FOREST COVER CHANGE IN HINTHADA DISTRICT, AYEYARWADY REGION

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Abstract

This paper aimed to present forest land changes in Hinthada District from the geographical point of view. Myanmar is one of the most forested countries in mainland South-east Asia. These forests are habitats for a large number of important species and endemics. However, like areas of other developing countries, the types of land use also changed in Hinthada District. The forest area decreased due to wildfire, cutting down trees, and weakness in institutional management, etc. In the study period, forest cover changed distinctly in Hinthada District, especially near Myanaung, Kyangin, Ingapu and Laymyethna townships. The objectives of the paper are to explore the forest area changes in Hinthada District, to investigate the major factors affecting forest cover changes in the study area and to find out the alternative ways that can reduce the forest cover decrease. Landsat TM 5 and TM 8 images (2000 and 2015) were applied to illustrate forest cover changes in the study area.

Keywords: forest area, land cover change, Landsat TM images

INTRODUCTION

Myanmar has been well known for its abundant forest resources that extend from tropical rainforests to alpine forests. The expensive forests in Myanmar make a significant contribution to global carbon sequestration, and it has also been recognized for its high value for biodiversity conservation. Recently a considerable amount of pressure has been exerted on Myanmar's forest cover and conditions because of radical demographic, economic, and social changes in the country.

Forest resource change typically occurs due to forces external factors, such as urbanization, demands for agricultural lands, mining or infrastructure development. In Myanmar (2018), 32,222,000 hectares (49.0% of land area) were forested. Between 1990 and 2000, Myanmar lost an average of 466,500 hectares of forest per year. The amounts showed an average annual deforestation rate of 1.19%. In total, between 1990 and 2005, Myanmar lost 17.8% of its forest cover (Myanmar Forest Land, 2015). According to the Global Forest Assessment (2015), Myanmar had the third-highest annual rate of forest reduction, just behind deforestation-plagued Brazil and Indonesia. (The Myanmar Times, 2018).

Potential forces of deforestation and forest degradation are commercial timber extraction, agriculture expansion, shifting cultivation (slash and burn), fuel wood production, charcoal burning, shrimp and fish farming activities, urbanization, local household and infrastructure needs, dam construction and wildfire. Potential environmental concerns of deforestation and forest degradation include climate change, carbon release, sea level rise, land slide, flood, water loss, low rainfall, global warming: high temperature and drought.

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Rapid deforestation in Myanmar has attracted extensive attention. Deforestation in Ayeyarwady Region was exacerbated, and the rates were accelerated to 2.96% (Soe Win Myint, 2016). In Hinthada District, deforestation mainly occurs due to human intervention in forest area and encroachment of agriculture lands into forest area. The western part of Myanaung, Kyangin and Laymyethna townships is covered with forest and local people living in the western part cut the trees in forest area for the purpose of getting fuel woods for daily cooking. It is one of the major issues of forest deforestation in the study area.

To present forest cover change that is one of the environmental problems of Myanmar as well as other developing countries, Hinthada District is selected as the study area and the research paper is presented from the geographical point of view.

Study area

Hinthada District is situated in the southernmost part of central lowland of Myanmar and located in the northernmost part of Ayeyarwady Region. It is located about 15° 40′, 18° 30′ north latitudes and 94° 15′ and 95° 50′ east longitudes. It is composed of six townships. In 1983, The population of the study area was 10,82,366 and it reached 11,50,064 by 2017. Hinthada Township has the highest population in district.

Research Question

What are the factors affecting the forest area in Hinthada District?

Aim and Objectives

The main aim of this paper is to find out the factors that affect the study area.

The objectives of the paper are:

-To explore the forest area changes of Hinthada District,

-To investigate the major factors affecting forest area changes in the study area and

-To find out the alternative ways that can reduce the forest area decreasing.

Sources of Data and Methodology

Primary data were collected through field surveys, questionnaires and interview. Secondary data were collected from topographic map (UTM), Landsat TM 5 and TM 8 Images (2000 and 2015), some thematic maps, Libraries, Population and National Registration Department, Department of Agriculture Land Management and Statistics, District General Administration Office, Meteorology and Hydrology Department, and Forestry Department. NDVI index was applied for forest cover change in research paper. The methodology was based on Geographic Information Systems and Remote Sensing and various statistical analysis in this research paper.

