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Impact of Tobacco Production on Indigenous Forests

(Case in Mutasa District, Zimbabwe)

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Abstract: *Clearing of forested land for agriculture coupled with the need for fuelwood for the curing of tobacco has been a cause of concern to various stakeholders. There is substantial evidence of, and largely irreversible, losses of trees and other plant species caused by tobacco production resulting in depletion of miombo ecosystems. Tobacco growing and its curing is cited among other factors contributing to the decline in forest density. The study assessed the extent of deforestation as a result of tobacco growing, and its curing using indigenous forest trees in Mutasa District. The data was collected using remote sensing techniques and direct observations. The data were analysed using image supervised classification and change detection methods. Results depict that deforestation is taking place with dense, sparse and wooded grassland woodlands decreasing in density. Dense woodland declined by 2.2%, sparse woodland by 13% and wooded grassland by 8% between 2000 and 2015. Findings from the study show that the production of tobacco is having a negative effect on Miombo woodland forests in Mutasa District. It is recommended that the government should embark on a more vigorous approach in the planting of trees and conserving the existing forests to mitigate the effects of climate change. All stakeholders should be involved in planning and decision making on issues related to forest conservation and technology in tobacco production. Penalties in the form of fines for people breaching conservation rules and regulations should be directly channelled to local forest conservation and management. Improved curing technologies and coal should be made available to farmers at subsidized prices to promote regeneration of already damaged forests.*

Keywords: *deforestation, woodlands, conservation, remote sensing & miombo ecosystems.*

1. Introduction

The area of indigenous woodland forests in Zimbabwe has shown a continuous decline (Kunjeku et al. 1998). Zimbabwe's indigenous forests supply fuelwood for both domestic and commercial purposes. According to Marongwe and Milne (1993), fuelwood harvesting is a contributing factor to deforestation and rated as the most serious environmental issue in the country. Mutasa district has several plantations and estates that provide employment and these are mainly for timber and tea. However, there is a reduced employment level due to dry spells which have prevailed for the past few years. This has an impact on forest resources as those not at work are cutting trees for firewood selling so as to earn a living.

Forests and woodlands cover about 40% of Zimbabwe. The total increment of wood is estimated to be approximately 29 million tonnes and the total annual consumption of fuelwood is approximately 5.1 million tonnes (UNFCCC, 2007). Half of the population lives in communal lands where the annual wood increment is only 1.1 million tonnes, and the demand for fuelwood is increasing gradually to 2.8 million tonnes (UNFCCC, 2007). Tobacco is increasingly becoming important as a cash crop in Mutasa District. As such, tobacco growing has an effect on Miombo ecosystems as land is converted from natural vegetation to cultivated land and tree felling for tobacco curing (Yanda, 2010). In 2010, total forested area in Zimbabwe was 15.6 million hectares, but the country has been losing its forest at a rate of 2.1% (327 000 hectares) per year mainly due to expansion for arable land and demand for fuelwood (FAO, 2010). Zimbabwe currently is the 9th largest producer of tobacco with cultivated surface area of 94 175 ha in 2010 (FAO, 2010). The situation in Zimbabwe is probably the most difficult to assess as a result of the new land tenure policy by the government.

In Malawi, tobacco production accounts for the largest share of agricultural land and is among the fastest growing industry in the world. Farming was estimated to have caused up to 70% of national deforestation in 2008 (Kagi and Schmid, 2010). In Miombo ecosystems, tobacco-related deforestation represents up to half the total annual loss of forests and woodlands (Mayes et al. 2015). Evidence also suggests that tobacco growing is much more aggressive in its impact on forest ecosystems than other uses such as maize farming or grazing (WHO, 2008). In Urambo district, Tabora region, Tanzania’s leading tobacco growing area the combined annual rates of forest removal as a result of land extension (3.5%) and fuelwood extraction (3%) were 10 times higher than the overall deforestation rate for Africa (0.64%) in 2000 (Mangora, 2012).

