LOCAL CAPACITY TO MANAGE FORESTRY RESOURCES UNDER A DECENTRALISED SYSTEM OF GOVERNANCE: THE CASE OF UGANDA

BY

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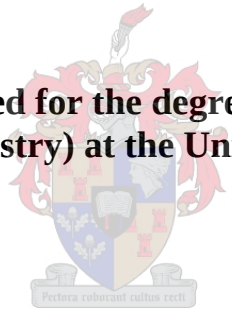

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Promoters: Professor Coert. J. Geldenhuys and Dr. White Scotney Watts

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Declaration

I, Nelson Turyahabwe hereby declare that the work contained in this dissertation is my own original work and has not previously in its entirety or in part been submitted at any University for a degree.

Signature:…… Date:……

Abstract

This study aims at examining technical and institutional capacity in local organisations to manage decentralised forest resources in Uganda. Specifically the study assessed the roles, responsibilities, powers and legal instruments, incentives, facilities and human and fiscal resources of local organisations to undertake decentralised forest governance. Semi-structured and key informant interviews were conducted in local organisations and legal and policy documents reviewed to ascertain strategies for implementing decentralised forestry. An inventory of selected forests was conducted to assess effect of decentralisation policy on the condition of forests in Uganda. Chi-square tests were used to show the factors that motivate local organisations to participate in decentralised forest governance. Tree species diversity and richness, density, diameter at breast height and basal area and sings of human disturbance were used to compare the condition of forests under local government and those under private and central government ownership. Similarity between the forests was assessed using a Two Way INdicator SPecies Analysis, while the differences in the composition and structural characteristics of trees among forest ownership categories were compared by one-way analysis of variance. Multiple regression analysis was used to show the influence of household pressure, forest size, the distance of the forest from roads and forest administrative office, and the market demand of the forest produce on the capacity of forest agencies to regulate timber harvesting. The findings reveals that local organisations supported devolved forest management functions such as forest monitoring, tree planting, environmental education, networking, collaborative and integrated planning, resource mobilisation and formulation of byelaws. The role of forestry in the livelihoods of the people, the desire to control forest degradation and access to forest revenue, donor and central government fiscal support were the most important incentives in decentralised forest management. However, limited capacity in terms of qualified staff, funds, facilities and equipment and inadequate decision-making powers over fiscal resources from forestry, inequitable distribution of forest revenue and unclear forest and tree tenure hindered decentralised forest management. The diversity and richness indices, density, diameter at breast height and basal area of trees were significantly higher in central forest reserves, intermediate in private and lower in local forest reserves. The frequency of human disturbances was significantly higher in local forest reserves than in private and central forest reserves. The variation in composition and structure of the local forest reserves is partly attributed to human disturbances. The capacity of the forest agencies to regulate forest resources use in the Mpigi forests was significantly affected by the size of forest, and its location in relation to the well-maintained roads, forest administrative office and the number of households in close proximity and the market demand of the forest produce. Large forests in close proximity to densely populated areas and far a way from roads and the forest administrative office were more affected by timber harvesting. The results demonstrated that local governments are not yet efficient in monitoring and regulating forest use and maintaining the condition of forests in Uganda. Local organisations need to play an increased role in the implementation of the Forest Policy, the National Forestry and Tree Planting and the Local Government Acts for successful decentralisation of forest management and to recruit more technical staff, strengthen internal sources of revenue and develop integrated forestry work plans. There is also a need for the central government to integrate and co-ordinate local and central interests, and facilitate a working relationship with local governments, civil society and the private sector involved in forestry. Forest owners and managers in the Mpigi forests and Uganda's tropical forests in general need to manage human impacts so as to balance utilisation and conservation forest resources. There is need for long-term studies to fully understand the real significance of ownership on the composition and structure of the Mpigi forests and forests in other districts of Uganda.

Opsomming

Die doel van hierdie studie was om die tegniese en institusionele kapasiteit in plaaslike organisasies om gedesentraliseerde bestuur van woudhulpbronne in Uganda te ondersoek. Die studies het spesifiek die rol, verantwoordelikhede, magte en wetlike instrumente, aansporings, fasiliteite en menslike en fiskale hulpbronne van plaaslike organisasies ondersoek om gedesentraliseerde woudbestuur te onderneem. Semi-gestruktureerde en sleutel-informant onderhoude is onder plaaslike organisasies gedoen en oorsigte van wetlike en beleidsdokumente is gedoen om die strategië om gedesentraliseerde bosbou te implimenteer, te bepaal. ‘n Opname van geselekteerde woude is gedoen om die effek van die desentralisasiebeleid op die toestand van die woude in Uganda te bepaal. Chi-kwadraat toetse is gebruik om die faktore wat plaaslike organisasies motiveer om aan gedesentraliseerde woudbestuur deel te neem, uit te lig. Die diversiteit en rykdom van boomsoorte, die digtheid, stamdeursnee op borshoogte, basale oppervlakte van bome, en tekens van menslike versteuring is gebruik om die toestand van verskillende woude onder bestuur van onderskeidelik private eienaars en plaaslike en sentrale regering te vergelyk. Ooreenkomste tussen woude was beoordeel deur die gebruik van Tweerigting Indikator Speciesanalise (TWINSPAN), terwyl die verskille in die spesiesamestelling en strukturele eienskappe van boomopstande tussen eienaarskapskategorië met eenrigting variansieontledings bepaal is. Meervoudige regressie-analise is gebruik om die invloed te toon van die druk vanaf huishoudings, woudgrootte, die afstand van die woud vanaf paaie en die bosbou-administratiewe kantoor, en die markaanvraag vir woudprodukte op die kapasiteit van die woudbestuursagente om houtbenutting te reguleer. Die resultate het getoon dat plaaslike organisasies gedesentraliseerde woudbestuursfunksies ondersteun, soos woudmonitering, boomaanplaning, omgewingsopvoeding, onderlinge skakeling, gesamentlike en ge-integreerde beplanning, hulpbronmobilisasie, en die formulering van plaaslike regulasies. Die belangrikste aansporings vir gedesentraliseerde woudbestuur is die rol van bosbou in die lewensonderhoud van die mense, die drang om wouddegradering te beheer, en die toegang tot ‘n inkomste uit bosbouaktiwitieite, en fiskale ondersteuning vanaf donateurs en die sentrale regering. Desnieteenstaande is gedesentraliseerde bosbestuur belemmer deur die beperkte kapasiteit in terme van gekwalifiseerde personeel, fondse, fasiliteite en toerusting, onvoldoende besluitnemingsmagte oor fiskale hulpbronne vanaf bosbou-aktiwiteite, ongelyke verspreiding van die inkomste uit bosbou, en onduidelike eiendomsreg oor die woud en bome. Die indekse van diversiteit en spesiesrykdom, die stamdigtheid, stamdeursnee op borshoogte en basale oppervlakte van bome was betekenisvol hoër in woude onder bestuur van die sentrale Bosboudepartement, intermediêr onder private bestuur, en laer onder plaaslike regeringsbestuur. Die frekwensie van menslike versteuring was betekenisvol hoër in woude onder plaaslike bestuur as onder private en nasionale bestuur. Die variasie in speciesamestelling en struktuur in woude onder plaaslike bestuur is deels toegeskryf aan menslike versteuring. Die kapasiteit van die bosbouagentskappe om woudhulpbrongebruik in die Mpigi woude te reguleer was betekenisvol beïnvloed deur die woudgrootte, die ligging van die woud in verhouding tot die afstand na goeie paaie en die bosbou-administratiewe kantoor, die aantal huishoudings naby aan die woud, en die markaanvraag vir woudprodukte. Groot woude naby aan ‘n digte menslike populasie en ver weg van paaie en die bosbou-administratiewe kantoor was meer deur houtbenutting beïnvloed. Die resultate toon dat plaaslike regerings is nognie effektief in die monitering en regulering van die gebruik van woudprodukte en die handhawing van woude in Uganda in ‘n goeie toestand nie. Plaaslike organisasies behoort ‘n toenemend groter rol te speel in die implementering van die bosbeleid, in Nasionale Bosbou en Boomaanplanting, en in die formulering van Plaaslike Regeringswette vir suksesvolle desentralisasie van bosbestuur, om meer tegniese personeel te werf, om interne inkomstebronne te versterk, en om ge-integreerde bosbestuursplanne te ontwikkel. Daar is ook ‘n behoefte dat die sentrale regering plaaslike en nasionale belange

integreer en koordineer, en ‘n werksverhouding fasiliteer met plaaslike regerings, die siviele gemeenskap en die private sektor met betrokkenheid in bosbou. Eienaars en bestuurders van woude in die Mpigi Distrik en Uganda se tropiese woude in die algemeen behoort menslike impakte te bestuur om benutting en bewaring van die woude te balanseer. Daar is ‘n behoefte aan lantermynstudies om die werklike invloed van eienaarskap op die samestelling en struktuur van die Mpigi woude en woude in ander distrikte in Uganda te verstaan.

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I owe great thanks to the Almighty God from who wisdom and strength to do this work come from. Thine be the Glory.

Dedication

This work is dedicated to my Mother Mrs. Generous Kamunyena Kinyata for laying the foundation and introducing me to the basic education. She had always wondered when I would ever finish and settle with my family!

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 Background to the study

Forests provide human society with a wide range of private and public goods (World Commission on Forest and Sustainable Development, 1997; FAO, 2003). However, deforestation and forest degradation due to unsustainable use patterns and conflicting priorities and policies by state agencies have seriously reduced forest cover in several parts of the world. According to FAO (1999), the annual forest cover change in the natural forests of developing countries was 13.7 million hectares between 1990 and 1995. This has resulted in declining access to forest goods and services (Hobley, 1996; Evans, 1997; Arnold, 1998; FAO 2001). As such, the legal authority of state agencies as the sole managers of forest resources is increasingly being questioned due to their failure to adequately and efficiently control forest resource use (Stewart, 1985; Harris, 1996; Shepherd, 1996; Carney and Farrington, 1998).

Globally there has been a deliberate shift in responsibility for forest management away from central forest administration to local community organisations (FAO, 1999, 2001; Ribot, 2002). Local governments, the private sector, and local communities have been entrusted with the implementation of forest management plans. The decentralisation of forest resource management and control is based on the assumption that it will lead to more efficient, equitable and sustainable forest resource use (Hobley, 1996; Fisher, 1999; Larson, 2002). In contrast, Smith (1985) and Crook and Sverrisson (1999) argue that local governments and community organisations lack human, financial and technical resources and will not be able to provide services under decentralisation. They suggest that power to manage decentralised sectors should remain in the hands of central governments that are relatively well endowed with financial and human resources. However, these claims have not been tested and the evidence that exists is not convincing. Thus, the decentralisation outcomes are mixed (Larson, 2003; Ribot, 2003).

Mawhood (1983) and Smith (1985) define decentralisation as an act in which central governments formally cede powers to actors and institutions at lower levels in a political-administrative and territorial hierarchy. It is a composite of different elements: political or

democratic decentralisation, deconcentration or administrative decentralisation, fiscal decentralisation, devolution, delegation and privatisation.

Political or democratic decentralisation occurs when powers and resources are transferred downwardly to authorities and representatives more directly accountable to local populations (Crook and Manor, 1998). Furthermore, deconcentration or administrative decentralisation refers to the transfer of power to local branches of the State, such as administrators, or technical line-ministry agents (Agrawal and Ribot, 1999). These are upwardly accountable bodies appointed as local administrative extensions of the State and are primarily accountable to the central government.

Fiscal decentralisation refers to the decentralisation of fiscal resources and revenue generating powers (Crook and Manor, 1998). Delegation refers to spinning off certain functions of the central government into autonomous or semi-autonomous bodies that could be private, or any other authority outside the regular political administrative structure to implement programmes on behalf of the central government (Agrawal and Ribot, 1999). Privatisation refers to the permanent transfer of powers to any non-state entity, including individuals, corporations and NGOs (Balogun, 2000). Devolution refers to any transfer from central government to any non-central government body, including elected governments, NGOs, customary authorities, and private bodies (Ahmed and Mahmood, 1998). In this study, the concept of decentralisation adopted and referred to in Uganda is devolution.

Uganda is one of the sub-Saharan African countries that has embraced the decentralisation system of governance. The government has devolved some powers and responsibilities, including those of governing natural resources to the local government authorities and civil society organisations. The decentralisation process, which has been implemented since 1993, aims at improving service delivery by shifting responsibility for policy implementation from central government to local beneficiaries (Government of Uganda, 1993, 1995a, 1997). The decentralisation process is also designed to challenge the local government authorities and citizens to become initiators, implementers and overseers of development plans geared towards addressing local problems.

The management of forest resources in Uganda has vacillated from centralisation to decentralisation over the past century. The first attempt to decentralise the management of forests was between 1939-1947 with legislation establishing local forest reserves under the

Local (District) Administration, village forests under local authorities and communities and central forest reserves under the control of the Forest Department (Forest Department, 1955). The local forest reserves were small, but numerous and catered for local demands such as supplies of building poles, firewood for rural areas and minor townships, and supplies of timber to rural carpenters and house builders (Forest Department, 1950, 1955). At the time, each District had an African Local Government (ALG) consisting of a District Council constituted by councillors and chiefs. The District Council had powers to make byelaws on the use of forest resources whereas the chiefs had the powers to arrest offenders, issue licenses, collect revenues, and regulate the cutting of timber and wasteful exploitation of trees on public and private lands (Uganda Protectorate, 1919, 1949). The policy of devolution of local forest responsibilities to the African Local Government was pursued steadily from 1952 onwards, with the building up of the African Local Government forestry staff (Webster and Osmaston, 1999). The African Local Government forestry personnel worked as agricultural extension workers and played an important role in encouraging small-scale private tree planting and farm woodlots in agricultural areas.

However, the political crisis of the mid-1960s in Uganda led to the abolition of the role of local forest administrations. For example, the Forests Act of 1964 was amended in 1967 and centralised the forest services hitherto run by the Local Administrators and absorbed them into the centrally organised Forest Department[1] (Hamilton, 1984). This was not based on the failure of local administration to govern forest resources, but rather a general political move towards centralisation following Uganda's independence. It was believed that this move would ensure efficiency and rationality in the development of forest resources. This change in governance meant that the institutional arrangements that had been instituted by the Local Administrators and forest users to limit entry and harvesting levels lost their legal standing. The decisions regarding forest resource use were entrusted to the Forest Department as the sole agency with powers to regulate the harvesting of forest produce in all government forest reserves and the use of tree products on public and private land. Most sectors in Uganda's economy, including forestry, were affected by the country's political changes of the 1970s to mid-1980s (Howard, 1991; Jacovelli and Carvalho, 1999). However, the years of political and economic upheavals caused massive hardships and national regression. The peace

[1] The management of Uganda's forest estate has been under the Forest Department since 1898. In April 2004, the Forest Department was divested into an autonomous National Forestry Authority (NFA) after conclusion of this study. In this study the Forest Department will refer to as NFA.

created in most parts of the country since the late 1980s has allowed a new look at all policy and legal instruments for managing Uganda's natural resources.

The government has recognised that building partnerships with private entrepreneurs, NGOs, CBOs and local governments would facilitate the achievement of sustainable management of forest resources under the current decentralised system of governance (MWLE, 2002). For example, the government passed the National Environment Statute (1995) and the Local Government Act of 1997 (Government of Uganda, 1995b, 1997). As a result, some powers and responsibilities were transferred from the central to local government authorities, including the management of the country's forest resources. Through the National Environment Management (NEMA) Statute (1995) and the Local Government Act (1997), institutional structures known as Production and Environmental Committees (PECs) have been put in place at all local government levels for governing natural resources (Figure 1.2). PECs are functional committees within the Local Councils established in accordance with decentralisation and environmental policies in Uganda (Government of Uganda, 1997). They are institutionalised in the local government system to facilitate bottom-up planning and management of natural resources with active participation of local communities. PECs formulate and develop district-based policies and byelaws on production and sustainable environmental management, and co-ordinate all activities of the local governments on matters relating to the environment, natural resources and production. They also ensure that environmental concerns are integrated in the plans and projects approved by the local government.

In the forestry sector, the management of local forest reserves was decentralised in 1998 back to the District Councils with the mandate of local government to manage forest resources (Government of Uganda, 1998; MWLE, 1999, 2001b). Along with many other public service functions, the objectives for decentralising forestry were to: (i) enhance the role of local government with more developed responsibility to plan and implement forestry activities; (ii) reduce the burden on public finances by empowering local government outsourcing for financial resources and privatisation of forestry activities that were carried out by the central government; and (iii) encourage more participation of local communities and farmers in the management of the country's forest resources.

The assumption by conservationists is that forests in Uganda are threatened with degradation, and negative environmental change can be reversed through the participation of local

community organisations (Lind and Cappon, 2001). In some government forest reserves, collaborative forest management has been initiated to foster collaboration between forest user communities and the Forest Department (Banana and Turiho-habwe, 1994; Turyahabwe, 1997). As such, some support for forestry has been enlisted from local authorities and forest users. The National Forest Plan of 2002 (MWLE, 2002) also emphasises the roles and responsibilities of local governments in decentralised forestry governance, such as to (i) collect and retain revenue accruing from forestry activities on private lands and local forest reserves; (ii) mobilise funds for forest management; (iii) develop and enforce byelaws; (iv) create and manage community forest reserves; (v) manage watershed areas; (vi) support and ensure quality control of forestry extension services; (vii) facilitate agreements between farmers and service providers; and (viii) provide market information.

In practice, genuine devolution of power over the management of forest resources to local organisations has been occurring only to a limited extent in Uganda, even when decentralisation and devolution are major themes of the Uganda Forest Policy of 2001 (MWLE, 2001a). For example, only small forests gazetted in the early 1940s as local forest reserves (LFRs) have been transferred to the Local Government Authorities. The large economically viable forests gazetted as central forest reserves (CFRs) have been retained under the state Forest Department to be managed under the National Forestry Authority (MWLE, 2002). This has generated political, administrative, legal, technical and constitutional difficulties and confusion between the Forest Department and the local government authorities (District and Sub-county Local Councillors). This has been detrimental to the country's forest resources because it has brought confusion among the stakeholders involved in the implementation of decentralised forest governance in Uganda. It is against this background that this study has been designed to assess the capacity of local organisations to manage decentralised forest resources in Uganda.

1.2 Uganda's socio-political system and geographical location

1.2.1 Geographical location and socio-economic background

Uganda is a landlocked country straddling the equator between 1^{o} 29′S and 4^{o} 12′N and stretching from 29^{o}34′E to 35^{o} 0′E (DLS, 1967) (Figure 1.1). The total surface area is about 241,500 km^2 of which 194,000 km^2 is land, and the rest comprises water bodies and wetlands (NEMA, 2001). It occupies the Central African plateau, North of Lake Victoria, between the

Democratic Republic of Congo (DRC) in the West, Republic of Kenya in the East, Sudan in the North, and the Republics of Rwanda and Tanzania in the South.

