Land use change and local people's perception of the effects of change in Ssese islands, Uganda.

C.K. Abonyo[1*], M. Isabirye[2], D. Mfitumukiza[1], M.K. Magunda[2], J. Poesen[3], J. Deckers[4]
[1]*Institute of Environment and Natural Resource Management,*
Makerere University, P.O. Box 7062, Kampala, Uganda

[2]*National Agricultural Research Organisation,*
Kawanda Agricultural Research Institute, P.O. Box 7065, Kampala, Uganda;
[3]*Katholieke Universiteit Leuven, Physical and Regional Geography Research Group*
Celestijnenlaan 200 E,, 3001 Leuven, Belgium;
[4]*Katholieke Universiteit Leuven, Division Soil and Water Management,*
Celestijnenlaan 200 E, 3001 Leuven, Belgium

* Corresponding author
Abonyo Christine Kasedde
acsnekasedde@yahoo.com; +256-712-833813 /+256-774-686013 /+256-702-833813

ABSTRACT (206 words)

Conversion of forestry to agricultural land use is a major change associated with loss of vegetation in the Lake Victoria basin. This study aimed at determining the trend and extent of land use changes, their drivers and the local people's perception of the effects of land use change on Ssese islands. Change analysis using vegetation cover map 1960, Landsat TM 2001 and Aster 2006 satellite images demonstrated the drastic change in land use associated with the introduction of oil palm plantation occurred between 2001 and 2006. In the period 1960 – 2001, agriculture increased by 473 hectares at the expense of grasslands and forest while a drastic increase by 5223 hectares in agriculture occurred in the period 2001 – 2006. Much as agricultural expansion is known as major driver of deforestation, it is observed that government policy to alleviate poverty through the modernization of agriculture, proved to be the mega driver of land use change in Ssese Islands. Contrary to government policy to alleviate poverty, the local people had a negative view about the oil palm establishment in Ssese islands in preference to the ecological and socio-economic values they attach to the forest.

Key words: Lake Victoria, Uganda, Land use change, oil palm, drivers, policy, local people's perception

1.0 Introduction

Land use/cover changes have long been viewed as continuous and slow but recent studies show that this is not always the case. In the global change news letter, Lambin and Geist (2001) describe land cover change as a disjunct process, with periods of rapid change and often triggered by shock event which if not checked initiates other changes along the system. Changes in land cover by land use do not necessarily imply a degradation of the land. It might be presumed that any change produced by human use is an improvement, until demonstrated otherwise, however there is growing concern globally about negative impacts resulting from land use/cover changes (Meyer, 1995). Though land use and land cover changes are usually local and place specific, their impacts collectively add up to global environmental change, which changes include: desertification, biodiversity loss, global warming and eutrophication, (De Sherbinin, 2002; Leper *et al* 2004; Rudel *et al*, 2005).

One of the main land cover changes on increase is forest degradation often as a result of change in land use (Lambin and Geist 2001; Rudel *et al* 2005). From a world perspective, agricultural expansion and infrastructural development contributes 37% of forest deforestation which is one third of the causal factors for tropical deforestation (Geist and Lambin, 2001). In Uganda, forest degradation has been on the rise, the tropical high forest dwindled from 12.5% in 1900 (of the total land area) to 3% in 1987 (NEMA 2005). Looking at examples of forests reserves in Uganda that have been recently degazetted for agricultural investments and economic growth like in Butamira, Kalangala islands and Sango bay (NEMA, 2005), it is clear that land cover is continually being molded and transformed by land use changes. Thus Lambin *et al* (2001) conclude that land use change is the proximate cause of land cover change.

In the year 2000, the government of Uganda sought the degazettement of 3,500ha of the approximately 6,500ha of forest reserve gazettled in 1940's in Bugala island (one of the Ssese Islands in Kalangala district) for development of an oil palm estate by Bidco oil refineries limited (MAAIF, 2001). Of the 10,000ha of oil palm plantations to be established, 6,500ha will be a nucleus estate financed by Bidco and its partners while 3,500ha will be planted by out-growers/small holders. The oil palm project is a component of the vegetable oil development project (VODP) being undertaken by government of Uganda in an effort to reduce on vegetable oil imports by promoting domestic production of oil bearing crops. The project (VODP) aims at contributing to broader sector objective of increased agricultural growth and diversification of economy in line with the Plan for Modernization of Agriculture (PMA) (MFPED, 2001). Also as part of the strategic interventions embodied in the poverty eradication action plan (PEAP), pillar number three (3) of the PEAP seeks to fight poverty through promotion of commercial Agriculture (MFPED, 2001), thus commercial growth of oil palm in Buagala Island.

The historical perspective indicates that Ssese islands' inhabitants way back in 19th century put much pressure on land to an extent that some islands had the trees and shrubs all cut down for

fuel and tufts of coarse grass were burnt (Thomas 1941). The situation however changed when sleeping sickness appeared in 1902 and swept through the islands killing both animals and humans forcing the remaining inhabitants to be relocated to the mainland in 1909, the once forested areas rapidly recovered (Thomas 1941, Lambrecht, 1964). However, when sleeping sickness was brought under control, the inhabitants were encouraged to return but many preferred the mainland and by 1940's the population of the islands was about only 4,000 according to Thomas (1941). The national census of 1980, 1991 and 2002 revealed a population of 8,575, 16,371 and 34,766 people respectively (UBOS, 2005). With the steady rise in population, establishment of oil palm plantations and other economic activities that are taking place; collectively these have caused some land use/cover changes in the islands.

This study therefore examined the extent of land use/cover changes in Bugala Island between 1960 and 2006, the driving forces of these changes and the local peoples' perception of the effects of land use/cover changes in the island.

2.0 Site description

Ssese Islands administratively constitute Kalangala district in Uganda (Fig 1). The 84 islands making up Ssese islands are located in the North-western part of Lake Victoria, just south of the equator and of which 63 are inhabited. The study was done in Bugala Island (also commonly called Kalangala) which is the biggest among the group of 84 islands of the district. Bugala is approximately 29,600ha, 58km long, 2-5 km wide and roughly S-shape.

The Mean annual rainfall for Ssese Islands is about 2200mm. Bufumbira, Bukasa and Bugala islands have the highest mean annual rainfall of 2248, 2193 and 2181mm respectively. The heaviest rainfall occurs in the periods March-May and November-December. The mean annual minimum temperature is 18^0C and the mean maximum annual temperature ranges from 27^0C and 30^0C. The mean monthly temperature at Kalangala town council is lower than 17^0C for 5 months of the year.

3.0 Material and Methods

3.1 Materials

The material used in this study included: Topographic maps, satellite images and data capturing materials.

3.1.1 Topographic maps

Topographic map sheets of 1960 developed from 1955 aerial photos were obtained from the department of Lands and Surveys. The topographic sheets are at the scale of 1:50,000 and show the land use/cover of the islands in 1960.

3.1.2 Satellite images

The satellite images used were: Landsat Thematic Mapper (TM) and Aster images. The Landsat TM images were of October 2001. Though the visible and near infrared bands of Land Sat TM images are of spatial resolution of 30 meters, the Landsat TM images used in this study were obtained from Afri-cover project as pan-sharpened images, re-sampled to 15 meters resolution. The Aster images used were for June 2006 and this study made use of visible (wavelength of 0.52-0.69) and the near infrared (wavelength 0.76-0.86) range bands, having spatial resolution of 15 meters.

