Reconciling Conservation and Livelihood Needs in Got Ramogi Forest

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By

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Abstract

Sustainable forest management remains a serious challenge in Kenya, particularly for community-managed forests. The situation is attributed largely to the failure of past forest management interventions to integrate conservation and livelihood needs of communities adjoining these forests. We present a sustained-yield utilitarian model that seeks to harmonize conservation and utilization functions of Got Ramogi forest resources. An inventory of resources of 2007 indicated that the forest has approximately 53.2 m^3 of wood ha^{-1}. The resource is utilized at the rate of 2.7 m^3 of wood ha^{-1} $year^{-1}$ against a mean annual renewal rate of about 1.9 m^3 of wood ha^{-1} $year^{-1}$. The forest has been severely degraded over the past two decades threatening important plant and animal species with extinction. A number of sacred sites have been destroyed, while the bulk of them are dilapidated. We propose a range of resource management interventions, some of which are currently at the pilot stages. These include zoning the forest on the basis of conservation and utilization priorities, controlling resource off-take levels and promoting non-wood forest-based micro-enterprises in order to reduce community dependence on woody resources and diversify livelihood support functions of the forest.

Keywords: conservation, sustained-yield utilization, management zones

Introduction

Over the last two decades, government agencies and the civil society have realized the failure of centralized forest management systems and the weaknesses of disenfranchising local communities from forest management (Ongugo & Njuguna, 2004). A paradigm shift built on participatory forest management in a decentralized strategy focusing on production of multiple forest goods and services is emerging in many developing countries. The Kenya government recently took cognizance of this new development in setting the stage for a new forest management policy (Forest Policy Sessional Paper no. 9, 2005). The overall objective of the forest management policy is to attain sustainable utilization of forest resource. Got Ramogi forest is an important candidate for a sustained-yield utilitarian model that seeks to harmonize conservation and utilization functions of community-managed forests because of its rich biological diversity and cultural heritage (Bagine, 1998). However, prospects and opportunities for conserving and utilizing biodiversity and historical relics on Got Ramogi cannot be examined in the absence of a clear understanding of the state of the forest ecosystem. It is imperative to identify and characterise its resources prior to developing a management plan for a sustained-yield management programme.

The local community recently formed a trust to develop a community-based natural resource management programme to oversee forest governance embracing sustainable use of biodiversity and promoting the development of sustainable forest-based micro-enterprises. This paper outlines the results of a forest resource inventory sponsored by the trust in the last quarter of 2007 to provide a baseline for planning and implementing a sustainable natural resource management programme. The overall objective of the management programme is to incorporate environmentally-friendly nature based enterprises in forest conservation. The management programme is expected to serve as a prototype for harmonizing conservation and utilization in community managed forests under the new forest management policy.

Materials and methods

Study area

The study was carried out in Got Ramogi forest, one of the eastern remnants of the Guineo–Congolian forest block. The forest lies between 00^{o} 06´ 23´´ S and 34^{o} 04´ 10´´ E on the north-eastern shores of Lake Victoria in Yimbo Central Location, Usigu Division, Bondo District. It rises from an elevation of 1160m to 1320m above sea level and covers an area of 374 ha. The area receives a mean annual rainfall of 800mm and a mean annual temperature of 28^{o}C. The soils in the area are well drained, shallow, dark red to brown sandy-clay loam and clay, with rock outcrops in many places. The forest contains unique forms of biodiversity and historical relics that are of environmental, cultural, religious and economic importance to local, national and the international community.

The forest was managed sustainably for many years by a local council of elders until it was taken over by Siaya County Council in the 1960s. The county council subsequently assigned it to the forest service for management as a trust land. Forest management programmes including plantation development were introduced from this early time, but these have since run down following countrywide decline in forest investment, emerging socio-economic challenges and policy failures (Biosafety News, 2004). Figure 1 below shows the Got Ramogi forest and neighbouring locations in Usigu Division.

