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Research Article

Land Use Changes and Their Effects on the Provisioning Services for 32 Years in Temiang Village, Giam Siak Kecil-Bukit Batu

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Abstract
Research on land use change in Temiang Village is important as it is a part of Giam Siak Kecil-Bukit Batu Biosphere reserve conservation area which protects and conserves the ecosystem and the biological resources and genetic resources in it. This research was conducted to determine land use changes and their effects in Temiang village, Bukit Batu. Effects of changes in land use in Temiang village can be seen in provisioning services. Provisioning services are the benefits obtained from the supply of food and other resources from ecosystems. To collect primary data, a field trip was conducted, in addition to in depth interview and Focus Group Discussion method. The land uses in Temiang village are driven mainly by local societal preferences and practices which are rubber and oil palm plantations. The other factors that drive land use change are conversion for housing and village facilities which is also the result of population growth and the arrival of migrants.

Keywords: Temiang Village, land use change, ecosystem services, provisioning service.

Introduction
The natural world provides benefits through the ecosystems. Humans are part of the ecosystem and each person depends on the ecosystem for their welfare. Ecosystems are the source of obvious necessities such as food and fresh water. The Millennium Ecosystem Assessment (MEA) shows that over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period in human history, largely to meet fast-growing demand for food, fresh water, timber, fiber, and fuel (Azapagic 2010: 141). There are

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many other things that cause people to overuse environmental resources to survive from day to day. That is why there is strong relationship between 'people' and 'nature', between 'the economy' and 'the environment', or between 'human well-being' and 'ecosystems'.

The five most important groups of indirect factors in changing the ecosystem are (1) population change (demographic drivers), (2) change in economic activity (economic drivers), (3) sociopolitical drivers, (4) cultural and religious drivers and, (5) technological changes. Important direct drivers to consider are (1) habitat change driven through land use/cover change (2) physical modification of rivers, or water withdrawal from rivers, (3) over exploitation, (4) invasive alien species, (5) pollution, and (6) climate change (Tomich, et.al. in Ash 2010:89).

Land use change, which is one of the direct drivers of the changing ecosystem, has happened in Temiang Village Riau. Similar to other provinces, Riau is also home to various ethnic groups who arrive because of employment opportunities, as tradesmen, or for other reasons. They are from Minangkabau, Java, Melayu, Tapanuli, and other areas. They went to Riau when Japan colonized Indonesia around 1942, as forced labour, known as romusha. The Japan military government in Indonesia needed manpower in strengthening defense against attacks. Apart from the Java people, the Batak and other ethnic groups also come to Riau to work as labourers and as public servants.

Temiang village is one of 14 urban villages in the districts located in Bukit Batu, Bengkalis, Riau. The area is part of Bukit Batu Biosphere Reserve in Riau. The central government and the provincial government established Giam Siak Kecil-Bukit Batu in Riau as biosphere reserves. This biosphere reserve is in Bengkalis and Siak, as proposed by The Man and Biosphere (MAB)-Indonesia Committee and Sinar Mas Forestry, which allocates 72,255 hectares of forest production for permanent conservation. This area is part of ecological corridors that combines two wildlife reserves, Giam Siak Kecil (84. 967 ha) and Bukit Batu (21. 500 ha) (Profil Desa Temiang, 2011). The concept of biosphere reserve, an integrated and comprehensive management system, enables sustainable use and community involvement in management.

Material and Methods

To collect primary data, field trips were conducted on July 2nd to 8th, 2012 in the area of the Giam Siak Kecil-Bukit Batu Biosphere Reserve, Riau and close to the village of Temiang which is located at 1°23'53.3" East Longitude and 101°54'17.2" South Latitude, at altitude of 375 meters above sea level. Secondary data on Temiang Village was collected 2 years prior to the field trip.

Materials collected were about the history of the village, livelihood of the rural people, population, village borders, and the education level of Temiang villlagers. This village is one of the 'basecamps' for a joint research between our Institution (LIPI-Indonesian Institute of Sciences) and Kyoto University.

The first method of collecting primary data was in depth interviews with the village Secretary and community leader. The in depth interview method is used to identify the structure of society and their perspective about the environment. The second method is FGD (*Focus Group Discussion*). In this activity, there were 30 respondents made up of young people, old people, and village officer. The FGD was used to make a village sketch related to the changing land use and other ecosystem services. The sketches that we made were of the past (32 years ago), present and future plans of village management related with the ecosystem. This method is part of visual anthropology.