3.1.3 Data capturing materials

These included: a GERMIN type, hand help GPS set having 12 channel receivers used to capture location coordinates, a digital camera aided in capturing evident scenes of interest which were not captured on the images and pre-tested questionnaires used to capture response from the local people.

3.2 Methods

3.2.1 Data collection

The methods employed for data acquisition included historical land use/cover mapping, mapping from remotely sensed images, Ground truthing, administration of questionnaires and participatory rural appraisal.

3.2.1.1 Historical land use/cover mapping (from topographic maps)

In order to carry out historical land use/cover mapping, the topographic maps covering the islands were scanned, georeferenced and digitized. Using ILWIS GIS soft ware, the scanned sheets were georeferenced at four corner points, and zoomed to a scale of 1: 7500 in order to digitize the different land use/cover types. The coordinate system projection used was as follows; Projection: Transverse mercator, Datum: Arc 1960, Datum area: Mean (Kenya and Tanzania) and Epllisoid: Clarke 1880 (modified). The digitizing exercise produced segments which were edited; segments errors including self overlap, dead ends, intersections checked and then joined to form Ssese segment map. Bugala Island area was extracted from the Ssese segment map and polygonized to form Bugala land use/cover polygon map. Based on the topographic maps used and according to legend developed during ground truthing, the land use/cover polygons were accordingly labeled as; Forests, Small scale Agriculture, Grasslands, Wooded grasslands, Swamp forest and Wetlands.

3.2.1.2 Land use/cover mapping from remotely sensed images

The two satellite images, Aster and Land-sat were given the same coordinate system as in the topographic sheet maps. The images were processed in ILWIS software, each image was re-sampled using bicubic method to the same georefenece as for Bugala land use map produced from topographic sheets. In carrying out image classification, an attempt to use digital supervised image classification was unsuccessful and rather visual classification was used.

- *Visual image classification*

The two images Landsat and Aster images medium spatial resolutions of 15 meters were visually classified. The *figures 3.2* and 3.3 below shows a clipped section of aster and Landsat images in which their clarity aided digitizing and classification of features observed. The two images were zoomed to scale of 1:7,500 and the different land uses/covers digitized to form map segments. The digitized map segments were checked for errors, polygons formed and labeled according to the legend developed from ground truthing exercise. The two maps obtained were namely: Land use/cover 2001 from Land sat image and Land use/cover 2006 from Aster image.

3.2.1.3 Ground truthing

Ground truthing exercise was carried out in Bugala Island in which the different land use/cover types existing were verified. The observed land use/cover types included: Small scale Agriculture with inclusions of settlement, oil palm cultivation (large scale agriculture), built up areas, forests, grasslands, woodlands, swamp forests and wetlands. These land use/cover types were used in developing the map legends. With the aid of global positioning system (GPS), training set data used for image classification were acquired. Coordinates from sampled land cover types were captured. Other features which were not clear on the images were navigated to using a GPS in order to verify the existing land cover. During this ground truthing exercise, photo of scenes of interests were also taken.

3.2.1.4 Administration of questionnaires

Using semi-structured pre-tested questionnaires total of 183 local people including fishermen, farmers, traders, timber harvesters from seven (7) different villages in Bugala Island namely: Kanyogoga, Kizza, Mwena, Bujumba, Busango, Kizira and Banga.

3.2.1.5 Participatory Rural Appraisal (Focus group discussions)

Two (2) sessions of focus group discussions were held with attendances of 60 and 44 in first and second sessions respectively. In each session the community members were divided into five (5) focus groups, each group consisting of 8-12 members. The groups consisted of females and male adults, mixed ages ranging from 16 to 86 years. Each focus group had a trained facilitator who guided the participants through sets of prepared questions and Pair wise matrix ranking was carried out for the different listings of problems, natural resources, activities that the community generated. The focus group discussions were useful in highlighting drivers of land use/cover change.

3.3.2 Data analysis

3.3.2.1 Images and Maps

The three lands use/ cover maps produced from Topographic sheet 1960; Landsat image 2001 and Aster image 2006 were exported to TNT MIPS software from which attribute tables containing areas of polygons among others were automatically generated for each map and edited in Arc

view. The extent of change was got as a difference between the areas for the different years, 1960, 2001 and 2006 for each land use/cover type as indicated in *Figure 4.3.* Also percentages for each land use/cover (LUC) area were calculated. Statistical tests were done to test whether the extent of changes in each land use/cover type were significant at 95% confidence percentage for the periods 1960-2001 and 2001-2006 respectively. The normal distribution test for mean, Z and the non-parametric Mann-Whitney U tests were used in the analysis. For the Mann-Whitney test, when counts, n_1 or n_2 become greater than 20, the tabulated U values can not be used for comparison thus deviation, d is calculated. The assumption here is that as the counts increase in size, the sampling distribution of U rapidly approaches the normal frequency distribution (Sprent 1993, Siegel and Castellan 1988). Thus the calculated deviation, d was compared with tabulated Z value at 5% level.

3.3.2.2 Questionnaires

The questionnaires were edited, coded and data entered into SPSS computer program. Several descriptive analyses of the data were carried out including frequency tables, pie charts and histograms as indicated in chapter four.

3.3.2.3 Participatory Rural Appraisal (Focus Group discussions)

The results from Focus Group discussions were summarized into tables and represented in pair wise matrices generated during the discussions.

4.0 Results;

4.1 Trend and Extent of Land use Change

In *Table 1* and *Fig. 2* the changes that have occurred in land-use/cover in Bugala Island for the last 46 years are shown in land use/cover maps for 1960, 2001 and 2006.

Table 1: The area per land use type for years 1960, 2001 and 2006

Land use/cover type	**Area coverage in 1960**		**Area coverage in 2001**		**Area coverage in 2006**	
	Area(ha)	**Area (%)**	**Area(ha)**	**Area (%)**	**Area(ha)**	**Area (%)**
Built up area			2,759.30	10.34	3,596.43	12.66
Oil palm plantation			0.00	0.00	5,207.67	18.34
Forests	15,621.82	57.54	15,604.97	58.50	13,382.07	47.12
Small scale Agriculture	912.96	3.36	440.36	1.65	425.44	1.50
Grasslands	7,228.32	26.62	4,644.74	17.41	2,568.96	9.05
Swamp forests	604.34	2.23	590.93	2.22	642.81	2.26
Swamp/wetlands	2,582.94	9.51	2,471.53	9.26	2,537.18	8.93
Wooded grassland	200.29	0.74	165.23	0.62	39.41	0.14
Total	**27,150.66**	**100.00**	**26,677.07**	**100.00**	**28,399.97**	**100.00**

4.1.1 The trend of land use/cover change

Looking at years 1960, 2001 and 2006 the land use/cover area coverage were as follows: Forests with the largest cover of 15,621.82ha in 1960 representing 57.54% of total land cover, it remained more less the same in 2001 but dropped in 2006 to 47.12% of total land cover. The grassland had the second largest coverage in 1960 and 2001 representing 26.62% and 17.41% respectively. However by 2006, it had become the fourth largest land cover representing 9.05% of total land area. Swamps/wetlands represented coverage of 9.51%, 9.26% and 8.93% of total land area for the years 1960, 2001 and 2006 respectively. The swamp forests like wetlands were relatively stable with percentage coverage of 2.23%, 2.22% for 1960, 2001 respectively and 2.26% in 2006. Small scale Agriculture covered 912.96ha (3.36%) of total land area in 1960 and seemly dropped to 1.65% and 1.50% in 2001 and 2006 respectively. Wooded grassland was 200.29ha representing 0.74% total land area in 1960, 0.62% in 2001 and a decrease to 0.14% in 2006. The Built up areas and Oil palm plantations were non existent by 1960 but built up places shot up to 10.34% of total land area in 2001 and 12.66% in 2006 turning out to be the third largest land cover in those respective years. As for oil palm plantation that did not exist by 2001 (excluding research plots set up in 1972) greatly rose to 5, 207.67ha representing 18.34% of total land area in 2006 which was the second largest then. Of course since clearing of vegetation is still going on, these percentages will change and actually it had changed by time this report was complete.

