

Forest land use by the community in Sorong Natural Tourism Park at Sorong City, West Papua Province

YOHANES YOSEPH RAHAWARIN

Faculty of Forestry, the State University of Papua, Jl. Gunung Salju, Amban-Manokwari 98314, West Papua, Indonesia, Tel & Fax.: +62-986-211364, email: yohanesrahawarin@yahoo.com

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ABSTRACT

Rahawarin Y (2011) Forest land use by the community in Sorong Natural Tourism Park at Sorong City, West Papua Province. Biodiversitas 12: 222-227. The aim of the research was to: (i) identify the type and extent of forest land use alteration at Sorong Natural Tourism Park (or SNTP), (ii) investigate society activities that cause forest land use alteration, and (iii) make the zoning level of environmental damage (iv) investigate the causative factors of forest land use alteration at SNTP. The method used was survey with field observation and semi-structural interview techniques. The primary data of biophysical aspects consist of type and extents of land usage by society; while data of socio-cultural aspects consist of level of community dependency upon land and the existing of local institution and management of SNTP. Secondary data that had been collected consist of study results documentation and report of SNTP management aspects. Data were analyzed by using (i) qualitative descriptive analysis of society socio-cultural and management aspects, (ii) spatial analysis of biophysical aspects, and (iii) environmental analysis of biophysical, socio-cultural and management aspects. Evaluation of environmental analysis was used to arrange directive and environmental management strategy at SNTP. Result of research indicated that since its establishment in 1981 to 2009, SNTP forest land utilizing for settlements, forest product extraction and shifting cultivation activity by society had been cause of land use alteration occurred which was incompatible with area function about 11,53%. Changing in the land use caused by society activities in land utilizes such settlements, forest product extraction and shifting cultivation. Level of environmental degradation in the catchments area of damage SNTP level indicates that 8.01% of total of land area was in slightly damaged, 2.36% was moderately damaged and 1.16% is in heavily damaged. Inadequate support on socio-cultural aspects of society at SNTP and the lack of founding and supervising upon SNTP management was pointed as causative factors on environmental damage. Based on level of environmental damage, community based forest management system will be able to be implemented as environmental management strategy at SNTP.

Key words: forest land use, environmental degradation, Sorong Natural Tourism Park.

INTRODUCTION

Forest is multifunctional natural resources in support of human life, not only as a place for the conservation of biodiversity and maintenance of ecosystem functions, but also to produce goods and services for the community. The forest area in Papua has the potential of natural resources with a rich diversity that is high enough, by requiring the protection, conservation and sustainable use to maintain its diversity. Conservation, also function as a protected area, area also has other functions such as life-support systems and as a means of research and development of science, education, nature tourism and support for aquaculture activities. Sorong Natural Tourism Park (SNTP) or "Taman Wisata Alam (TWA) Sorong" is a tourism park located in the province of West Papua. It has a high biodiversity and is based on the Decree of the Minister of Agriculture No. 397/Kpts/Um/5/1981 date may 1981 07 a surface of 945.9 ha (MoA 1981; BKSDA West Papua 2007). This region serves as a nature which can be exploited for tourism and recreation natural conservation area.

The existence of the conservation area at this time usually undergoes a variety of incredible pressure. There is

no conservation area which is free from illegal activity, either in form of illegal logging, poaching, the invasion of the area for growing, settlements, exploration and exploitation of minerals, land use conflicts or other uses. Moga (2005) suggested that the cause of the destruction of the area of conservation was because of the weakness of the social aspects of the surrounding community. Nitibaskara (2005) said that there was an institutional limitation of Government which was responsible for the management of conservation, as the weakness of the growth of the population, especially in the communities around the edge of the forest area reduction policy areas.