The last method of this research was to give questionnaires to 30 respondents in Temiang Village. The age range was based on the participants of the FGD. We divided these participants into 3 groups. The first group had respondents in the 69 to 84 years old age group (4 people) to make a village sketch of the past. The second group covered ages 53 to 68 years (2 people) who made a village sketch of the present, and the third group that had people in the 29 to 52 years age group (24 people) made a village sketch based on the future plan. Most of the participants are farmers, others work in business, rubber plantations, and fisheries. Some are housewives and drivers. The questionnaire focused on comparisons between the past and present and what changes have happened to Temiang village for 32 years, related to land use change. Based on the village sketch, we analyzed and compared the difference between the past, present and the future. From raw data of questionnaires, we made graphics of statistic distribution.

Results

Background Information of FGD Participants

From the questionnaire, the demographics data of FGD participants in Temiang Village (Figure 1), we know that the participants work as farmers and most were educated up to Senior High School (11 persons).

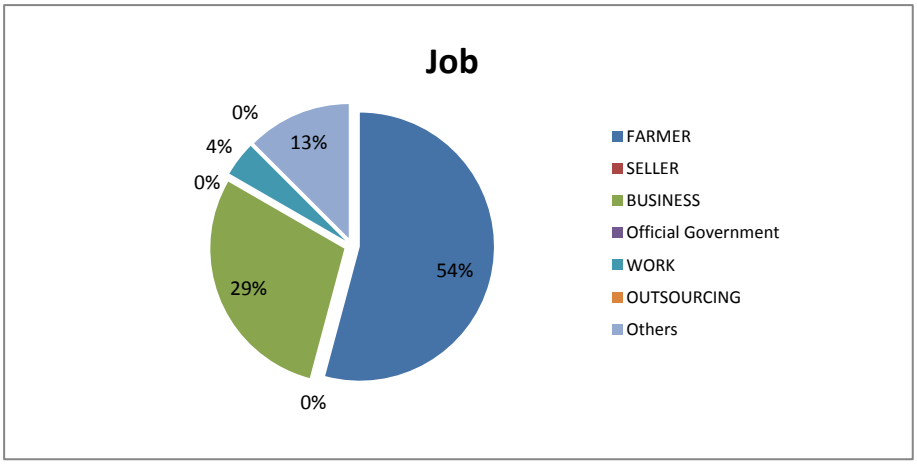

Figure 1. Graphic of demographic data of FGD Participants in Temiang Vilage

From the questionnaire, results showed that in the previous twelve months the communities earned income from planting rice, rubber, and palm trees (Figure 2). In addition, the society also received income from breeding chickens, cows and pigs. Others are self-employed, government employees or involved in private business. This result shows they work mostly on rubber plantations.

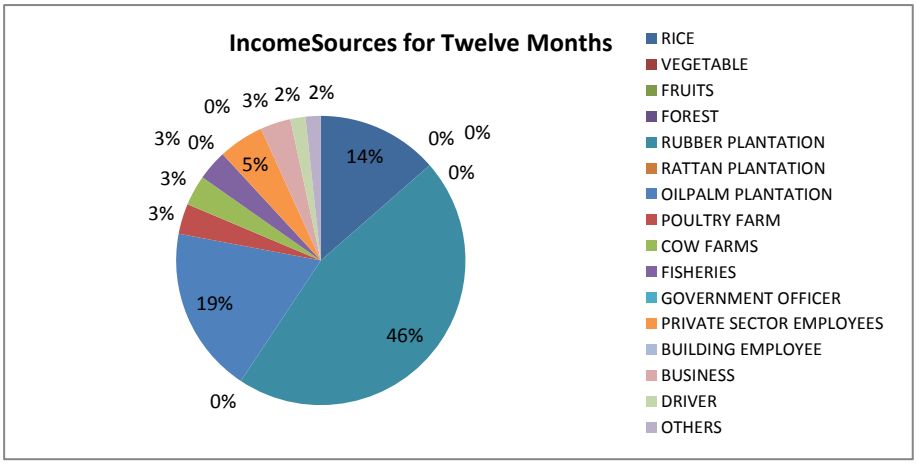

Figure 2. Graphic of Income Sources for Last Twelve Months of FGD Participants in Temiang Village

In terms of family property, most people now have a motorcycle. Previously traffic could only be traversed by rivers, so they had to rent or own a small boat (Figure 3).