In *Fig. 3* the trends of change are illustrated using trend lines for each land use/cover type. The trend lines show a relatively stable coverage in Forests, Swamps forests and Wetlands, relatively stable fall in grasslands, a steady rise in built up areas between the two years, 1960 and 2001. After just five years a drastic change in land-use/cover had occurred in the Forest and Grasslands land covers which dropped while there was a rise in oil palm plantation and built up areas.

4.1.2 Extent of each land use / covers change.

The graph in *Fig.4* shows the extent of land cover change in hectare between 1960 -2001 and 2001-2006. From *Fig.4*, the note worthy changes from 1960-2001 are in built up areas, grasslands and small scale agriculture. While in between 2001 and 2006, drastic change is seen in Oil palm plantation (Commercial Agriculture) as the biggest land use/cover, followed by forests, grasslands, built up areas and wooded grasslands. This is illustrated by *Fig.5* which shows the spatial locations of where the forests and grasslands were lost in the period 2001 and 2006, principally due to oil palm plantation establishment.

4.1.3 Statistical tests for significance of land use/cover change.

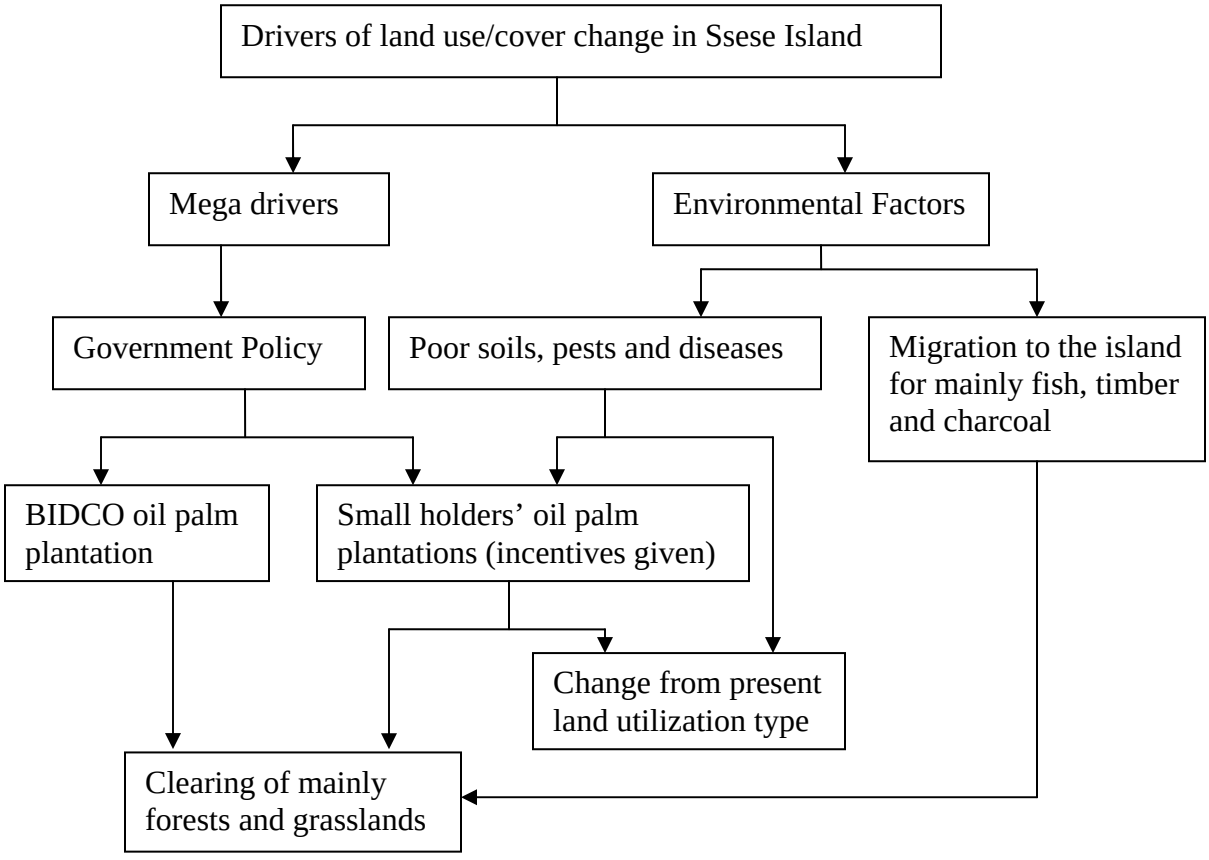
In order to establish whether the changes in land use/cover were significant for the periods 1960-2001 and 2001-2006, a test of hypothesis of mean using the normal distribution (Z tests) was carried out for each land use/cover. The mean area values for 1960 were taken as the population means and those of 2001 and 2006 were treated as sample means. The calculated values of Z in the year 2001 for all the land cover types are less than the tabulated Z value of 1.96 at confidence

level of 95%. Thus Ho is accepted and H_1 rejected, meaning there was no significant change in any of land use/cover types between 1960 and 2001. For the period 2001-2006, Ho is rejected and H_1 accepted at 5% level of significance. The calculated Z value for wooded grassland of 2.122>1.96, (P=0.05), means that significant land cover change occurred in wooded grassland vegetation in that period.

Since not all rules of parametric test were satisfied by the data especially homogeneity of variance, a cross check at 5% level of significance of change for selected land use/covers was done using Mann -Whitney U test. Again the Mann-Whitney U test produced similar results as the Z test. For the land use/cover types forests, grasslands and built up areas, the median tests produced a deviation, d<1.96 at 5% level, indicating no significant change in those land cover types between 1960 and 2001 and in the five years (2001-2006). However for wooded grasslands the smallest calculated U value for the years 1960 and 2001 for wooded grasslands is 21 which is greater than the tabulated value of six (6) when n_1, n_2 are 11 and 4 at 5% level. Likewise for the years 2001 and 2006, calculated U > U tabulated at 5% level. Thus Ho is rejected and H_1 accepted for wooded grasslands, significant change occurred in this cover type for the period 1960-2001 and 2001-2006.

4.2 Driving forces of land use/cover change in the island.

The finding of this study regarding drivers of land use/cover change is summarized in the flow chart below.



4.2.1 Government Policy to Establishment of oil palm plantation

The mega driver of land use/cover change in Bugala Island has been the government policy to establish plantation. The analysis revealed area coverage of 5,207.67ha (19% of total land coverage) had been planted by June 2006 at the expense of forests, wooded grasslands and grasslands. This area coverage is inclusive of BIDCO plantations and small holders who get incentive to convert their land to oil palm. The incentives involve financing the locals to acquire seedlings, fertilizers, pesticides and meet costs of clearing land.