Sorong Natural Tourism Park is adjacent to the location of the residential areas. It is resulted in the interruption of the broadening of the forests. This area has become the stone angle society needed to meet the needs of everyday life. Some of the internal effects among others are settlement in the region, the forest for activities not related to the conservation and agriculture, gardens and fields, the use of wood and other forest products, mainly for land use firewood, illegal to local needs, logging hunting and trapping in the region. External effects with predominantly happen among others are wildlife and move the fields on

the form, the use of the area of conservation for other purposes such as mining and others, as well as the construction of roads in the area of conservation overlay.

Negative impact of such utilization is reduction recharge area in SNTP region. It can lead to surface runoff and erosion causes floods, landslides or during the rainy season. It is caused of because the loss of trees with its wide crown serving as water retention. A way that can be done to overcome the negative impact is that by increasing the flow of groundwater of infiltration. Several impacts of logging activity are a threat to environmental damage of SNTP. This research aims to analyze the form and the extensive use SNTP, to analyze forest land utilization by people around, the effect damage emerged and to analyze the effect factors of the cause of land use change.

MATERIALS AND METHODS

Data collection

The method used in the research was survey with field observation and semi-structural interview techniques. Biophysical aspects of primary data consist of the shape and the use of soil and vegetation cover area. Socio-cultural of society aspects, including the degree of dependence of the population of the land and the Community institutions and the SNTP management data. Secondary data are achieved from documents/reports the results of research related to aspects of management of SNTP. Secondary data is done through listing documents or research reports.

Land use change

There is forest land utilization done by the people around in the forest land. In order to know the location, the form, and the land use change, the tracking through GPS is implemented. The data obtained are spatially processed in a way to calculate the area of overlapping polygons using an ArcView GIS using version 3.3 of the program (FoGGMU 2009)

Catchment areas damage

Processing of data for the analysis of damage to areas of recharge used spatial analysis with scoring method (Kastaman et al. 2007). Natural environmental components affected the infiltration of outstanding potential, type of soil, and precipitation, whereas the land use affect the real infiltration land use. Score method with a system of classes based on Permenhut No. P.32/MENHUT-II/2009 (MoF 2009).

Socio-cultural aspects of society

Aspects of weighting system and the parameters used in the assessment of the socio-cultural aspects of society. The general formula used to calculate a value for each parameter of the aspects socio-cultural is: the indicator value = frequency x score x weight parameters. In addition, aspects of socio-cultural support for each parameter value is calculated based on the percentage weight of each parameter in the lowest and better qualifications.

Data analysis

Parameters aspects management of SNTP observed included the integrity of the boundaries of the area, if any bad supervision and guidance to the public. The descriptive data processing based on interviews and comments field, and information as well as secondary data. Data analysis was performed by: (i) qualitative descriptive analysis for the social aspects of public culture and parameters management SNTP, (ii) the spatial analysis of the aspects of biophysics (land-use change), and (iii) an environmental assessment for the aspects of social and cultural management region, which later became the basis in the formulation of the direction and strategies for environmental management of SNTP.

RESULTS AND DISCUSSION

Land use change

Land use activities

SNTP laid down in the Decree of the Minister of agriculture No.397/Kpst/UM/I/1981 area of 945.90 hectares per day in October 2009 Note research occurred during the use of the soil that is incompatible with the region in SNTP functions. SNTP land-use change began around the year 1998, starting with the public for a variety of needs, land use activities both for settlements, forest product extraction and shifting cultivation.

Type and size of land use

The results of measurement and analysis of spatial forms of land are known that from the total SNTP land of 945.9 Ha, the converted areas for others used about 109.06 hectares (11.53%). The form and area land use SNTP are presented in Table 1, and spatially depicted in thematic land use such as shown in Figure 1.

