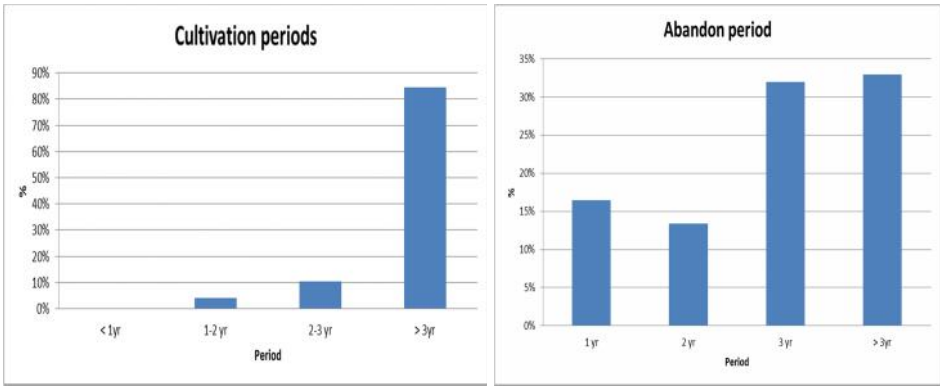

Figure 4 Period of land cultivation before abandoning (left) and period of abandoned land before recultivated (right)

The history of the land ownerhip by the indigenous people of Matangga shows that 54% (97 respondents) of farmers was previously opening the forest and 46% inherited the land from their family. The driving factors of the forest conversion by these farmers are mostly due to economic necessity (59 %) and 31% practicing the swiddening by following their ancestors way while 10% due to other factors and most of the people (84%) merely depending on their swiddening agriculture for their lifelihood.
The swiddening practice by the indigenous farmers are not merely practiced intuitively. In fact 73% of the respondents admitted the guidance on conservation practices has been delivered from the forestry department of the local government.

Conclusions

Subsistence farming practices in in Matangga-Indonesia are stil practiced with periodical the interchange between cultivated and forested land.
The main driving force of forest conversion in Matangga are the economic reasons and the inheritage way of life from their ancestors.

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