4.2.2 Migration onto the Island for Fish, timber and charcoal

The analysis of questionnaires revealed that migrants were of frequency counts of 100 while 83 interviewed were natives, thus more migrants than natives. The cross tabulation analysis also clearly indicated that so many people have moved onto the island in recent years. The study showed that 52% of the migrants have come in the last four (4) years (from 2003 to April 2007), 26% migrated between 1998 and 2002, thus 78% of the migrants came in the last nine (9) years. These migrants are engaged in various activities which in turn impact on land cover as was revealed by analysis of questionnaires and focus group discussions.

In a participatory rural appraisal in two different sites A and B, the communities were asked to list and rank the different activities they are engaged in and their sources of income. The activities in order of ranks were fishing, farming, animal rearing and small scale businesses. Note worthy is the fact that these groups from two different locations came up with the same listing. The involvement in these activities was irrespective of whether one is a migrant or native. In order to show whether the common activities are necessarily the sources of income or not, again the focus group discussions in two different locations A and B generated the lists of sources of income and ranked the four most common sources of income. From the listings and pair wise ranking, the focus group discussions revealed reasons why many are flocking onto the island, the most common reason being fishing brought out in the two groups A and B. Growing of crops and animal rearing was only by those owning land. Brick making was also brought out by group A. while timber harvesting which ranked third in both groups A and B, had attracted many people onto the Island.

These economic activities were further confirmed by analysis of questionnaire responses. From the responses, the migrants who are on the island are involved in farming, fishing, charcoal burning, timber harvesting and small scale businesses like brewing and selling alcohol, selling fish, shop keeping, running restaurants and bars.

4.2.3 Poor soils, pests (monkeys) and diseases

Within the land use type, small scale agriculture, there were changes in the types of crops grown (land utilization type) for various reasons, among them: poor soils (19.8%) and the problem of monkeys (19.8%). From the focus group discussions, among the problems identified were: poor soils, lack of food and monkeys. From the listings of the problems the communities are faced with,

lack of food and poor soils which are related in a sense ranked second (2nd) and third (3rd) in sites A and B respectively. The analysis in trend in farming by the focus groups, clearly indicated poor soils, pests/monkeys and diseases have been the greatest hindrances in crop production more so in recent years. When analyzing trends in food availability over the years, in both sessions one and two brought out the same problems of low yields due to poor soils, pests and diseases. They also mentioned crops that have been introduced over the years like Irish potatoes, cassava, rice, bananas among others, one that performed best being banana variety *phia* . These are changes in land utilization types within small scale agriculture brought about by mainly poor soils.

4.3 Local people's perception of effects of land use/cover change on Bugala Island

Effects of land use/cover change can be either positive or negative. The views of the local people on the effects of land use/cover change were sought in this regard and the results were as follows: The highest of the good results of land use/cover change was income and employment from BIDCO Company with 17.5%, 11.1% mentioned benefit from construction of infrastructure, 9.9% look forward to future benefits when they begin harvesting their palms while 9.3% are happy with income from timber harvesting, charcoal burning and fishing. Though not a land use change but driver of change, the high population due to migration was identified by 4.7% as a positive effect in terms of market availability. A small percentage of 1.2% mentioned tourists coming to the beaches as a positive effect of land use change. However a big percentage of 46.2% saw nothing good from land use/cover change. The local people's perception regarding negative effects of land use/cover change were as follows: The highest percentage response of 25.5% was about no trees in the future since they are being cut down. About 13.6% mentioned loss of agricultural land to palm growing, 12.5% concerned with rainfall reduction, 9.1% talked about too much heat (temperature rise) because the trees are cut down and 2.3% said monkeys had increased because of change in land use/cover. These five negative responses mentioned so far totals to 63%, which negative effects are all centered on establishing of oil palm plantation in the island. This percentage of 63% was indicative of local people's perception of effects of change in Bugala. Other negative effects mentioned included pollution of the lake (3.4%), loss of cultural values and norms (0.6%) and loss of soil fertility (4.5%).

5.0 Discussion;

5.1 The trend and extent of change

The relative stability seen in forest cover for the last 41 years does not mean no change took place in the forests but rather the area coverage remained relatively the same. Inside the forests, activities like pit sawing, charcoal burning and even some settlement existed; these could not be mapped from the image. Additionally since it was difficult to exclude areas of small scale agriculture from the image of 2001 which were easily viewed as forests, this contributed to the 15,604.97ha of forests in 2001. However as echoed by recent studies like Lambin and Geist (2001), (2002); Leper *et al* (2004); Rudel *et al* (2005) land use/ cover change can be very drastic. This kind of drastic change in land use/cover was seen in forests in Bugala Island between 2001

and 2006. This was attributed to government policy to alleviate poverty through the modernization of agriculture which leads to the clearing of forests for oil palm establishment by both the BIDCO and small holders, the locals. Though forest cover was still the largest by 2006 with 47.12% of total land area, these will greatly change since clearing of vegetation is still going on.

The areas covered by grasslands reduced gradually between 1960 and 2001 since new built up areas partly came up in grassland areas especially fishing villages at the lake shores. Of course the drastic fall between 2001 and 2006 is clearly due to oil palm plantation establishment. As for small scale Agriculture with inclusions of settlement, the seemly declining trend may not be precise since it was rather difficult to map out such areas from the image. Most of these areas are covered up with trees thus easily included in forest areas. Additionally some areas that existed as small scale agriculture in 1960 become built up areas by 2001 for example where Kalangala district offices are located. The increase in built up areas was partly due to upgrading of previous small scale agricultural lands to built up areas but also due to the fact that many migrants moved onto the island and mainly settled along the shores of the lake commonly known as fishing villages.

The wooded grassland experienced a significant change (Z, 2.12>1.96 at P=0.05) since it was the smallest coverage of 0.74% of total land cover in 1960. Clearing of such a small coverage significantly affects its existence unlike other cover types that are relatively abundant. In a few years, this vegetation type may cease to exist. The swamp forests and wetlands were relatively stable because they had not been encroached on. Any differences observed in area coverage are attributed to mapping error. To ensure that clearing of vegetation does not affect these covers which are mainly at the periphery of the lake, 200 meter distance from the Lake is left as land is cleared for oil palm plantation.

The oil palm establishment by June 2006 covered an area of 5,207.67ha including nursery beds, small holders and investors establishments which is 18.34% of total land area, the second largest cover in Bugala Island by 2006. These areas were formerly grasslands, wooded grasslands and forests mainly. According to Resource manager for Wilmar Plantation Services (company contracted by BIDCO to establish oil palm plantation), the target is 10,000ha of oil palm plantation of which 6,500ha will be planted by the investor and 3,500 by small holders. Since clearing of vegetation started in October 2003, the 5,207.67ha is a drastic change in approximately three (3) years thus the rate of establishment is actually 1,735.92ha/year. Given this rate of clearing then, by the next three (3) years in 2010, Oil palm plantation will become the largest land cover in Bugala Island.

5.2 Drivers of land use/cover change

The findings of this study show that underlying drivers of land use/cover are specific to a location as was revealed by other similar studies elsewhere (Geist and Lambin 2002, Leper *et al* 2004, Rudel *et al* 2005). The key driving forces of land use/cover change in Bugala fall into two

categories mentioned by Framer-Browers *et al* (2006) namely: mega driver and environmental factors which we hardly have any control over. The mega driver in this case was oil palm plantation establishment while the environmental factors include the poor soils, the many monkeys and migration onto the island. The mega driver Oil palm plantation establishment has been exhaustively discussed in the previous section, 5.1. Let us turn our attention to some aspects of environmental factors observed in the results.