GEOGRAPHIC BACKGROUND OF THE STUDY AREA

Hinthada District is located in the northernmost part of Ayeyarwady Region. It is located about 15° 40′ and 18° 30′ north latitudes and 94° 15′ and 95° 50′ east longitudes. The study area has an area of 6,985.92 sq. km (2,697 sq. miles). It is composed of six townships: Kyangin, Myanaung, Ingapu, Lamyethna, Hinthada and Zalun. (Figure 1)

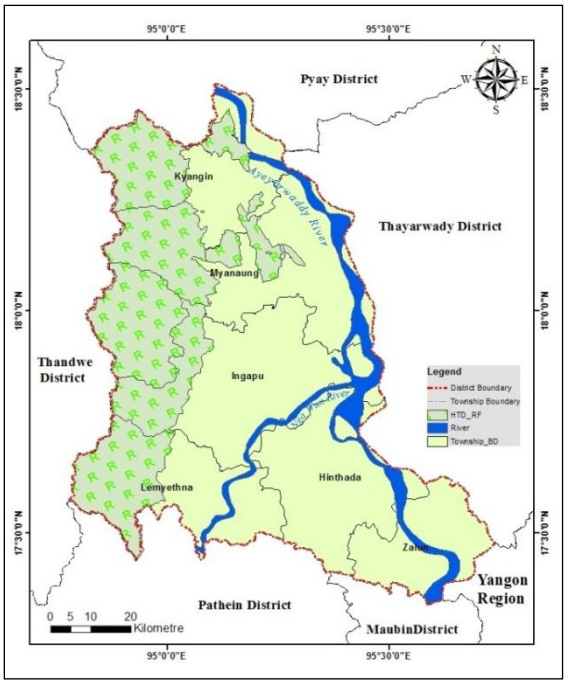

Figure: 1 Location of Hinthada District
Source: Agriculture Atlas (2002)

Physical feature of Hinthada District can be divided into three divisions. They are the eastern flanks of the Rakhine Yoma, the foot-slope of the Rakhine Yoma and the alluvial plain (Figure 2).

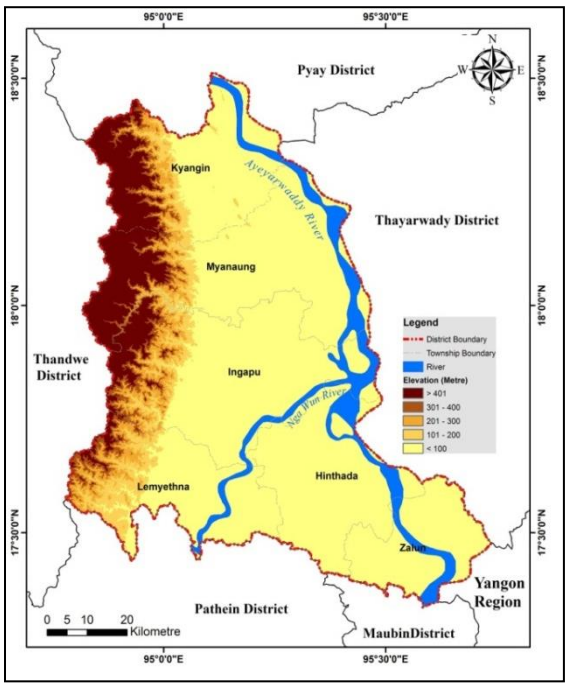

Figure: 2 Relief and Drainage Pattern in Hinthada District
Source: Digital Elevation Model

Hinthada District is located in the north of Ayeyarwady Region, generally experiences the Tropical Monsoon Climate (Am). Mean maximum temperature is 35.91^{o}C, mean minimum temperature is 19.10^{o}C and Mean temperature is 27.50^{o}C.Total rainfall is 2624.52 mm (Figure 3).