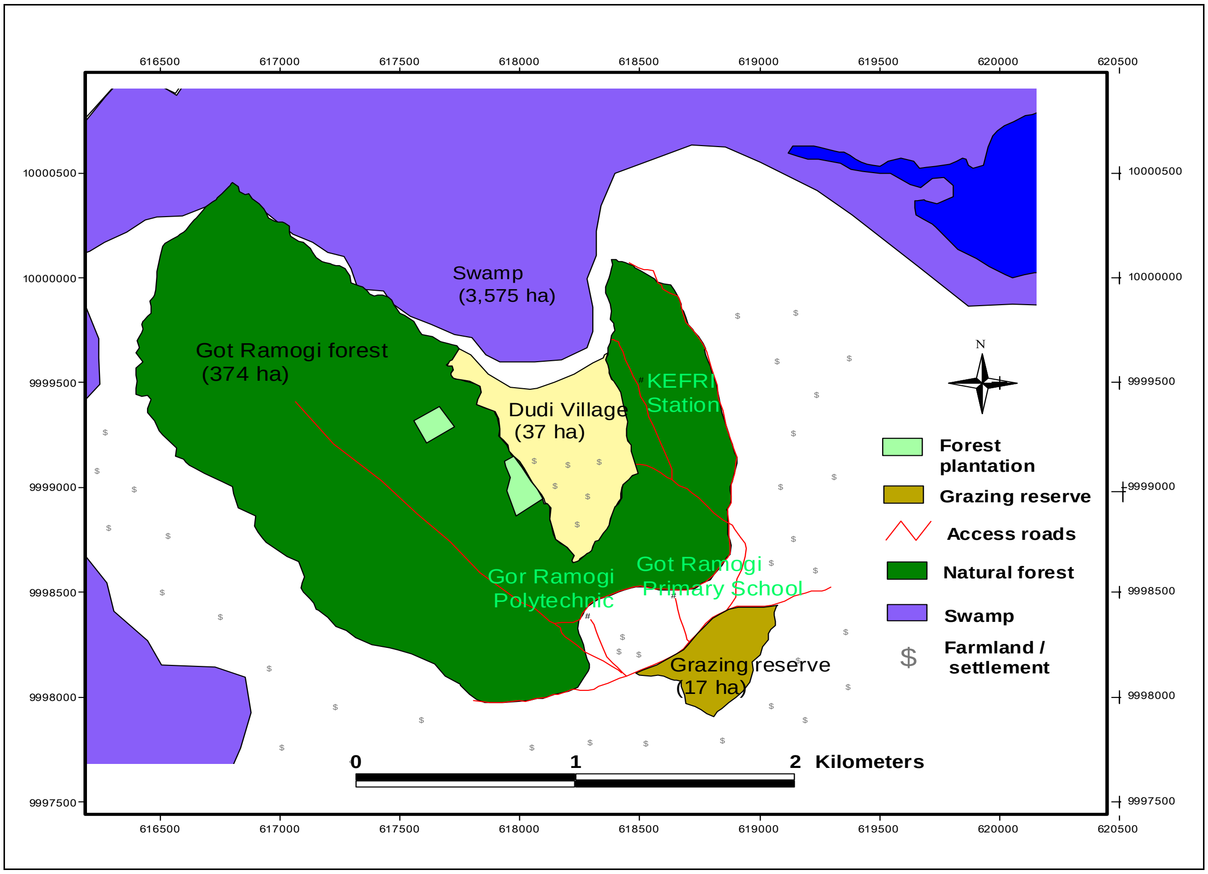

Figure 1: Got Ramogi area

Vegetation structure, species diversity, abundance and distribution

Line transects were made across the forest vegetation, capturing most of the observed variation in vegetation structure. Sample plots measuring 30 m by 20 m were systematically located along each transect at intervals of 250 m. A total of 36 plots were sampled to determine vegetation community types, woody vegetation structure, species diversity, abundance and distribution. Woody vegetation structure was described by canopy type, stratification (canopy layers and height of foliage above the ground), species abundance, height and diameter at breast height (dbh), where applicable. Floristic composition was assessed for each canopy layer. Trees and withies were assessed in the 30 m by 20 m sample plot. Tree saplings and shrubs were assessed in a 10 m by 5 m sub-plot nested within the 30 m by 20 m sample plot. Tree saplings of less than 1.3 m height were assessed as tree seedlings. Tree seedlings, herbs and grasses were assessed in a 2 m by 1 m sub-plot nested within the 10 m by 5 m sub-plot. The height and root collar diameter of each seedling were recorded, while the percentage cover was recoded for herbs and grasses. An analysis of variance was carried out on the vegetation data to determine disparities in species abundance, diversity and distribution in the various zones of the forest. A systematic sample of 100 trees, evenly distributed within each plot, was taken for each plantation forest species in the study area. Tree height and dbh measurements were taken for purposes of estimating the available merchantable wood.

