

The Effect of Deforestation on Tree Species in IGALAMELA Local Government Area of KOGI State, Nigeria

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Abstract: This research was carried out to examine the effect of deforestation on tree species in four communities (Ajaka, Imere, Okpe and Okochogbe) in Igalamela Local Government Area of Kogi State. Quadrat plots measuring 30 metres square each, separated by transects of 5 metres of undisturbed forest were used for the analysis, also undisturbed farmland were used as control. Simpson's Index was used to determine species diversity within the study area. The result revealed that agriculture has been abandoned by the youth as the aged people are mostly limited to subsistence farming most of who adopt indigenous farming techniques such as bush burning which invariably contributes to deforestation and loss of tree species in the study areas. Furthermore, results also revealed that the plant species of *Magnifera indica* (Mango), *Elaeis guineensis* (Oil palm), *Pentaclethra macrophylla* (locust tree), *Azadirachta indica* (Neem) and *Bambusa vulgaris* (Bamboo) which serve as economic tree species were being affected by human activities due to the fact that the wild tree species such as *Milicia excelsa* (iroko), *Entandrophragma angolense* (Mahogany), *Lophiralanceolata* (Obeche) which provide timber for various uses were no longer in abundance as a result of deforestation. However, Okochogbe community in Igalamela L.G.A has the highest tree species diversity with Simpson's diversity index value of 0.9731 compared to Imere (0.9703), Okpe (0.9665) and Ajaka (0.8111) communities. The study recommended that sustainable forestry practices should include the development of rapidly growing tree species such as *Gmelina*, neem and *Daniellia* which can be harvested after five to eight years and easily be replanted in order to reduce pressure on the slow growing species such as Iroko, Mahogany and Obeche which take a life time to mature.

Keywords: Deforestation, afforestation, reforestation, Species, Forestry, Quadrat, transect, diversity.

I. Introduction

Deforestation is the process of cutting down of trees for various reasons without replacement. The reasons can be for farming, construction (housing, road, bridges and dam) and other uses in the form of firewood, timber, charcoal and medicinal uses. Deforestation poses a significant concern because of increased human encroachment upon wild areas, increased resource extraction and threats to biodiversity (Rudel, 2005).

Anthropogenic activity of man is a serious factor depleting trees and affecting the trees significant proactive and regenerative capabilities, creating an avenue for desert encroachment. In Africa, almost all countries rely on forest to meet basic energy needs. The share of wood fuels in African primary energy consumption represents on average 86% of total African energy consumption (Amous, 1999).

Cleared land is used as settlements, pasture for livestock, and agricultural plantations. One reason for forest depletion is to plant cash crops. Many West African countries depend on cash crop exports. Products like rubber, gum, oil palm, cocoa, and kolanuts provide a steady income. Disregard or ignorance of intrinsic value, lack of forest management and deficient environmental laws are some of the factors that allow deforestation to occur on a large scale (Susanna *et al.*, 2006).

The reliance on area expansion to meet the needs of rapidly increasing human populations has resulted in increased deforestation resulting in serious environmental problems including erosion, loss of soil fertility, loss of medicinal plants and fruits, extinction of species, changes in climatic conditions, and displacement of indigenous people (Marcoux, 2000).

To redress this problem, this research determine the effect of deforestation on tree species diversity in Igalamela Local Government Area of Kogi State with the hope that the information provided would help in successful forest reestablishment in the area.

II. Materials and Methods

The study site covers an area of 2175 km² in Igalamela local government area of Kogi State in the north central region of Nigeria, with mean annual rainfall of 1532mm and average temperature of 28^oC (Ayoade, 2004). Five villages were chosen from each of the four communities in the study area by Simple random Sampling method as sample size for the study. Each of the communities in the study area was coded and a table of random digits was used to draw out four communities; this technique was used to ensure an unbiased selection. Field inventory was carried out in each of the forests and agricultural lands. Questionnaire was administered to all the

household heads in selected villages. The criterion for village selection was based on agricultural practices and accessibility to forest.

Twenty households were sampled from each of the five villages that make up the study communities, making a total of 400 households. In administering the questionnaire, the family was the basic unit of survey and the heads of households were mainly the respondents.