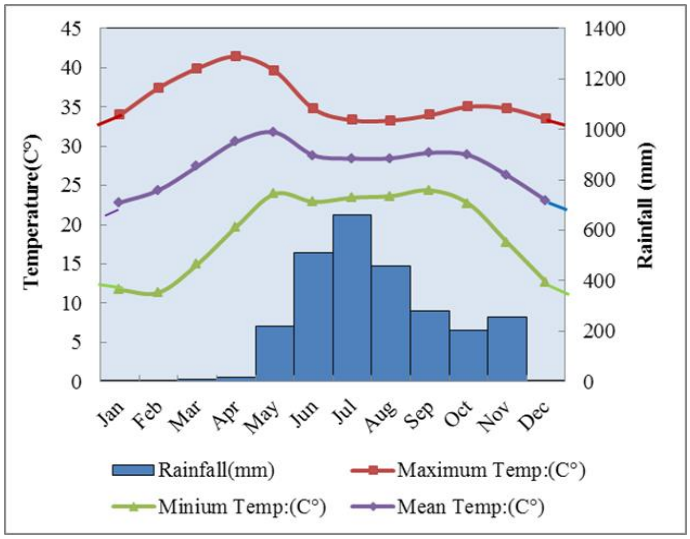

Figure: 3 Climograph of Hinthada Township (2007 to 2016)

Soils in the Hinthada district can be divided into seven types. There are Red Brown Forest soil, Yellow Brown Forest Soil, Yellow Brown Dry & Indaing Soils, Glay & glay swampy Soils, Swampy Soil, Meadow & meadow alluvial Soils and Alluvial Soils. (Figure 4)

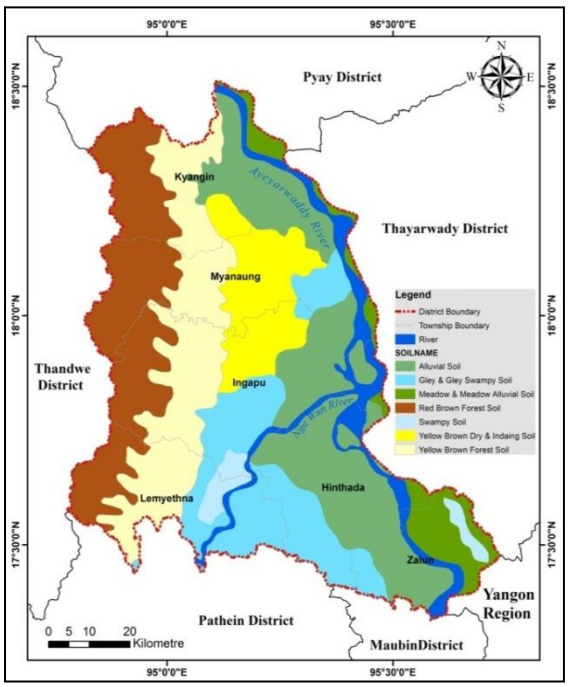

Figure: 4 Soil Types in Hinthada Distric**t**

Source: Land Record Department, Yangon

RESULTS AND FINDING

General Land use in Hinthada District

In studying the land cover change in Hinthada District, general land use in the district can be classified as:

(1) Cultivated Land

(2) Cultivable Waste Land

(3) Forest land and

(4) Others.