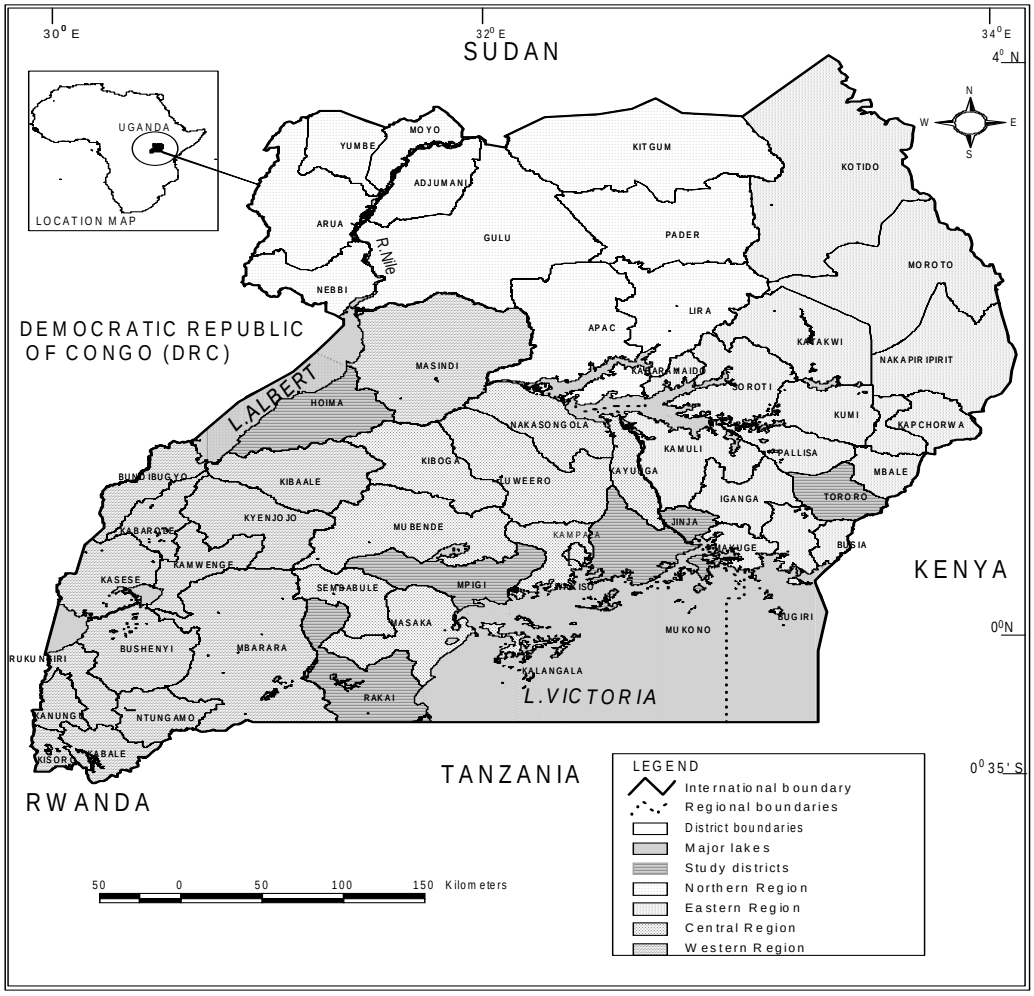

Figure 1.1 Uganda, showing study regions and districts**.**

Uganda's population has been growing at an average rate of 3.4% per annum according to the 1991-2002 intercensal period and it is estimated to have increased from 16.70 million in 1991 to 24.70 million persons in 2002 (UBOS, 2002). This represents an increment of about 8 million persons in 12 years. The population is predominantly rural, with only about 15% living in urban areas. A high population growth in the rural areas has a direct bearing on the use of the country's natural resources and development trends because rural people continue to encroach on forestland for agriculture.

Uganda's economy relies heavily on the agricultural sector, which annually accounts for about 43% of the gross domestic product (GDP) and provides the source of livelihood for

over 80% of the population. Agricultural exports currently contribute about 85% of the total foreign exchange earnings, divided into traditional exports which include coffee, cotton, tea and tobacco and non-traditional agricultural exports comprising cereals, pulses, cocoa, oil seeds, fish and fish products, hides and skins and various horticultural products (NARO, 2001).

1.2.2 Decentralisation and the Local Government System in Uganda

Uganda is administered under a decentralised system of divisions referred to as districts. In January 2002, Uganda had 56 districts (Figure 1.1). The country is further divided into four regions: central, eastern, northern and western. With decentralisation, local government assumed most of the responsibilities formerly undertaken by the central government ministries (Government of Uganda, 1997). These responsibilities were devolved to the district and the sub-county. These included income tax collection, service provision and managing the environment. The current local government in Uganda is organised into a five-tier system of elected representatives called Local Councils (LCs), from level one (LC1) to level five (LC5) (Figure 1.2).

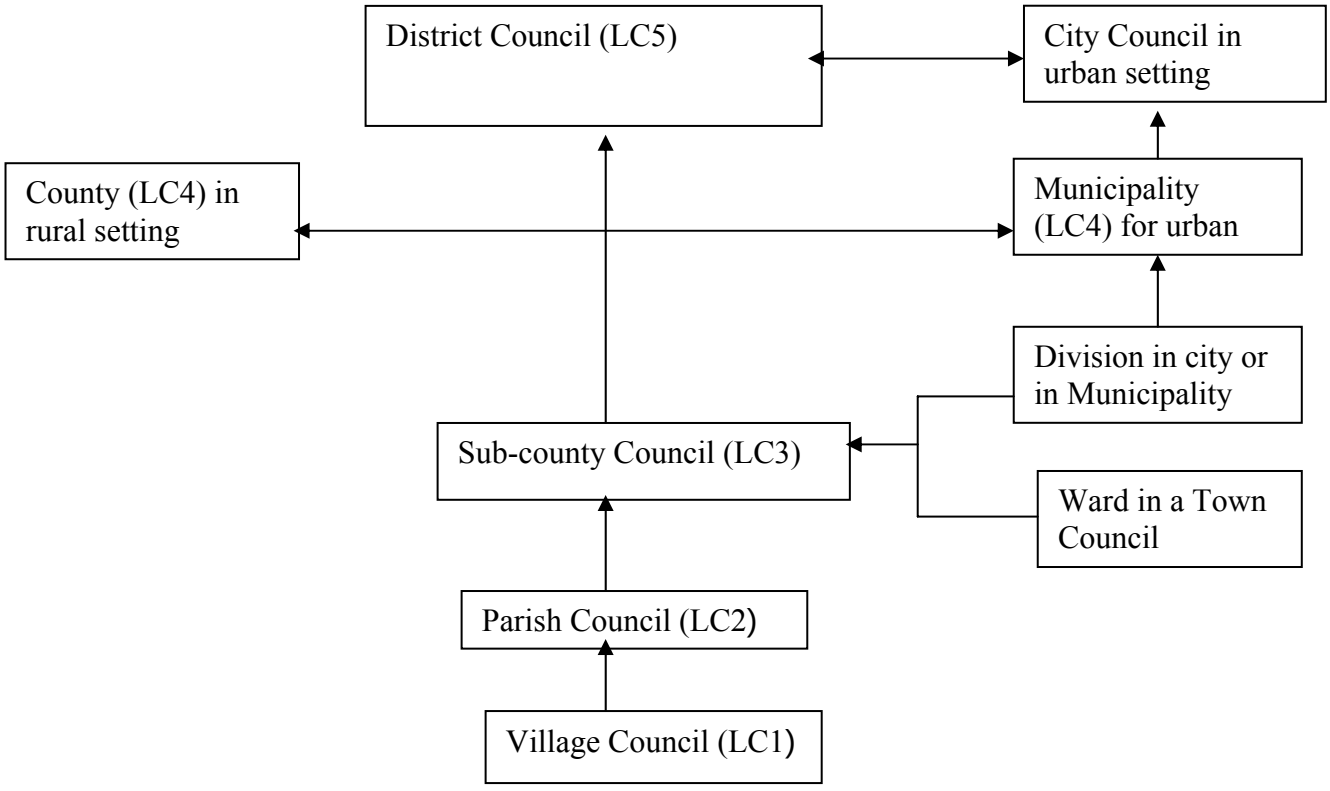

Figure 1.2 The Local Government structure in Uganda.

The District Council or the fifth level (LC5) is the highest political organisation in a district with legislative and executive powers. It comprises elected councillors who represent specific

constituencies and interest groups, and is headed by the District Chairperson, who presides over meetings of the executive committee. Below the District Council is the County or Municipality Council (LC4) in the rural and urban settings respectively, which is an administrative unit. The sub-county (LC3) is the second level of local government. Below the LC3 are the Parish (LC2) and the Village (LC1) levels. Each Local Council at every level includes an executive committee of nine members and a position for the secretary for production and environment (Tukahebwa, 1998).

At the local government level, the District Council has legislative powers, while the executive committee, which is part of the council, is responsible for executive functions, but it is answerable to the council. The executive (administrative) functions are exercised through a hierarchy of employed officials with the Chief Administrative Officer (at the district level), followed by the Assistant Chief Administrative Officer (County level), Sub-county and Parish chiefs at Sub-county and Parish levels, respectively. The executive committee initiates and formulates policies for approval by the council, oversees the implementation of central government programmes, including the management of natural resources and council's policies, monitors the implementation of council's programmes, and receive and solve problems and disputes forwarded to it from lower local governments. The executive committee does accounting and supervision of the Local Government staff. The legislative functions are exercised through a hierarchy of elected representatives with LCs running from LC1 to LC5. These are charged with formulation of policies, ordinances and byelaws for managing the districts' resources. In this study, only two levels of the Local Government, LC3 and LC5, that are legally mandated to formulate and plan the implementation of natural resources management policies, were considered.

1.3 Forest resource management in Uganda

1.3.1 Distribution and ownership of forest resources

Uganda's forest cover was estimated at 10.8 million ha (45% of the total land area) in 1898 (Hamilton, 1984), but this has shrunk to approximately 4.9 million hectares (24% of the present total land area) (National Biomass Study, 2003) (Table 1.1). The forest resources comprise areas classified as savanna woodland (80.5%), natural forest (tropical high forest, THF, 18.7%) and less than 1% of forest plantations (Jacovelli and Carvalho, 1999).

Table 1.1 Approximate area (ha) of forest land and woodland under different categories of ownership and management in Uganda

Cover type	Category of ownership				Total
	Government land			Private land	
	Central Forest Reserves	Local Forest Reserves	National Parks & Wildlife Reserves	Private and Customary land	
Tropical High Forest	319,810	544	253,724	350,129	924,207
Woodlands	414,066	512	461,276	3,098,235	3,974,089
Plantations	19,463	578	2,310	12,715	35,066
Total forest	**753,339**	**1,634**	**717,310**	**3,461,079**	**4,933,362**
Other cover types*	420,414	3,322	1,211,597	17,586,377	19,221,710
Total land	**1,173,753**	**4,956**	**1,928,907**	**21,047,456**	**24,155,072**

Source: National Biomass Study (2003).

*Grasslands, wetlands (papyrus and swamp), built up areas, rocks and commercial mono-crop estates (tea, sugar, tobacco).

The distribution of these resources varies greatly by region (Table 1.2). The northern region is dominated by savanna woodland and the majority of THF occurs in the western region (National Biomass Study, 2003). The proportion of land under central forest reserves is substantially higher than that under local forest reserves in all the four regions of Uganda. The western region has a significantly smaller area under local forest reserves than the central, eastern and northern regions (Table 1.2).

Table 1. 2 Approximate area (ha) of Local and Central Forest Reserves by region in Uganda during 2002

Region	Local Forest Reserves	Central Forest Reserves	Total forest area
Central	1,584	300,491	302,075
Eastern	1,541	314,093	315,634
Northern	1,415	234,646	236,061
Western	416	324,524	324,940
Uganda Total	**4,956**	**1,773,754**	**1,178,710**

Source: National Biomass Study (2003).

In addition to the 4.9 million hectares of forest and woodland, there are also substantial forest plantations on farms, in the form of scattered trees and agroforestry crops, holding 24% of the country's biomass. Together with the existing natural forests on private land and in government reserves, these on-farm resources are the major focus of the National Forest Plan (NFP), with particular reference to decentralisation and the development of farmer-driven

advisory services and agroforestry (MWLE, 2002). In terms of land ownership, 70% of the forest area is on private and customary land. The remainder is held in trust by the government for the citizens of Uganda: 15% of the central forest reserves is managed by the Forest Department and 15% forms part of the national parks and wildlife reserves managed by the Uganda Wildlife Authority. The District and sub-county local governments manage small areas (about 5000 ha) of local forest reserves distributed in the different parts of the country. The majority of private forests are woodlands, and are being depleted rapidly due to restrictions on harvesting of wood and wood products from protected areas (Jacovelli and Carvalho, 1999). The total area of the Tropical High Forest is almost equally distributed between private owners, the Uganda Wildlife Authority (UWA) and the Forest Department (MWLE, 2002).

The rate of forest clearance was estimated to be between 70,000 and 200,000 ha for the period 1990-1995 and the annual deforestation rate of 0.95-3.15% per year (MWLE, 2001b). The principle causes of deforestation are fuelwood collection for domestic and industrial use and harvesting of timber and poles for construction, as well as clearing land for grazing and other forms of agriculture (Jacovelli and Carvalho, 1999). The demand for charcoal, saw logs and poles in particular is expected to increase due to the increase in urbanisation, economic growth and rapidly growing population. The combined effects of deforestation and high consumption rates result in an accelerating imbalance between national demands and supply for forest products. Even under the optimistic scenario, Uganda moved into a national fuelwood deficit in the year 2000 (Jacovelli and Carvalho, 1999). This decline will particularly affect the poorest Ugandans who are unable to respond to the shortages by choosing alternative sources of energy.

1.3.2 Contribution of the forestry sector to the national economy

Forestry contributes substantially to the nation's economic development and well being, although the extent of this is not fully recognised. This implies that there are many opportunities for poverty alleviation, for economic development and for environmental improvement through the forestry sector development (MWLE, 2001b, 2002). Forests contribute significantly to the gross domestic product (GDP) of Uganda. Sepp and Falkenberg (1999) estimated that more than 70% of wood consumption in the informal (non-monetised) sector contributed up to 2.75% to the gross domestic product (GDP). The forestry sector accounts for about 6% of the country's GDP, including the informal sector and a

modest estimate of the value of environmental services provided by forests. The major contributors to this are domestic fuelwood (US$ 63 million[2]), charcoal production (US$ 36.8 million), non-wood forest products (US$ 34.7million), commercial fuelwood (US$ 22.6 million), sawn timber (US$ 21 million) and US$ 174 million from environmental benefits (MWLE, 2002).

The forestry sector is an important employer especially for the local people in Uganda, providing the equivalent of nearly 850,000 full time employment (MWLE, 2001b). The formal sector employs about 100,000 full time persons. In the informal sector, employment is equivalent to 750,000 full-time persons (Sepp and Falkenberg, 1999). Secondary processing, particularly carpentry and joinery and the distribution and marketing of wood and wood products employs an estimated 250,000 people (Impact Associates, 1999).

Forests and woodlands are a major source of fuelwood in Uganda, used domestically by over 90% of the rural households and by some in urban homes. About 18 million tonnes of firewood and nearly 500,000 tonnes of charcoal are consumed annually. Fuelwood also serves as a primary source of energy in the tea, tobacco and brick making industries (MWLE, 2000). In addition, large volumes of timber are also used for construction, furniture making and other manufacturing industries. Total timber utilisation is estimated at 800,000 m^3 per year. The value of non-timber products derived from forests such as medicines, craft materials and food is also significant (MWLE, 2001b). Furthermore, a large proportion of the rural population depends on forest resources for basic subsistence needs for wood and non-wood forest products, food security, and cultural and spiritual values, whether from farm forestry or from natural forests and woodlands.

A significant contribution of the forestry sector to the economy is through the range of ecological services and biodiversity values that the forests provide. Although these services and values are not easily quantified, they are recognised as integral to agricultural productivity, climate regulation, soil and water conservation and nutrient recycling. Forests are also reservoirs of the country's biodiversity, including its unique genetic resources (plant and animal species) and diverse ecosystems (Howard, 1991; MWLE, 2002).

Much of the tourism in Uganda is based on forests, woodlands and their constituent wildlife and natural scenic beauty. Although poorly developed as compared to other East African

[2] 1US$ was equivalent to 1900 Uganda Shillings at the time of conducting this study (2003).

countries, tourism contributes to economic and social development and to forest resource conservation. Revenues from wildlife-based tourism are estimated at US$ 1.5 million per annum (MWLE, 2002).

1.4 Forest policy and legal framework in Uganda

1.4.1 Forest Policy

Formal management of forests in Uganda started in 1898 when the colonial government's Scientific and Forestry Department was established. A Forestry Department was established as a separate body in 1917 and renamed the Forest Department in 1927 (Forest Department, 1951). The first trained foresters were British expatriates who arrived in the country in 1921. At that time the Chief Conservator of Forests, until recently the Commissioner for Forestry, headed the Forest Department, but there was no formal policy formulation by the colonial government.

The Forest Department is mandated to protect and manage all forest reserves, control harvesting of forest produce from gazetted forests and advise on sound management of private forests and tree growing on farmers' land (MWLE, 2001a). It is also responsible for carrying out publicity and forestry extension services. The Forest Department is composed of three divisions, namely: planning, administration and training; natural resource management and extension; and the forest industries and marketing division.

Structurally, the department operates according to a hierarchy of staff, based on the principle of narrow span control. The structure is reinforced by an elaborate system of rules and regulations, and working plans as vehicles for delivery of services. Field activities are co-ordinated at the District Forest Office, which is the essential operating unit of the Forest Department. The District Forest Office is headed by the District Forest Officer (DFO) with other field staff under him in the ranks of Assistant Forest officers (AFOs), Forest Rangers (FRs), Forest Guards (FGs) and Patrolmen. The functions of the district forest office are to co-ordinate government policies and government programmes on forestry in the districts; guide local government councils (district and sub-county) on forestry matters; and provide extension services (MWLE, 2002). Control and monitoring of extraction of forest products is limited to the issuing of permits and licences. The fees for harvesting forest products are set by the Forest Department and implemented by the district forestry staff. The fees are periodically reviewed by the Forest Department, depending on the market demand for forest

products and the rate of inflation. Despite forestry being decentralised, field staff are partly answerable to the District Councils and the Commissioner for Forestry, while disciplinary actions and transfers are handled by the Commissioner for Forestry alone.

The Forest Department in Uganda has throughout its history of existence separated legal from policy issues. It has regularly formulated, gazetted and revised its policy. The first national forest policy was formulated in 1929, and with it came the organisation of the Forest Department into roughly its present form (Forest Department, 1955). The policy stressed the retention of more areas under forests, the reafforestation of more land, the management of forests for timber production and the generation of adequate financial returns to the country. This policy statement clearly defined the official aims of forest management and the period that followed was characterised by active and all-round good forestry that won international acclaim (Kamugisha, 1993). The first clause of the policy laid the foundation for the creation of forest reserves. Actual gazetting soon followed until the 1940s, by which time the boundaries of the forest estate, more or less as it now stands, became established (Hamilton, 1984). This policy was revised in 1938, 1948, and 1970 with more emphasis on the productive function than the protective function of forests (Howard, 1991, Kamugisha, 1993, 1997; MWLE, 2001b).

In 1988, another forest policy was issued to redress the gaps in the previous policy (Government of Uganda, 1988). It placed more emphasis on environmentally sound forest harvesting, biodiversity conservation and ecosystem approaches to forest management; targeting production of pulp wood and value addition for export; establishment of recreation forests; encouraging research in all aspects of forestry and promotion of public awareness and agroforestry. However, the policy contained limited guidance on principles and strategies for the management of forest resources outside the gazetted reserves and on the balance between production and conservation (MWLE, 1999). It was also silent on the role of local government, the private sector and rural communities in forest management, and the linkages with other sectors and land uses.

A new Uganda forest policy was developed and published in 2001 (MWLE, 2001a). The forest policy has 11 specific policy statements and/or objectives (Box 1.1). The Uganda Forestry Policy 2001 sets out guiding principles for the forestry sector development. The policy addresses more recent areas of concern in the forestry sector, such as the management of forests outside gazetted forest reserves, collaborative forest management, private sector

involvement in commercial plantations, urban forestry, the management of forests on private lands, local participation, and gender equity in the use of forest resources (MWLE, 2001a).