The primary data were collected through field inventory with the help of a Taxonomist and four other local helps to determine species diversity and tree density. Two rectangular plots of land measuring 30metres square each and separated by transect of 5metres of an undisturbed forest and farmland were used for the control. The diameter at breast height (dbh), were measured in the sample plots. All trees were noted, counted and documented. For each species the diversity index was calculated and the frequency distributions obtained were characterized by their mean, standard deviation and coefficient of variation.

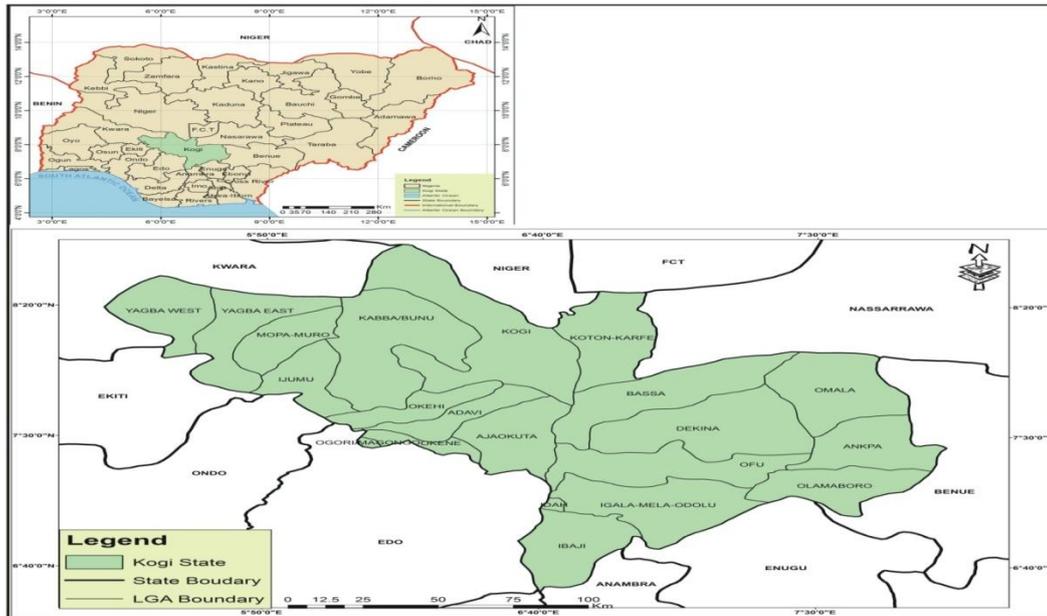


Fig. 1: Nigeria showing Kogi State.

Source: NASRDA, 2015

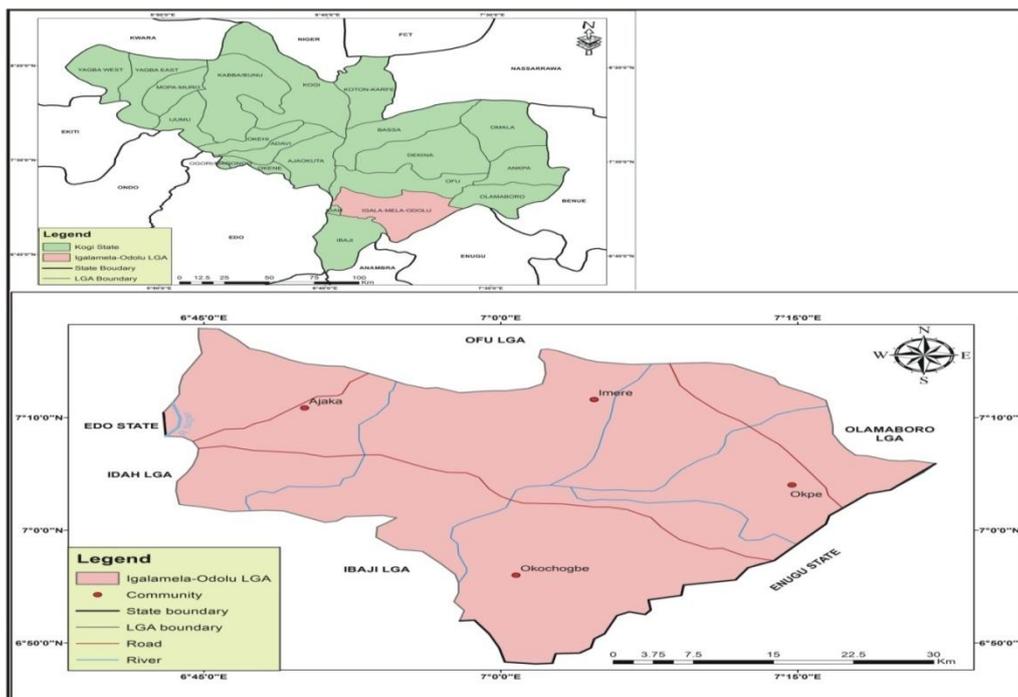


Fig. 2: Kogi State showing Igalamela L.G.A.