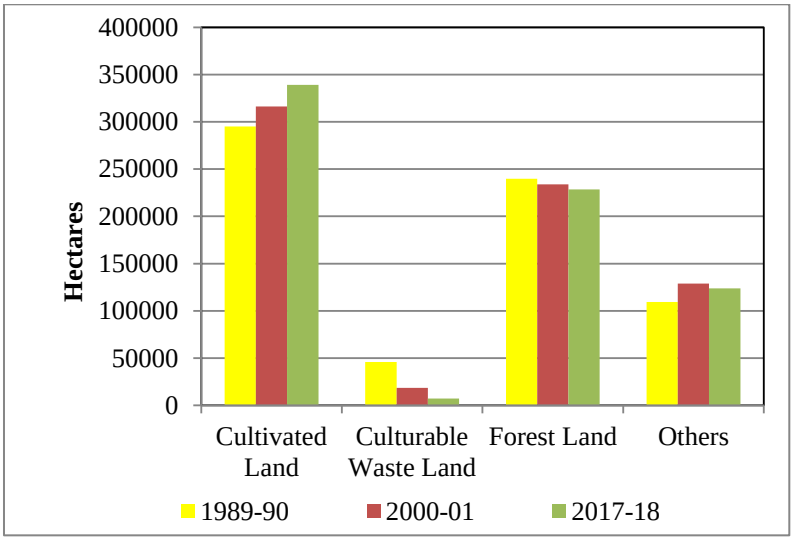

Figure: 5 General Land use of Hinthada District

Source: Department of Agriculture Land Management and Statistics in Hinthada

The cultivated land includes net sown area and fallow land area and the cultivable waste land comprises vacant and waste lands. The forest land represents reserved forest lands and non-reserved forest lands. Other types of land use include pasture, transportation land use, settlement land and lands used for factories, mining, cemetery and the unclassified land. According to Department of Agriculture Land Management and Statistics in Hinthada, the cultivated land accounted for 2,95,180 hectares in 1989-90, 3,16,205 hectares in 2000-2001 and 3,39,068 hectares in 2017-18. Thus the increase rate in the area of agricultural land is found. In 1989-90, the fallow land was 8,309 hectares, 1,139 hectares in 2000-01 and 351 hectares in 2017-18, the decrease area of fallow land was resulted from the conversion to cultivated land. The area of cultivable waste land represented 45,843 hectares in 1989-90, and it decreased to 18,576 hectares in 2000-01 and further to 7,157 hectares in 2017-18 due to the extension of cultivated land. The area of forest land was 2,39,897 hectares in 1989-90, decreased to 233,771 hectares in 2000-01 and again to 2,28,562 hectares in 2017-18. In 1989-90, area of the other land was 1,09,380 hectares in 1989-90, 1,28,918 hectares in 2000-01 and 1,23,753 hectares in 2017-18 (Figure 5).

Normalized Different Vegetation Index (NDVI)

NDVI method is applied according to its characteristic like vegetation at different NDVI threshold values such as between 0.1and1.0. The simulation results show that the NDVI is highly useful in detecting the surface features of the visible area which are extremely beneficial for policy makers in decision making. The vegetation analysis can be helpful in

predicting the unfortunate natural disasters and provides humanitarian aid, damage assessment and new protection strategies. From the empirical study, the forest or shrub land and barren land cover types have degraded forest land area 1,69,200.8 hectares from 2000 to 2015 respectively, while agricultural lands, settlement areas have increased.

NDVI simple ratio images are very effective in discriminating vegetation, soil and water. This index is computed by dividing the difference of the NIR and visible red band (TM 5, bands 4 and 3) by their sum. NDVI is a reliable indicator of rainfall and vegetation Index. The NDVI values are range of -0.1 to 1.0. The value of (-1 to 0.2) indicates bare soil, (0.2 to 0.7) is for different categories of green vegetation and (0.7 to 1) indicates the denser vegetation. Negative value indicates the presence of water. NDVI is strongly correlated to the green leaf biomass (Tucker 1979). The NDVI index is calculated by (b4-b3/b4+b3). The band 4 is near infrared and band 3 is red which refers to Landsat 5. Landsat TM 8 image, NDVI index is calculated by (b5-b4/b5+b4). The bands 5 is near infrared and band 4 is red. The larger the NDVI is, the denser the vegetation (Dutta, 2006). NDVI is an indicator of the intension of biomass. (Figure 6 and 7)

This is NDVI index which is employed here to study the forest cover changes in the study area. The NDVI values for the district level are worked out based on NDVI images. The result values are notable high in Kyangin, Myanaung, Ingapu and Lamyethna townships. In the images of the years 2000 and 2015, calculating NDVI index in the study area showed that in the image of 2000, NDVI index was between -0.6 and 0.7 and it was considered to be covered with natural vegetation. In the image of 2015, NDVI value was between the -0.2 and 0.5 level. This situation showed that NDVI value changed significantly within 15 years.