1. "To protect and sustainably manage the permanent forest estate under government trusteeship
2. To promote the development and sustainable management of natural forests on private land
3. To promote profitable and productive forestry plantation businesses
4. To promote a modern, competitive, efficient and well regulated forest products processing industry in the private sector
5. To develop collaborative partnerships with rural communities for the sustainable management of forests
6. To promote tree growing on farms in all farming systems, and develop innovative mechanisms for delivery of forestry advisory services
7. To conserve and manage Uganda's forest biodiversity in support of local and national socio-economic development and international obligations
8. To establish, rehabilitate and conserve watershed protection forests
9. To promote urban forestry
10. To encourage the government to support sustainable forestry sector development through appropriate education, training and research
11. To develop innovative mechanisms for the supply of high quality tree seed and improved planting stock"

Box 1.1 Policy statements from Uganda's Forestry Policy, 2001 (MWLE, 2001a).

The core themes are conservation and sustainable development, livelihood enhancement, and institutional reform, with new roles for central and local government, the private sector, local communities, NGOs and CBOs (MWLE, 2001b).

1.4.2 Forest legislation

In Uganda, legislation seeking to regulate and/or control the use of natural resources has evolved in three eras along sectoral lines. The first phase was when regulations were enacted under the African Orders in Council of 1889 (Kamugisha, 1993). The principle laws made in the British Parliament gave enabling powers and authority to the Governor. Later, the Legislative Council (LegCo) of the Uganda protectorate made subsidiary laws for good governance in Uganda. The second phase, from 1902 up to the time Uganda gained

independence from Britain in 1962, was characterised by the Ordinances made under the Uganda Orders in Council enacted by the Governor and/or LegCo (Kamugisha, 1993). Independence ushered in the third era, consisting of the Acts of the Parliament enacted by Uganda parliamentarians or decrees enacted in the absence of parliament.

The Forests Act is a framework for management, regulation, protection, conservation and control of the forest estate (Kamugisha, 1997). The 1900 forest protection regulations enacted under Article 99 of the African Orders in Council of 1889 were the first legislation to be enacted for use and management of forests in Uganda (Forest Department, 1951). The regulations enacted covered, *inter alia*:

1. prohibiting cutting of forest produce without licence except by natives for domestic use;
2. making it a punishable offence to cause or set fire to a crown forest;
3. prohibiting clearing of vegetation within 90 metres of a stream, river or lake without a permit; and
4. prescribing that when clearing for agriculture, at least three trees of a minimum height of six metres should be left per hectare of leased land that had 20 or more hectares of forest.

The regulations were replaced in 1903 by an enabling law, the first Forestry Ordinance which gave the Governor[3] powers to make rules that had the same legal force as the main provisions, concerning timber cutting, wild rubber tapping and collection of fees. A new Forests Ordinance was enacted in 1913 giving the governor wider powers over forests (Uganda Protectorate, 1913, 1919). It defined what was meant by the Crown Forests (central forest reserves) and forest produce, gave powers to forest officers to issue licences for cutting or removal of forest produce and prohibited removal without licence, burning, clearing, cultivation, residence or grazing in Crown Forests. It also gave powers of arrest to forest officers and fixed sanctions for breaches. The various administrative agreements and arrangements that were concluded between local administrations and the British Crown contained provisions on forests.

In 1931, several important amendments to the Forests Ordinance of 1913 were passed and the Governor was given powers to declare any area a demarcated or undemarcated forest reserve

[3] Overseer of the implementation of Uganda Protectorate laws made under the British Parliament before Uganda got independence in 1962.

(Forest Department, 1955). Rules were also issued in the same year specifying the various types of licences to be used (Kamugisha, 1997). The privileges of cutting timber and wood products by local people were also amended to exclude planted trees and those in the list of reserved trees, comprising mainly the more important timber species.

In 1938, amendment No.7 to the Forests Ordinance of 1913 legalised native government forestry throughout the country (Forest Department, 1950). The amendment secured a firm footing on this activity by instituting a new class of forest reserves, namely, native forest reserves, which were renamed local forest reserves (LFRs) in 1947. The first batch was gazetted in 1939 and by 1960 the total area under LFRs was 284,900 ha, constituting about 18% of the national forest estate (Kamugisha, 1997). The powers of the Chief Conservator of forests were vested in the Local Administrators. Thus, Local Administrators were empowered to make rules in respect of species and quantities of wood to be cut, harvesting seasons and methods, fees, enforcement officers and categories of people entitled to free issue. This law was considered beneficial since it encouraged the people to develop interest in the management of forests within their jurisdiction. However, the Governor could revoke the existence of a reserve irrespective of the interests of the other party. The powers given to the Governor later seemed inappropriate as this made the Local Administrators virtual tenants, the situation that led to over-exploitation of some of the national forests due to insecurity of tenure (Kamugisha, 1993).

While retaining the laws within the previous ordinances, the Forests Ordinance No. 28 of 1947 was enacted (Forest Department, 1955). It was supported by the Forests Rules of 1947. This consolidated all the previous laws in addition to, *inter alia*:

1. expanding the definition of forest produce to include litter, soils, stones, gravel and sand;
2. establishing a legally recognised three tier forest management system, namely, central forest reserves under the control and management of the Forest Department, local forest reserves under the Local Administration, but with advice from the Forest Department and village forests aimed at involving Local Administrators and communities in forestry;
3. closure of any forest from any human activity for purposes of planning, and recognising the climatic and general ecological values of crown forests;
4. local administrators to make rules for local forest reserves;

5. imprisonment for a period of 6 months or fine of two thousand Uganda Shillings (at that time) or both for breach of law;
6. people living near the forests are obliged by law to help in preventing forest damage from fires at no cost; and
7. powers of licensing forest produce were vested in the Chief Conservator of Forests.

In 1967, however, statutory instrument No.67 abolished local forest reserves and converted those established hitherto into central forest reserves (Hamilton, 1984). Thereafter, the Local Administrators were no longer allowed to undertake any forestry work, except maintaining a few village forests, which were not affected by the statutory instrument. Up to that time, the central government and the Local Administration Forest Services had developed parallel organisations. This important change in legislation was welcomed by everyone interested in forestry, including most of the staff of the former District Administration Forestry Services. They believed that this would ensure efficient and rational development of forest resources throughout the country.

Up to 2003, the 1947 Forests Act, (Cap.246), amended in 1964, with its derived forest rules were the principal legislative instruments for Uganda's forestry sector (Government of Uganda, 1964, 2003). However, the provisions of the Forests Act of 1964 were weak and failed to ensure sustainable management of Uganda's forests resources because some provisions were outdated and could not reflect adequately the existing forest management practices. For example, the Act said little about the plight and control of fauna inhabiting gazetted forest reserves, and/or tree resources outside gazetted areas. In addition, the deterrent effect of the cash fines had completely disappeared with the passage of time due to inflation (Aluma and Kahembwe, 1996; Kamugisha, 1997). The laws also did not take into account the latest concepts, especially participatory forest management, lacked incentives for forest conservation and failed to cover and/or cater for all the principles outlined in the 1988 Forest Policy.

In 2003, a National Forestry and Tree Planting Act was enacted with the necessary legal instruments for the implementation of Uganda's 2001 Forest Policy (Government of Uganda, 2003). The purpose of the act is to create an integrated forestry sector that will facilitate the achievement of sustainable increases in economic, social and environmental benefits from forests and trees for all the people of Uganda.

1.5 Conceptual framework for the study

Understanding of property rights regimes, their form, function and normative characteristics has matured in recent decades through work of new institutional economists and common property theorists (North, 1986, 1990; Ostrom, 1990; Bromley, 1991; Feeney *et al*., 1998). Even so, literature has yet to establish the conditions promoting successful resources management under a given institutional arrangement. Common property theorists argue that property regimes rely on institutional structure with well designed rules, rights and enforcement mechanisms. However, most central governments frequently use lack of capacity to argue for or against local organisations' ability to implement natural resources management programmes (Bazaara, 2001; Larson, 2002).

Capacity has been described as having knowledge, skills and abilities to fulfil a given role, and increased access to financial resources, information, equipment and appropriate legal framework (Linde *et al.,* 2001). Local government performance in decentralised service delivery depends on the total amount of resources decentralised by the central government (Onyach-Olaa, 2003). According to Smith (1985), local organisations are bound to fail in implementing government programmes once there is inadequate capacity in terms of human resources, finance, information, equipment, skills, and appropriate legal framework. The factors that affect the capacity of local organisations to manage decentralised forest resources are summarised in Figure 1.3.

As noted by Muphree (1994) and Shepherd (1996), local arrangements for managing forest resources may not only depend on the human and financial resources in community based organisations, but also on the government for enabling legislation and/or enforcement of operational rules. For example, local organisations are more likely to manage forest resources sustainably when their rights to devise rules and regulations are not challenged by external authorities (Ostrom, 1990). In addition, effective local control of forest resources requires the willingness and ability of government to legitimise and empower local authorities and community groups and help them enforce their rights (Borrini-Feyerabend, 1996; Arnold, 1998). Thus, for effective governance of forest resources, the central government should not undermine the capacity of local authorities (Wade, 1988). As noted by Wily and Mbaya (2001), giving secure tenure of the forest resource to local authorities motivates them to effectively participate in regulating its use.

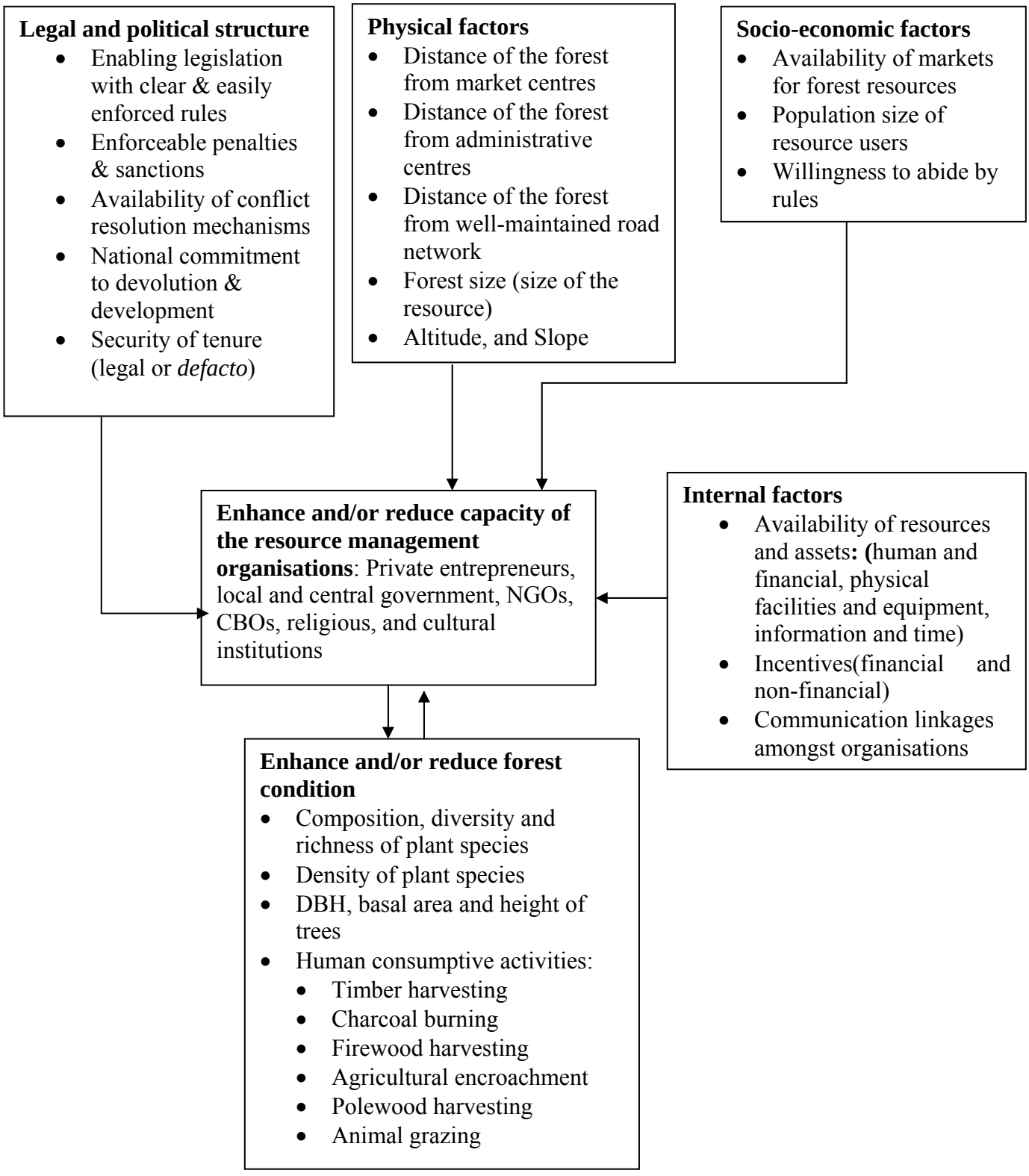

Figure 1. 3 The relationship between the capacity to manage decentralised forest resources and factors affecting the condition of forests (modified from Gregersen *et al*., 1990; Ostrom, 1990; Shepherd; 1996; Arnold, 1998; Becker and León, 2000)

Furthermore, management of forest resources is more likely to be effective if the resource is physically close to local forest agencies because it can be readily monitored (Beland and

Platteau, 1996). According to Banana *et al*. (2001), effectiveness of local institutions to monitor and maintain the condition of forests in Uganda decreases with increase in the size of the forests and the distance of forests from the forest administrative centres.

Local government internal political structure is also essential in decentralised service delivery because it determines success or failure in its different political projects (Johansson, 2000). The overall political system under which decentralisation occurs is critical for its success. Politics is an important skill, especially when local governments and civil society organisations are negotiating for a share of the national revenue with the national government. For example, Carney and Farrington (1998) found that joint forest management was successful where there was support of local politicians. In most cases, resources, particularly finance, are often predetermined by national governments (Lewis and Hartley, 2001). It almost becomes impossible for local bodies to undertake separate initiatives and local actions if national governments have not devolved decision-making powers to them. As noted by Bazaara (2001), a good political environment enhances the ability of forest agencies and local community organisations to sustainably maintain forest conditions.

Population pressure is also a factor that makes local forest management vulnerable. The demand for forest resources by communities living adjacent to forests has a great impact on institutions engaged in resource management (Ehrlich and Ehrlich, 1991; Wilson, 1992). For example, variations in population density and changes in demographic pressures on forest resources, whether as a result of local changes, or through migration, are significant in influencing the ability of users to follow existing rules and norms of resource management (Agrawal and Yadama, 1997). The resource shortages associated with high population densities create competition and tension amongst local users, which local institutions are unable to resolve (Little and Brokensha, 1987). According to Berkes and Folke (1998), commons including forests become open access once institutions are no longer able to control access resulting from external and internal disturbances.

Commercialisation of forest produce is another factor that affects incentives for forest resource use, effort levels and compliance with rules. Increasing markets usually have an adverse impact on the management of common pool resources, especially where users have access to markets for forest produce (Chemotz, 1995). As local economies become better connected to larger markets and common property managers confront cash exchanges, subsistence users are likely to increase harvesting levels because they can exploit resources

for cash income as well (Colchester, 1994). The arrival of markets and new technologies and the changes they prompt in existing resource management regimes create different incentives for the products to be harvested, technologies of harvest and rates of harvest (Regev *et al*., 1998). The availability of markets for forest produce also affects the condition of the forest. A study carried out in Uganda's tropical moist forests (Banana *et al*., 2001) found that density and basal area of commercial timber species increase with increasing distance of the forests from the urban centres (*proxy* for market of forest produce), implying that market pressure declines with distance from major trading centres. They further noted that forests close to dense population, and accessible roads had low density and diameter at breast height (DBH) of trees because of increased forest resource use. Thus pressure from markets and the population on the forest reduce organisational effectiveness and hence degradation of forest conditions.

According to Becker and León (2000), changes in the floristic and structural composition of forests (species diversity, density, mean basal area, and stem diameter) can vary in response to population pressure, market demand of the forest products and the enabling environment created by the government. When an organisation has adequate resources (time, information and material assets, adequately trained personnel, finance and appropriate legal framework), and it is capable of allocating such resources to forestry, then it will be effective in monitoring the forest resource. In such a situation, the condition of the forest is expected to have few human consumptive activities, high density and size of trees. This is based on the assumption that there are alternative modes of livelihood. Otherwise any innovative legislation and adequate logistical support will not prevent people from illegal exploitation of natural resources. It is also assumed that forests located close to the forest agency and well-maintained roads will have high tree density and DBH due to increased monitoring by forestry staff.

Other authors (e.g. Dykstra *et al*., 1996; Larson, 2002) have noted that availability of financial and human resources can enhance the capacity of organisations to monitor and regulate forest use, thus maintaining the condition of forests. According to Schweik (2000), physical factors like location of forests in areas far away from roads and administrative centres and inaccessible areas may reduce the effectiveness of forest agencies to monitor and maintain forest conditions, while Arnold (1998) believe that resources close to local authorities are well maintained because they are closely monitored. The interaction of these variables (Figure 1. 3) provides the context in which the effectiveness of local organisations in maintaining the

conditions of selected forests under different institutional arrangements can be interpreted, and form the framework for this study.

1.6 Research problem

Forests in Uganda are essential for the country's current and future livelihoods and growth due to their high levels of biodiversity (Hamilton, 1984; MWLE, 2001a, 2002). However, sustainable management of these forests is a great challenge to forest managers and to policy makers because the population is heavily dependent on them for timber, agriculture, energy production and other non-timber forest products. Furthermore, the Forest Department like other forest agencies in developing countries has been notably unsuccessful in its effort to design an effective monitoring system, partly due to the breakdown in law, ineffective rules and inadequate funding to manage its forest estate (Hamilton, 1984; MWLE, 1999). As such, the condition of Uganda's forest resources continues to deteriorate.

Since 1986, Uganda has been committed to devolution of power to local government agencies, including the management of natural resources (Government of Uganda, 1998). The government recognises local organisations as key players in the promotion of the forestry sector. Similarly, the government believes that through devolution of power over forests, local organisations can manage forest resources on behalf of the state at a lower cost. The central government is reluctant to fully decentralise forest governance in spite of the fact that most government sectors, including forestry, have been decentralised. Effective decentralised service delivery is enhanced once organisations have a well-developed incentive structure, adequate and competent human resources, finance, information, technology, skills, and appropriate legal framework. In addition, those with the current authority to make management decisions should be prepared to transfer the authority to local organisations (Fisher, 1999; Larson, 2002).

Recent studies in Uganda (Makara, 1998; Tukahebwa, 1998; MISR, 2000) have focused on the role of central government in empowering local community organisations in service delivery and political participation. However, the roles and responsibilities of local governments, and civil society organisations, their powers and legal instruments and incentives for involvement in the sustainable management of forests have not been assessed and there is inadequate information on their ability to implement decentralised forest governance. The physical, political and socio-economic conditions under which local

organisations work in fostering forestry development have not been documented. In addition, the capacity of local community organisations to maintain and monitor the conditions of forests under their jurisdiction has not been assessed. For effective devolution, there is need to understand the role of local actors and institutional arrangements in place. A study was therefore carried out to provide such information. The information from this study will add to the knowledge of sustainable management of forest resources in the country and enable policy-makers and planners to make informed decisions on the decentralisation of forest resources management.

1.7 Objectives of the study

The overall objective of the study is to examine and document the capacity of local organisations to manage forest resources in a decentralised system of governance in Uganda and to recommend relevant policy reforms. The specific objectives are to:

1. analyse the roles, responsibilities, powers and incentives of local organisations involved in the management of decentralised forest resources;
2. assess resource availability, allocation and principal constraints to undertake decentralised forest management in local organisations;
3. assess the role and scope of the Forest Department as a central government agency in fostering decentralised forest governance;
4. assess the productive condition and management of the selected forests under private, local and central government management regimes; and
5. recommend policy guidelines on effective decentralised governance of forest resources in Uganda.

Specific objective 1

To analyse the roles, responsibilities, powers and incentives of local organisations involved in the management of decentralised forest resources.