The supply of coal has been erratic over the past few years due to the collapse of the country’s railway system and this has promoted the unsustainable harvesting of trees for tobacco curing. This has threatened the country’s indigenous and commercial forest woodlands. Woodlands on tobacco production farms have very high stump mortality than horticultural or maize woodland sites (Katsvanga et al. 2008). The population density in Zimbabwe is 41 per km^2. Land is becoming less and less and this has an effect on resources such as fuelwood and water.

2. Methodology

2.1 Study area

The study area is situated in ward 23 Mutasa District. The study area is made up of two old farm areas Grange and Laverstock (32^{0}34’ E; 18^{0}52’ S). Grange farm is located 20km from the city of Mutare and Laverstock is 5km from Mutare-Nyanga highway road. Grange resettlement area is located at an elevation of 1140 metres and Laverstock resettlement is 1169 metres above sea level. Ward 23 was selected for the study because it contained the research interest. It is in this ward where most farmers settled in 2000/1 during the fast track land reform programme. It has the infrastructure in the form of tobacco barns, canals and dams for irrigation. The main economic activity in Mutasa District is farming, and mining activity mainly in the Penhalonga area. The main crops grown include maize, tobacco, bananas, potatoes, sugarcane, and plantations for fruit trees. The farmers also keep cattle, pigs, goats and poultry.

Soil types in Grange and Laverstock range from sandy loams to clay soils. Loam soils dominate the areas and are most suitable for tobacco production. Some isolated pockets of red soils are found particularly on the eastern part of Grange. The Grange area is located in the dryer farming region IIb with mean annual rainfall of 400mm and Laverstock area is in the farming region II with mean annual rainfall of 600mm. Annual temperatures range from 18-21^{0}C in winter and 27-30^{0}C in summer. The climate is suitable for dairy farming forestry, tobacco, tea, coffee, fruit, beef and maize production (FAO, 2009).

The district is rich in miombo ecosystems which provide a good source of firewood for tobacco curing and occur on well-drained slopes. It therefore covers most parts of the mountain and hill slopes. These ecosystems vary from closed to open and are dominated by the deciduous tree species. It is a mixture of *Brachystegia spiciformis*, *B. tamarinodoide*, *Julbenardia globiflora* and *Uapaca kirkiana* (Shumba, 2001). The trees are fairly small at high altitudes and bigger at lower altitudes. *Acacia* and *Brachystegia spiciformis* species are common at lower altitudes.

2.2 Data collection and analysis

2.2.1 Field visits

Field visits were carried out to identity change in forest cover over a period of time. The dominant vegetation cover types were identified and recorded.

2.2.2 GIS and remote sensing

Geographical Information System (GIS) and Remote sensing technique was used to assess the spatial coverage of natural indigenous forests in Mutasa ddistrict (Figure 1). The year 2000 represented the state of natural indigenous forest before tobacco production in the area by smallholder farmers. The year 2015 represented the current state of the forest with over 100 A1 and A2 smallholder farmers engaged in tobacco production. Image supervised classification and change detection method uses the ENVI software to classify images using multispectral moderate resolution data from Landsat 5, 7 and 8 satellites. This involved collection of GPS coordinates from various parts of the study area (Figure 1). These were then fed into the computer software ARC GIS that computed the images into Normalized Difference Vegetation Index (NDVI) and then processed. Remote sensed data was collected when trees were still green before shading leaves. During this period the fields were having dry matter. Data was collected every April to May period each year because the sky would be cloudless most of the time and has the chance of producing quality images.