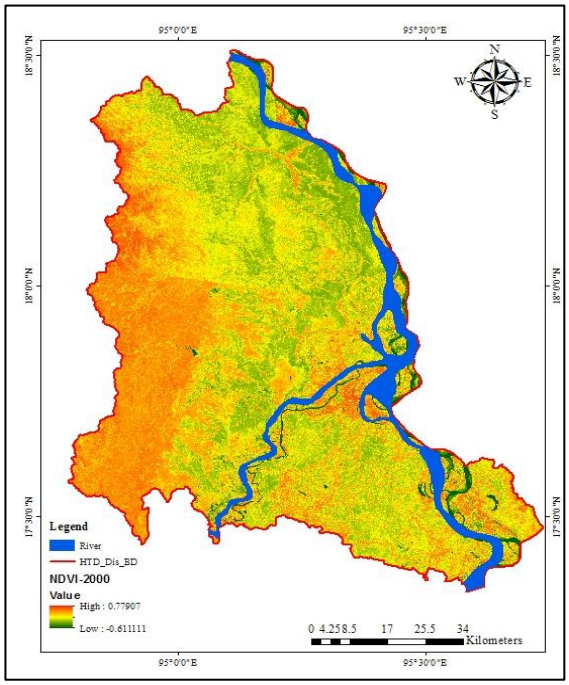

Figure: 6 NDVI image of 2000 in Hinthada District
Source: Landsat TM 5 133-47-48

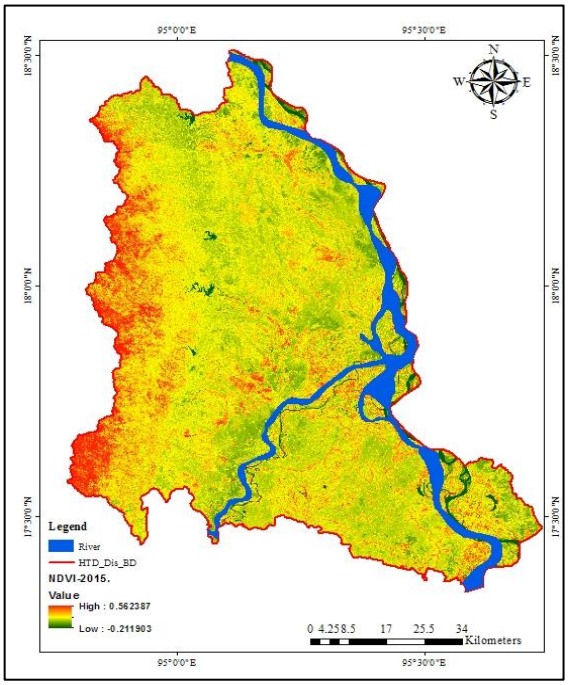

Figure: 7 NDVI image of 2015 in Hinthada District
Source: Landsat TM 8 133-47-48

Table.1 Land Cover Changes between 2000 and 2015

Land cover	2000	% of Total Dist. Area	2015	% of Total Dist. Area
Close Forest	145940.72	20.69	16649.82	2.38
Open Forest	150907.79	21.60	83356.79	11.93
Agricultural Land	336504.22	48.17	400659.11	57.35
Water Body	17967.55	2.57	12533.05	1.79
Others	49445.83	7.07	18356.80	2.63
Degraded Forest Area	-	-	169200.80	24.22