Related research questions

i) What kinds of local organisations are involved in forest resource management and what role do they play in the implementation of the forest policy under decentralisation?

ii) What incentives, powers and legal instruments do local organisations have for managing decentralised forest resources?

iii) What knowledge and skills do they have to foster forestry development?

iv) How do local organisations work with the existing central government structures and amongst themselves?

v) What potential conflicts exist in implementing decentralised forest governance and what mechanisms are there for conflict resolution?

Related hypothesis

Motivation (*proxy* for incentives) to undertake forest management in local organisations is dependent on factors, such as: (i) enticement from donors; (ii) local and central government financial support; (iii) desire to generate revenue from forests; (iv) awareness of the importance of forests; (v) desire to conserve the forests and rehabilitate degraded areas (preserve environment); and (vi) response to the government's policy to bring more land under forest.

Specific objective 2

To assess resource availability, allocation and principal constraints to effectively undertake forest resource management in local organisations.

Related research questions

(i) What resources (financial, competent personnel, material, and information) are available in local organisations to effectively undertake decentralised forest management?

(ii) What mechanisms are there for mobilisation and generation of resources in local organisations to foster forestry development?

(iii) Is there an enabling environment for local organisations to effectively use resources in the implementation of decentralised forest governance?

Related hypothesis

There is no relationship between the capacity of local organisations to undertake decentralised forest governance and: (i) the organisations available resources; (ii) per capita income of the organisation; (iii) organisations ability to plan and formulate forest byelaws, and (iv) ability to apprehend and penalise forest offenders.

Specific objective 3

To assess the role and scope of the Forest Department as a central government agency in fostering decentralised forest governance.

Related research questions

(i) How effective is the Forest Department in providing support and advice to established local organisations in the implementation of decentralised forestry?

(ii) Is the Forest Department supporting the need for change from central to decentralised governance of forest resources?

(iii) Are there partnerships or linkages between the Forest Department and local organisations geared towards the sustainable management of forest resources?

(iv) Are there conflicting roles between the Forest Department and local organisations involved in decentralised forest management?

Specific objective 4

To assess the productive condition and management of the selected forests under private, local and central government management regimes.

Related research questions

(i) What kind of human disturbances exist in forests under private, local and central government management regimes?

(ii) Which kind of institutional arrangement (private, local and central government) can effectively maintain healthy condition of the forests under its jurisdiction and what organisational capacity exists to maintain the natural state of these forests?

Related hypotheses

(i) There is no difference in the composition and structural condition of forests (mean density of shrubs and trees, mean diameter at breast height (DBH) and height of saplings and trees; and plant species richness and diversity) of forests under private, local and central government management regimes.

(ii) There is no difference in the frequency of human disturbances (timber, charcoal, pole, and firewood harvesting, and collection of medicinal plants, livestock grazing and agricultural encroachment) within plots of forests under the private, local and central government management regimes.

(iii) There is no difference in the capacity of the forest organisation to effectively monitor the forest and maintain productive condition of the forest and the factors such as: (i) size of the forest; (ii) plot steepness; (iii) plot elevation; (iv) proximity of the forest to the well maintained road network, market and urban centres, and forest administrative centre; (vii) presence of rules and sanctions; and (viii) population pressure on the forest by the communities living adjacent to the forest resource.

1.8 Scope of the study

The study covers local organisations engaged in forest management in the districts of Mpigi, Mukono, Rakai, Hoima, Jinja and Tororo (Figure 1.1). These include local government units at the district and sub-county levels (Government of Uganda, 1997), aid agencies, non-governmental organisations, and civil society organisations mandated to support local governments in implementing natural resource management programmes. In addition, a case study was conducted to assess the capacity of the private, local and government authorities in the Mpigi District to sustainably manage and maintain the productive conditions of selected forests under their jurisdiction.

The districts were selected because of the presence of decentralised forests and had social, economic, political and geographic variability. The districts contain different types of forests and varying levels of success of the adoption of collaborative forest management. Apart from Hoima, the other districts had pioneered the implementation of decentralised services in Uganda (Ministry of Local Government, 1997). The biophysical and demographic characteristics of the study districts are presented in Table 1.3.

Table 1.3 Summary of the biophysical and demographic characteristics of the study sites

District	Land area (km^2)	Forest area (km^2)	Forest area under central government (km^2)	Forest area under local government (km^2)	% of forest land	Population density (persons per km^2)
Hoima	5,932.8	1605.1	595.36	0.32	27.0	59
Mpigi	3,605.6	719.5	303.40	3.30	19.9	115
Mukono	12,655.7	1,079.8	515.27	4.99	8.5	64
Rakai	4,908.7	382.6	363.04	0.85	7.4	96
Jinja	722.7	61.3	40.00	1.50	5.5	573
Tororo	1,849.3	31.1	7.00	0.63	1.6	302

The districts experience a tropical climate with two rainy seasons in March to June and September to November. The highest amount of rainfall is received in April and November.

The dry months are from December to February and July to August. The annual rainfall ranges between 1250 and 1500 mm in Hoima, 1320 and 2000 mm in Mpigi, 1400 and 1600 mm in Mukono, 1350 and 2125 mm in Rakai, 1200 and 1500 mm in Jinja and 1130 and 1750 mm in Tororo. The annual temperature ranges for the districts are 15^{o}C-32^{o}C in Hoima, 11-33.3^{o}C in Mpigi, 25^{o}C-27.5^{o}C in Mukono, 17-28^{o}C in Rakai, 27^{o}C-29^{o}C in Jinja, and 15.7^{o}C-30.6^{o}C in Tororo. Agriculture is the main source of income for the districts.

1.9 Thesis structure

The thesis is divided into seven chapters. The current chapter describes the background to the study, conceptual framework and objectives of the study, administrative and environmental management system in Uganda. The next chapters cover the specific studies to address the stated objectives: (i) Local organisations and decentralised forest governance in Uganda; (ii) Technical and institutional capacity in local organisations to manage decentralised forest resources in Uganda; (iii) The role of the Forest Department in decentralised forest management in Uganda; (iv) Structure and composition of forests under private, local and central government ownership in the Mpigi District, central Uganda; and (v) Physical, socio-economic and institutional factors affecting the private, local and central government to effectively manage and maintain the condition of forests under their jurisdiction in the Mpigi District, central Uganda. Finally, the last chapter presents a general discussion, conclusion and makes relevant recommendations for policy reforms in relation to the decentralisation of forest governance in Uganda and in general.

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CHAPTER TWO

LOCAL ORGANISATIONS AND DECENTRALISED FOREST GOVERNANCE IN UGANDA

2.1 Introduction

In recent years, the rights and responsibilities of local governments in forest governance have increased. Large community based initiatives began in South Asia in the early 1980s with the introduction of joint forest management (Kothari *et al.*, 1996; Poffenberger and McGean, 1996). It is believed that better resource management would be achieved by giving forest users property rights and decision-making powers over the use of forest resources. Attention has now shifted to many African countries, and a number of civil society organisations have been formed to take up this challenge (Agrawal and Ribot, 1999; FAO, 2001; Ribot, 2002). The trend towards political democratisation and weakening of authoritarian tendencies have made it possible for civil society and non-governmental organisations (NGOs) to work with governments in fostering the delivery of forestry services to local communities. This reorientation coincided with a growing awareness of the need to protect forest resources for the sake of peoples' livelihoods and for the preservation of global ecosystems. The basic idea is that community based forest management is a more effective way to monitor forests and combat deforestation (Richards, 1997).

Policy and legal changes recently in Uganda have focused on the involvement of local community organisations in the management of natural resources. Accordingly, the management of local forest reserves (LFRs) has been decentralised so that local governments and other community based organisations become stakeholders in forest governance (Government of Uganda, 1998). Decentralised forest management offers an opportunity to reduce government bureaucracy, democratise decision-making and equitably distribute benefits from forest resources. Unlike traditional forest managers, local organisations must address a range of forest management goals, including forest protection, production and poverty alleviation (MWLE, 2002a). In Uganda, there are many organisations[4] at the local level involved in the management of natural resources, including forestry. Most often, these organisations have unclear and overlapping jurisdictions and mandates in the management of

[4] For the purpose of this study, organisations include local governments, non governmental organisations (NGOs), community based organisations (CBOs), research institutes, and cultural and religious institutions that influence natural resources management at local government level in Uganda.

decentralised forest resources that have led to institutional conflicts (Kamugisha, 1997). As a result, forest resources continue to suffer from degradation because of ineffective institutional arrangements.

According to Wily and Mbaya (2001), most countries have separated formal functions of forest policy formulation from operational responsibilities, which are increasingly passing onto local governments, the private sector and civil society organisations. Local control is expected to be more effective and equitable than state-managed systems, which have often been troubled by incompetence and corruption and have tended to bypass local interest (Sharpe, 1998). Meaningful devolution, however, requires that local organisations should have incentives, knowledge and skills, powers and an appropriate legal framework to effectively undertake decentralised forest management (Smith, 1985; Turner and Meer, 2001). Clear roles, responsibilities and powers of actors must be spelt out and institutionalised amongst local organisations in order to sustainably manage forest resources. This information is, however, lacking and as a result local organisation roles, responsibilities, powers and incentives to manage forests have been underestimated and not recognised in the implementation of decentralised forest management in Uganda. The objective of this study was to examine the roles, responsibilities, powers, legal instruments and incentives of local organisations in implementing decentralised forest governance.

The following questions were addressed to achieve this objective:

(i) What kinds of local organisations are involved in forest resource management and what role do they play in the implementation of the forest policy under decentralisation?

(ii) What incentives, powers and legal instruments do local organisations have for managing decentralised forest resources?

(iii) What knowledge and skills do they have to foster forestry development?

(iv) How do local organisations work with the existing central government structures and amongst themselves?

(v) What potential conflicts exist in implementing decentralised forest governance and what mechanisms are there for conflict resolution?

2.2 Methods

2.2.1 The study area

This survey was conducted between August 2002 and February 2003 in the Mpigi, Mukono, Jinja, Hoima, Rakai and Tororo districts of Uganda. These districts constitute about 10.7% of the total number of districts in the whole country (Figure 1.1). The districts were selected based on the presence of decentralised forests, and their socio-economic, political and geographic variability. The districts also have different types of forests and varying levels of adoption of collaborative forest management. Apart from Hoima, the districts pioneered the implementation of decentralised services in Uganda (Ministry of Local Government, 1997). The biophysical and socio-economic characteristics of the study districts are presented in Table 1.3.

2.2.2 Sampling procedure

Initially, documents from the non-governmental forum in each district were reviewed to identify local organisations that influence forest management, provide services, training, research and support to the forestry sector at the local government (district and sub-county) levels (see Appendix 2.1). These included the district and sub-county governments, non-governmental organisations (NGOs), community based organisations (CBOs), research institutes, and cultural and religious institutions. The district and sub-county local governments were selected because they are the key levels in relation to policy-making, financing and planning forest governance and other natural resources under the Local Government Act of 1997 (Government of Uganda, 1997). NGOs and other community organisations were also selected because they are mandated to support local governments in implementing natural resource management programmes. Within the sub-county and district local governments, only members of Production and Environment Committees were selected for interview because they hold decentralised powers for managing natural resources, including forestry (Government of Uganda, 1997; 1998).

All the six district governments in the districts of Mpigi, Mukono, Jinja, Hoima, Rakai and Tororo were included in the survey. In each district government, at least eight members of the Production and Environment Committee were interviewed. They included five elected Local Councillors, the Chief Administrative Officer (CAO), the District Environment Officer and the Director of Production and Marketing, constituting 47 (98%) of all the Production and Environment Committee members for the studied districts. The CAO is the accounting

officer who supervises and oversees the implementation of district programmes, while the latter two are the technical personnel in the District Directorate of Production that implement natural resources management programmes, including forestry.

Within each district, five sub-county governments were randomly selected from a list of the sub-counties provided for each district, making a total of 30 sub-counties (25%) of the total number of sub-counties in the study districts. At the sub-county government level, at least five elected Local Councillors and the Sub-county Chief were interviewed, constituting 169 (94%) of all the Production and Environment Committee members. The Sub-county Chief performs similar roles as those of CAO at the sub-county level. In other organisations, at least one member of staff from each organisation was interviewed, making a total of 20 members. This represented 25.6% of the total number of staff in the non-governmental organisations (NGOs), research institutes, community based organisations (CBOs), and cultural and religious institutions. According to Hetherington (1975), 20% sample of a population is the minimum size that can be taken to be a representative of the population. In total, 236 interviews were conducted in 53 organisations that were almost equally distributed in the study districts as follows: 11 in Rakai District, 10 in Mpigi District, nine in Hoima and Tororo districts and seven in Jinja and Mukono districts (Appendix 2.1).

2.2.3 Data collection

Structured and semi-structured questionnaires were administered to selected personnel in local organisations with the help of assistants. According to Mitchell and Slim (1991), interview based approaches have been criticised for several reasons, including the researcher leading the respondent, the respondent anticipation and desire to please the researcher, and pushing for concise answers, while Borgerhoff-Mulder and Caro (1985) argue that there are discrepancies between what people report and what they actually feel or do. Despite the shortcomings, questionnaires have the great advantage of generating systematic variables, of covering large samples and of being relatively efficient (Nichols, 1991; de Vaus, 1996). Questionnaires were pretested in August 2002 in Luwero District (Figure 1.1) to enable estimation of the duration of interview and the way people will react to questions (Moser and Kalton, 1971). Advice was taken beforehand to modify the survey questions. The Luwero District met the criteria for the other districts selected for the final survey (see Subsection 2.2.1).

Questions focused on the roles and responsibilities in the implementation of decentralised forestry, their perceptions and awareness about decentralised forest governance, and forestry activities undertaken in these organisations (Appendix 2.2). Other questions dealt with incentives and disincentives for undertaking decentralised forest management, decision-making powers devolved to manage forest resources, forest rules and byelaws formulated, the sanctions imposed on forest offenders and enforcement of forest rules and byelaws. Information was also sought on linkages with other organisations as these enhance access to resources critical to organisations involved in the management of decentralised forest resources.

Local organisations' legal documents and reports and other related documents were reviewed to ascertain forest related activities supported, forest rules and byelaws formulated and passed, and minutes of meetings with other stakeholders engaged in forestry. Key informant interviews were held with members of the Parliament Sectoral Committee on natural resources, representatives from the Ministries of Local Government and Water, Lands and Environment, the Decentralisation Secretariat and the Faculty of Forestry and Nature Conservation, Makerere University as major actors in policy formulation and implementation on natural resources management. Key informants provided reliable information on factual matters, regarding the subject under investigation (Nichols, 1991). Information from organisations' documents, secondary sources and key informant interviews were used to back-up information from questionnaires.

2.2.4 Data analysis

Questionnaire responses were collated and analysed using the STATISTICA statistical package version 6.0 (StaSoft, Inc, 2003). Multiple responses with repeated answers were categorised and tallied using the multiple dichotomy method (de Vaus, 1996). This helped to obtain the frequency distributions for each variable. To facilitate easy analysis, organisations were grouped into three categories: namely district governments, sub-county governments and support organisations that constituted NGOs, CBOs, research institutes, and cultural and religious institutions. Discrete variables were summarised by the frequency of each code within the questionnaire and summary statistics computed for all numeric variables. Categorical data on the opinion of respondents were analysed based on individual responses.

Chi-square tests (Zar, 1999) were used to show whether revenue generation, financial support from donors, and local and central government, and awareness of the importance of forestry to local people motivated local organisations to engage in decentralised forest governance.

The ability of respondents to plan, monitor forest resources, formulate forest byelaws, penalise and apprehend forest offenders, and to collect revenue from forest resources were used as proxies for assessing their powers to manage devolved forest resources in local organisations. Collation of responses sometimes resulted in low counts from some expected frequencies and on these cases, data from adjacent categories were combined (Wheater and Cook, 2000). The Pearson Chi-square was used where the expected cell frequency was ≥5, while Maximum-Likelihood (M-L) Chi-square was used when the expected cell frequencies were lower than five (Rao, 1973; Fienberg, 1977; Hays, 1988).

2.3 Results

2.3.1 Organisational affiliation and educational background of the respondents

The organisational affiliation and educational background of the respondents are presented in Table 2.3.1. The majority of the respondents (91.5%) were from the local government.

Table 2.3.1 The organisational and educational profile of the respondents involved in decentralised forestry in Uganda (N=236)

Characteristic	% Response
Nature of the organisation	
Sub-county governments	71.6
District governments	19.9
Non-governmental organisations (NGOs)	3.4
Community based organisations (CBOs)	3.0
Research institutes	1.3
Cultural and religious institutions	0.8
Total	**100.0**
Duration of service	
< One year	42.0
+1-5years	49.1
Over 5years	8.9
Total	**100.0**
Educational level	
Primary education	3.0
Secondary education	44.0
Tertiary and/or University	53.0
Total	**100.0**
Attended forestry and/or environment related training	
Yes	68.2
No	31.8
Total	**100.0**

The period served by respondents in the implementation of forestry activities ranged from six months to 10 years. Sixty eight percent of the respondents had attended forestry and

environmental training. The reasons they gave for attending training were to learn about forestry and environmental management (59.7%), represent the interests of their organisations (33.5%) and develop a professional career (7.5%). The high number of respondents with forestry training implies that there are many people who are aware that decentralised forest management occurs in Uganda. The respondents were well educated because about 53% had tertiary education. It is thus logical to assume that they understand decentralisation policy and forest resource management. More than half of the respondents (53.4%) mentioned that forests had been decentralised, 36% indicated that they were only aware of forests being decentralised, while (10.6%) indicated that they had no knowledge of forests being decentralised. Most local authorities were generally aware of government interventions to decentralise forests.

2.3.2 Respondents' knowledge of the status of forests

To understand whether people knew about the level of forest degradation, respondents were asked about the status of forest cover. About 70% thought that forest cover and quality were declining, 28.8% felt that forest cover was increasing, while 1.7% indicated no change in forest cover. The reasons given for the decline in forest cover were the over use of the forests (71.3%), clearance for agriculture and other land uses (28.2%), and failure to implement forest laws (0.5%). Of the respondents who thought that forest cover was increasing, 85% attributed it to local efforts to plant more trees, 7.5% attributed it to support from NGOs and CBOs, while 7.5% attributed it to the implementation of the government policy to increase forest cover.

2.3.3 Roles of local organisations in decentralised forest governance

The majority of respondents mentioned that their organisations were involved in tree planting, establishing and managing tree nurseries, and carrying out environmental education and awareness (Table 2.3.2). Tree planting was the most common activity undertaken by nearly all the organisations. The observed and expected frequencies of the responses on the roles and activities supported in local organisations from Pearson and Maximum-Likelihood Chi-square analysis are summarised in Appendix 2.3. In general, the roles and activities mentioned by respondents differed significantly among local organisations (Table 2.3.2). District governments were perceived to be more involved in environmental education and awareness than support organisations and sub-county governments (M-L χ^2 =20.64, df=2,

p<0.05). Similarly, district governments and support organisations were perceived to be more involved in planning than sub-county governments (M-L χ^2 =52.19, df=2, p<0.001).