The results indicated that there are more migrants (100) than natives (83). The high number of migrants moving onto the island certainly affects land cover especially clearing of vegetations for settlement. Looking at population statistic of 2002, the ratio of those born in Bugala to those elsewhere in Uganda is 6,128 to 10,837 respectively (UBOS 2005). Thus in both the census results of 2002 and from this research study, there are more migrants than natives in Kalangala involved in various activities which were revealed in the focus group discussions and analysis of questionnaires as presented in the results.

Another driver was the problem of poor soils and monkeys. From results, regarding the problems facing subsistence agriculture, a total of approximately 40% was attributed to poor soils and monkeys as greatest hindrances thus this partly explains why many farmers would change their present land utilization from subsistence agriculture to commercial oil palm growing. Since the soils are of poor and can not sustain subsistence agriculture, the oil palms are grown with application of fertilizers. Initially rock phosphate is sprinkled around newly planted palms and continually Nitrogen, phosphate and potassium (NPK) fertilizers and other micro nutrients are used depending on the fertility of the soil. Among the problems identified in the focus group discussions were poor soils, lack of food and monkeys. The increases in the number of monkeys that greatly destroy crops were attributed to the fact that the forests were being cleared and the monkeys have to find food and settlement elsewhere which turns out to be gardens. From the focus group discussions, farming has also been hindered by other pests and diseases which could be investigated.

The results of the focus group discussions together with the interview sessions clearly show that low soil fertility, pests and diseases are contributory factors in driving land use change in Bugala. Thus because of these problems of poor soils, monkeys, other pests and diseases, the farmers have resorted to oil palm growing which is seemly economically viable.

5.3 Local people's perception of effects of land use/cover change on Bugala Island

The 46.2% that said nothing good came from current land use change is an indicator of either biasness to change or of the fact that the negative effects out weighs any apparent positives ones. The summation of negative effects of 63% which centered on establishing of oil palm plantation in the islands was indicative of local people's perception of effects of change in Bugala. It is apparent that the results from this study agree with the concepts of Trudgill (2001) regarding the growing concerns about current land use/cover changes. First, the anthropocentric concept that change will be detrimental to human existence and secondly that changes will be detrimental to life forms and

environments on earth for which we are stewards. Though perceptions or attitudes of people are often relative, it goes a long way in sounding a warning and usually indicative of what is on ground. Contrary to government policy to alleviate poverty, the local people had a negative view about the oil palm establishment in Ssese islands in preference to the ecological and socio-economic values they attach to the forest.

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Figure Legends;

Fig. 1 Location of the study area

Fig. 2 Land use/cover (LUC) maps for the years 1960, 2001 and 2006

Fig. 3**:** A graph showing the trends in land use/cover change

Fig. 4: A chart showing the extent of Land use/cover change in 41 years (1960-2001) and drastic changes in 5 years (2001-2006)

Fig.5: A change map for Grasslands and Forests between 2001 and 2006

Figure 7: A chart showing responses about bad results of land use/cover change.

Figure 6: A chart showing responses about good results of land use/cover change

Figures.