Table 1. Type and land use area of SNTP

Location and type of land use	Area (ha)	Percentage (%)	Information
Garden and field			
▪ Klasaman village	5.30	0.56	2 plot
▪ Klablim village	19.29	2.04	11 plot
Sub-total	24.59	2.60	
Settlement			
▪ Klasaman village	0.38	0.04	1 plot
▪ Klablim village	7.85	0.83	2 plot
Sub-total	8.23	0.87	
Shrub			
▪ Klasaman village	1.89	0.20	2 plot
▪ Klablim village	73.87	7.81	1 plot
Sub-total	75.76	8.01	
Open land			
▪ Klasaman village	0.47	0.05	1 plot
Lowland forest			
▪ Klasaman and Klablim village	836.81	88.47	
Total	945.9	100.00	

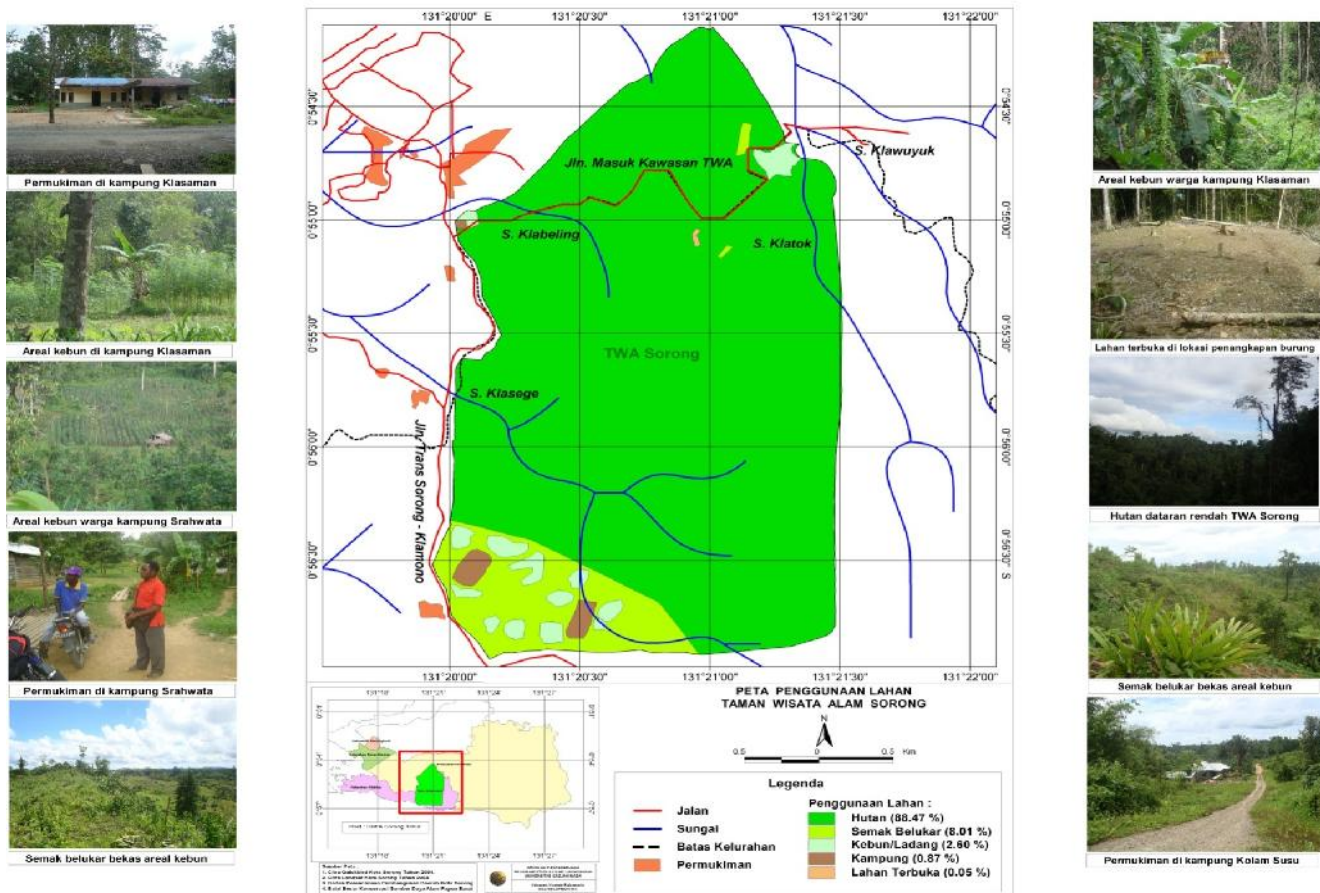


Figure 1. The map land use in Sorong Natural Tourism Park (SNTNP)