Source: Landsat TM image 5 and 8 133-47-48

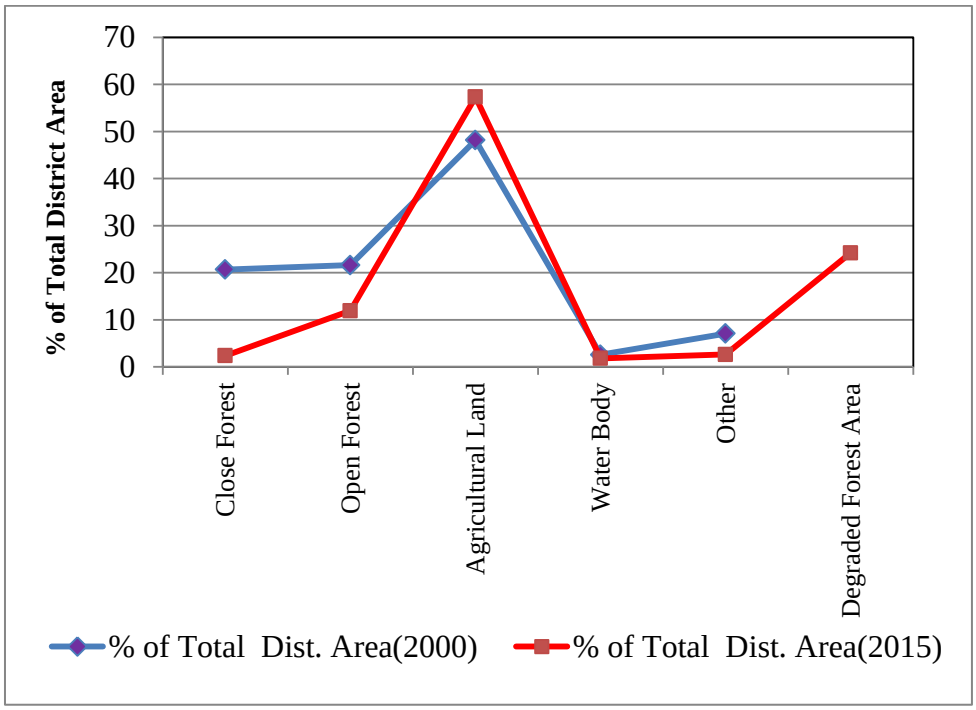

Figure:8 Forest Area Changes between 2000 and 2015
Source: Based on Table 1

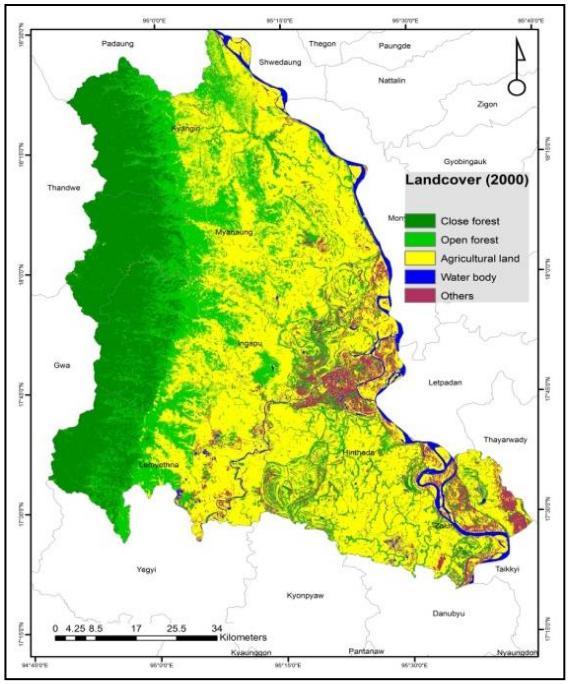

Figure: 9 Land Cover Types of Hinthada District in 2000

Source: Landsat TM 5 133-47-48

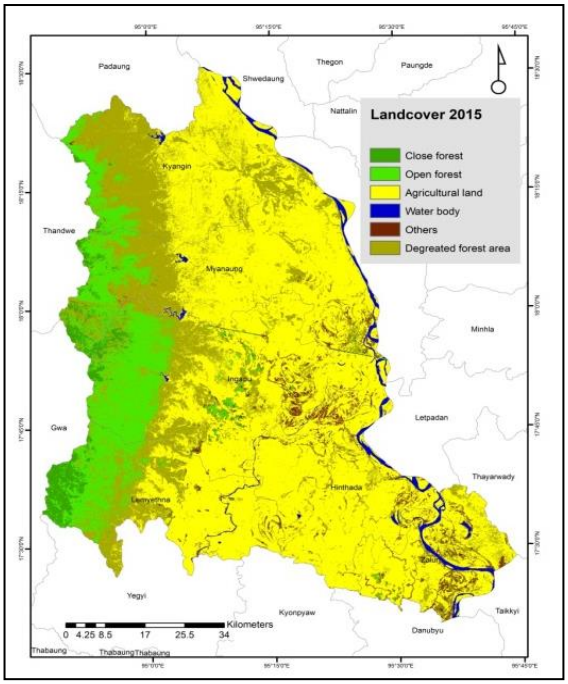

Figure: 10 Land Cover Types of Hinthada District in 2015

Source: Landsat TM 8 133-47-48

According to Table 1 and Figure 8, the land cover change can be seen in Hinthada District from 2000 to 2015.Among the five types of land cover, the change was most pronounced in the land cover types of close forest and open forest. In 2000, the area of close forest was 1,45,940.72 hectares occupying 20.69 percent of the township area but in 2015, it declined to 16,649.82 hectares , 2.38 percent.

The change of land cover of open forest was ranked second in changed area from1, 50,907.79 hectares (21.60 percent) in 2000 to 83,356.79 hectares (11.93 percent) in 2015. Agricultural land area was ranked third in the land cover change from 2000 to 2015 period. In 2000, the area occupied by agricultural area was 3,36,504.22 hectares (48.17 percent) and it increased to 400659.11 hectares (57.35 percent) in 2015. The change was positive, expending 64,154.89 hectares of land in 15 years. The expansion of cultivated land was due to availability of irrigation water from embankment and dam, the conversion of cultivable waste land and pasture land into cultivated land. The cultivated land is located mostly in the central and western part of the district. Moreover, these land areas also exist in reserved forests as an agricultural encroachment.