Evaluating current woody resource utilization rates

Focus group discussions were held with key users of forest resources and community leaders to evaluate woody resources utilization levels. Field assessment was carried out to validate the estimates obtained from the group discussions. For instance, visits were made to fresh charcoal kilns to determine the tree species used for charcoal production, the zones from which they were felled; their sizes and the volume of wood required to produce a given amount of charcoal. The same approach was applied to evaluate the amount of timber, poles, withies, fitos and firewood collected from the forest. The data was used to estimate current annual resource removal rates. A household survey was conducted among 89 out of about 500 households occupying a distance of 0-4km from the forest. Households were selected proportionately across the 4 villages surrounding the forest. In each village, questionnaires were distributed evenly to cover a distance of 0 – 4 km from the forest edge. The purpose of the survey was to estimate the rate of extraction of various forest products and the possibility of a resource utilization gradient explained by the distance a household from the forest edge.

Estimating low impact harvest schedule

The data on standing woody biomass, stem growth rate and the utilization of woody resources by the local community was used to develop a sustained-yield utilization model focusing on an annual low impact harvesting quota for each vegetation community. For each diameter class, standing woody biomass was divided by average annual growth yield to determine the time required to replace the resource (Gaugris, *et al.,* 2007). Annual growth yield was estimated based on data from similar vegetation types (Shckleton, 1993; Luoga *et al*., 2002; Norgrove & Hauser, 2002) and informal interviews with key users of various forest resources. A sustainable annual harvest schedule was estimated at about 80% of the average annual growth yield.

Mapping sacred sites

Major historical and sacred sites were located using a global positioning system. Their GPS coordinates were recorded and entered into a geographic information system (GIS) for purposes of mapping the sites.

Results

Vegetation structure

Two vegetation types were identified in Got Ramogi Forest: a closed canopy multilayered woodland and an interrupted bushland, both of which are made up of dry semi-deciduous vegetation. The woodland vegetation was located in the higher elevation zone of the hill (1,240m to 1,320m above sea level). The bushland vegetation was located in the intermediate zone between the foot of the hill and the woodland vegetation (1,160m to 1,240m above sea level).

The woodland vegetation had 4 canopy layers: emergent, main, understorey and shrub layer. The ground layer was generally lacking except for disturbed areas. The bushland vegetation also had 4 canopy layers: emergent, a rather blurred main canopy, a less pronounced understorey and a highly conspicuous shrub layer. Below the shrub layer was a ground layer of herbaceous life-forms. Figure 2 below shows the location of the two vegetation communities in Got Ramogi Forest.