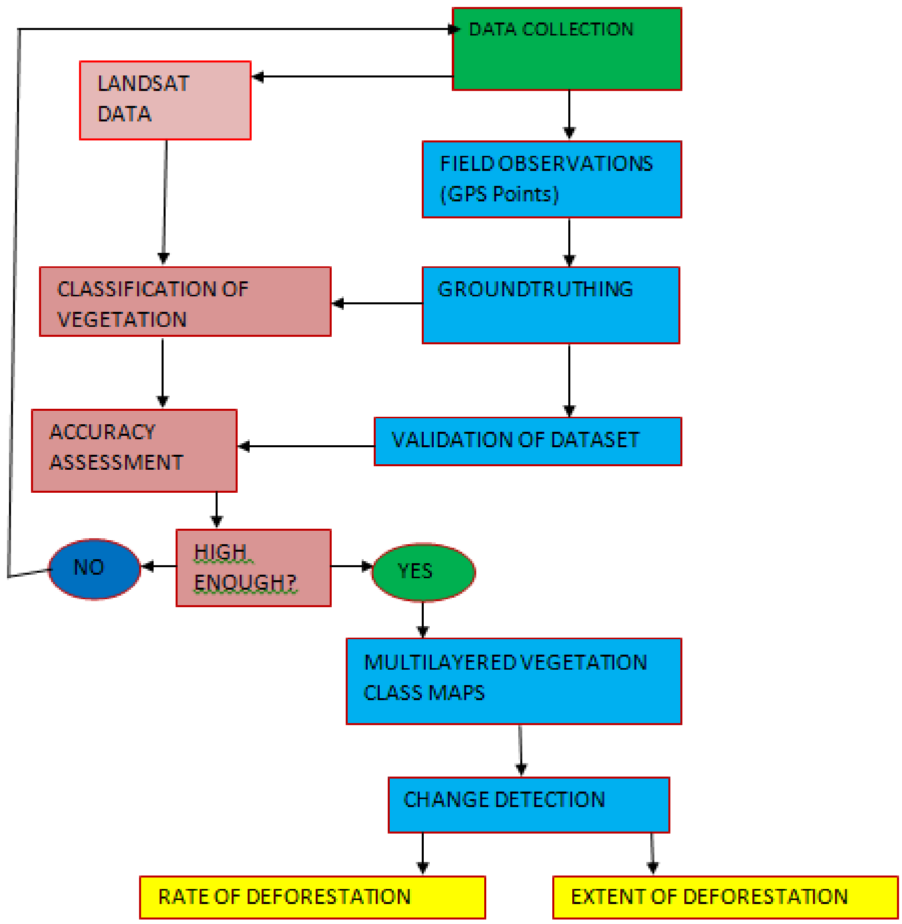

Figure 1: A cartographic model showing the process of GIS and remote sensing

2.2.3 Classification of vegetation

Using the GPS point coordinates, satellite images were acquired. The information on vegetation density was obtained from the images. The state of vegetation cover was obtained from the digitalisation of vector layers. All the pixels were assigned to a class in which they fitted into the range of an identified land use type. To generate vegetation classes, field data and observations were used, a process called groundtruthing. Also to verify the images, Google earth images were used to ascertain the vegetation. The satellite images were geo-referenced with images collected for the years 2000 and 2015. The vegetation distribution images of the year 2000 were used as the basis of change for the vegetation classes. These were wooded grassland, bush land, sparse woodland and dense woodland. Vegetation sparse woodland and dense woodland classes were of interest as they constituted harvestable firewood and located in mountainous areas. These would interchange over the period under investigation.

3. Results

3.1 Assessing rates of deforestation in Grange and Laverstock resettlement areas

Figure 2 below shows land use/land cover distribution and changes in the Grange and Laverstock resettlement areas in Ward 23. The map of 2000 shows that the ward had large areas of dense (dark green colour) and sparse woodland (light green colour) vegetation mainly on mountain slopes extending into the wooded grasslands (golden coloured) and cultivated areas (pink coloured) (Figure 2; Table 1). The 2015 year map shows that changes had taken place with regard to vegetation cover types.