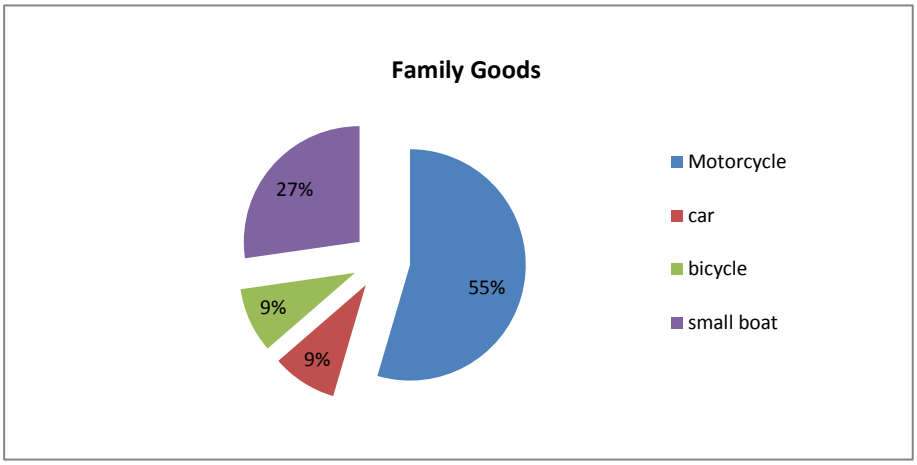

Figure 3. Graphic result of family goods own

A Brief Description of Temiang Village

Temiang village, a historic village, is a conservation model village established in 2004. A total of 300 households live in this village. The village used to be part of the Temiang forest and called 'the village of the grass' (*kampung si alang*). Temiang village began to develop when some companies came to this area before 1945, i.e. before the Dutch came to this area. At that time, the streets were still filled with soil and bushes. Before the Dutch came, nut trees are also found in Temiang, but after that, orders were given for rubber planting. With a high sale price, eventually people preferred rubber over nuts. Around the 1950s there was a group of people come who came from the Siak River into an area through Bukit Batu area. The group was deliberately moved by Datuk Laksmana to open plantations by cutting down forests around rivers. Datuk Laksmana was most feared and his word was an order - and he gave the order to keep the forest. Datuk Laksmana then gave the area to Maadun, the village head in Temiang (Profil Desa Temiang, 2011).

Previously this village only had 4 families. Some groups had also lived and bathed around the river and then felt that their skin had become itchy (*Miyang-Miyang*). After that, these people called the area they occupied as Miyang. When the district asked for the name of the village, community

leaders deliberated and said the name of the village is Temiang village. Temiang village is located 30 km north of Bukit Batu and 48 km from the capital. The village has a total area of 2,400 ha with limits as follows:The North is bordered by the village of Api-ap;
-The South is bordered by Sukajadi village;
-The East border is with Parit Satu Api-api village;
-The West border is with a company (PT SPM/BBHA)

In 2012, Temiang Village had a population of about 1,344 people scattered in two village areas. Of this number, 692 were male and 652 were female. People in Temiang depend on from agriculture (54 %), plantation and fisheries sector (17 %), and business (29 %). The Temiang village is an area surrounded by forest, plantation and Bukit Batu River, where education levels are Elementary School (SD) (33 %), Junior High School (SMP) (21 %), and Senior High School (SMA) (46 %).

Land Use Change in Temiang Village

Bukit Batu area included in the Bengkalis District has not escaped from land use changes. To report the land use change in Temiang village, we use an approach from Leslie, Barson, and Smith, by identifying areal change which is presented graphically with identified changes compared and trends observed (Byron & Lesslie 2008: 46).

The Temiang village in the recent past (32 years ago) was still filled with primary or secondary forest and shrubs (Figure 4). Most forest areas that have been converted to other land types have become rubber plantations. In terms of land use change, land use change patterns of other uses (forest, shrub, open land and fields) into a rubber plantation, fields and road construction are very dominant in Temiang Village (Figure 5); the ownership of land was also unbundling and limited. The function of forest around the village started to change drastically i.e. for plantation, fields, as well as housing.