Source: NASRDA, 2015

In order to be able to achieve the objectives of this study, both descriptive and inferential statistical methods such as Structured and non-structured questionnaire, oral interview, Simpson’s Diversity Index, arithmetic mean, standard deviation and coefficient of variation were used.

III. Results and Discussion

Respondents were mostly males (78%) in their middle and old ages (41years and above) (77.5%) with most of them having attended Primary school (50%) and possessed at least a hectare of farmland (46.5%). The dominance of the aged population in this survey is an indication that agriculture has been abandoned by the youth as the old people are mostly limited to subsistence farming most of who adopt indigenous farming techniques such as bush burning which invariably contributes to deforestation and loss of tree species in the study area.

Most of the respondents covered by this study attributed farming activities (39%) as the major factor responsible for deforestation in the study area followed by construction works (14.25%), population growth (10%) and rural poverty (9.75%). The study observes that farming activities is the overwhelming cause of deforestation in the entire study area

As a result of increase in population in the Local Government Area, people resort to clearing of forest to provide shelter and to plant crops either for subsistence or for sale in the markets in order to augment a living. The implication of this finding is that farming activities when not practiced in a sustainable way can lead to destruction of tree species. This is supported by the earlier findings of Marcoux, (2000), Myers, (1991) and Vanclay, (1993).

The study noted heaps of fuel wood for sale in most of the communities studied. The reason could be attributed to the high cost of alternate energy sources which is beyond the reach of the rural poor as observed by Pearce (2001). Hunting activities were also prevalent in many villages of the study area particularly, Ikelegwu, Ofarachi, okpachala andokanekpa. It was a common sight to see young people and their dogs traversing one forest or the other with sticks, machetes and catapults in search of rodents, squirrels, alligators, and bush fowls. In most cases, they set a portion of the forest/bush ablaze in a bid to force the animals out from their hideouts. Table 1 shows population of plant species which was used to determine species diversity in Table 2.

Table 1: Plant Species Population in the Study Area

Community	Villages	No of Tree Species		Total No of Individuals of Species	
		Forest	Farm	Forest	Farm
AJAKA	Ikare	28	4	526	37
	Ayikpele	32	5	256	16
	Otobo	33	6	431	24
	Ugbatugba	27	3	540	31
	Ogajogwu	29	4	180	22
	Total		149	22	1933
Mean (X)		29.8	4.4	386.6	26
Std. Dev.		8.69	25.91	43.24	31.35
C. Var.		29.16	588.9	11.18	120.6
IMERE	Okanekpa	28	4	840	57
	Ibochi	27	2	324	14
	Ikelegwu	31	3	420	52
	Ogbagba	36	5	1080	104
	Ujeji	21	3	315	26
	Total		143	17	2979
Mean (X)		28.6	3.4	595.8	50.6
Std. Dev.		5.51	1.14	345.58	34.78
C. Var.		19.27	33.53	58.00	68.74
OKPE	OkpeEgbili	28	4	460	24
	Okpeogane	33	5	320	36
	kpetelube	28	3	376	18
	ojuwocha	34	4	410	22
	okpachala	35	5	688	82
	Total		158	21	2254
Mean (X)		31.6	4.2	450.8	36.4
Std. Dev.		3.36	0.84	142.05	26.36
C. Var.		10.63	20	31.51	72.42
OKOCHOGBE	Ugbogbo	39	7	1062	108
	Ere-ogane	34	3	1190	48
	oforachi	31	2	524	21
	Ate	45	7	920	54
	Ogane	35	2	280	14
	Total		184	21	3976
Mean (X)		36.8	4.2	795.2	49
Std. Dev.		5.40	2.59	381.32	37.79
C. Var.		14.67	61.67	47.95	75.79
Grand Total		634	81	11142	810
Mean (X)		31.7	4.05	557.1	40.5
Std. Dev.		5.16	1.50	303.02	28.48
C. Var.		16.28	37.12	54.39	70.32