The results of Table 1 and Figure 1 shows the largest land conversion is a shrub (8.01%), followed by plantations/crops (2.60%), residential (0.87%) and open field (0.05%), while the rest continue forming lowland forests (88.47%). Due to the availability of the road and the entrance to the forests of the community to facilitate development of housing, gardening fields area land use change/and forest harvesting. Basuni et al. (2009) said that human activity is usually inside and outside the area of conservation, particularly in unregulated land use and become a threat to the sustainability of the area of conservation. When the threat is permanent, without end (eternal external threat) then land conservation areas and their products will remain the limited resources for a growing population.

Catchment areas damage

Potential infiltration

Potential penetration values obtained from the type of soil and factors slope factor rain infiltration in SNTNP. Precipitation infiltration coefficient will be multiplied by the amount of precipitation divided into 100 days with rain. On the basis of climatic data (BMG Sorong 2009) showed that the rainfall over the last 10 years (1999-2008) was 2887.40 mm, the number of rainy days as many as 218 days, precipitation infiltration 6295 mm, including classification of very large (> 5500 mm). Forest land in SNTNP is divided into two kinds of Brown podzolic and

alluvial soils. Brown podsol ability penetration is fairly large, and alluvial soils are classified as small. SNTNP conditions slope with flat areas (0-8%) and slope (8-15%).

Spatial analysis results showed that 90.06% of SNTNP able to absorb the water with great skill, while the rest (9.94%) is of average size water infiltration. Hamzah (1975) in Tokede (1989) states the ability to store water forest soils depends largely on the percentage of silt and clay. The higher the percentage, the more water is stored; it is not excessive humidity that can lead to poor soil aeration. Commonly known that the growths of trees in clay soils are better than in clay or sandy soil.

Actual infiltration

Land use, vegetation cover mainly affects the infiltration through three forms, namely: the root and the pores enlarge permeability soil, vegetation cover to hold run-off and vegetation cover reduces the amount of percolation of water through transpiration. Canopy trees falling rain erosivity power to change is by changing the speed and grain size of rain drops. Factors that contribute to high canopy cover, canopy thickness, density, so the garbage, grass and herbs as ground cover. Given the role of vegetation cover and or use of land in SNTNP region, the value of the actual infiltration rate of the area, then based on qualitative Permenhut No P.32/MENHUT-II/2009 (MoF 2009) presented in Table 2.

Table 2. Classification value of actual infiltration of SNTP

Type of land use	Scale closure	Value of actual infiltration
Low land forest	76-100%	large
Shrub	51-75%	small large
Garden and field	25-60%	moderate
Settlement	0.5-25%	rather small
Open land	< 0.5%	small

Source: Modified from Barbour et al. (1987); Indriyanto (2006); MDNR (2007); MoF (2009).

Table 2 explains that this area of land is in various forms of land use conversion above have resulted changes in the level of cover. SNTP forest serving act to protect the interests of biology nature conservation area. The

ecological function of natural processes that took place became interrupted due to changes in the abundance of cover, such as pressure and threats the diversity of species and changes in patterns of succession of forests and the diversity of species and the community in a landscape patterns.