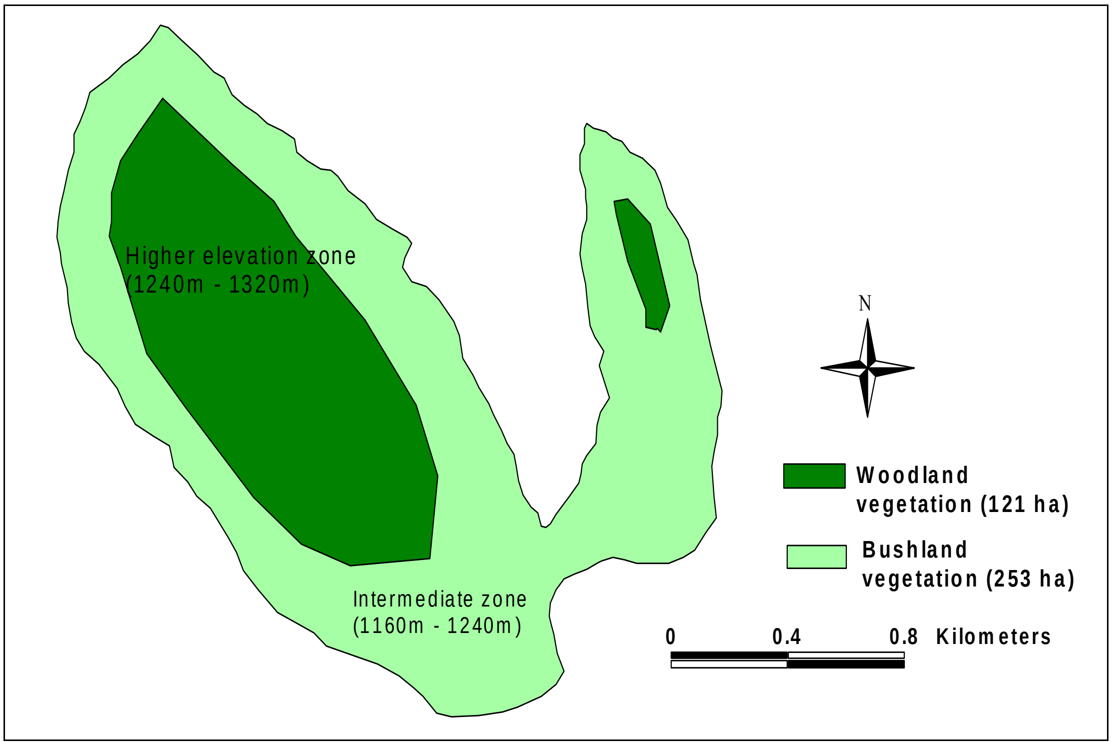

Figure 2: Map showing vegetation types in Got Ramogi Forest

Species diversity and distribution

A total of 80 plant species from 38 families were recorded in Got Ramogi Forest. The major life-form categories in the forest were woody and shrubby species. The population of herbs was generally low. There were distinct variations in the vegetation community structure and canopy stratification between the woodland and the bushland, but their species composition was fairly similar except for minor variations. Dominant woody species in the emergent canopy of the woodland vegetation included *Haplocoelum foliosum* (Bullock), *Synadenium grantii* (Hook.f.) and *Lannea schweinfurthii* (Engl.). The main canopy was dominated by *Synadenium grantii*, *Strychnos henningsii* (Gilg) and *Psydrax schimperiana* (A.Rich). The understorey layer comprised *Strychnos henningsii*, *Ochna ovata* (F. Hoffm) and *Synadenium grantii* as the dominant species. The canopy cover was closed and lacked a ground layer. Woody species such as *Brachylaena huillensis* (O.Hoffm), *Vitex doniana* (Sweet), *Euclea divonorum* (Hiern) and *Boscia agustifolia* (A. Rich) were represented within the woodland vegetation, but their population was generally low. The bushland vegetation comprised occasional emergents dominated by *Euphorbia tirucalli* (L.), *E. candelabrum* (Kotschy) and *Synadenium grantii*. The main canopy, which was less distinct in most places, was dominated by *Synadenium grantii, Teclea trichocarpa* (Engl.) and *Croton dichogamus* (Pax). The understorey canopy composed *Euphorbia tirucalli*, *Combretum molle* (G. Don) and *Synadenium grantii* as dominant species. The shrub layer was dominated by *Ochna ovata, Psydrax schimperiana* and *Strychnos henningsii*.

Abundance and density of woody life-forms

Tables 1 and 2 below show the abundance and density of woody life-forms in the woodland vegetation and bushland vegetation, respectively.

Table 1: Abundance and density of woody life-forms in the woodland vegetation

Woodland vegetation (121 ha)					
Canopy layer	**Abundance**			**Mean dbh (cm)**	**Mean height (m)**
	Life-form	**No.**	**Density**		
Emergent	Trees	9,856	81	33.9	10.5
	Withies	-	-	-	-
Main canopy	Trees	19,936	164	22.2	7.0
	Withies	4,256	35	8.6	5.8
	Saplings	-	-	-	-
Understorey	Trees	5,376	44	12.6	5.4
	Withies	11,648	96	5.0	4.9
	Saplings	8,512	70	1.9	3.4
Shrub layer	Trees	-	-	-	-
	Withies	1,344	11	4.2	3.7
	Saplings	4,704	38	2.0	3.1
Total	**Trees**	**35,168**	**290**	**22.9**	**7.8**
	Withies	**17,248**	**142**	**5.9**	**3.7**
	Saplings	**13,216**	**109**	**1.9**	**3.2**