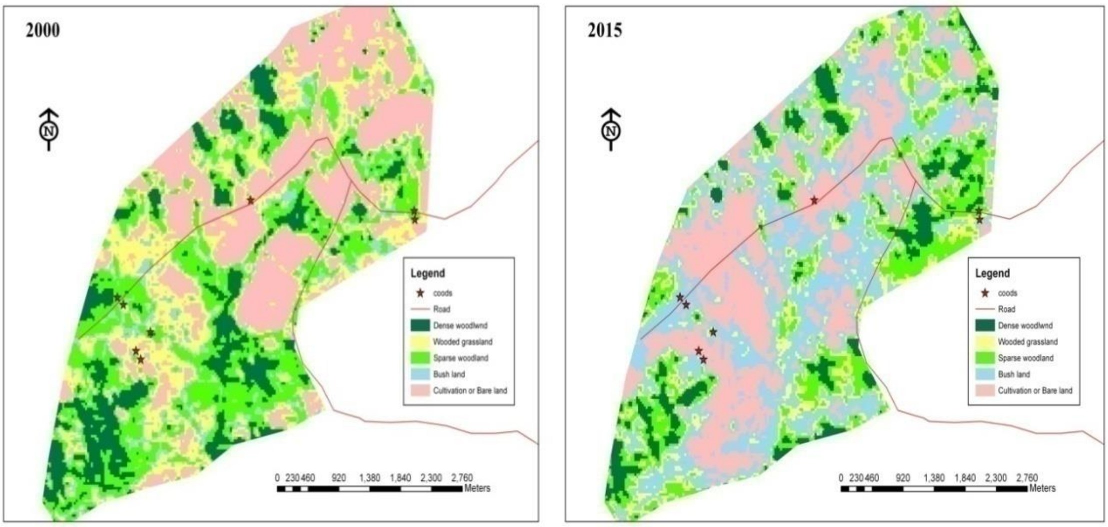

Figure 2: Colour Composite of classified images of 2000 and 2015 for Grange and Laverstock

Bare land, wooded grassland and bush land decreased. There was an increase in sparse woodland dense woodland from 2000 to 2015 (Table 1). The image shows noticeable differences in colour codes.

Table 1: Land Cover types and distribution (Ha) from 2000 to 2015

Land cover type	Colour	YEAR		
		2000	2015	Change from 2000
Bare land	Pink	457.5	144.6	-312.9
Wooded grassland	Golden yellow	210.4	174.1	-36.3
Bush land	Blue	363.1	689.2	-326.1
Sparse woodland	Light green	386.9	1062.2	+675.3
Dense woodland	Dark green	98.0	155.7	+57.7

Cultivated land increased by 24% from the year 2000 to the year 2003 and fell by 5% between 2003 and 2006. The overall cultivated land was lost by 24% (Table 1). Wooded grassland did not change from 2000 to 2003. The overall grassland increased by 8% from 2000 to 2015. Bush land was lost by 3% from 2000 to 2003 but gained between 2006 and 2009. The overall change in bush land was 6% between 2000 and 2015. Sparse woodland was lost by 20% between 2000 and 2003 and gained by 8% between 2006 and 2009 (Table 1). Sparse woodland decreased by 2% between 2009 and 2013. The overall sparse woodland increased by 13% from 2000 to 2015. Dense woodland fell by 5% between 2000 and 2003 and by 4% between 2003 and 2006. The overall forest cover change in dense woodland was 2.2% between 2000 and 2015.

Table 2: Percentage change in land use and land cover distribution for 2000; 2003; 2006; 2013 and 2015 in ward 23, Mutasa District

Landcover type	Period		%	Period		%	Period		%	Period		%	Period		%	Overall Change (%)
	2000	2003		2003	2006		2006	2009		2009	2013		2013	2015		2000-2015
Cultivation/bare	30	54	24	54	49.0	5	49.0	20	29	20	35	15	35	6	29	24.0
Wooded grassland	14	14	0	0	10.0	10	10.0	23	13	23	19	4	19	8	11	8.0
Bushland	24	21	3	22	22.0	0	22.0	27	5	27	19	8	19	31	12	6.0
Sparse woodland	26	6	20	15	15.0	0	15.0	23	8	23	21	2	21	48	27	13.0
Dense woodland	10	5	5	5	4.0	1	4.0	6	2	6	8	2	8	7	1	2.2
Total	100		0		100		100			100			100			