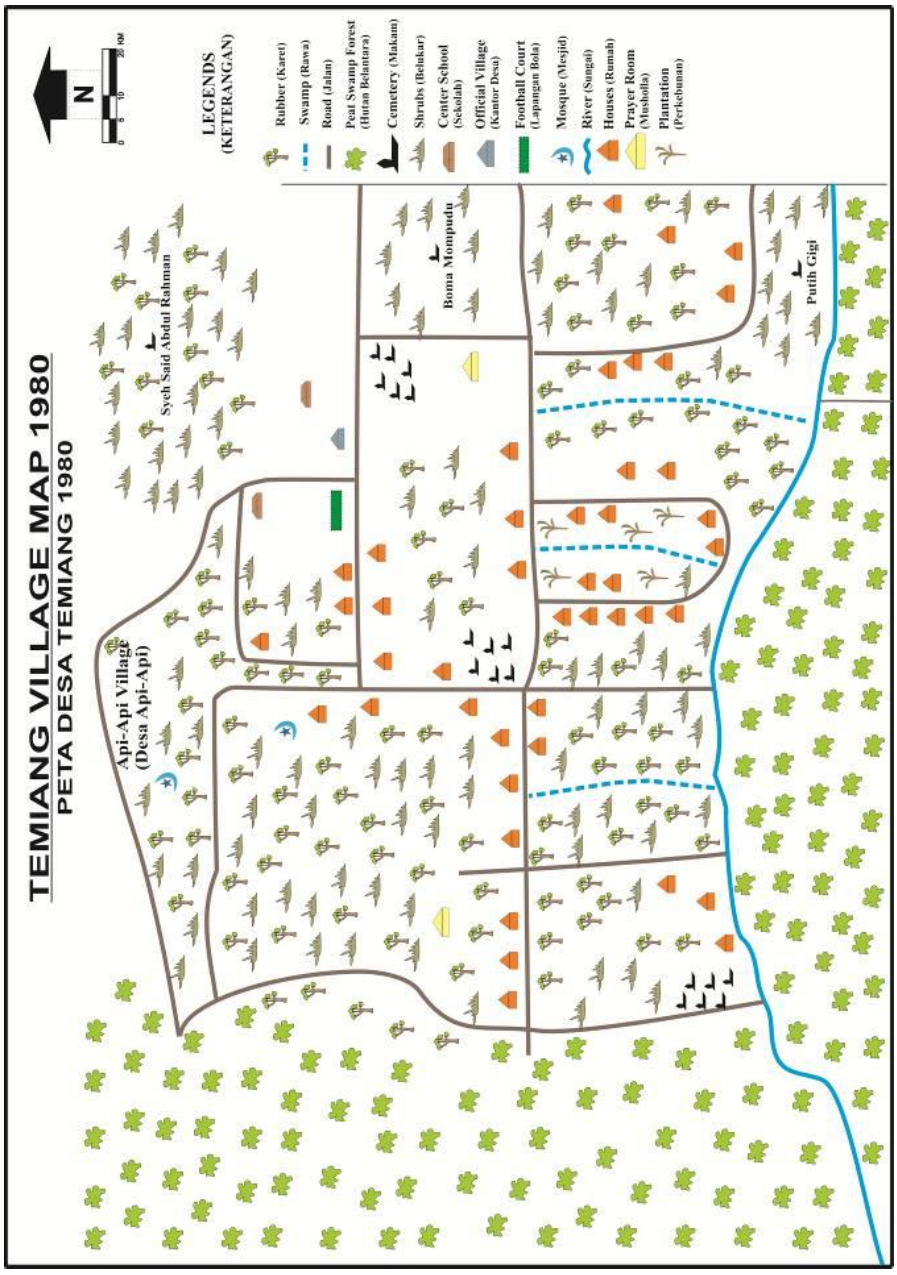

Figure 4. Temiang Village Map 1980 (sketched by Suhendra based on FGD)