Table 2.3.2 Responses on the roles and activities of local organisations supported in decentralised forestry governance in Uganda

Roles	DGs (N=47)	SCGs (N=169)	SOs+ (N=20)	Total (N=236)	χ^2
Promotion of tree planting (afforestation and agroforestry)	46 (98)	160 (95)	18 (90)	224 (95)	1.873ns
Tree nursery establishment and management	40 (85)	147 (87)	17 (85)	204 (86)	0.149ns
Environmental education and awareness	46 (98)	126 (75)	19 (95)	191 (81)	20.64**
Promotion of energy conservation technologies	4 (9)	73 (43)	7 (35)	84 (36)	22.89***
Planning forestry activities	33 (70)	34 (20)	14 (70)	81 (34)	52.19***
Monitoring illegal forest use	27 (57)	38 (23)	4 (20)	69 (29)	20.94***
Promotion of bee keeping	14 (30)	38 (23)	4 (20)	56 (24)	1.251ns
Formulation of policies and byelaws	22 (47)	32 (19)	3 (15)	57 (24)	15.04***
Promotion of ecotourism	8 (17)	16 (10)	3 (15)	27 (11)	2.344ns
Promotion of forestry research	4 (9)	7 (4)	7 (35)	18 (8)	15.69***
Writing proposal for funding forestry activities	2 (4)	5 (3)	5 (25)	12 (5)	10.78**

Note: DGs=District governments, SCGs=sub-county governments, SOs=support organisations.
+Support organisations include: NGOs, CBOs, research institutes, and cultural and religious institutions.
Numbers in the parenthesis represent percentage of responses (Percentages may total over 100 due to multiple responses).
df=2, ns =non-significant, **, *** =significant at p<0.05 and p<0.001, respectively.

More respondents from district governments were involved in monitoring of forest resources against illegal use than from sub-county governments and support organisations (M-L χ^2 =20.94, df=2, p<0.001). Similarly, more respondents from district governments than from sub-county governments and support organisations said that their organisations were involved in the formulation of forest policies and forest byelaws (M-L χ^2 =15.04, df=2, p<0.001). Sub-county governments and support organisations were reported to be more involved in promotion of energy conservation technologies than district governments (M-L χ^2 =22.89, df=2, p<0.001). Furthermore, support organisations were more involved in research and project proposal writing than district governments and sub-county governments (M-L χ^2 =10.78, df=2, p<0.05)(Table 2.3.2). Beekeeping and promotion of ecotourism did not differ significantly among the activities of local organisations although they were being integrated among their programmes (Table 2.3.2).

2.3.4 Incentives for undertaking decentralised forest management

The most important incentives mentioned for participating in decentralised forest governance were the control of degradation of forest resources, raising awareness of the importance of forestry, conservation of the environment, generating revenue from forests and rehabilitating degraded lands (Table 2.3.3). The observed and expected values from the Pearson and

Maximum-Likelihood Chi-square analysis are summarised in Appendix 2.4. Some of the perceived incentives reported by respondents for promoting decentralised forest governance differed significantly among local organisations (Table 2.2.3). More respondents from sub-county and district governments than from support organisations said that awareness of the importance of forestry to the livelihoods of the communities motivated their organisations to participate in forestry (Pearson χ^2 =8.79, df=2, p<0.05; Table 2.3.3). The desire to rehabilitate degraded forest areas and financial support from donors motivated support organisations to participate in decentralised forestry than sub-county and district governments (Table 2.3.3).

Table 2.3.3 Responses on the incentives motivating local organisations to engage in decentralised forest management in Uganda

Incentive(s)	DGs (N=47)	SCGs (N=169)	SOs+ (N=20)	Total (N=236)	χ^2
Control degradation of forest resources from overuse	43 (92)	150 (89)	19 (95)	212 (90)	1.062ns
Awareness of forestry importance to communities	29 (62)	121 (72)	8 (40)	158 (67)	8.79**
Revenue generation from sale of forest produce	23 (49)	77 (46)	10 (50)	110 (47)	0.629ns
Rehabilitate degraded areas	12 (26)	17 (11)	18 (90)	47 (20)	58.91***
Financial support from donors	5 (11)	9 (5)	15 (75)	29 (13)	80.69***
Financial support from local government	6 (13)	18 (11)	1 (5)	25 (11)	1.026ns
Financial support from central government	5 (11)	13 (8)	2 (10)	20 (9)	0.705ns
Government policy	8 (17)	7 (4)	1 (10)	19 (8)	12.23**
Available technical staff	3 (6)	6 (4)	1 (5)	10 (4)	0.698ns
To have access to cheap planting materials	1 (4)	5 (3)	1 (5)	7 (3)	0.366ns

Note: DGs=District governments, SCGs=Sub-county governments, SOs=Support organisations.
+Support organisations include: NGOs, CBOs, research institutes, and cultural and religious institutions.
Numbers in the parenthesis represent percentage of responses (Percentages may total over 100 due to multiple responses).
df=2, ns=non-significant, **, *** significant at p<0.05 and p<0.01, respectively.

The government policy to bring more land under forestry motivated district governments to participate in decentralised forestry than support organisations and sub-county governments (M-L χ^2 =12.22, df=2, p<0.05). The desire to control forest degradation, financial support from local and central governments, availability of technical staff, and the desire to generate revenue from forests and to enable local people access planting materials did not differ significantly among the respondents as incentives motivating local organisations to participate in decentralised forest governance.

2.3.5 Decision-making and decentralised forest governance

About 55% of the respondents said that their organisations had powers for managing decentralised forest resources, while 45% felt that their organisations had no powers. The decision-making powers mentioned by respondents were planning and budgeting (56%),

monitoring compliance with forest rules (47%), formulation of forest rules (byelaws and ordinances) (43%), and licensing forest produce (10%). The reasons given by those whose organisations had no powers over decentralised forests were lack of legal mandate to manage forests (72.8%), ownership of forests by the central government (19.2%), and lack of cooperation from the Forest Department staff (8.0%).

2.3.6 Byelaws and sanctions regulating decentralised forest resource use

About 43% of the respondents said that their organisations participated in formulation of forest rules. More respondents from district governments (51%) said that their organisations had powers to regulate forest use and formulate forest byelaws than from sub-county governments (44.4%) and support organisations (10%) (M-L χ^2=11.97, df=2, p<0.05). Respondents from support organisations said that their organisations rarely participated in the formulation of byelaws. The most frequently mentioned forest rules and/or byelaws formulated by local organisations were related to tree planting and regulation of forest resource use (Table 2.3.4).

Table 2.3.4 Responses on the kind of forest byelaws formulated to regulate decentralised forest resource use by local organisations in Uganda

Kind of byelaws made	District governments (N=24)*	Sub-county governments (N=75)*	Support organisations+ (N=2)*	Total (N=101)
Tree planting at all levels	17 (71)	43 (57)	1(50)	61 (60)
Harvesting forest products for commercial use need a permit	7 (29)	33 (44)	1(50)	41 (41)
Protection of hills and water sources	8 (33)	16 (21)	0	24 (24)
Local Councillors to recommend forest users for permits and licences to the Forest Department	2 (8)	10 (33)	0	12 (12)
Levying high taxes on "outsiders" involved in forest exploitation	4 (17)	7 (9)	0	11 (11)
No use of power saws to harvest timber in natural forest	2 (8)	9 (12)	0	11 (11)

+Support organisations include: NGOs, CBOs, research institutes, and cultural and religious institutions.
Numbers in the parenthesis represent percentage of responses (Percentages may total over 100 due to multiple responses).

2.3.7 Sanctions and penalties for forest resource use

About 48% of the respondents (n=236) said that sanctions and penalties were imposed on offenders for misuse of forest resources, while 52% mentioned that powers to impose sanctions against offenders are upheld by the Forest Department. The most frequently imposed sanctions were said to be impounding of equipment and timber from offenders, and arresting and handing over of offenders to the Forest Department staff for prosecution (Table 2.3.5).

Table 2.3.5 Responses on the sanctions and penalties local organisations impose on offenders for misuse of forest resources in Uganda (N=113)

Penalties and sanctions	% Response
Impounding equipment and timber	58
Arrest and hand the offender to the Forest Department staff for prosecution	58
Verbally warning the offender	42
Paying a cash fine	32
Offender committed to community work	12
Making a public apology	8

Note: Percentages may total over 100 due to multiple responses.

More than half of the respondents (65.3%) mentioned that forest users comply with forest sanctions, while 34.7% thought that offenders did not comply. The reasons given by respondents for non-compliance with forest sanctions were collaboration between the offender and the Forest Department staff in illegal forest harvesting (50%), lack of recognition of byelaws and sanctions by government officials, particularly soldiers and politicians (40.7%), lack of available alternatives to forest users (19.8%), and lack of awareness about sanctions by local people living close to forests (14%).

2.3.8 Linkages established for implementing decentralised forest governance

About 86%, of the respondents (n=236) mentioned that their organisations had established links with other organisations to implement forestry activities, while 14% said that their organisations work independently. The most frequently mentioned linkages in local organisations were exchange of information, technical backstopping and input supply (Table 2.3.6).

Table 2.3.6 Frequency of responses on linkages established amongst organisations for implementing forestry activities in Uganda

Kind of linkage	District governments (N=45)	Sub-county governments (N=142)	Support organisations+ (N=17)
Technical advice in forestry management practices	87	78	94
Exchange of information about forestry governance	80	70	94
Input supply	57	37	47
Joint implementation of forestry activities	31	28	53
Provision of credit facilities to those involved in forestry	24	18	47

+Support organisations include: NGOs, CBOs, research institutes, and cultural and religious institutions.
*Percentages may total over 100 due to multiple responses.

Seventy three percent of the respondents said that their organisations are motivated to work with others to utilise the expertise and technical knowledge they are lacking, while 53% mentioned sharing of financial resources and facilities. Other factors promoting partnerships were sharing roles and responsibilities (48%), sharing information (38%) and legal mandate to network with others (27%). Twenty two percent indicated the existence of formal co-ordinating mechanisms, such as board and local council meetings and informal meetings of staff. Information exchange amongst organisations was said to be through meetings (60.8%), workshops (48%), and field visits (30.4%). Provision of credit was said to involve giving financial support to enable local organisations implement forestry activities.

The most frequently mentioned partners collaborating with study organisations were the district departments of agriculture, forestry and environment and district based non-governmental organisations (NGOs) (Table 2.3.7).

Table 2.3.7 Other natural resources management organisations linked to study local organisations for managing decentralised forest resources in Uganda

Partner organisations	**District governments (N=45)**	**Sub-county governments (N=141)**	**Support organisations[+] (N=17)**
District departments (agriculture, forestry and environment)	27 (60)	61 (43)	11 (65)
NGOs operating at the district and sub-county government levels	28 (62)	60 (43)	11 (65)
CBOs	17 (38)	65 (46)	10 (59)
Private sector	6 (13)	20 (14)	0
Religious groups	4 (9)	9 (6)	4 (24)
Educational institutions	4 (9)	6 (4)	6 (35)
Research institutes	1(2)	13 (9)	2 (12)
Uganda prisons	1 (2)	0	2 (12)

[+]Support organisations include: NGOs, CBOs, research institutes, and cultural and religious institutions.
Numbers in parenthesis represent percentage of responses (Percentages may total over 100 due to multiple responses).

Respondents mentioned that there was flexibility amongst organisations in the implementation of forestry activities. Most respondents (77%) mentioned that organisations worked together when there was a need, monthly (58%), quarterly (21%) or twice a year (12%).

2.3.9 Conflicts over management of decentralised forestry services

The majority of respondents (72.5%) indicated that they had a good working relationship with different organisations and the Forest Department in implementing forestry management

practices, while 27.5% mentioned conflicts with the Forest Department in implementing decentralised forest governance. The most frequently mentioned conflicts were inequitable sharing of forest revenues with the Forest Department (89.2%), the Forest Department prioritising exploitation at the expense of rehabilitating degraded areas (26.1%), and lack of a clear policy to control forest produce on private forests and farmers' land (9.2%). Eight percent of the respondents indicated that conflicts occurred because of the Forest Department's unwillingness to cooperate with local authorities.

The conflicts mentioned by respondents in the management of decentralised forest management varied significantly among local organisations (M-L χ^2=7.98, df=2, p=0.018). Respondents from district governments (34%) were more likely to report conflicts between their organisation and the Forest Department staff in the implementation of forestry than from sub-county governments (29%) and support organisations (5%). Furthermore, conflicts identified in the management of decentralised forest resources differed significantly among the districts of the respondents (Pearson χ^2=10.94, df=5, p<0.05). More respondents from the Mpigi District (24.6%) reported conflicts between their organisation and the Forest Department staff than from the districts of Rakai (21.5%), Mukono (20%), Tororo (15.4%), Hoima and Jinja (9.2% each). The level of respondents' training in forestry was significantly associated with conflicts in implementing decentralised forestry governance (Pearson χ^2=5.28, df=1, p<0.05). Respondents who had attended forestry and environmental training were more likely (56.9%) to report conflicts with the Forest Department staff than those who had not. The important conflict resolution mechanisms mentioned by the respondents were negotiation with the Forest Department (53%), representation on decision-making boards (26%), and meetings with the Forest Department officials (13%).

2.4 Discussion

2.4.1 Local strategies for implementation of decentralised forest governance

The results from interviews show that local governments (district and sub-county), non-governmental organisations (NGOs), community based organisations (CBOs), research institutes, and cultural and religious institutions were involved in the implementation of decentralised forestry activities. The roles and responsibilities of these organisations varied from promoting tree planting, environmental education, monitoring forest resources, and forest policing to activities geared towards poverty alleviation and improvement of

livelihoods of local people. These are the core activities under the National Forest Plan for implementing decentralised forest governance (MWLE, 2002a). According to Appelstrand (2002), active involvement of local organisations in forestry activities can assist in monitoring of policy implementation, especially where state agencies are understaffed. Local governments were mainly involved in monitoring forest resources, developing plans for forestry activities, and formulating forest policies and byelaws. This could be explained by the fact that district and sub-county governments are legally empowered by the Local Government Act of 1997 to formulate policies and make plans for managing forest resources (Government of Uganda, 1997; MWLE, 2002a). This study shows that local governments and community based organisations formulate environmental action plans that integrate forestry activities in local government programmes. The involvement of local authorities in the formulation and implementation of plans introduces an element of ownership and development of good governance, which are critical in achieving better results under decentralisation (Government of Uganda, 1997). This implies that local organisations are focused on implementing forestry as stipulated in section 36 of the Local Government Act of 1997. On the other hand, NGOs, CBOs and cultural and religious institutions play an important role in mobilising local people to participate in forestry activities. These organisations are believed to operate at grassroots level, close the poorest of the poor, have a strong focus on poverty alleviation, and are able to reach community members effectively (Farrington and Bebbington, 1993; Lane, 1995; FAO, 1999). Furthermore, community based organisations and religious and cultural institutions have the advantage of a large and wide following, as opposed to state agencies (Mukamuri *et al*., 2003).

NGOs and research institutes conduct research to generate agroforestry technologies. Agroforestry has a great potential in the alleviation of poverty through food supply, soil conservation, firewood, fodder and other social and environmental benefits (Young, 1989; Nair, 1993; Tewari, 1995; Arnold and Dewees, 1997).

Local organisations were also involved in promoting conservation of natural resources through tourism, environmental education and awareness campaigns with communities and other stakeholders. The Uganda forestry extension system has not kept pace with changing social, economic and environmental values of forestry to local people (MWLE, 2001b). As a result, local organisations have taken up this challenge to educate and sensitise forest users. Sensitisation is believed to create awareness amongst various forest stakeholders about the importance of forest resources in improving the livelihoods of local people. Awareness also

create popular demand for a more responsive government and nationally recognised local rights over the use and management of forest resources (Ashley and Roe, 1998; Scott, 1998; Wily and Mbaya, 2001; Kaarhus *et al*., 2003).

NGOs and CBOs promoted energy conservation technologies through training of local people in the use of efficient fuelwood cooking devices as well as the efficient use of woodfuel technologies. In Uganda, over 90% of the energy used is woodfuel in the form of firewood and charcoal (MWLE, 2001b). Since the forest cover is declining and Uganda's population is increasing, it is expected that woodfuel demand will continue to exert pressure on the existing forest resources in the foreseable future. Efficient use of forest resources, particularly woodfuel, is thus considered among the priority activities in local organisations, with the belief that it will reduce fuelwood consumption and deforestation (Wallmo and Jacobson, 1998). Local organisations that are actively involved in the development of fuelwood energy saving devices are the Integrated Rural Development Initiatives (IRDI) in the districts of Mpigi and Rakai and the Joint Energy and Environment Protection (JEEP) in the Tororo District.

2.4.2 Incentives for organisations' involvement in decentralised forest management

The need to control forest degradation, raise awareness of forestry importance, the desire to rehabilitate degraded areas and generate revenue from forest resources, as well as financial support from donors were mentioned as important incentives that motivate local organisations to get involved in decentralised forest governance (see Table 2.3.3). Forest degradation in Uganda occurs due to the ineffective monitoring system of the Forest Department (MWLE, 2001b). However, personnel in local organisations consider local communities to be most affected as long as forest resources continue to be degraded. Lack of adequate control of illegal activities by the Forest Department and consequent degradation of forest resources motivate local organisations to engage in decentralised forest governance (Castro and Nielsen, 2001). Thus local organisations participate in decentralised forestry because they have lost confidence in the ability of the Forest Department to regulate forest resource use and curb forest degradation. Recent studies (e.g. Agrawal *et al*., 1998; Agrawal and Ribot 1999; Larson 2002) showed that local organisation engage in forestry so as to conserve the remaining forest resources and rehabilitate the areas considered to be degraded.

Financial support from donors was also an important incentive motivating local organisations to support decentralised forestry, especially for NGOs, CBOs and research institutes. These organisations largely depend on financial support from donors and hence their activities are designed partly to meet the interests of donors. The fact that local organisations receive international funding for forestry activities highlights the role of donors and international organisations in promoting devolution of forest management. The most common donors providing financial support to local organisations involved in forestry are the Ford Foundation, the World Bank, the Norwegian Agency for Development Co-operation (NORAD), the Danish International Development Assistance (DANIDA), USAID, UNDP, the Global Environment Facility (GEF) and the European Union (EU). Although the interests of donors may sometimes override those of the lead agencies, financial support from donors has been successfully used to support forestry programmes in Uganda (Kamugisha, 1997; MWLE, 2001b). However, funding cuts and the fear of losing government and donor favours hinders the performance of local organisations in sustainable forest management. Successful implementation of decentralised forest governance needs top-level commitment on the part of the donors to improve financial management of local organisations through bottom up development planning, budgeting and formulation of exit strategies of donor funds.

The desire to access planting materials was also an incentive motivating local involvement in forest governance. Access to tree planting materials for local communities is a critical factor that should be considered in planning forestry activities because most community tree planting programmes fail due to lack of appropriate and adequate planting materials. Sharing revenue from forests was an important incentive motivating local authorities and community organisations to participate in decentralised forestry. Participation of local authorities in forest management enables them to gain access to forest resources and income from sale of forest products. As noted by Larson (2002), access to forest revenue enhances local participation and effective management of decentralised forest resources. It also creates incentives for local organisations and communities to protect forest resources and invest in forestry.

Financial support from local and central government is also an important incentive motivating organisations to implement decentralised forest management (Table 2.3.3). For example, devolved central government funded programmes like the Plan for Modernisation of Agriculture (PMA) and the National Agricultural and Advisory Services (NAADS) integrate forestry as a strategy to improve the livelihoods of people through increased wood production

(MWLE, 2002a). Thus local governments formulate environmental action plans as a precondition to access central government funding. According to Larson (2002) and Ribot (2002), central government financial support to local organisations help in the governance of decentralised forest resources and form a base for improvement of livelihoods of many people.

The role of government policy in motivating organisations to engage in forest management was also recognised as an incentive for decentralised forestry by local organisations. In 1992, the President of the Republic of Uganda launched the Tree Planting Agenda, where each household was supposed to plant at least 10 trees. Furthermore, in 2001, the government launched the 2001 Forest Policy (MWLE, 2001a). These policies motivate local authorities to participate in decentralised forestry as they are charged with implementing national programmes. However, implementation has been slow due to the restructuring and divestment of the Forest Department into the National Forestry Authority. The government should ensure that policies formulated are implemented, if they are to be meaningful to local community organisations. Policies that take unusually long to be implemented are overtaken by events and eventually do not motivate local authorities to invest time and resources in their implementation (Kamugisha, 1997). This study shows that the availability of technical staff motivated local organisations to participate in decentralised forest management. However, most organisations were not adequately staffed to engage in forestry and this has a bearing on the implementation of forestry activities by local organisations. According to FAO (2001), without adequate technical staff, local organisations cannot effectively implement decentralised forestry activities.