Forest areas opening activity SNTP society to be used as a bird capture zones acted by vegetation cover. The development of settlement by municipality Klasaman activities, Srahwata and Kolam Susu coatings intend to reduce the abundance and spread community activities that make rotation of crops through the opening of the gardens or the fields in this area.. Thus, abundance decline due to development solution from SNTP, land use change coverage collection of forest products and gardening activities or agriculture is a threat of damage to the environment if not properly managed will threaten the existence of functional areas.

The level of damage of recharge area

The results indicate spatial analysis with overlay and scoring method between the potential of thematic infiltration and actual infiltration thematic. Based on the analysis, it is true that the thematic level of damage catchment areas is in accordance with Permenhut No. P.32/MENHUT-II/2009, as it is shown in Figure 2. Based on Figure 2 it is known that the change in the land use caused by society activities in land utilizes such settlements, forest product extraction and shifting cultivation. Level of environmental degradation in the catchments area of damage SNTP level indicates that 75.77 ha (8.01%) is in slightly damaged, 2.36 ha (2.36%) is in moderate damaged and 10.97 ha (1.16%) is in heavily damaged. The damage of the recharge area is caused by land use change with little abundance of land cover and also spread of rarely so that it emerges bigger surface stream. Changing in the use and ground vegetation cover hydrological is very influential in quantities. In this case, it is the amount of infiltration so that regions with a level of abundance and cover will be much better then recharges water. It is good and natural. On the other hand, the more scarce the land over and damage, the higher the damage level of recharge area (Bruce 1966 in Nurlita 2008).