Source: Field Work, 2015

Table 1 shows the population of tree species in the sample plots of the study villages. The result reveals a total of 634 tree species in the sampled forests. Ajaka community has 149 tree species; Imere community has a

total of 143 tree species, Okpe community has 158 tree species while Okochogbe community records the highest number of 184 tree species. There is a total of 81 tree species in the sampled farms, with Ajaka, Imere, Okpe and Okochogbe communities having 22, 17, 21 and 21 tree species respectively. Their study records a total of 11,142 individual trees and an average of 557 trees in the sampled forests. While a total of 810 trees and average of 41 trees in the sampled farmlands. Okochogbe community has the highest number (3976) of individuals of tree species in sampled forests, followed by Imere community (2979), and Okpe community (2254). Ajaka community has the least number of individuals of tree species in sampled forests.

Table 2: Estimation of species Diversity in the Study Area

Community	Village	No of Tree Species		Total No of individuals of species		Simpson's Index	
		Forest	Farm	Forest	Farm	Forest	Farm
AJAKA	Ikare	28	4	526	37	0.9606	0.7392
	Ayikpele	32	5	256	16	0.9561	0.7813
	Otobo	33	6	431	24	0.964	0.8111
	Ugbatugba	27	3	540	31	0.959	0.641
	Oni Idah	29	4	170	22	0.9595	0.7397
IMERE	Okanekpa	28	4	840	57	0.9615	0.7288
	Ibochi	27	2	324	14	0.9574	0.4082
	Ikelegwu	31	3	420	52	0.9576	0.6635
	Ogbagba	36	5	1080	104	0.9703	0.7487
	Ujeji	21	3	315	26	0.9474	0.5769
OKPE	Egbili	28	4	460	24	0.96	0.4132
	ogane	33	5	320	36	0.9489	0.7978
	kpetelube	28	3	376	18	0.9631	0.6481
	ojuwocha	34	4	410	22	0.9601	0.7219
	okpachala	35	5	688	82	0.9665	0.7864
OKOCHOGBE	Ugbogbo	39	7	1062	108	0.9711	0.8433
	Ere-ogane	34	3	1190	48	0.9686	0.6660
	oforachi	31	2	524	21	0.9665	0.3628
	Ate	45	7	920	54	0.9731	0.8217
	Ogane	35	2	280	14	0.9678	0.5

Source: Field Work, 2015.

The index (Table 2) revealed that species in the forests recorded higher values than species in the farms in the communities which is an indication of greater species richness (diversity) in the forests compared to the farms. This implies that conversion of forests to non-forest use, such as farmland has negative effect on tree species diversity as also observed by Houghton, (1994), Myers, (1994) and Achard et al., (2002). Comparing the diversity of the forests in the different villages of the sampled communities, it was noticed that the forests have closely related values of Simpson Index. However some villages have forests with greater diversity as shown in Table 2. These include okochogbe ate village (0.9731) and ugbogbo village (0.9711) in okochogbe community, ogbagba village (0.9703) in Imere community. Villages with the least diversity of species include Ujeji (0.9474) in Imere community and Okpe - Ogane (0.9489) in Okpe community.