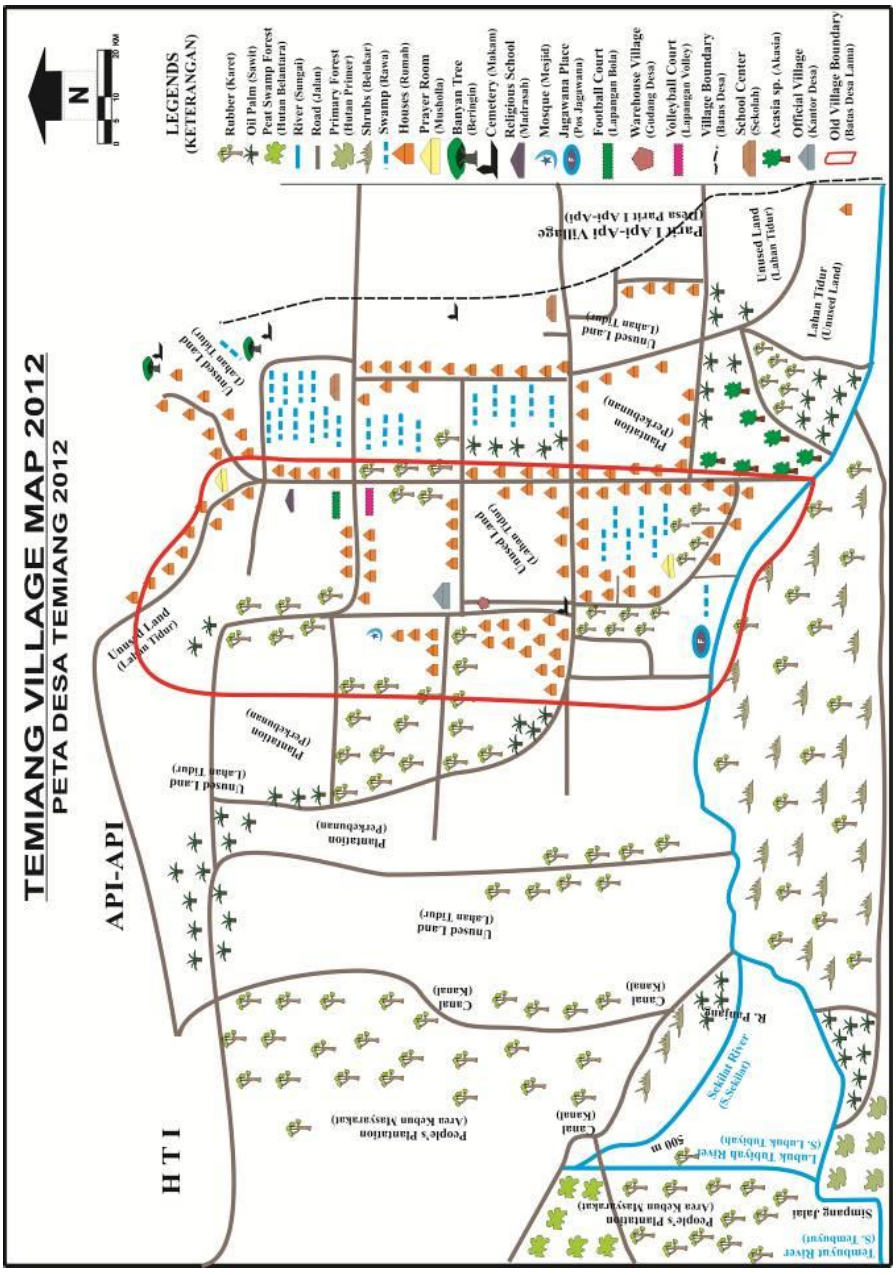

Figure 5. Temiang Village Map 2012 (sketched by Suhendra based on FGD)

Land use (LU) term entails the manner in which human beings employ the land and its resources (Ramachandra & Kumar, 2004 in Joshi & Priyanka 2011: 52). Land use changes are driven mainly by multi-scale driving forces including local societal preferences and practices (food, farming, livelihood etc.), the global economy, environmental conditions, land policies, various development programmes, and feedback between these factors, including past human activity on the land (Joshi & Priyanka 2011: 55). In general land use change has been the main driver of terrestrial biodiversity loss during the past century (Trisurat, Shrestha & Alkemade 2011: 2). Land use is a key human activity, which, through the exploitation of natural resources, fosters socio-economic development and alters structures and processes in the environment. Direct drivers of land use change are activities such as logging, cropland expansion, road building, and other types of infrastructure development (Tomich, et.al. in Ash 2010:88).