2.4.3 Powers devolved for decentralised forest governance

The involvement of local government authorities in the management of forest resources was generally limited to responsibilities for helping the Forest Department in implementing the forest policy. Decision-making over most strategic activities, including the issuing of permits and licenses for forest exploitation, and a wide-ranging authority for apprehending and prosecuting offenders are retained by the central government (see Subsection 2.3.5). This indicates that the Forest Department is not willing to relinquish power over the management of forest resources. The fact that local authorities have not been entrusted with powers and rights to control and regulate resources they are managing suggests that the central government is unwilling to facilitate decentralised forest management. To be effective, devolution should not be about devolving responsibilities for decentralised service delivery,

but should rather devolve rights and powers to make decisions over the use of productive resources (Craig, 2000). Studies conducted in Asia and southern Africa found that local organisations can enhance legal assessment on the use of natural resources and might, by extension, promote more respected and efficient environmental legislation (Shackleton *et al*., 2002). Local organisations must be in a position to determine the distribution of benefits and costs from forest resources. Ribot (2003) argues that downwardly accountable and representative local authorities need discretionary powers over resources that affect their constituencies for them to become legitimate actors. It has also been reported by Watts (2002) that ensuring forest resource use rights to various actors in a society can make them directly and financially responsible for environmental damage arising from practices on their holding.

Unlike support organisations this study has shown that local governments have some powers to formulate forest byelaws for sustainable forest management (Table 2.3.4). These byelaws regulate forest resource use, encourage tree planting and prohibit illegal destruction of trees. The byelaws create offences as well as sanctions and penalties. This is provided for in sections 39 and 40 of the Local Government Act of 1997 (Government of Uganda, 1997) and the National Forestry and Tree Planting Act of 2003 (Government of Uganda, 2003. Powers to formulate byelaws are carefully scrutinised to ensure that local governments only make laws that support national environment policy or legal framework (Government of Uganda, 1997; Onyach-Olaa, 2003). Thus, local governments can make byelaws but only byelaws which strengthen central government policies. As noted by Bazaara (2001), byelaws formulated by local governments only reduce central government's costs in maintaining forest resources rather than transfer of actual powers of making policies by the local governments. Lack of a legal mandate over forests makes local authorities consider forests as the central government property and hinders the effectiveness of local organisations in the implementation of decentralised forest governance (Shackleton *et al*., 2002). Local governments can make meaningful and independent forest byelaws only if the central government devolves significant decision-making powers over forest resources management.

This study shows that Local Councillors only arrest but the powers to prosecute offenders were upheld by the Forest Department (see Table 2.3.5). This finding reveals that there is a struggle for power and authority between the democratically elected management arm of the local government (Local Councillors) and the Forest Department. The fact that local organisations are unable to prosecute offenders confirms the weakness of the National

Forestry and Tree Planting Act to serve as an enabling legislation for the implementation of decentralised forest management. In order to deter offenders from cooperating with the Forest Department in illegal exploitation of forest resources, local organisations need to be given legitimate power to arrest and prosecute offenders. This would also create self-confidence and motivation at the local level to apprehend and penalise offenders. Ribot (2002) and Kaarhus *et al*. (2003) argue that for an organisation to function effectively, there is a need for a set of rules to govern its activities and operations and the government must be willing to provide support for their actions.

The result from this study further shows that soldiers and politicians in higher government positions have no respect of byelaws formulated by local authorities (see Subsection 2.3.7). It was reported that the soldiers are in most cases armed, while politicians fabricate cases against law enforcers that they are against national government programmes. This implies that forests are illegally exploited as a political strategy to increase territorial control rather than promoting local autonomy (Crook and Sverrisson, 2001). Lack of respect for the byelaws enacted by local governments frustrates local authorities in effecting forest regulation. This is also one of the reasons that probably make local authorities believe that forests belong to the State and they are used by the State to protect them. Effective empowerment to manage decentralised forest resources needs to recognise the rules made by local organisations. Legitimate powers over forest resources create confidence in local organisations, thus ensuring effective use and management of forest resources. According to Ostrom (1990) and Arnold (1998), local authorities are motivated to devise rules for managing forest resources sustainably when their rights to devise rules are not challenged by external or central government authorities. Initiatives taken by individual district and/or sub-county governments, and even support organisations, to manage forest resources sustainably and effectively, if supported by central government, will only stimulate others to do the same, or better, and could then be used as examples, or models, of good management. These should not be seen as conflicts with national policy, if they are based on good principles of sustainable forest management.

Lack of alternative sources of livelihoods is another reason for lack of compliance with forest rules. In Uganda there is widespread poverty due to unemployment, high population growth and inability of seasonal agriculture to meet the needs of local people (NARO, 2001). As a result, many of the economically active population illegally exploit forest resources as an immediately available alternative source of income. Unless sources of alternative income are

available, forest rules will always be violated and forests will continue to be illegally exploited. As long as local people are too poor to afford basic needs, implementation of sustainable resource use activities will not be achieved. In addition, violation of forest rules is a result of inadequate awareness of the forest rules as well as the procedures of acquiring forest permits and licences from the Forest Department. The need for awareness is necessary for effective implementation of decentralised forest activities. Furthermore, the study shows lack of compliance with forest rules from forest offenders because offenders collaborate with the forest law enforcers (see Subsection 2.3.7). Local authorities reported that equipment impounded from offenders who were arrested often found its way back to the same offenders. It was also noted that the Forest Department selectively provided preferences or exemptions from prosecution to offenders depending on their ability to pay and their social and political status, thereby hindering local organisations from apprehending forest offenders for fear to conflict with the Forest Department.

2.4.4 Linkages amongst organisations for managing decentralised forest resources

There were attempts by local organisations to collaborate with other actors in the implementation of forestry activities (see subsection 2.3.8, Table 2.3.7). The most important approaches used are informal staff meetings, information exchange, field visits, provision of credit, joint planning, and representation at formal administrative functions and on structures like task-forces, councils and boards. Linkages amongst local organisations are essential in mobilising local communities and in providing human and financial resources, facilities and equipment for use in the implementation of decentralised forest management (Kowero and Spilsbury, 1997). In addition, linkages enable organisations to have access to shared information because some organisations, particularly NGOs, are considered to be well endowed with resources, and are able to provide inputs as well as credit facilities to other organisations. Furthermore, linkages are established to bridge the gap between the Forest Department and local forest users. According to FAO (2001), NGOs are important in availing stakeholders with information on new legislation and policies concerning decentralisation and community based forest management. Integration enables organisations to avoid duplication or counterproductive competition, enhances exchange of information and supports each other's programmes (IUFRO, 1994; van Gelder and O'Keefe, 1995). It also helps local organisations to draw consistent lines of action towards those involved in the promotion of forestry activities.

2.4.5 Conflicts in the implementation of decentralised forestry services

While the 2001 Forest Policy (MWLE, 2001a) emphasises equitable sharing of benefits from forest between local governments and the Forest Department, those interviewed were of the view that a greater proportion of the benefits are taken by the national government and by private individuals associated with decision-makers within the Forest Department (see Subsection 2.3.9). Only 40% of the income generated from central forest reserves goes back to the district local governments, while 60% goes to the central government (Forest Department, 2002). Local authorities are dissatisfied with the 40% share of the revenue because they consider themselves as the *de facto* owners of the forests that are located within their jurisdiction. Unequal distribution and sharing of benefits between the Forest Department and the local governments create an atmosphere of suspicion leading to disinterest in forestry activities by local organisations. This kind of conflict limits budgetary commitment to forestry, as most local governments are reluctant to invest more money in forestry without the assurance of adequate returns. According to Wade (1988), inequitable distribution of benefits is a disincentive to forest development because local forest users are reluctant to invest in forestry once the resource is unable to meet users' needs and benefits are unpredictable. As noted by Ostrom (1990) and FAO (2003), equitable sharing of benefits has an important bearing on forest management, protection and sustainability of forest resources. It also makes it easier for local authorities to mobilise local people and to strengthen the collective responsibility needed to protect forest resources. Unequal sharing of benefits is a disincentive for local governments and hinders them to effectively participate in regulating forest resource use (Kaimowitz *et al.,* 1998; Larson, 2002).

The findings of this study show that the Forest Department prioritises forest exploitation at the expense of forest conservation (see Subsection 2.3.9). Discussions with local government officials revealed that a greater percentage of revenue generated from the sale of forest produce is not ploughed back into forestry by the central government. Furthermore, most local organisations hardly receive financial support from the Forest Department, although forestry is a source of revenue for the central government. This has created confusion between local authorities and the central government on budgetary support to the forestry sector because neither the local government nor the central government is willing to commit adequate financial support. As a result, forestry is allocated less than 1% of the total operating budget of the local governments included in this study. Limited budgetary support to forestry means that the forestry sector will always lag behind other decentralised public sectors in Uganda. This is a critical issue facing many State forest agencies today (Soetarto *et*

al., 2001; Post and Snel, 2003). Thus, local governments and the Forest Department need to devise strategies on how to reinvest the money generated from forest produce into forestry. This will create a positive public image of the forestry sector and give a sense of ownership to local authorities once they realise positive results.

This study revealed that decisions made by the central government on the ownership and control of forest resources on private land appeared to be inconsistent with those prescribed by the 2001 Forest Policy that guarantee ownership of tree resources to the owners of the land (MWLE, 2001a). In Uganda, reserved trees, for example, *Milicia excelsa* grow on farmers' land, but harvesting control is handled by the Forest Department. In such a situation, people have no incentive for planting and protecting such trees, because they cannot control their exploitation. For example, in the Tororo District, people uprooted reserved trees in favour of food and cash crops and other trees, because they are able to control their exploitation. In some districts with private forests such as Mpigi, Mukono and Hoima, local people have resorted to clearing private forests in favour of crop production. Lack of clarity on who owns and controls trees on private land hinders the implementation of private tree planting under decentralisation. Insecurity of tenure hinders local community participation in tree planting (Dykstra *et al*., 1996). According to Ostrom (1990) and Beland and Platteau (1996), individuals are more likely to conserve a resource when they believe they will reap long-term benefits from it. There is thus a need to harmonise government policies to specify forest resource ownership on privately owned land. This will create public interest in tree planting as well as give local authorities an opportunity to implement decentralised forest management.

2.5 Conclusions and recommendations

2.5.1 Conclusions

The following conclusions can be drawn from this study:

1. Nested layers of local governments, NGOs and civil society organisations exist at the local level and provide a platform for the implementation of the core themes of the Uganda Forest Policy under decentralisation such as forest conservation and sustainable forest management to improve the livelihoods of local communities.
2. Local organisations have devised strategies for implementing decentralised forest governance among which are promotion of tree planting, environmental education,

research on appropriate agroforestry technologies, bee keeping and integrated planning.

3. Decentralisation is also increasingly providing some political and legal space for local governments to make byelaws regulating forest resource and to pursue innovative forms of collaborative and participatory forest resource management. However, support organisations have not been given mandate to formulate forest policies, apart from promotion of awareness.
4. Linkages have been established amongst local organisations to maximise the use of the available resources as well as to facilitate mutual professional and technical support in the implementation of decentralised forest management.
5. There are both financial and non-financial incentives such as the desire to control forest degradation, donor and central government funding, awareness of the importance of forestry to the livelihoods of communities, the desire to conserve forest resources and rehabilitate the degraded areas that motivates local authorities to undertake decentralised forest management.
6. Local authorities hardly control of key aspects of forest management such as revenue collection and prosecuting offenders that are key incentives for local participation in forest management. These responsibilities are upheld by the central government through the Forest Department, showing the lack of genuine shift in authority over the management forest resources to local organisations.
7. Decentralised forest governance is hindered by lack of a clear policy on the ownership and control of trees and forest resources on private land, unequal sharing of revenue from forest resources between local governments and the Forest Department and inadequate delegation of decision-making powers over forests to local authorities.

2.5.2 Recommendations

1. Decision-making powers of local organisations over control of revenue and access to forest resources need to be clarified because this will strengthen collective responsibility for protecting the forest resources as well as budgetary commitment to the implementation of decentralised forest governance. The jurisdiction of the local governments and the central government in relation to forest policing needs to be clear to all those involved in forest governance.

2. The existing collaboration between local governments and support organisations need to be strengthened so that resources available from support organisations are fully utilised in the development of the forestry sector.
3. There is need for the central government to make financial commitments to local organisations to cater for forestry activities as it does with other decentralised sectors. This will stimulate local governments and support organisations to commit fiscal resources for decentralised forest governance.
4. Further research is need on how to strengthen and institutionalise the role of support organisations from decentralised service provision to forest policing and regulation.

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CHAPTER THREE

TECHNICAL AND INSTITUTIONAL CAPACITY IN LOCAL ORGANISATIONS TO MANAGE DECENTRALISED FOREST RESOURCES IN UGANDA

3.1 Introduction

The process of devolution of power to local government agencies, including the management of forests and other natural resources in Uganda started in 1986 (Government of Uganda, 1998). The central government recognises local organisations as key players in forestry development. Through devolution, local organisations can manage forest resources on behalf of the central government cost effectively. Meaningful devolution, however, requires that local organisations should have adequate and competent human resources, finance, information, technology, skills, and the appropriate legal framework to manage decentralised services. According to Dykstra *et al*. (1996), the level of capacity in local organisations is a crucial factor in the decentralisation process because good natural resource management practices come from strong capacity and plans.

Linde *et al.* (2001) and Dykstra *et al*. (1996) described the capacity of an organisation as possession of financial resources, information, equipment and an appropriate legal framework, knowledge, skills and abilities to fulfil a given role. Dia (1996) classified capacity into technical and institutional capacity. Technical capacity is associated with training, education and technical assistance in local organisations. The major component of technical capacity is the available resources i.e. qualified and experienced staff, money, infrastructure and equipment to undertake decentralised forest governance. Institutional capacity deals with the features of the environment that encourage local organisations to strive for effective implementation of decentralised forest governance, and make good use of the resources available to the organisation. According to Moore (1995) and Dia (1996), the main features of institutional capacity are: (i) commitment of organisational leadership to implement organisations' programmes; (ii) ownership of a programme; (iii) representativeness and legitimacy of institutions; (iv) accountability of leaders to clients; (v) autonomy of the organisation to take decisions independent of the central government; (vi) ability to craft and enforce rules; and (vii) the extent to which incentives encourage service delivery and improve performance.

As suggested by Dubois (1998), technical capacity is enhanced if there is an appropriate institutional environment because commitment of leaders who are downwardly accountable and representative of local people fosters the adoption of decentralised programmes. He further argues that past emphasis by donors on technical capacity rather than institutional capacity in most developing countries failed to improve the delivery of services.

Capacity to function efficiently is used by most central governments to argue for or against local organisations' ability to implement decentralised national priority programmes (Larson, 2002; Onyach-Olaa, 2003; Faguet, 2004). Smith (1985) and Adamolekun (1999) reported that local organisations in developing countries lack financial and human resources to manage decentralised forest resources. In these countries, inadequate finance and human resources and facilities have constrained the implementation of policies in forestry and related sectors. However, it is difficult to measure impacts associated with capacity development for managing decentralised services in the short run because the decentralisation of forests has recently been institutionalised in most developing countries. According to Turner and Meer (2001), it takes many years to build capacity within institutions to manage forest resources at the local level.

In Uganda, the central government reluctantly decentralised forest governance in spite of the fact that most government sectors had already been decentralised. This is because local organisations were believed to have inadequate capacity to deliver decentralised services (Bazaara, 2001; MWLE, 2001). Without systematic evidence documenting the strength and weakness of local organisations, the capabilities and advantages to implement decentralised forest governance over state forest departments remain largely untested. The capacity of local organisations to govern decentralised forest resources has not been assessed and there is lack of information on how to implement forestry activities under decentralisation. This study was therefore carried out to assess the technical and institutional capacity of local organisations to manage forest resources. This will add new knowledge to the management of forest resources in Uganda and assist policy-makers and planners to make informed decisions about decentralised forest governance.

The following questions were addressed to pursue this objective:

(i) What resources (financial, competent personnel, material, and information) are available in local organisations to effectively undertake decentralised forest management?

(ii) What mechanisms are there for mobilisation and generation of resources in local organisations to foster forestry development?

(iii) Is there an enabling environment for local organisations to effectively use resources in the implementation of decentralised forest governance?

3.2 Methods

3.2.1 The study area

The study took place between August 2002 and February 2003 in Hoima, Mukono, Mpigi, Jinja, Rakai and Tororo districts constituting 11.1 % of the total number of districts with decentralised forests in Uganda (Figure 1.1). The districts were selected because of the presence of decentralised forests, and variation in their socio-economic, political and geographic settings. They also pioneered the implementation of decentralised services in Uganda (MLG, 1997). These districts have different types of forests and varying degrees of success in collaborative forest management. The biophysical and socio-economic characteristics of the study districts are presented in Table 1.3.

3.2.2 Sampling procedure

Initially, documents available from the non-governmental organisations' forum at each district were examined to identify organisations that were involved in the implementation of forestry activities at the district and sub-county levels of local government. These included the statutory organisations that are legally mandated to implement natural resource policies, including formulation of byelaws, e.g. sub-county and district local governments, and aid agencies and non-governmental organisations (NGOs), community based organisations (CBOs), research institutes, and cultural and religious institutions mandated to support local governments in implementing natural resource management programmes (Appendix 2.1).

The members of Production and Environment Committee of the district and sub-county governments were selected for the survey because they play key roles in policy-making, financing and planning forest governance and other natural resources under the Local Government Act of 1997 (Government of Uganda, 1997). The same procedures as in Chapter 2 (Subsection 2.2.2) were followed in the selection of respondents.

3.2.3 Data collection

Structured and semi-structured questionnaires were administered to the selected respondents in 53 organisations to solicit their perception of their organisation's capacity to manage decentralised forest resources. Questionnaires were pretested and advice was taken beforehand to modify the questions (see Chapter 2, Subsection 2.2.3). Questions focused on the physical and financial resources available, how they are allocated to forestry and other activities, the factors determining the spending priorities, available opportunities and the factors hindering local organisations from implementing decentralised forest governance (Appendix 2.2). In this study, the resources referred to were time, available finance and technical personnel, equipment, facilities, information assets such as published reports, and process assets such as procedures for collecting and synthesising information on forestry activities. Documents were reviewed to collect information on internal revenue generation, external funding, and how money was reinvested in forestry activities by local organisations.

3.2.4 Data analysis

Questionnaire responses were analysed using the STATISTICA statistical package version 6.0 (StaSoft, Inc, 2003). Data on opinions were analysed based on individual responses, while data on budgets and resources for implementing decentralised forestry were analysed on organisational basis. Chi-square tests were performed to show the relationship between resource allocation to forestry, sources of income for the organisation and per capita income of local organisations. Furthermore, chi-square tests were used to establish the relationship between the opinions of respondents about the capacity of local organisations to manage decentralised forest resources and educational level of respondents, presence of byelaws, and presence of information assets, technical staff and sources of funding for the organisation. One-way analysis of variance (ANOVA) (Zar, 1999) was used to show the differences in the staff establishment and equipment and facilities available for forest governance in local organisations. Numeric variables on the financial allocation to forestry amongst organisations failed the assumption of normality and homogeneity of variance. Thus Kruskal Wallis test (H) one-way analysis of variance using ranks (non-parametric) (Siegel and Castellan, 1988) was performed to show the difference in the amount of money allocated for decentralised forestry amongst local organisations in Uganda.

3.3 Results

3.3.1 Human resources for implementing forestry activities

More than half of the established staff positions in the district governments were occupied, while the sub-county governments and cultural and religious organisations had less than 20% of their established staff positions occupied (Table 3.3.1). The majority of trained forestry staff in the district governments were seconded from the central government, while other organisations had recruited their own staff.