Water area was ranked fourth in the land cover change in the 2000-2015 period. In 2000, water area was occupied 17,967.55 hectares (2.57 percent) and it decreased to 12533.05 hectares (1.79 percent). Water body was decreased due to the increase of Kaing-Kyun area. Other land area decreased from 49,445.83 hectares (7.07 percent) in 2000 to 18,356.80 hectares (2.63 percent) in 2015. The change in this type of land was ranked fifth in terms of area.

Generally, the land cover change in the 15-year period between 2000 and 2015 was most pronounced by the expansion of the farming frontier and depletion of forest cover mainly

as a result of rapidly growing population pressure. The increase of population causes demanded larger amount of fuel wood and cultivated areas. (Figure 9 and Figure 10)

Hinthada District occupies the northern portion of the Ayeyarwady deltaic area and lies between Rakhine Yoma in the west and Ayeyarwady River in the east, low-lying topography is found in the western part of the district on the eastern spur of the Rakhine Yoma, especially Kyangin, Myanaung, Ingapu and Laymyethna townships. The climate and soil conditions are favorable for growth of the forests. Forests and forest resources support local people in the district after agriculture and fishing industry.

In Hinthada District, forest cover changes were noticeably found in the western part of the study area. According the result of the study, forest area and cultivable waste land were transformed into agricultural land. Moreover, forest area distinctly decreased due to human intervention and local people mainly used fuel wood for cooking.

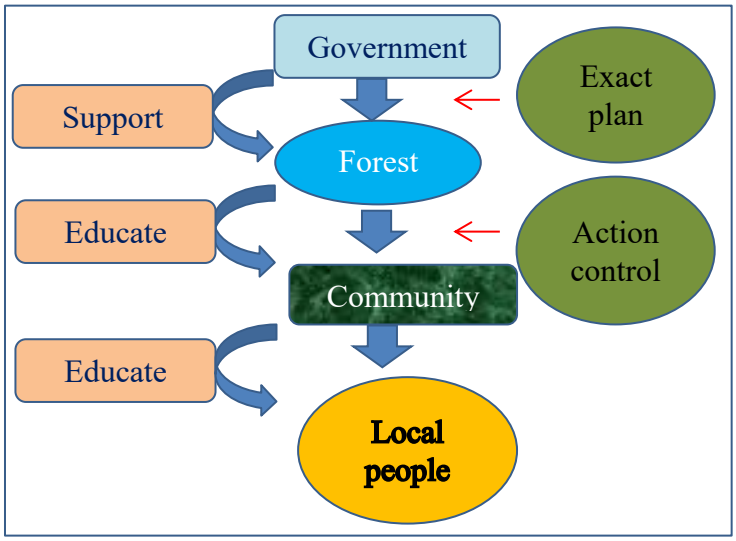

Figure 11: Knowledge Sharing for Local People in Forest

To conserve the forest area, not only transformation from forest land into agricultural land must be prohibited but fuel for domestic use like fuel wood must be controlled by replacing another type on fuel (Figure 11).

The principal objectives of the forest sector are to extract forest products without depleting forest resources in the long run and to preserve the manufacturing of value-added wood products. Government policies are needed to implement forest conservation effectively. Public awareness and information dissemination are also important. Alternative ways that reduce fire wood in cooking should be supported to local people. It is also necessary to educate the local people.

CONCLUSIONS

Hinthada District is located in the northernmost part of Ayeyarwady Region. Being located at the northern apex of the Ayeyarwady Deltaic region, it is accessible to one of the most developed regions of the country. It is located about 15° 40´ and 18° 30´ and 94° 15´ and 95° 50´ east longitude. Like other areas in Myanmar, forest area decreased in Hinthada District. It is due to the increase in fuel wood requirement caused by population growth and

encroachment of agricultural lands into forest area. Lack of knowledge on forest conservation plays an important role in forest degradation. Although the government laid down the policies to conserve the forest area, it is weak in practice. It is important that widespread forestry education and environmental education is to be supported to the local communities to reduce deforestation and forest area decreasing.

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