Based on the result of the Focus Group Discussion that we conducted, there are three types of land use in Temiang village; rubber, oil palm and, agricultural lands, forest areas, and village facilities (Figure 6). Apart from being used for agriculture and housing, land in Temiang village is also used for village facilities such as a mosque, football court, volleyball court, and also school. It can be seen in the map of 2012 (Figure 5).

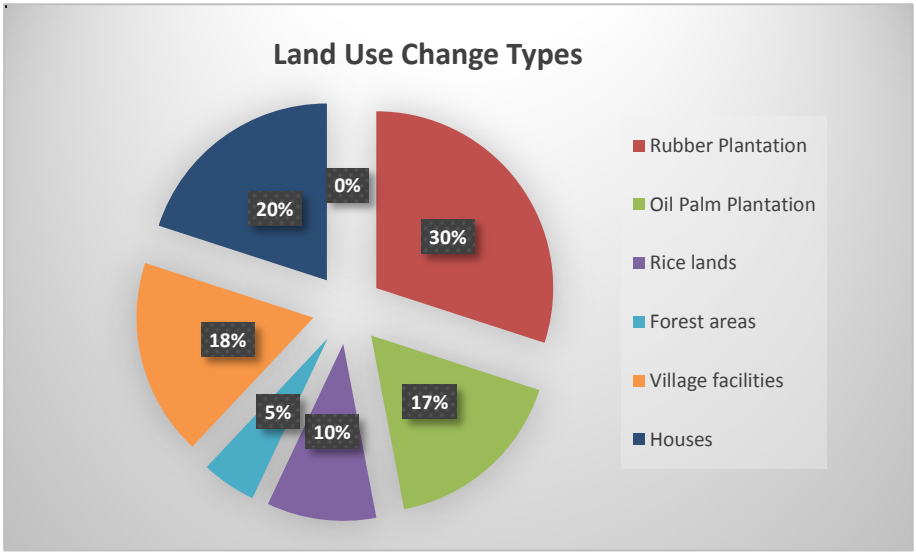

Figure 6. Graphic result of land use in Temiang Village in 2012

Land use in Temiang village is driven mainly by multi-scale driving forces including local societal preferences and practices (food, farming, livelihood etc.) such as rubber and oil palm plantations. Land use for rubber plantation is dominant in Temiang village. It also can be seen when the two maps of Temiang Village in 1980 and 2012 are compared (Figure 4 & Figure 5). In 1980 we can see that Temiang village consisted mostly of peat swamp forest (Figure 4). By 2012, the forest area was converted into rubber plantation (Figure 5). The opening of the land was not only to meet need for land but also for the value of selling timber. The entry of the plantation company in this area not only changed land use from natural forest to plantation but also triggered people to encroach the forest. The damage was uncontrollable. Change of land use in the region has an impact on the lives of local people; it also impacts climate change that has swept the world. The change of land use and loss of forests impact fisheries. Compared to 32 years ago, people have to go to further to find fish. Degradation of traditional values also happened. Unfortunately, changes in land use can lead to a number of environmental problems, including water scarcity, water pollution, soil erosion and biodiversity loss (personal communication, 2012)

Forest conversion is mainly due to the spread of agriculture (including plantations), urbanisation and mining exploration. Based on the village history, a plantation company had entered the area before 1945. This company had altered land use from forests to plantations. In the process of land clearing, the company did not pay attention to historical aspects and traditional land ownership. Even the boundary with the land owned by the company is traditionally one which is managed by the community as an area of their fields. From a map made by the company, it appears that the village is surrounded by large companies involved in plantations (Figure 7).

When the plantation first opened, there were conflicts between people and companies because the fields that people have traditionally used became the territory of the company. The presence of companies and land clearing do not only change the area but also the culture of the local people, especially related to ecosystem services. Medicinal plants, sacred sites, and a variety of cultural practices that were usually done are now rarely found, because the main factors in supporting culture (environment) has changed. Medicinal plants are hard to find, and gradually change to medical treatment. Rituals associated with land clearing, respect for tigers, and other rituals associated with the environment are now rare.