Table 3.3.1 Existing and proposed human resources by organisations and qualifications in local organisations for managing decentralised forest resources in Uganda

Staff qualification	DGs (N=6)	SCGs (N=30)	NGOs (N=6)	CBOs (N=7)	RI (N=2)	CR (N=2)
Degrees						
No. of positions established	18	30	19	6	26	4
No. of positions occupied	13	1	11	1	16	0
% of positions occupied	72.2	3.33	57.9	16.67	61.5	0
Mean ±SD of occupied positions in each organisation	2.1±0.98	0.03±0.2	1.8±2.6	0.14±0.4	8±7.1	0
Diplomas						
No. of positions established	30	41	44	8	22	5
No. of positions occupied	14	10	6	0	5	1
% of positions occupied	46.7	24.4	13.6	0	22.7	20
Mean ±SD of occupied positions in each organisation	2.3±1.8	0.33±0.6	1.0±1.6	0	2.5±3.5	0.5±0.7
Certificates						
No. of positions established	95	74	44	15	9	7
No. of the positions occupied	29	16	19	0	4	1
% of positions occupied	30.5	21.6	43.2	0	44.4	14.3
Mean ±SD of occupied positions in each organisation	4.8±2.9	0.5±0.9	3.2±3.9	0	2±2.8	0.5±0.7
Casual workers*						
No. of positions established	108	88	10	11	24	0
No. of positions occupied	80	19	0	6	8	0
% of positions occupied	74.1	21.6	0	54.5	33.3	0
Mean ±SD of occupied positions in each organisation	13.3±9.3	0.63±1.1	0	0.86±1.9	4.0±5.6	0
Overall staffing						
No. of positions established	251	233	117	40	81	16
No. of positions occupied	136	46	36	7	33	2
% of positions occupied	54.2	19.7	30.76	17.5	40.7	12.5
Overall mean ±SD of occupied positions in each organisation	22.6±13	1.53±1.7	8.1±6.8	1.0±1.9	16.5±19	1.0±1.4

DGs=District governments, SCGs=Sub-county governments, RI=Research institutes, CR=cultural and religious institutions, SD=Standard deviation.
* Includes patrolmen and nursery attendants.

The mean number of forestry graduates employed was significantly higher in research institutes than the district local governments, NGOs, CBOs, and sub-county governments ($F_{5,47}$=14.72, p<0.001) (Table 3.3.1). Cultural and religious institutions had no employed forestry graduate. The mean number of employed forestry staff with a diploma was

significantly higher in research institutes than the district governments, NGOs, and cultural and religious institutions and sub-county governments ($F_{5,47}$=5.63, p<0.001). CBOs had no employed staff holding a diploma in forestry. The mean number of forestry staff holding a certificate in forestry was significantly higher in district governments than the NGOs, research institutes, sub-county governments, and cultural and religious institutions ($F_{5,47}$=8.02, p<0.001) (Table 3.3.1).

None of the CBOs had employed a staff holding a certificate in forestry. The mean number of employed casual workers (patrolmen and nursery attendants) was significantly higher in district governments than in research institutes, CBOs, and NGOs ($F_{5,47}$=15.8, p=0.001) (Table 3.3.1). NGOs had no employed casual forest workers, while cultural and religious institutions had no established positions for casual forest workers.

3.3.2 Physical facilities and equipment for implementing decentralised forestry

The available physical resources for managing decentralised forest resources in the study local organisations are presented in Table 3.3.2.

Table 3.3.2 Existing and proposed number of physical facilities and equipment in local organisations for implementing decentralised forestry activities in Uganda

Asset category	DGs (N=6)	SCGs (N=30)	NGOs (N=6)	CBOs (N=7)	RI (N=2)	CR (N=2)
Vehicles						
Number required	59	40	13	9	20	12
Number available	38	4	5	1	15	4
% of the number available	64.4	10	38.5	11.1	75	33.3
Mean±SD of the number available in each organisation	6.3±3.9	0.13±0.34	0.8±1.2	0.14±0.38	7.5±10.6	2±1.4
Motorcycles						
Number required	378	140	32	35	25	11
Number available	279	68	22	17	17	4
% of the number available	73.8	48.6	68.7	48.6	68	36.4
Mean±SD of the number available in each organisation	46.5±20.9	2.3±2.6	3.7±1.4	2.4±2.0	8.5±12	2±2.8
Telephones lines						
Number required	39	52	15	9	4	11
Number available	11	10	6	7	2	3
% of the number available	28.2	19.2	40	77.8	50	27.3
Mean±SD of the number available in each organisation	1.8±0.75	0.33±0.7	1.0±1.1	1.0±0.6	1.0±0.0	1.5±0.71
Computers						
Number required	43	42	25	16	19	9
Number available	14	3	10	6	13	2
% of the number available	32.6	7.14	40	37.5	68.4	22.2
Mean±SD of the number available in each organisation	2.3±1.2	0.1±0.3	1.7±1.50	0.86±0.4	6.5±7.8	1.0±1.4

DGs=District governments, SCGs=Sub-county governments, RI=Research institutes, CR=Cultural and religious institutions, SD=Standard deviation.

Most organisations lacked adequate facilities and equipment to implement decentralised forest governance. The mean number of vehicles available for carrying out decentralised forest activities was significantly higher in research institutes and district governments than in NGOs, CBOs, sub-county governments, and cultural and religious institutions ($F_{5,47}$=13.027, p<0.001) (Table 3.3.2). On average, sub-county governments, NGOs, and CBOs had less than one vehicle available for forestry. The mean number of motorcycles available for monitoring forestry activities was significantly higher in district governments than in research institutes, NGOs, CBOs, sub-county governments, and cultural and religious institutions ($F_{5,47}$=54.44, p<0.001) (Table 3.3.2). The mean number of telephone lines being used in decentralised forest governance was significantly higher in district governments ($F_{5,47}$=5.60, p<0.001) than in research institutes, NGOs, and cultural and religious institutions, CBOs and sub-county governments. On average, each organisation had at least a telephone line for communicating with partners (Table 3.3.2). The mean number of computers available for managing decentralised forestry was significantly higher in research institutions than in district governments, NGOs, and cultural and religious institutions, CBOs and sub-county governments ($F_{5,47}$=10.85, p<0.001) (Table 3.3.2).

3.3.3 Information assets

Knowledge on the availability of legal forestry documents varied significantly among the local organisations that employed respondents (M-Lχ^2=37.25, df=2, p<0.001). More respondents from NGOs, CBOs, research institutes, and cultural and religious institutions (55%) said that their organisations had copies of the forest policy and other legal documents, unlike district governments (17%) and sub-county governments (4%). Knowledge of respondents on the availability of minutes of meetings about forest management varied significantly among local organisations (Pearson χ^2=25.48, df=2, p<0.001. More respondents from district governments (79%) said that their organisations have meeting minutes, compared to NGOs, CBOs, research institutes, and cultural and religious institutions (50%) and sub-county governments (37%).

Knowledge on the availability of maps showing forested areas and natural vegetation cover differed significantly among the respondent's organisation (M-L χ^2=23.22, df=2, p<0.001). More respondents from NGOs, CBOs, research institutes, and cultural and religious institutions (30%) said that they their organisations had vegetation maps, unlike the district governments (4.3%) and sub-county governments (0.6%). The availability of periodic reports on forest management and revenue from forest produce varied significantly among study

organisations (Pearson χ^2=91.59, df=2, p<0.001). More respondents from district governments (81%) said that their organisation had periodic reports on forest management than from NGOs, CBOs, research institutes, and cultural and religious institutions (45%) and sub-county governments (11%). Knowledge on the availability of work plans for decentralised forest governance did not differ among the respondents' organisations (Pearson χ^2=9.53, df=2, p>0.05). Nearly all organisations had an integrated work plan encompassing activities undertaken, including forestry. Details of the observed and expected frequencies from the chi-square analysis on the information assets in local organisations are presented in Appendix 2.5

3.3.4 Time allocation for forestry activities

Most respondents (77.1%) said that they allocate time for forestry activities, while 22.9% mentioned that they rarely have time for forestry. Time is critical for their successful implementation of forestry activities e.g. planning, monitoring, extension and follow-up visits and dissemination of forestry technologies. The average weekly contact time allocated to forestry significantly differed among the study organisations ($F_{5, 176}$=2.88, p< 0.05). The mean weekly contact time in terms of hours devoted to forestry work was higher in research institutes (92 hours±24) than in district governments (40 hours ±39), NGOs (35 hours ±25), CBOs (33.6 hours ±30.6), sub-county governments (33.2±31), and cultural and religious institutions (30 hours ±25).

3.3.5 Fiscal resources for implementing decentralised forestry activities

Local revenue (taxes) and funds received from the central government were said to be the most common sources of revenue for local governments (Table 3.3.3).

Table 3.3.3 Responses to question about sources of revenue for organisations involved in the implementation of decentralised forestry activities in Uganda

Source of revenue	DGs (N=47)	SCGs (N=169)	NGOs (N=8)	CBOs (N=7)	Research Institutes (N=3)	CR (N=2)
Local taxes	42 (92)	158 (94)	0	1 (14)	0	0
Central government transfers*	47 (100)	143 (85)	5 (63)	0	2 (67)	0
International NGOs and donors	38 (81)	57(34)	8 (100)	7 (100)	3 (100)	2 (100)
Credit facilities from credit institutions	0	12 (7)	0	2 (25)	0	0
Voluntary contribution of funds by organisation members	0	0	1 (13)	3 (43)	0	1 (50)
Other sources	1(2)	4 (3)	0	2 (25)	0	0

DGs=District governments, SCGs=Sub-county governments, CR=Cultural and religious institutions.
Numbers in the parenthesis represent percentage of responses.
* Includes conditional, unconditional and equalisation grants.

By contrast, nearly all respondents from research institutes, NGOs CBOs and cultural and religious institutions mentioned aid from international aid agencies as the main source of revenue for their organisations. Other sources of revenue mentioned by respondents were fees from tourists and sale of forest products for sub-county and district local governments, and sale of seed and agricultural inputs for CBOs (Table 3.3.3).

The amount of revenue generated from forests was generally low, contributing to less than 1% of the total budget for the district governments (Table 3.3.4). Local governments, however, allocated more funds to forestry than actual contribution of forestry to their total budget (Table 3.3.4).

Table 3.3.4 Revenue (Uganda shillings)* generated from and allocated to forestry among district governments in Uganda for the 2001/2 and 2002/3 financial years

District government	Total budget in FY 2002/3	Revenue from forests in the FY 2001/2	(%) forestry contribution to total budget	Funds allocated to forestry in the FY 2002/2003
Hoima	13,431,179,424	53,583,347	0.26	56,545,372
Mukono	27,595,754,000	33,442,312	0.12	34,699,000
Mpigi	14,920,699,000	16,909,250	0.28	28,255,000
Jinja	12,752,894,000	2,439,473	0.02	2,000,000
Rakai	16,206,000,000	553,661	0.01	3,720,000
Tororo	19,579,263,075	3,437,446	0.02	2,707,021

* 1US$=1900 Uganda shillings in 2003.

Data generated from district budgets indicates that over 60% of the district budgets are funded from central government transfers (Table 3.3.5).

Table 3.3.5 Fiscal revenue by source, and contribution to the total budget of district governments in Uganda for the 2002/2003

District	Revenue source	Amount (Uganda shillings)*	% of the total budget
Hoima	Local revenues	449,774,122	3.4
	Donor and NGO Support	4,095,034,000	30.5
	Central government transfers	8,886,371,302	66.1
	Total budget	**13,431,179,424**	**100.0**
Mukono	Local revenues	3,395,056,000	12.3
	Donor and NGO Support	2,460,601,000	8.9
	Central government transfers	21,740,097,00	78.8
	Total budget	**27,595,754,000**	**100.0**
Mpigi	Local revenues	285,000,000	0.02
	Donor and NGO Support	694,312,000	0.04
	Central government transfers	13,941,387,000	93.4
	Total budget	**14,920,699,000**	**100.0**
Jinja	Local revenues	348,335,000	2.7
	Donor and NGO Support	215,225,000	1.7
	Central government transfers	12,189,334,000	95.6
	Total budget	**12,752,894,000**	**100.0**
Rakai	Local revenues	800,000,000	4.9
	Donor and NGO Support	2,559,000,000	15.8
	Central government transfers	12,847,000,000	79.3
	Total budget	**16,206,000,000**	**100.0**
Tororo	Local revenues	1,167,787,347	6.0
	Donor and NGO Support	1,933,023,729	9.9
	Central government transfers	16,478,451,999	84.1
	Total budget	**19,579,263,075**	**100.0**

Source: Government of Uganda, 2003. *The exchange rate was 1,900 Uganda shillings per 1US$ in 2003.

3.3.6 Allocation of funds for decentralised forestry in local organisations

Generally, there was limited budgetary support to forestry activities in local organisations (Table 3.3.6; Figure 3.3.1). A small proportion (less than 1%) of the total budget in local governments was allocated to the forestry sector.

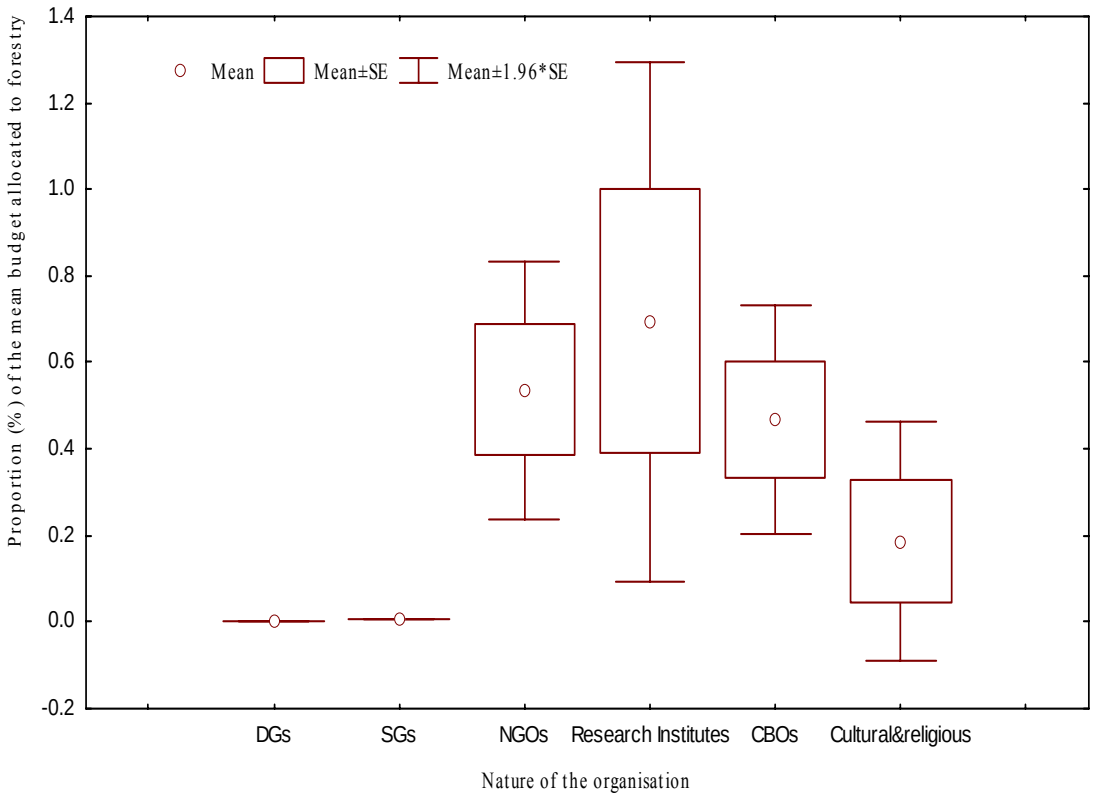
Table 3.3.6 Average revenues (Uganda shillings)* and percentage of the revenues allocated to forestry within local organisations in Uganda for the financial year 2002/3

Organisations	Average budget	Average amount allocated to forestry	% of budget allocated to forestry
NGOs	125,316,400	80,373,800	64.0
CBOs	55,284,300	16,900,500	31.0
District governments	17,414,298,000	19,870,200	0.1
Sub-county governments	147,403,900	782,800	0.5
Cultural and religious	16,169,000	3,839,900	24.0
Research Institutes	685,331,900	619,331,600	90.0

*1US$ =1900 Uganda shillings in 2003.

The mean fiscal allocation to forestry differed significantly among the study organisations (Kruskal Wallis, $H=57.707$, $p<0.001$) (Figure 3.3.1). Funds allocated to forestry were

significantly higher in research institutes, NGOs, CBOs and cultural and religious institutions than in district and sub-county governments. Research institutes received most funding from donors, while sub-county and district governments depend on local revenues and central government revenues, which are appropriated according to national priorities.



DGs=District government, SCGs=sub-county governments

Figure 3.3.1 Box-plot of funds allocated to forestry by local organisations in Uganda for 2002/2003 financial year.

3.3.7 Allocation of funds for forestry in the study districts

The amount of financial support to forestry activities differed significantly among the study districts (Kruskal-Wallis, $H=56.510$, $p<0.001$). Mean fiscal allocation to forestry was highest in the Mpigi District and lowest in the Hoima District (Figure 3.3.2).

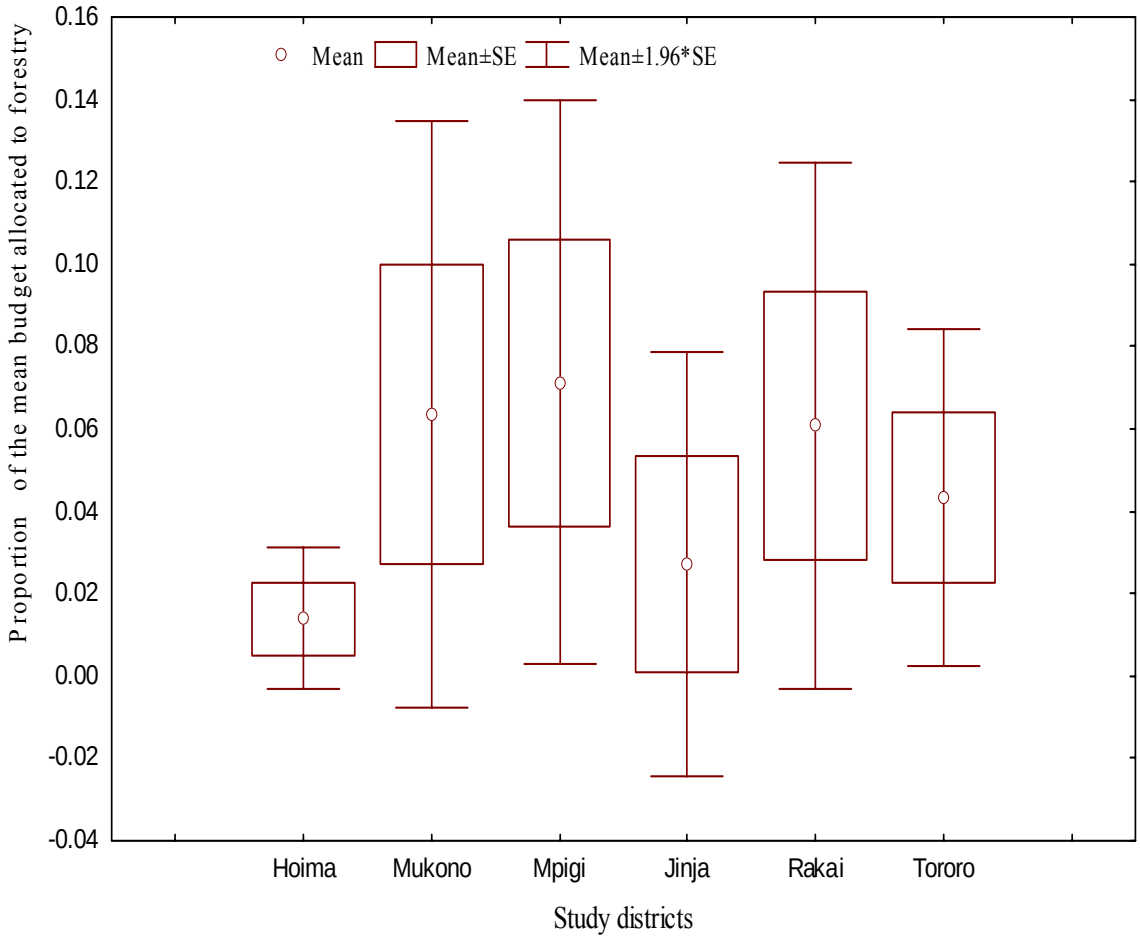


Figure 3.3.2 Box-plot of funds allocated to forestry by district governments in Uganda for the financial year 2002/3.