Table 3: Plant species affected by deforestation in the study area

Community	Villages	Tree Species	No of Individual (n) in Sampled Plots		Diameter at Breast Height (cm)	
			Forest	Farm	Minimum	Maximum
AJAKA	Ikare	<i>Artocarpus communis</i>	37	12	8cm	26cm
	Ayikpele	<i>Tectonagrandis</i>	2	*	27cm	34cm
	Otobo	<i>Elaeis guineensis</i>	13	2	18cm	29cm
	Ugbatugba	<i>Irvingia gabonensis</i>	32	14	15cm	34cm
	Ogajogu	<i>Milicia excelsa</i>	16	7	38cm	62cm
	Total		100	35	103	185
	Mean (X) Std. Dev. C. Var.		20 12.82 64.1	8.75 4.657 53.22	20.6 13.24 60.18	37 15.79 40.49
IMERE	Okanekpa	<i>Elaeis guineensis</i>	52	21	18cm	29cm
	Ibochi	<i>Dacryodes edulis</i>	22	10	8.2cm	23cm
	Ikelegu	<i>Elaeis guineensis</i>	38	19	12cm	28cm
	Ogbagba	<i>Elaeis guineensis</i>	41	24	22cm	28cm
	Ujeji	<i>Treculia africana</i>	15	1	18cm	28cm
	Total		168	75	78.2	136
	Mean (X) Std. Dev. C. Var.		33.6 12.95 38.54	15 5.45 30.62	15.64 6.14 40.79	27.2 2.71 10.04
OKPE	Egbili	<i>Mangifera indica</i>	27	18	18cm	39cm
	Ogane	<i>Azadirachta indica</i>	49	*	15cm	31cm
	Kpetelube	<i>Gmelina arborea</i>	17	8	16.5cm	30cm
	Ojuwocha	<i>Treculia Africana</i>	38	10	18cm	28cm
	Okpachala	<i>Pentaclethra macrophylla</i>	48	22	20cm	32cm
	Total		179	58	87.5	160
	Mean (X) Std. Dev. C. Var.		35.8 13.77 38.46	14.5 6.61 45.59	17.5 1.87 10.69	32 4.18 13.06
OKOCHOGBE	Ugbogbo	<i>Mangifera indica</i>	59	21	12cm	37cm
	ere-ogane	<i>Elaeis guineensis</i>	51	8	18.5cm	25cm
	Oforachi	<i>Gmelina arborea</i>	21	16	8.2cm	31cm
	Ate	<i>Raphia</i> spp.	57	16	14cm	28cm
	Ogane	<i>Terminalia virens</i>	14	*	12cm	25cm
	Total		202	61	64.7	146
	Mean (X) Std. Dev. C. Var.		40.4 21.26 52.62	15.25 5.38 35.28	12.94 3.75 28.98	29.2 5.02 17.19
Grand Total		649	229	333.4	627	
Mean (X) Std. Dev. C. Var.		162.25 37.98 23.406	57.25 14.36 25.08	83.35 13.94 16.72	156.75 18.403 11.74	

Source: Field Work, 2015.

Table 3: shows tree species affected by deforestation in the study area. The mean number of individual tree species in sampled plots is 162.25 (forest) and 57.25(farmland); the standard deviation is 37.98 (forest) and 14.36(farm). The result showed moderate variability for forest (CV=23.406) and high variability for farmland (CV = 25.08). The result of analysis revealed that most of the trees in the study area are small (8cm-23cm dbh) and medium trees (23cm-38cm dbh) with a few large trees (>38cm dbh). The implication is that most of the old growth tree species have been cut down in the study area, while the small trees are no longer allowed to grow to maturity before being felled. This result corroborate with the findings of Reenberg et al., (2002) and Wardell et al., (2004).

IV. Conclusion

The realization of the fact that deforestation can have negative effect on tree species diversity leading to loss of valuable economic and medicinal trees, climate change, erosion, flooding amongst others led to the need for this study in the area. The study suggested ways to mitigate the environmental problems associated with deforestation in the Area. Efforts aimed at attaining sustainable forestry practices should include the development of rapidly growing species of trees such as gmelina, daniellia and neem. These trees can be harvested after five to eight years and easily replanted. This will help to reduce pressure on the slow-growing species such as *Milicia excelsa* (Iroko) and *Triplochitonscleroxylon* (Obeche) which take a life time to mature. Since farming has been implicated as one of the primary causes of deforestation. There is need to adopt farming systems that encourage afforestation and reforestation. This should include introduction of greenhouse gardens, slash and char rather than slash and burn, as well as alley farming in which crops are interspersed with small trees.