The other forces which drive land use changes in Temiang village are various development activities (agricultural programmes, road building, zoning, construction). Peoples' homes and road construction are part of land use changes that occurred in the Temiang village (Figure 5). Rubber and palm oil

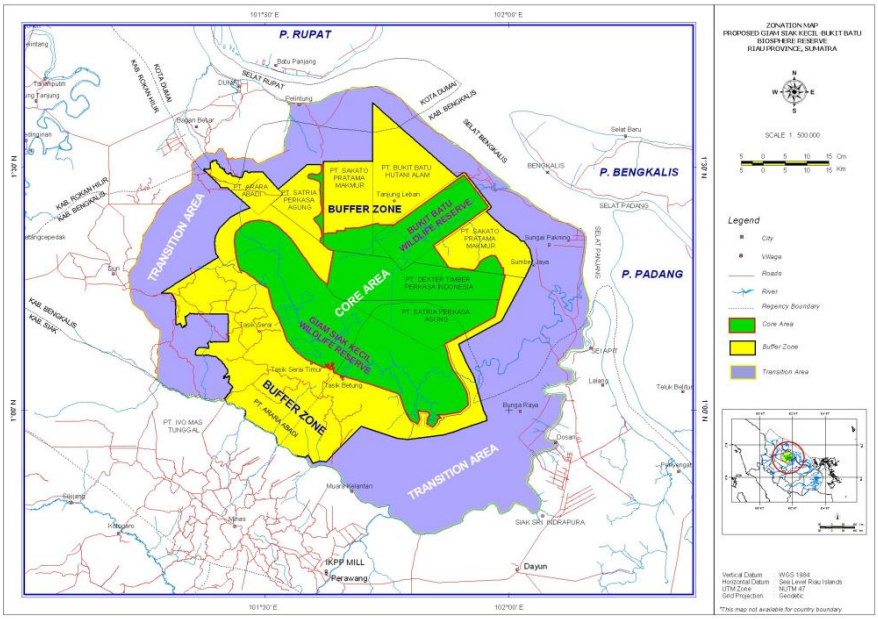

Figure 7. Map made by company described the village is surrounded by large companies

harvests need to be transported. Based on questionnaires; the road is now also more developed. It makes it easier for people to travel and transportation and infrastructure allows Temiang people to carry out activities in other regions and obtain a new lifestyle, such as the ownership of mobile phones. Mobile phones have became significant items in village of Temiang. This is the same case with television - the public wants to acquire more and information and this can be seen with the increasing number of people who have a television, and decline in the number of radios.

As a daily activity, agriculture is one of the factors of land use change. Over a period of 45 years from 1961 to 2006, growth of agricultural output (crop and livestock agriculture) in Indonesia was 3.6 per cent per annum; between 1968 and 1992 it was 4.8 per cent per annum (Booth et.al 2012: 52). Outside Java, the expansion of land under smallholder cultivation is the result of population growth leading to more land being used for food crops, and the growing world demand for a range of products including rubber, cocoa, palm oil, coffee, and spices, which has led to more land being brought under tree crop cultivation (Booth et.al 2012: 58). According to Anna Booth, apart from large estates, which now mainly produce palm oil, virtually all agricultural production in Indonesia is carried out by “smallholder” producers. The agricultural household is a household where at least one household member undertakes activities

which produce agricultural output for the market or for exchange or which yield income or profit at the person's own risk (Booth et.al 2012: 61). Agricultural area expansion and transmigration had three effects on forest cover in the outer islands: forest was converted for agricultural and pressure was placed by the transmigrants on the land and forest managed by local people. In Temiang village, the community is no longer raising fish or relying on forests, but work in the agricultural sector.

The other factors that drive land use change is for more lucrative use for people, especially in areas which are close to growing urban areas. There is much cropland has been used for housing and village facilities which is also the result of population growth. In Temiang Village, housing is one of the land use changes that has happened. As we see in Figure 5, many houses were built around rubber plantations. Besides housing, people in Temiang village also build facilities (Figure 5) such as volley ball court, school, and religious facilities.

Discussion

One of services mostly affected by the land use change in Temiang village is provisioning services. Provisioning services are services in providing food, water, wood, and fiber (Ash, et.al, 2010: xi). In Temiang village, there are changes in terms of provisioning to water. With many forests turned into rice paddies; it is hard to get ground water. In terms of usage and water resources, people use water from rain and wells for cooking, farming, washing, and drinking. Rain water and wells become more widely used as a source of water for the community, which is one of the results of land use change. The loss of open areas reduced the absorption area, so that the community would have to find other sources of water. People in Temiang Village depend on ground water and rain water for their daily lives (Figure 8). For Temiang people, clean water is not too important; they are more concerned with practicality in obtaining water. Nowadays people prefer water gallons which are sold to homes, because they do not need to boil water for drinking.