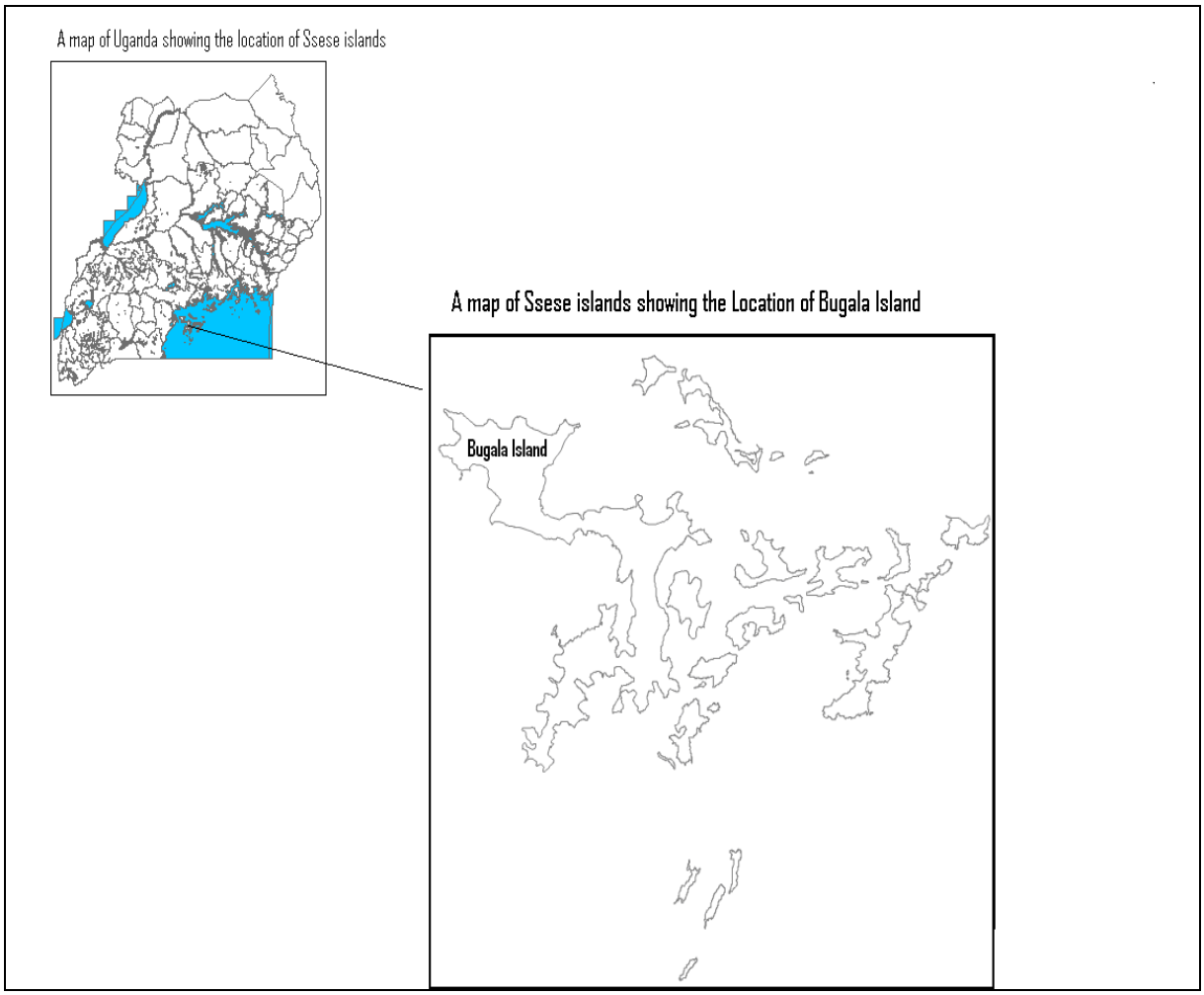


Fig. 1 Location of the study area

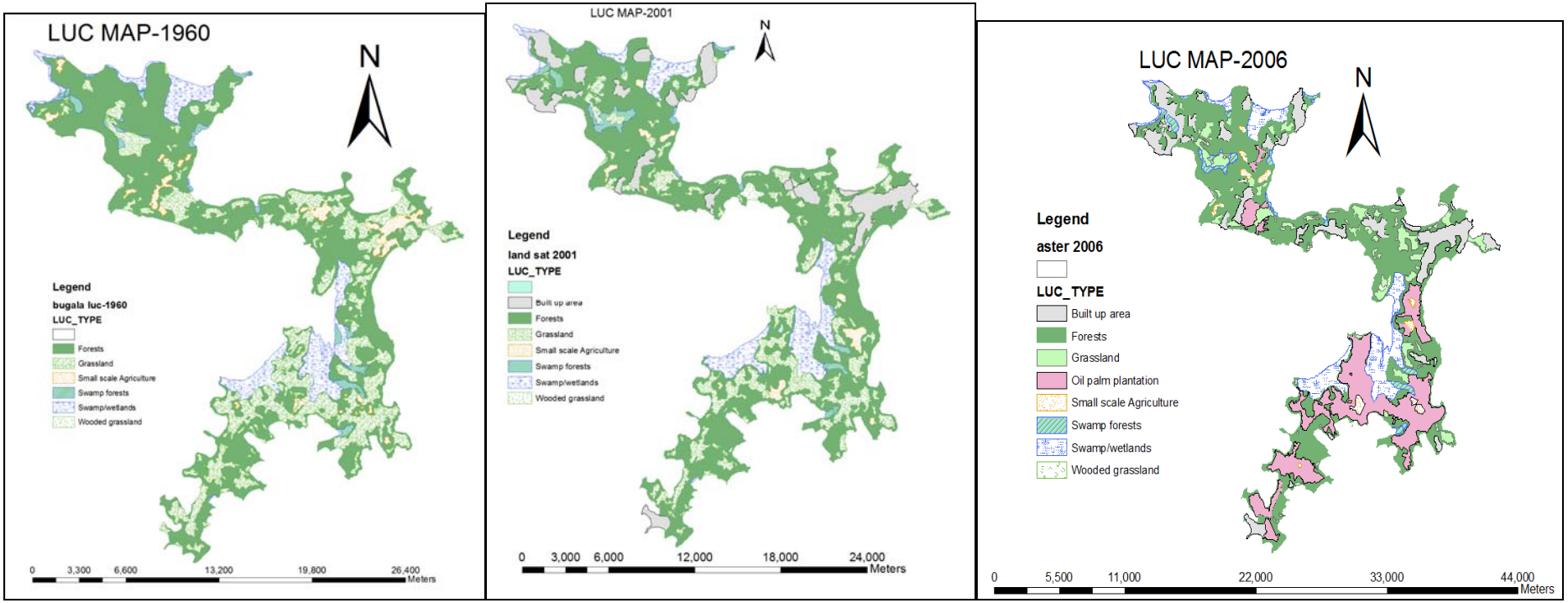