References

- [1]. Achard, F., Gallego, J., Richards T., Malingreau J., Eva H., Stibig H., and Mayaux P. (2002). "Determination of deforestation rates of the world's humid tropical forests." *Science*, Vol. 297, No.5583, pp. 999–1002.
- [2]. Agbola, T. (2008). "The Value of land use planning to sustainable development." Paper presented at the Urban Summit held at the Transcorp Hilton Hotel, Abuja, 1st- 3rd September.
- [3]. Akinsami, F.A. (2006). "Challenges of forest production for economic development." Paper presented at 31st Annual Conference of the Forestry Association of Nigeria, Markurdi, Benue State, Nigeria, 20th -25th November, pp.1-9.
- [4]. Amous, S. (1999). "The role of wood energy in Africa," in *Wood Energy Today for Tomorrow (WETT) Regional Studies*.FAO Forestry Department Working Paper FOPW/99/3, FAO, Rome.
- [5]. Ayoade, J. O. (2004). *Introduction to Climatology for the Tropics* (2nd ed.). Ibadan:Spectrum Book Limited.
- [6]. Burgonio, T.J. (2008). "Corruption blamed for deforestation". *Philippines Daily Inquirer*.http://newsinfo.inquirer.net/breakingnews/nation/view_article.php?article_id=110193.
- [7]. FAO (2009). "Adoption of Sustainable Forest Management Practices." *International Forestry*, Vol. 11 No. 14, p. 147. www.atyponlink.com/CFA/doi/pdf/10.1505/ifer.11.4.514
- [8]. Houghton, R.A. (1994). "Land-use change and tropical forests," *BioScience*. Vol.44, pp. 305–331.
- [9]. Cummings, Jr., (eds.) *Land Clearing and Development in the Tropics*. pp. 299-315. Balkema. Rotterdam.
- [10]. Marcoux, A. (2000). "Population and deforestation". *SD Dimensions*. Sustainable Development Department, Food and Agriculture Organization of the United Nations (FAO). <http://www.fao.org/sd/WPdirect/WPan0050.htm>.
- [11]. Myers, N. (1991). Tropical forests: Present status and future outlook. *Climatic Change*. Vol. 19, No.1–2, pp. 3–32.
- [12]. Meyers, N. (1994). Tropical deforestation rates and patterns. *The causes of tropical deforestation*.
- [13]. Pearce, D. W. (2001). "The Economic Value of Forest Ecosystems". *Ecosystem Health*, Vol. 7, no. 4, pp. 284–296.
- [14]. Reenberg, A., Nielsen, T.L., Rasmussen, K. (1997). *Field expansion and reallocation in the Sahel-land use pattern dynamics in a fluctuating biophysical and socio-economic environment*. *Global Environmental Change*, Vol.8, No.1, pp. 309-327.
- [15]. Ron, N. (2006). *The Little Green Handbook: Seven Trends Shaping the Future of Our Planet*, Picador, New York.
- [16]. Rudel, T. (2005). Tropical Forests: **Regional Paths of Destruction and Regeneration in the Late 20th Century**. Columbia University Press.
- [17]. Sample, I. (2006). "Forests are poised to make a comeback, study shows". *The Guardian*. November 14, 2006.
- [18]. Science Daily (2007). Confirmed: Deforestation Plays Critical Climate Change Role.
- [19]. Stock, J. and Rochen, A. (2009). "The choice of doomsday or arbor day" <http://www.umich.edu/~hgs265/society/deforestation.htm>. Retrieved January 15, 2015.
- [20]. Susanna, B., Susan, K., Ileana, G., Nelson C., and Herman R. (2006). *Globalization, Forest Resurgence, and Environmental Politics in El Salvador*. *World Development*, Vol. 34, No. 2, pp. 308–323.
- [21]. Uneke, C. and Ibeh, L. (2009). Impacts of deforestation on malaria in south-eastern Nigeria: the epidemiological, socio-economic and ecological implications. *The Internet Journal of Third World medicine*, Volume 8, Number 1.
- [22]. USATODAY.com (2008). Amazon deforestation rises sharply in 2007, "Use Energy, Get Rich and Save the Planet", *The New York Times*, April 20, 2009.
- [23]. Vanclay, J. (1993). Saving the tropical forest: Needs and prognosis. *Ambio*, Vol, No. 4, pp. 225–231
- [24]. Wardell, D.A., Reenberg, A., Tettrup, C. (2004). *Historical footprints in contemporary land-use systems: forest cover changes in savannah woodlands in the Sudano-Saharan zone*. *Global Environmental Change*, Vol. 13, No.4, pp. 235-254.
- [25]. World Population Day (2012). Politics/The Earth Times. Environmental News. www.earthtimes.org. Retrieved 25 October, 2014.
- [26]. World Rainforest Movement (2003). "World Rainforest Movement Bulletin Number 74". <http://www.wrm.org.uy/bulletin/74/Uganda.html>.