One of the land-use changes that could affect people's behaviour in water resources acquisition is the development of oil palm plantations. The development of oil palm plantation area has a significant impact on the environment such as the decreasing availability of water. Palm oil plants need lots of water in the process of growth. The change of land use from natural forests to monoculture systems (oil palm) will change the balance of water in the region. Because of the mechanism of monoculture crops, either directly or indirectly, there is effect on water balance of land and water availability in the region.

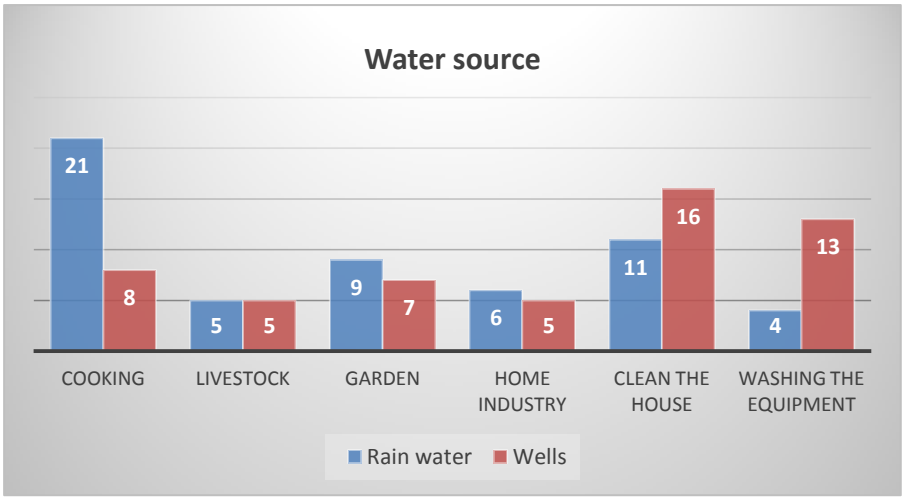

Figure 8. Graphic result of water management in Temiang Village in 2012

In addition to an effect on water, land-use changes also impact provisioning service in timber. Since the beginning, Temiang villagers use timber species such as meranti (*Shorea* sp.), punak (*Tetramerista glabra*), and ramin (*Baccaurea javanica*) in their daily lives. Based on the interview about the types of wood that are used now, ramin (*Baccaurea javanica*) is a type of wood that is very rarely used because it is hard to find. It is directly related with the effect on biodiversity. Generally biodiversity can be divided into three hierarchical categories – gene, species and ecosystems that describe different aspects of living organisms. In conjunction with this study, the category of biodiversity that has impact form land use change is species diversity. Species diversity refers to the variety of species within a region. It is the most commonly considered aspect of biological diversity. Basically species diversity can be measured in many ways, such as species richness and species diversity (Trisurat et.al 2011: 4). The simplest measure often used to describe biodiversity is 'species richness', i.e. the number of species found for a given area (Cochard 2011: 26).

Land use change in the Temiang village also gives effect on provisioning in food. Human security covers a wide range of issues including basic elements, such as food to eat, homes to live, good health, education, freedom from violence, safety during natural and human-caused disasters, democracy, good governance, and respect for human rights (Ravjanshi & Mathur 2010: 68). One of the factors responsible for hunger and poverty today is the unprecedented

loss of biodiversity associated with ecological deterioration (Ravjanshi & Mathur 2010: 70).

According to interviews, people in Temiang village utilize cassava (*Manihot esculenta*) as a food supplement. Today besides cassava, palas (*Licuala spinosa* Thunb.) and galam also use as food supplements. Increasing variety of plants that can be used as supplements associated with increased knowledge of people about the species can be eaten. The arrival of migrants is part of the changing demographics of the population which can also lead to land use change in the region. The migrants would build their homes and open land for plantations to meet their basic needs. Many migrants who come to this village and bring knowledge from their native place are one of the factors of the increasing of the people knowledge about the utilization of plant as food.

Conclusions

Land use change in Temiang village gives effect to provisioning service in water, timber, food. The land uses in Temiang village are driven mainly by the development of rubber and oil palm plantations, agricultural programmes, road building, housing, village facilities, which are also the result of population growth and the arrival of migrants.

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