Fig. 2: Land use/cover (LUC) maps for the years 1960, 2001 and 2006

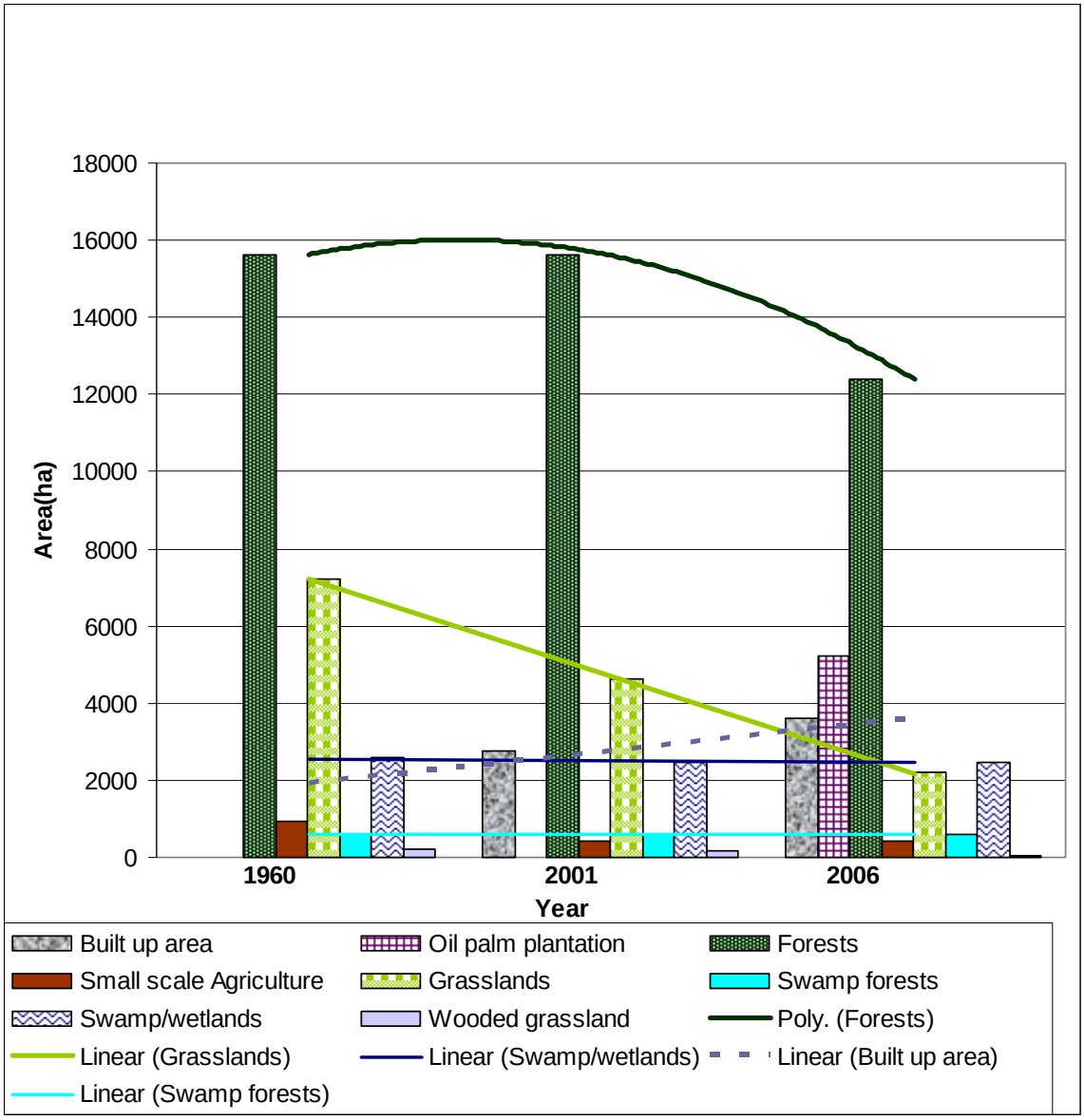
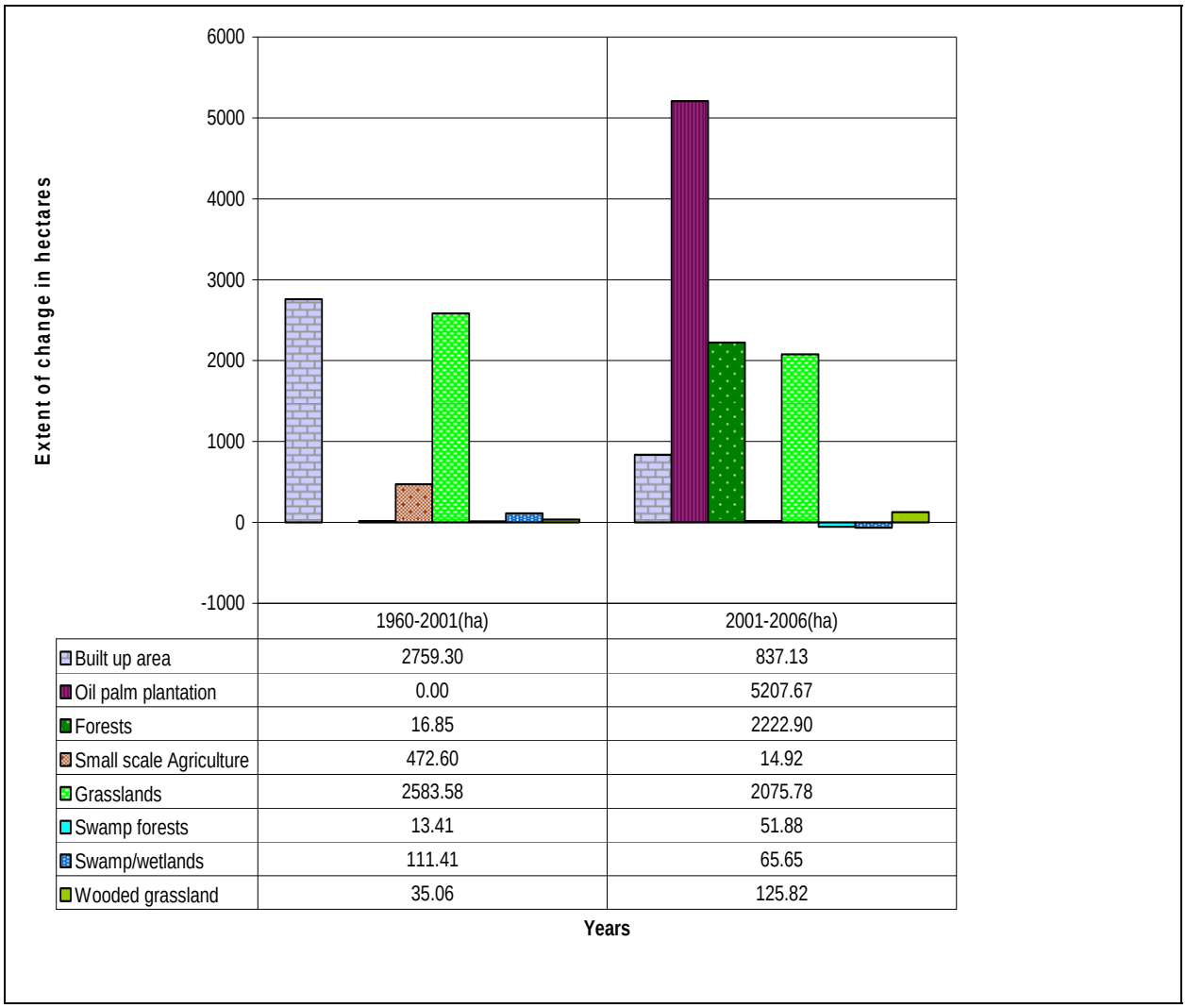