Table 2: Abundance and density of woody life-forms in the bushland vegetation

Bushland vegetation (253 ha)					
Canopy layer	**Abundance**			**Mean dbh (cm)**	**Mean Height (m)**
	Life-form	**No.**	**Density**		
Emergent	Trees	8,419	32	22.2	6.8
	Withies	931	3	8.3	6.1
Main	Trees	17,334	68	29.4	5.5
	Withies	11,244	44	6.4	5.2

canopy	Saplings	468	2	2.9	5.0
Understorey	Trees	1,405	5	10.6	4.8
	Withies	13,572	53	5.9	3.5
	Saplings	1,874	7	2.0	2.3
Shrub layer	Trees	937	3	10.0	3.0
	Withies	15,444	61	4.2	2.9
	Saplings	34,200	135	2.1	1.8
Total	**Trees**	**28,095**	**111**	**18.1**	**5.0**
	Withies	**41,191**	**162**	**6.2**	**4.2**
	Saplings	**36,542**	**144**	**2.3**	**3.0**

Standing woody biomass and annual growth yield

Table 3 below shows the standing woody biomass and annual growth yield in the woodland vegetation and bushland vegetation, respectively.

Table 3: Standing woody biomass and annual growth yield

Diameter class	**Woodland vegetation (121 ha)**		**Bushland vegetation (253 ha)**	
	Standing stock (m^3ha^{-1})	**Annual growth yield ($m^3ha^{-1}yr^{-1}$)**	**Standing stock (m^3ha^{-1})**	**Annual growth yield ($m^3ha^{-1}yr^{-1}$)**
Lumber (dbh ≥ 50cm)	51.6	1.5	-	-
Poles (dbh 10 – 49cm)	77.6	2.6	14.3	0.5
Withies (dbh 3 – 9cm)	1.4	0.2	1.6	0.3
Saplings (dbh ≤ 2.9cm)	0.08	0.03	0.2	0.05
Dead wood	0.6 tons	0.5 tons	0.3 tons	0.2 tons

Table 4 below shows the standing woody biomass and annual growth yield for forest plantations.

Table 4: Standing woody biomass and annual growth yield for forest plantations

Tree species (size of plot)	**Forest product**	**Abundance**	**Standing stock (m^3)**	**Annual growth yield (m^3yr^{-1})**
Eucalyptus (3 ha)	Lumber	957 trees	7,277.7	485.2
	Poles	168 poles	136.9	17.1
Markhamia (0.5 ha)	Poles	1,062 poles	746.7	62.08
Casuarina (0.25 ha)	Lumber	66 trees	136.9	6.8
	Poles	402 poles	529.3	52.9
Grevillea (1.5 ha)	Lumber	768 trees	2,682.1	107.3
	Poles	1,632 poles	4,102.9	410.3

Table 5 below shows the estimated annual woody resource extraction rates against the standing biomass in the forest.

Table 5: Mean annual woody resource extraction rates against the standing biomass

Forest resource	**Mean annual extraction rate ($m^3ha^{-1}yr^{-1}$)**	**Standing stock (m^3ha^{-1})**	**Households involved (%)**
Dead wood	0.7 tons	0.4 tons	74.1
Charcoal	2.6	-	25.8
Fitos	0.01	0.1	26.9
Poles & Withies	0.02	36.4	23.6
Lumber	0.03	16.7	1.1

Low impact sustainable harvest schedule

Tables 6, 7 and 8 below show the proposed annual low impact harvesting quota for each forest product in various vegetation communities, calculated at 80% of the mean annual growth yield.

Table 6: Proposed annual low impact harvesting quota for woodland vegetation

Woodland vegetation (121 ha)				
Forest product	**Standing stock (m^3ha^{-1})**	**Annual growth yield ($m^3ha^{-1}yr^{-1}$)**	**Annual allowable harvest ($m^3ha^{-1}yr^{-1}$)**	**Felling cycle (yr^{-1})**
Lumber (dbh ≥ 50cm)	51.6	1.5	1.2	1 tree for every 3 ha
Poles (dbh 10 – 49cm)	77.6	2.6	2.0	12 poles
Withies (dbh 3 – 9cm)	1.4	0.2	0.2	16 withies
Saplings (dbh ≤ 2.9cm)	0.08	0.03	0.02	21 fitos
Fire wood	0.6 tons	0.5 tons	0.4 tons	18 head loads