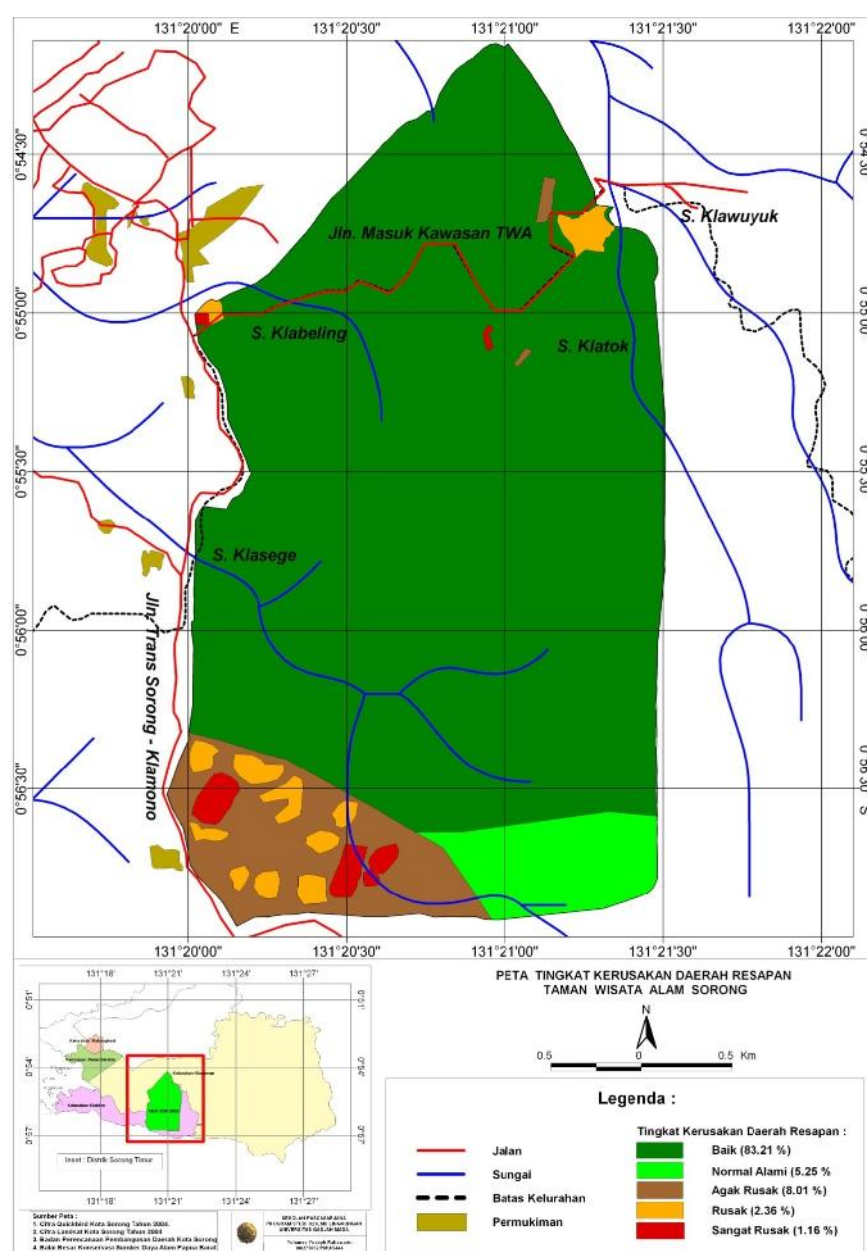


Figure 2. The map of damage level of recharge area in SNTP

Table 3. Indicator value support social and cultural aspects of society against environmental management SNTP

Socio-cultural aspects	Village				SNTP	
	Klasaman		Klablim			
Level of dependence of population on land						
▪ Land area	moderate	(6.50)	less	(4.68)	moderate	(5.59)
▪ Land status	very strong	(5.98)	strong	(4.55)	very strong	(5.27)
▪ Livelihood diversification	moderate	(3.55)	moderate	(3.75)	moderate	(3.65)
▪ Distribution and allocation of work time	less	(1.71)	moderate	(1.98)	moderate	(1.85)
▪ Special customs and traditions	strong	(2.38)	strong	(2.45)	strong	(2.42)
Total value (1)	strong	(20.12)	moderate	(17.41)	moderate	(18.77)
Community institutions						
▪ Institutional activity	less	(3.15)	less	(2.42)	less	(2.78)
▪ Forms and functions of institutions	less	(2.59)	moderate	(3.50)	moderate	(3.05)
Total value (2)	less	(5.74)	less	(5.92)	less	(5.83)
Total value of socio-cultural aspects (1) + (2)	moderate	(25.86)	moderate	(23.33)	moderate	(24.59)

Changing in forest cover to be housing, the open ground, bush and the dry land crop will reduce the ability to store the ground water supplies. This is in accordance with the proposal of Rauf (2009), the ability of the land to absorb the water varies depend on the characteristic of the soil, soil management, and in particular of the soil coverage itself. Forest land can absorb more water than land-use. According to Fahmuddin et al. (2004), when the use of forest land is converted into other use, soil, plants and the hydrological cycle in it are also influenced. This is because the impact caused by the physical, biological and chemical changes as well as the life on earth that is above them. Also be aware of the system of management of the land used for other functions, especially biodiversity is lost because of the conversion forest land.

The factors of environmental damage of SNTP

Socio-cultural aspects of society

The results of socio-cultural support the management of the SNTP area can be seen in Table 3. Table 3 shows that the level of dependency of the population on the land which remains weak contribution (18.77) against the management of SNTP. This fact can be seen in the contribution of less support far-reaching general land, livelihoods diversification and the distribution allocation of work time. This situation illustrates the possibility of strong enough environmental damages of SNTP to support the contribution of the aspects of the dependence of the population in the land for the management of the area. The parameters of the socio-cultural aspects of society that describes the support for tradition is strong; and the support of land use is very strong. According to Ekawati et al (2005) the state of the farm that is carved out by the owner, there is a tendency to be managed in a sustainable manner. Conversely, if it is not managed by the owners of the land, there is a tendency of the land managed without taking into account aspects of conservation, because the user is more result oriented at the time.