*Fig. 3***:** *A graph showing the trends in land use/cover change*



	1960-2001(ha)	2001-2006(ha)
Built up area	2759.30	837.13
Oil palm plantation	0.00	5207.67
Forests	16.85	2222.90
Small scale Agriculture	472.60	14.92
Grasslands	2583.58	2075.78
Swamp forests	13.41	51.88
Swamp/wetlands	111.41	65.65
Wooded grassland	35.06	125.82

Fig. 4: A chart showing the extent of Land use/cover change in 41 years (1960-2001) and drastic changes in 5 years (2001-2006)

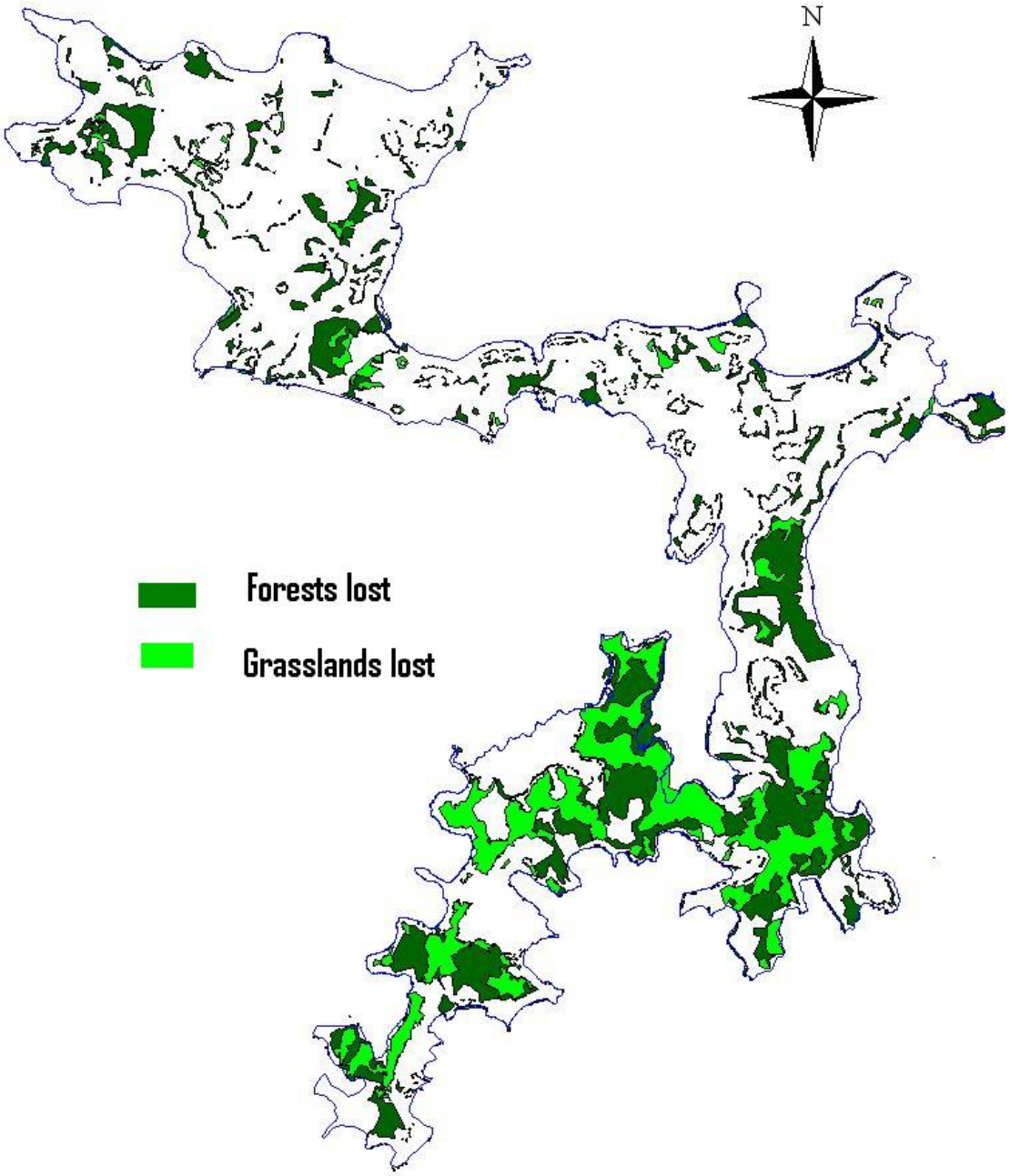


Fig.5: A change map for Grasslands and Forests between 2001 and 2006

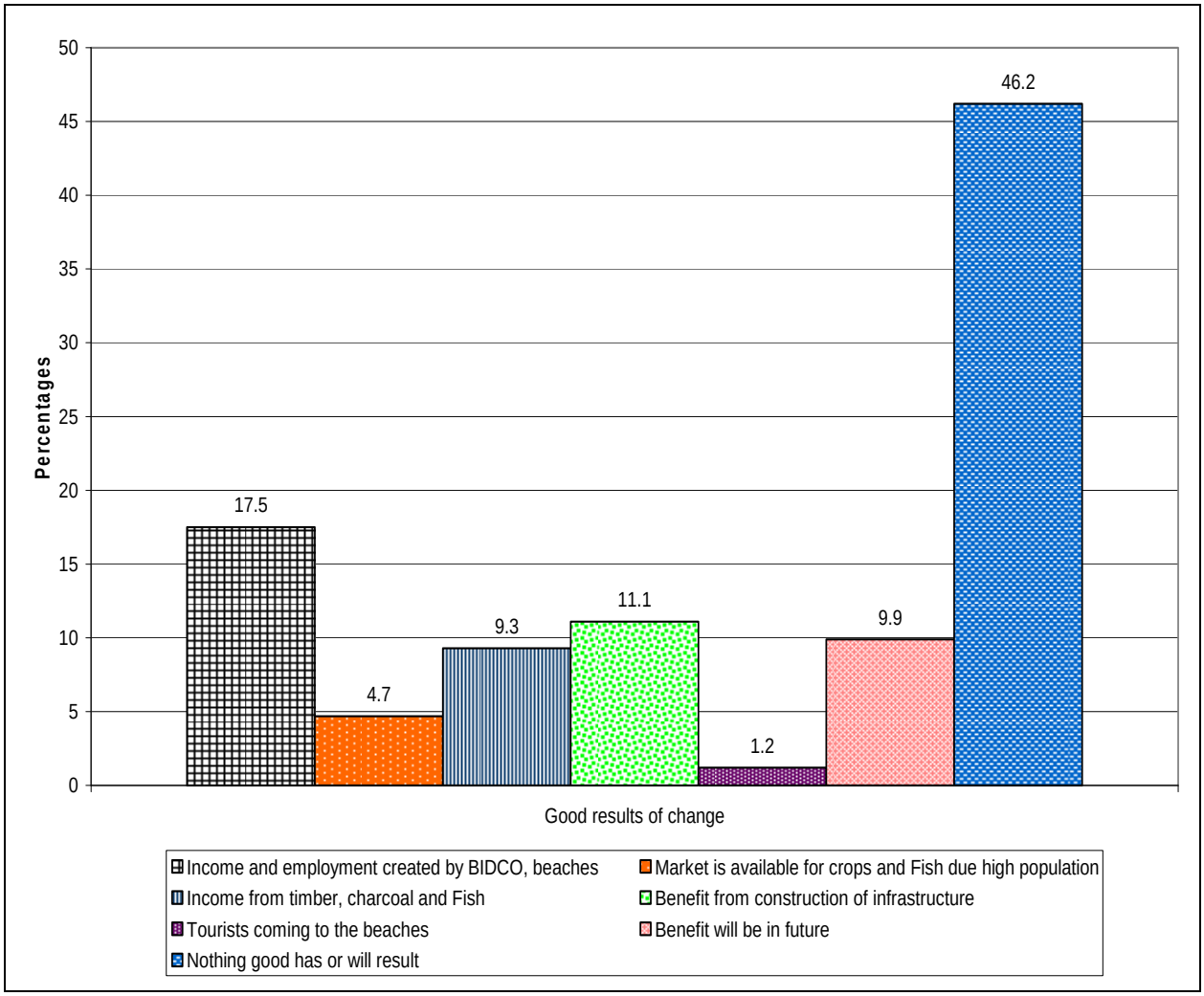


Figure 6: A chart showing responses about good results of land use/cover change

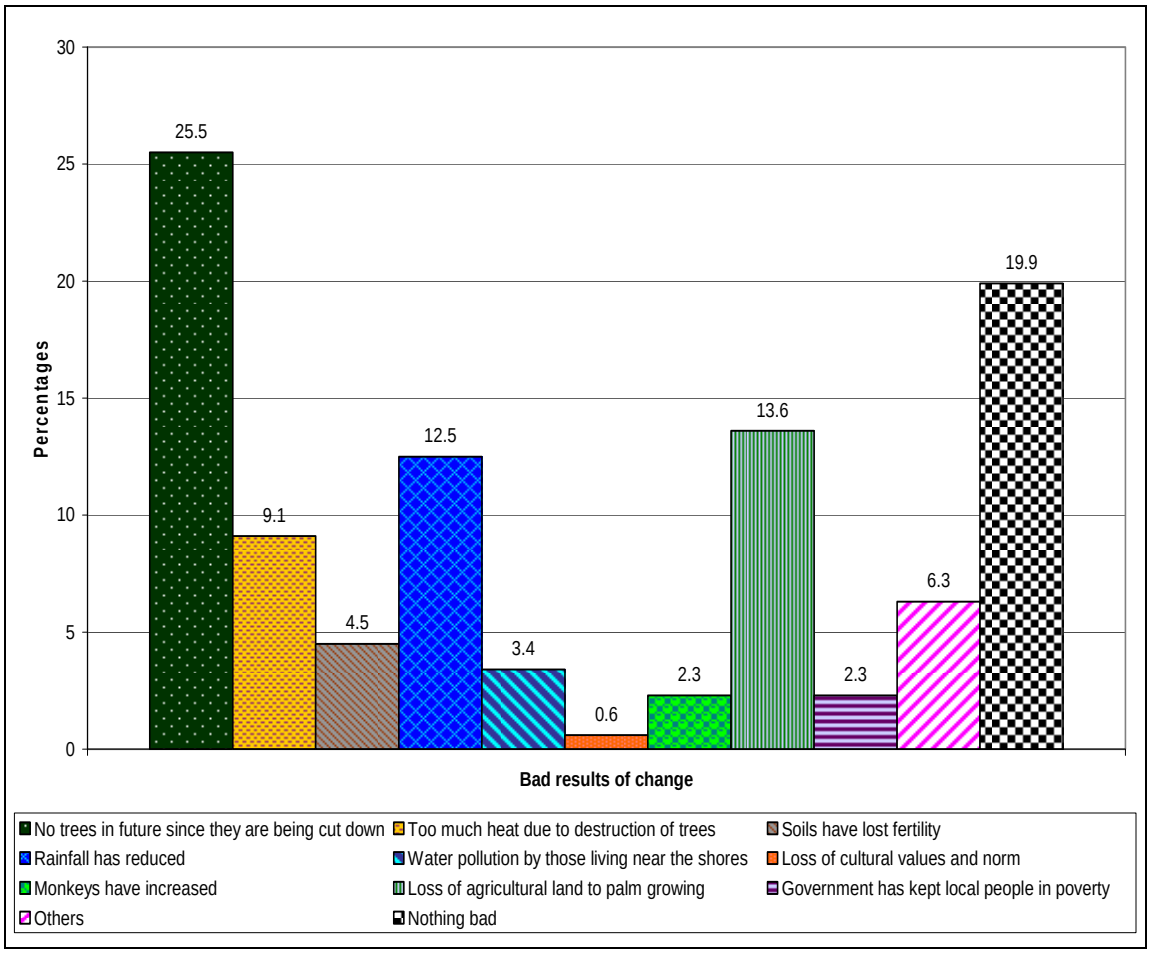


Figure 7: A chart showing responses about bad results of land use/cover change.