4. Discussion

4.1 Assessing the rate of deforestation

The area under cultivation increased by 24% from the year 2000 to 2015 (Table 2). This might be due to land occupation by farmers following the fast track land reform programme. According to Mavedzenge et al. (2008), the 2000 fast track land reform has been characterised by radical reconfigurations of land, production, economy, and livelihoods in the rural landscape. This also agrees with WHO (2008) which indicated an increase in area under cultivation by 7.6% from 1990 to 2007. The smallholder farmers embarked on tobacco production as one of the cash crops. As new farmers could not utilize the land that they had opened up due to lack of resources such as labour and inputs more grasslands were later observed. This area, from observation was affected by the diamond discovery in Marange and Chiadzwa areas. Most of the able bodied youths (labourers) moved out of the farms to the diamond fields leaving women and the elderly. The opened lands remained as grassland hence an increase in grassland area.

Sparse woodland was lost to cultivated land in the period 2000 to 20015 as these areas were opened for crop production. During the same period dense wooded forests were lost to sparse woodland. The farmers selectively harvested wood for shelter, fencing, housing construction and firewood. Each year in Malawi, 20 000 hectares of forests are cleared to cure tobacco (translating to 1000-2500 trees per hectare, which equals 20 to 50 million trees cut down every year, depending on type of tree) (FAO, 2003). This accounts for 5% of deforestation in developing countries, especially among major tobacco producers such as Malawi, Tanzania and Zimbabwe (FAO, 2003). Over 61000 hectares of forests are lost every year in Tanzania due to forest clearing for tobacco growing and its subsequent curing (Kagi and Schmid, 2010), leading to opening up of forests and triggering deforestation.

Bush land (blue) occupies a large portion of the resettlement area eating away most of the sparse woodland. The new vegetation coming up was made up of evasive tree species and the newly sprouting shoots in the areas which were not being utilized for crop production. The farmers spared some of the land for grazing. This land, previously grassland is experiencing serious bush encroachment. The most abundant tree species were *Acacia* and *Brachystegia* species as observed during groundtruthing.

There is also an increase in sparse vegetation at the expense of dense woodland. As observed during the study, the dense forests remained on mountains and hillside. Such spatial changes points to deforestation. During the most rapid period of growth in tobacco farming (1972–1991), national forest cover declined from 45% to 25% (Geist et al. 2008), and tobacco production is now the main agricultural driver of deforestation in Malawi. Geist et al. (2009) indicated that deforestation caused by tobacco cultivation and the curing process is considered to be the single most serious negative effect on Miombo ecosystems. From observation, specific trees and tree sizes were preferred as wood for the curing of tobacco. This selective cutting leaves some tree species and depletes others. The cutting was very selective targeting large trees especially miombo species. An increase in the sparse woodland area reflects loss of trees in the district particularly between year 2000 and 2015. Although a number of farmers claimed to have been using exotic tree species for the curing of tobacco, there is evidence that they were mainly relying on indigenous forest trees.

5. Conclusions

The study sought to provide evidence on the impact of tobacco production on indigenous miombo woodlands in Ward 23 of Mutasa District. Based on the findings of the study, the production of tobacco is having a negative impact on the miombo forests in Mutasa district. It is the dense woodland that has gradually dwindled between 2000 and 2015. The results from the study shows that dense wooded areas shrunk while sparse vegetation increased as more people were settled and ventured into tobacco farming. The results revealed that there was a gradual dominance of sparse woodland over the years. This was more pronounced between 2003 and 2006. This coincided with an increase in the area under tobacco farming. The dense wooded area fell slightly by 2.2% and this points to either the opening up of new cultivation fields or the cutting down of trees for the curing of tobacco. The study also shows that deforestation is causing a reduction in forest density. Legislative restrictions on the use of indigenous forest trees for the curing of tobacco should be prioritised for the conservation of the depleted miombo ecosystems.

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