The society custom is that taking benefit from the forest land fertility and potential environmental of SNTP relatively wide for their life. Purba (2005) says that agricultural systems that move periodically (rotated) are very adaptable to the environment and forests show proven

wisdom environment suitable for the preservation of the biodiversity of tropical forests. Thus, the degree of dependence of the population in an area that is strong and powerful reflects the status of land and traditions contributing to the community in supporting the efforts to preserve the region against the threat of environmental damage.

The lack of institutional aspects of the society to support the efforts of environmental management SNTP, is cause the form and function of local institution which is not fully involved in the management area. Apart from that, the absence of local institution activity provides support for the conservation and management of SNTP. The activities of management are inactive and the institutions are likely waiting for instruction from government institutions. According to Purba (2005), the plan and the implementation of the social environment management that are carried out by local government will not always guarantee community of people to always be able to get the best benefits in the environmental management to improve social welfare. The principle of the social environment management must give greater priority to the participation of the community and the community as a whole. Tokede et al. (2008) explained that forest management based on community of people is characterized by specific typology of forestry society that the final goal is the empowerment and welfare society.

The aspects of the SNTP management

The results showed that optimal development activities have not been done so and are still limited to the public in general as students, university student of Sorong. Illumination to people in both towns has not done well. This is clearly seen from existence of different point of view how about the community should participate in the management of the SNTP. The main limitation is the shortage of human resources and operational support. Based on field observations and interviews with people and officials, it is known that many landmarks are broken or gone, which are intentionally pulled out or broken in the landmark of SNTP. The landmarks which are built since the beginning are not taken care well. The nursing such as painting and giving new number are not done yet. Based on

the description of the aspects of area management, it is known that the incompleteness of the boundary region since it is broken, gone and the not optimum directing activity to society caused by the work control of SNTP.

Environmental management strategy of SNTP

In general, management policies are divided into three parts namely technical policy (water and soil conservation), socio-cultural address and the policy guidelines. Technical policy is in the form of activities and the implementation of reforestation and agroforestry systems. Socio-cultural policies referred to forest management systems based on community. Policy guidelines aimed at changing the paradigm of the management of single stakeholder to many stakeholders. SNTP strategies of management is done through the following activities: (i) the stabilization of the region, (ii) the formulation of the area, (iii) construction of infrastructure and facilities for recreation and tourism nature, (iv) the potential area management, (v) protection of the area, (vi) the research and education, (vii) the management of nature tourism, and (viii) development of cross-sector integration and coordination.

CONCLUSIONS AND RECOMMENDATIONS

Since established in 1981 until 2009, the activity of taking benefit from SNTP by community around (urbanization, forest product extraction and gardening or shifting cultivation activities) has led to a change of land use for 11.53%. The conversion of SNTP forest land to be housing and open field has increased of damage recharge area for 10.97 ha (1.16%) to be badly damage; 22.36 ha (2.36%) was in damage condition in the form of plantation land; 75.77 ha (8.01%) was in rather damage in the form of bush. The lack the support of social and cultural society and the ineffective supervision and monitoring of management activities are factors of the cause of environmental damage in SNTP. Based on the level of damage and the factors cause of environmental damage, SNTP environment management strategies can be implemented through forest management system based on community that includes a number of activities, namely: (i) the stabilization of the region, (ii) preparing a management plan that could accommodate the participation of communities and other stakeholders, (iii) construction of infrastructure and facilities for recreation and tourism nature, (iv) the potential area management, (v) the protection and security of the area, (vi), research and educational activities, (vii) the management of nature tourism (viii) development of cross-sector integration and coordination.

The need of approach changing paradigm in the management of SNTP from single stakeholder to many stakeholders with basic management change, namely from government based management to multi stakeholders based management (collaborative management). Improvement

and prevention toward the existence of threat to SNTP environmental damage can be done with involving surrounding people in reforestation and the implementation of agroforestry through forest management systems based on community.