Table 7: Proposed annual low impact harvesting quota for bushland vegetation

Bushland vegetation (253 ha)				
Forest product	**Standing stock (m^3ha^{-1})**	**Annual growth yield ($m^3ha^{-1}yr^{-1}$)**	**Annual allowable harvest ($m^3ha^{-1}yr^{-1}$)**	**Felling cycle (yr^{-1})**
Lumber (dbh ≥ 50cm)	-	-	-	–
Poles (dbh 10 – 49cm)	14.3	0.5	0.4	3 poles
Withies	1.6	0.3	0.2	19 withies

(dbh 3 – 9cm)				
Fitos (dbh ≤ 2.9cm)	0.2	0.05	0.04	40 fitos
Fire wood	0.3 tons	0.2 tons	0.17 tons	8 head loads

Table 8: Proposed annual low impact harvesting quota for forest plantations

Tree species (size of plot)	**Forest product**	**Standing stock (m^3)**	**Growth yield (m^3yr^{-1})**	**Annual allowable cut ($m^3 ha^{-1}yr^{-1}$)**	**Felling cycle (yr^{-1})**
Eucalyptus (3 ha)	Lumber	7,277.7	485.2	485.2	64 trees
	Poles	136.9	17.1	17.1	21 poles
Markhamia (0.5 ha)	Poles	746.7	62.08	61	88 poles
Casuarina (0.25 ha)	Lumber	136.9	6.8	6.8	3 trees
	Poles	529.3	52.9	52.9	40 poles
Grevillea (1.5 ha)	Lumber	2,682.1	107.3	107.3	40 trees
	Poles	4,102.9	410.3	410.3	163 poles
Note: Calculated at 100% of the mean annual growth yield for plantation species					

Sacred sites

Eight sacred sites were identified in Got Ramogi. Figure 3 below shows their spatial distribution.

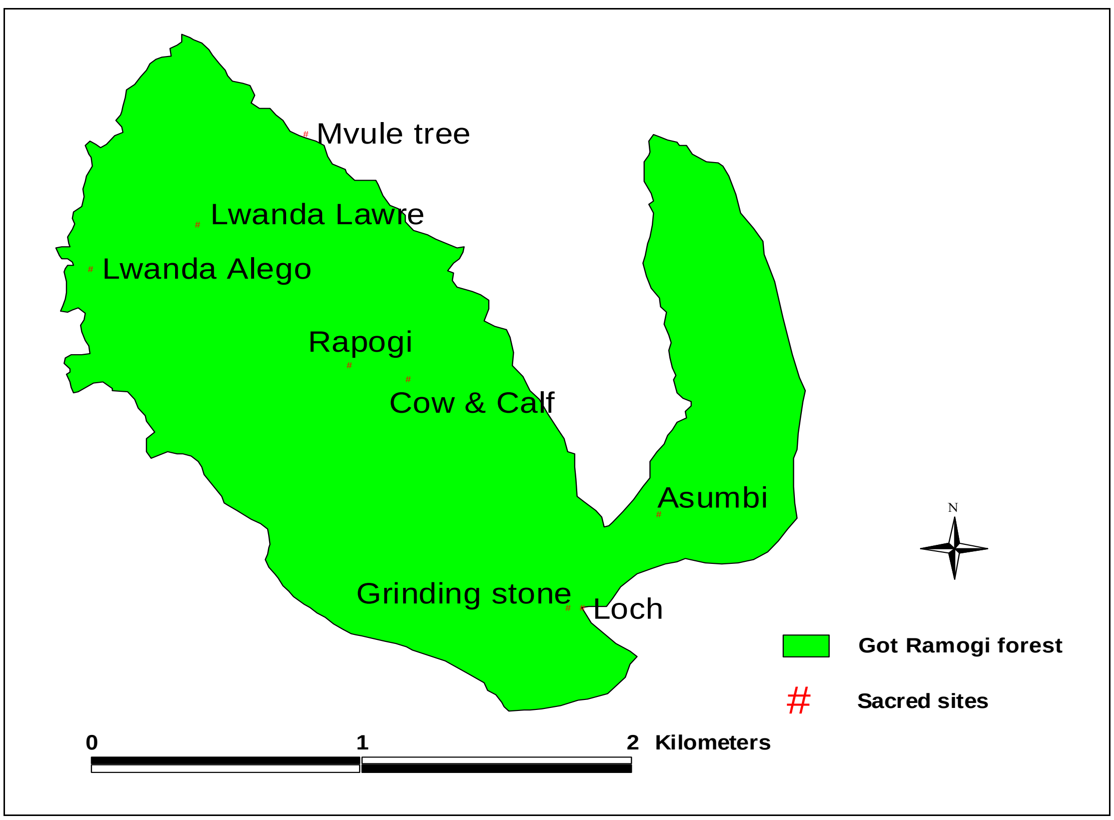

Figure 3: The spatial distribution of sacred sites in Got Ramogi forest

Discussion

The results of this study indicate that Got Ramogi forest is endowed with more floral diversity than earlier imagined. These include critically endangered species, such as *Brachylaena huilensis*, *Milicia excelsa* and *Vitex doniana*. However, analysis of standing stock against off-take levels shows that current resource utilization levels are much higher than can be supported on a sustainable basis. For instance, the amount of fuel wood obtained from the forest annually by communities bordering the forest is two and half times higher than the rate of formation of the resource. The trend is similar for other forest products, such as timber, poles, withies and fitos. At current resource off-take levels the forest is likely to be depleted of most of its woody resources within a decade. The situation calls for a sustained-yield utilization regime in order to save the forest from further degradation. One of the ways to achieve this is to provide alternative sources of wood to cater for the deficit, and promote non-wood forest-based micro-enterprises to ease pressure on woody forest resources. For instance, the acreage under forest plantations can be increased to offset the deficit on fuel wood, timber, poles and fitos. This can be complemented by the establishment of woodlots on-farm to cater for any shortfall since most households have sufficient land holdings to support tree farming. Some of the non-wood forest-based micro-enterprises that can be supported in Got Ramogi include eco-tourism, beekeeping, seedling production, bio-diesel production, handicraft and herbal medicine.

In order to reconcile conservation and utilization, six management zones are proposed for Got Ramogi area. These management zones include a conservation zone, a sustained-yield utilization zone, areas designated for plantation development, a community tree nursery to support afforestation activities, a farm forestry zone and a community workshop / polytechnic for processing and adding value to forest products (Table 9).

Table 9: Proposed forest management zones in Got Ramogi

Management zone	**Forest zone (relevant micro-enterprise)**
Conservation zone	Areas surrounding sacred sites • Eco-tourism
	All areas outside sacred sites

Sustained-yield utilization zone	• Biomass energy (fuel wood & charcoal) • Building & construction (timber, poles and fitos) • Thatch grass • Materials for handicraft (e.g. wood for curving, sedges and grass for making baskets, mats, chairs, brooms, etc) • Beekeeping
Forest plantations	Edges of the forest bordering community land • Plantation development (*Eucalyptus spp*, *Gmelina arborea*, *Terminalia brownii*, *Acacia spp*, etc) • Bio-diesel production (*Jatropha curcas* and *Croton megalocarpus*)
Community tree nursery	KEFRI tree nursery area • Seedling production
Farm forestry (out-growers scheme)	Private farmland neighbouring the forest • Woodlot establishment • Oil palm plantation (edge of swamp near Dudi village) • Sunflower production • Sericulture (silk farming) • Herbal medicine (*Aloe vera*, Neem, etc)
Community workshop / polytechnic	Upgrading existing village polytechnic • Value addition to various forest products e.g. carpentry products made from forest resources

Conclusion and recommendations

It is clear from this study that the rate of resource depletion in Got Ramogi forest is much higher than was earlier anticipated. This necessitates the need to reconcile conservation and utilization interests. It is expected that the process will take a considerable period of time before users of forest resources fully understand the implications of the proposals made in this document on their livelihoods. There is also a likelihood that the community will ask for readily available alternatives before committing themselves to a management agreement. They may also seek to understand how improved forest management will be of benefit to them at the individual/household level. As part of the process of harmonizing conservation and utilization needs, the following recommendations may be necessary:

- Ownership of the process by the community: It is necessary to capture the opinions and suggestions of community members regarding the proposals of this report.
- Develop a comprehensive plan for sharing benefits derived from improved resource management
- Carry out trend analysis to assess the sustainability of low impact harvest programme with regard to forest regeneration and resilience.

- The community should form committees to monitor compliance with the forest management strategies and address disputes arising out of the implementation of the plan.

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