REFERENCES

- Barbour MG, Burk JH, Pitts WD (1987) Terrestrial plant ecology. Benjamin-Cummings, San Fransisco, CA.
- Basuni HS, Soekmadi R, Setiawan I, Wiriadinata S (2009) Management and development of buffer zone. Center of forestry training-SECCEM-Korea International Cooperation Agency. Bogor. [Indonesia].
- BKSDA West Papua (2007) The KSDA book information field regions I Sorong. Center for the conservation of the resources natural of West Papua. Sorong. [Indonesia].
- BMG Sorong (2009) Climate data for the period 1999-2009. Agency of meteorology and geophysics. Weather station, Sorong city. [Indonesia].
- Ekawati S, Paimin, Purwanto, Donie S (2005) Monitoring and evaluation of socio-economic conditions in the watershed management: Case studies in sub watershed upper Progo. J Penelitian Sosial dan Ekonomi Kehutanan 2 (2): 171-181. [Indonesia].
- FoGGMU [Faculty of Geography, Gadjah Mada University] (2009) Geographic information systems training module. GIS Laboratory in Faculty of Geography, Gadjah Mada University. Yogyakarta. [Indonesia].
- Fahmuddin A, Van Noordwijk M, Rahayu S (2004) Hydrological impacts of forest, agroforestry, dryland agriculture and the association of gift giving to the producer for environmental services in Indonesia. Proceedings of the workshop in Padang/Singkarak, West Sumatra, Indonesia, 25 to 28 February 2004. ICRAF-SEA. [Indonesia].
- Indriyanto (2006) Forest ecology. Aksara Bumi, Jakarta. [Indonesia].
- Kastaman R, Kendarto DR, Nugraha S (2007) Use of fuzzy methods in the determination of the critical area using geographic information systems in the region sub-DAS Cipeles. J Fakultas Teknologi Industri Pertanian UNPAD 1 (2): 1-11. [Indonesia].
- MDNR (2007) A handbook for collecting vegetation plot data in Minnesota the relevé method. Minnesota Department of Natural Resources (MDNR). State of Minnesota.
- MoA [Ministry of Agriculture] (1981) Decree of the Ministry of Agriculture No. 397/Kpts/Um/5/1981, 1 February 1981, Ascertainment of Sorong Natural Tourism Park
- MoF [Ministry of Forestry] (2009) Regulation of the Ministry of Forestry No. P.32/MENHUT-II/2009, 11 May 2009. Plan procedure on forests and land rehabilitation engineering watersheds. Jakarta. [Indonesia].
- Moga F (2005) Building a conservation area management agreement. Proceedings of the national seminar: Developing the Natural Resource in Bintuni Bay. BAPPEDA of Bintuni Regency. [Indonesia].
- Nitibaskara UTB (2005) Conservation area management policy. Proceedings of the National seminar: Developing the Natural Resource in Bintuni Bay. BAPPEDA of Bintuni Regency. [Indonesia].
- Nurlita I, Grace A, Maria R (2008) Application of geographic information system to determine priority areas for rehabilitation in that basin. J Riset Geologi dan Pertambangan 18 (1): 23-35. [Indonesia].
- Purba J (2005) Social environmental management. Obor Indonesia, Jakarta. [Indonesia].
- Rauf A (2009) Optimizing the management of the association of agricultural land with flood efforts to reduce. Inauguration speech material fixed position in the field professor of soil science, Faculty of Agriculture, North Sumatra University, Medan. [Indonesia].
- Tokede MJ (1989) Site quality and volume standing *Agathis labillardieri* Warb in Klasaman, Sorong Regency, Irian Jaya. [Thesis] Bogor Agricultural University, Bogor. [Indonesia].
- Tokede MJ, Arwam CYH, Hadi P, Gandhi Y, Mardiyanto Z (2008) Administer justice forest natural sustainable: Application for the forest indigenous peoples welfare paradigm. UNIPA Press, Manokwari. [Indonesia].