3.3.8 Respondents' opinions on the capacity to undertake decentralised forest governance

The majority of the respondents (72.5%, n=236) said that their organisations had the capacity to manage decentralised forest resources, while 27.5% indicated that local organisations did not have adequate capacity. The reasons given by respondents for this are presented in Table 3.3.7. The organisational affiliation of the respondents was significantly associated with their opinions on the availability of capacity to manage decentralised forests (χ^2=15.95, df=5, p<0.05). Most respondents from sub-county governments (74.3%) said that local organisations had better capacity to manage decentralised forest resources than from district governments (21.1%), CBOs (1.8%), NGOs, and cultural and religious organisations (1.2%), and research institutes (0.6%). The position of the respondent in the organisation was also associated with the opinions of the respondent's on the capacity to manage decentralised forests (χ^2=13.041, df=4, p<0.001). Most elected officials (73.1%) said that local organisations have better capacity to manage decentralised forest resources compared to civil

servants (21.6%), development workers (3.5%), and cultural and religious workers (1.2%) and researchers (0.6%).

Table 3.3.7 Reasons given by respondents for having and not having the capacity to manage forest resources amongst local organisations in Uganda (Percentages may total over 100 due to multiple responses)

Variable	% Response
Reasons for having capacity to manage forests (N=171)	
Close proximity to the forest resource	37.4
Feel a sense of ownership of the forest	34.5
Presence of legally empowered Production and Environment Committees (PECs)	28.7
Availability of self-motivated groups and civil society organisations	22.8
Availability of technical staff	21.6
Willingness of local leaders	16.9
Presence of networking amongst organisations	10.5
Availability of security personnel	6.4
Available indigenous knowledge on forest resource use	5.8
Have power to hire and fire personnel	4.1
Reasons for not having capacity to manage forests (N=65)	
Lack of trained staff	64.6
Inadequate finance	53.8
Corruption amongst local government personnel	40.0
Lack of awareness on forest issues amongst local authorities	16.9
Lack of legal mandate to manage forests	7.7
Forests face degradation and overexploitation to generate funds	4.6

The source of funding available to an organisation significantly influenced the opinion of the respondents working in the organisation about the capacity to manage decentralised forest resources (χ^2=15.9, df=3, p<0.05). The majority of respondents from organisations supported by central government finances (72.5%) said that local organisations have the capacity to manage forest resources compared to respondents from organisations supported by locally generated revenues (23.4%), aid agencies (3.5%) and sale of forest products (0.6%). The presence of byelaws regulating forest use in an organisation was significantly associated with the capacity of organisations to manage forest resources (χ^2=9.63, df=1, p<0.05). More respondents from organisations that had forest byelaws (83.2%) indicated a capacity to manage forests than in organisations without byelaws (26.6%). There was no significant relationship between respondents' opinions on the capacity of organisations to manage decentralised forest resources and the presence of technical staff (χ^2=0.76, df=1 p>0.05), information assets (χ^2=1.758, df=1, p>0.05) and physical assets in local organisations (χ^2=0.268, df=1, p>0.05). The educational level did not influence respondents' opinions about the capacity to manage decentralised forest resources (χ^2=0.712, df=2, p>0.05). Most

respondents were generally literate with post-primary level of education. They were therefore able to critically analyse of their organisations' capacity to manage decentralised forests.

3.3.9 Constraints on decentralised forest governance by local organisations

Inadequate finance and lack of awareness on the importance of forestry by communities were mentioned by respondents as the most critical constraint on the implementation of decentralised forestry activities (Table 3.3.8).

Table 3.3.8 Constraints on the implementation of decentralised forest governance amongst local organisations in Uganda (N=236)

Constraint (s)	DGs (N=47)	SCGs (N=169)	NGOs (N=8)	CBOs (N=7)	RI (N=3)	CR (N=2)	Total (N=236)
Inadequate finance	32 (68)	88 (52)	6 (75)	4 (57)	2 (100)	2 (67)	134 (57)
Lack of awareness	25 (54)	74 (44)	6 (75)	5 (71)	1 (50)	1 (33)	112 (48)
Inadequate staff	17 (36)	71 (42)	3 (38)	3 (43)	1 (50)	1 (33)	96 (41)
Insecure land and tree tenure	14 (30)	39 (23)	1 (1	1 (13)	2 (29)	0	57 (24)
Inadequate field equipment	11 (23)	40 (24)	2 (25)	1 (14)	2 (100)	0	56 (24)
Inadequate delegation of authority	15 (32)	35 (21)	0	0	0	0	51 (22)
Lack of collaboration with the Forest Department staff	9 (19)	31 (18)	4 (50)	1 (14)	0	1 (33)	46 (20)
Inadequate inputs	3 (6)	34 (20)	0	1 (14)	1 (50)	0	39 (17)
Long rotation of trees	4 (9)	27 (16)	0	0	0	0	29 (13)
Poor staff motivation	7 (15)	20 (12)	0	1 (14)	1 (50)	0	12.3
Others	6 (13)	18 (11)	2 (15)	3 (43)	0	0	(19 (12)

DGs=District governments, SCGs=Sub-county governments, CR=Cultural and religious institutions.
Numbers in the parenthesis represent percentage of responses (Percentages may total over 100 due to multiple responses).

Other limitations were hostility from armed illegal forest users, poor weather conditions that affect tree planting, pests and diseases, fires, grazing, and cultural aspects associated with tree planting.

3.4 Discussion

3.4.1 Human resources for implementing decentralised forest governance

Nearly all the organisations experience inadequate human resources for implementing decentralised forestry. However, local organisations addressed the problem of inadequate human resources by building and establishing networks with other organisations and shared professional expertise to complement their capabilities. Merely having resources does not guarantee that forestry related activities would be effectively managed, and does not mean that capacity to effectively manage forests exists. This depends on the way in which resources are organised, managed, and utilised over time amongst local organisations. According to Farrington and Bebbington (1993), building linkages amongst local organisations enhances

professional and technical capacity in the provision of services to local communities. While NGOs, CBOs, research institutes, and cultural and religious institutions had limited human resources, they strategically encourage voluntary community participation in their programmes. They also pay better salaries and give other benefits to motivate hard work among staff (Lane, 1995). Volunteers significantly add thrust to programmes, provide fresh ideas and strong links with communities because they are an integral part of the community (Lewis and Lewis, 1983). This makes them capable of responding better to many challenges than the central government Forest Department.

In most decentralised sectors, sub-county and district governments recruit their own staff to provide services, but this has not been the case with the forestry sector due to inadequate decentralisation of forest governance. The management of decentralised forest resources in local governments is done by staff delegated from the central government, who are central in exercising counter-powers against local governments who hold powers over decentralised forest resources. The challenge facing local governments is the availability of accountable technical forestry staff, although analysis of the documents available in most organisations showed staff recruitment as a priority for forestry investment. As suggested by Turner and Meer (2001), local organisations benefit from investment in personnel because the availability of trained staff strongly influences future capacity and capability of local organisations to carry out forestry work. A key feature of the implementation of decentralised forestry in Uganda should be the quality and quantity of human resources because limited professional capacity hinders decentralised service delivery (Soetarto *et al*., 2001; Johnson, 2002).

3.4.2 Facilities and equipment for decentralised forest governance

The result shows that local governments were relatively well equipped with motorcycles, which may be because most decentralised field activities are handled at the local level. Motorcycles are considered as the most appropriate means of transport due to their manoeuvrability in rural roads and their efficiency in fuel consumption. The findings from this study further show that physical resources such as computers, communication facilities, and transport equipment were limited in local organisations (Table 3.3.2). Local organisations need transport and communication equipment for them to effectively monitor forest resources. In addition, access to computers, telephone and Internet services is essential for linking field teams, networking and to access new information on forest management systems. Analysis of documents and budgets of local organisations, however, showed

equipment to be among the priority areas for forestry investment. As suggested by Kowero and Spilsbury (1997) and Naka *et al*. (2000), investment in equipment and computerised database systems enables communication with the outside world and would benefit local organisations in implementing decentralised forestry.

3.4.3 Information assets

Information assets such as reports on forest resource use, maps of forests, forest policy and legal documents were not readily available in most organisations (see Subsection 3.3.3). However, NGOs, CBOs and research institutes had access to policy and legal documents relating to forest use and management, partly because they require information about existing policies to enable them plan activities that complement national policies and programmes. By contrast, district and sub-county governments were equipped with monthly and periodic reports on forest management and revenue generated from forest resources. These documents were provided by the Forest Department staff supervised by local government officials. It was noted that sub-county and district governments constitute Production and Environment Committees, whose members frequently meet Forest Department staff on the management of forest resources. Each organisation had an integrated work plan encompassing activities undertaken, including forestry. Most NGOs, CBOs and research institutes have taken a step further to develop, share and distribute visual materials such as posters, calendars, pamphlets, and leaflets about forest resource use and environmental management practices to communities. Free flow of information amongst stakeholders involved in forestry is an indicator of successful community based forest management (Dolon, 2003; Linde *et al*., 2001). Information about forest resource management is one of the critical assets where local organisations need to invest if they are to effectively govern decentralised forest resources.

3.4.4 Fiscal resources

Most funding for local governments was in the form of conditional, unconditional and equalisation grants from the central government, as well as donations from NGOs and aid agencies (see Tables 3.3.3 and 3.3.5). The unconditional grants support decentralised services at the discretion of local governments, while conditional grants fund national priority programme areas and the conditionalities are mutually agreed between the central and local governments (Government of Uganda, 2001; Onyach-Olaa, 2003). Consequently, the conditions frequently attached to these transfers limit local autonomy and undermine genuine local decision-making in local governments (Francis and James, 2003). As noted by Obwona

et al. (2000), conditional grants are the principal means through which the central government influences local government policies and programmes because it decides specific priority areas for these allocations. The other sources of revenue to the district and sub-county local governments are from local sources. These include taxes (graduated tax and property tax), user charges (trade licences, permits, and market dues), asset disposal and fines. The amount of revenue generated from local sources was generally low, contributing less than 10% of the total budget for most district governments to cater for decentralised services, including forestry activities (Table 3.3.5). This is one of the critical constraints to effective decentralised forest governance in local governments because funds are needed for staff training, recruitment and payment of their salaries, mobilisation of communities and purchasing of field equipment. Thus, implementation of new forest policy initiatives, including decentralisation of forests, requires additional financial resources to local organisations because failure to provide adequate funds results in slow adoption of new policies.

Forestry was also another source of revenue to local governments (see Table 3.3.4). This shows that decentralised forest management is beneficial to local authorities because forest management can pay for itself through the income generated from sale of forest produce. The fact that forests generate income implies greater opportunities for local organisations to improve the management of forest resources through the redistribution of forest resource control and by reinvesting the money back into forestry (Larson, 2003).

The results show that NGOs, CBOs, and research institutes received funding for their activities mostly from NGOs and international aid agencies. Financial support from donors highlights the role of the international community in facilitating devolution in Uganda. However, reliance on donor funding is unsustainable for decentralised forest governance and may affect the activities of local organisations in case the donor funds are withdrawn. As Ashley and Roe (1998) reported, withdrawal of donor funds negatively impacted on organisations involved in the management of wildlife resources in the southern African countries. Thus, effective decentralisation of forest resources requires long-term financial commitments not only from central governments and donors, but also requires local organisations to devise their own internal sources of revenue (Larson, 2003).

3.4.5 Allocation of funds for decentralised services

Results from this study show that most district governments commit more funds to forestry than the actual revenue generated from forest resources (see Table 3.3.4). The operational activities at the District Forest Offices and salaries of the District Forestry Staff were fully supported by local governments using locally generated revenue. This indicates the commitment of local governments in supporting decentralised forestry. However, the central government does not adequately transfer adequate fiscal resources to local governments and community organisations for forestry development. As a result, forestry activities under their jurisdiction go without supervision for long periods of time and cases of forest degradation are seldom followed up. The central government's contribution was too small to sustain the operational activities of the District Forest Office and was used to buy office stationary and to pay telephone bills. The low central government fiscal contribution to forestry shows the reluctance on part of the central government to improve the capacity of local governments and other community based organisations in the implementation of decentralised forestry services. This implies that the central government transferred extra responsibilities to local governments to manage forest resources on its behalf without providing adequate resources. According to Fisher (1999), giving local government units responsibilities without resources commensurate with additional responsibilities renders them unable to effectively manage forest resources. Unlike health and education, forestry is not considered a national priority programme (Onyach-Olaa, 2003). Discussions with local authorities revealed that other social service sectors like finance and planning, as well as management and support services, are allocated more funds than forestry in local governments because of the perceived immediate social benefits to the local people served by local governments. This shows that local organisations prioritise basic social services programmes above production programmes like agriculture and environmental protection programmes like forestry.

In Uganda, forests are typically undervalued economically and viewed as resources to be exploited to feed other economic sectors. In the financial year 2002/3, 1.1% of the national budget was allocated to support forestry activities (Government of Uganda, 2002). Local governments and other community organisations also develop work plans and budgets that reflect the national priorities and objectives. Forestry is often allocated less money because the central government does not recognise forestry as a priority sector. As a result, forestry activities at the local level lag behind other decentralised sectors because the revenue base for most local governments is weak to support all decentralised sectors, including forestry. The

importance of the forestry sector needs to be reconsidered and accorded the same priority as other sectors because of the socio-economic and environmental benefits of forests, with over 90% of Ugandans depending on woody biomass for energy (Jacovelli, 1999; MWLE, 2001).

According to Obwona *et al*. (2000), withholding central government support to local governments generates uncertainty in the funding environment for local governments by creating serious strains on the locally generated revenue. This, as a result, hinders their capacity to promote forestry activities prescribed under the Uganda Forest Policy. To be effective in implementing decentralised forest governance, local governments require a larger share of the national budget (Francis and James, 2003). While local organisations are supposed to generate their own funds, outsourcing for funds need skills in mobilising financial resources (Larson, 2003). Thus, the national government should take a leading role in empowering local organisations with skills in mobilising financial resources for forestry development. Studies carried out in Colombia (Fizbein, 1997) and Nicaragua (Larson, 2002) emphasise the importance of financial support from national to local governments for effective delivery of decentralised forestry services.

The findings from this study show that forestry sector received more funds in NGOs, CBOs, and cultural and religious institutions (Table 3.3.6). This is partly because these organisations are initiated with local communities and have a direct bearing on the needs of local people as well as a strong focus on conservation and sustainable development (Farrington and Bebbington, 1993; Lane, 1995). Thus environmental protection takes priority when they are allocating money for activities. In addition, these organisations operate independently from the State in implementing their programmes and actions (FAO, 2001, 2003).

3.5 Conclusions and recommendations

3.5.1 Conclusions

1) Nearly all the organisations experience inadequate human resources trained in forestry, equipment and facilities for planning and implementation of decentralised forestry activities.
2) Local organisations were aware of the barriers and threats to decentralised forestry, and had strategic plans to invest in human resources and equipment. In addition, local organisations mobilised and managed own revenue from local sources such as taxes and negotiated for a share of funds from the central government for decentralised

service delivery. However, locally generated funds, particularly the local taxes were low yielding to make any substantial contribution in the promotion of the forestry sector.

3) Funds from the central government and international aid agencies dominate the revenue base of local organisations involved in the implementation of decentralised forestry. Thus, local governments and support organisations planned most of their activities according to the conditions set by the national government and donors, and this limits their autonomy to plan and take into account their local priorities, including forestry.
4) Institutional capacity to implement decentralised forest governance existed in local organisations through established networks with other actors at local, national and international levels. In addition, local governments constitute democratic and downwardly accountable members that are important in mobilising people and resources for forestry.
5) Another important milestone is the potential of local organisations to formulate, approve and implement local budgets, draw up integrated development plans that incorporate forestry.
6) Forestry is undervalued and not considered a national priority sector and therefore allocation of funds to forestry, both at local and national government level is inadequate compared to other decentralised services.
7) Lack of fiscal commitment and collaboration from the national government and inadequate human resources, equipment and facilities reduce the effectiveness of local organisations to implement decentralised forest governance in Uganda.

3.5.2 Recommendations

(i) Considerable planning in local governments and support organisations need to go into recruitment of more technical and accountable staff.

(ii) There is a need for the national government to allocate conditional grants to back up the locally generated revenue in local governments specifically for forestry development as it is done for the other decentralised services like health, education and agriculture.

(iii) Local governments and support organisations need to mobilise own resources, balance donor support and integrate donor financed projects into their development plans. The national government needs to take a leading role in

empowering local organisations with skills in planning and mobilising financial resources and facilities for forestry development.

(iv) There is a need for the national government to reinvest a greater proportion of the revenue accruing from forest resources back into forestry development instead of funding other national programmes. This will stimulate local governments and support organisations to commit adequate budgetary support to the forestry sector.

(v) There is a need for proper valuation of Uganda's forest resources in relation to their social and economic contribution. This will encourage commitment of fiscal and human resources to forestry amongst actors at local and national government levels.

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CHAPTER FOUR

THE ROLE OF THE FOREST DEPARTMENT IN DECENTRALISED FOREST MANAGEMENT IN UGANDA

4.1 Introduction

Up to the mid-1980s, most of the efforts of the Forest Department were geared towards control of logging, revenue collection, and protection of the country's forest estate from fire and illegal users, with the former receiving the bulk of the Forest Department's attention (Kamugisha, 1997). This was based on conventional training of the Forest Department staff as foresters rather than specialists in both technical and socio-economic aspects of forestry. Their training primarily emphasised commercial forestry and protection of timber species for profit optimisation. The administrative infrastructure that was developed during the colonial times proved inadequate in the postcolonial era. According to Hobley (1996) and Palit (1998), decentralisation policies have brought changes in social, economic and political environments, some of which have seriously undermined the bureaucratic authority of most State forestry departments. As a result, most forest departments have begun to recognise and acknowledge that participation and cooperation with communities leads to sustainable economic and environmental benefits from planned forest use (Turyahabwe, 1997; Robertson and Lawes, 2005).

Trust building and overcoming scepticism of state forest departments are essential for developing partnerships with community based organisations in the management of forest resources (Headley, 2003). Forest departments need to facilitate the transition from state control to decentralised forest management by discussing management needs, local community concerns and priorities with local organisations. Gronow (1995) and Wily (2000) reported that transferring power to control decision-making over forests to local authorities has the potential to increase the supply of forest products to local communities through greater access and better management of forest resources. Greater control of forest resources can empower and legitimise local government by providing revenues and giving local authorities the powers to make decisions over resources on which local people depend (Ribot, 2003).

Decentralised forest governance in Uganda began in 1938 with a law that established the Native Government Forestry to manage native forest reserves that were renamed local forest

reserves (LFRs) in 1947 (Forest Department, 1955). The Local Administrators were empowered to make rules regulating the use of LFRs. The Native Government Forestry was considered beneficial since it encouraged local people to take an interest in the management of forests within their jurisdiction. The powers to govern native forests were entrusted to the Governor. For example, the Governor could revoke the existence of a native forest reserve irrespective of the interests of the local administrators. However, the powers given to the Governor seemed inappropriate because it made the Local Administrators virtual tenants, a situation that led to over-exploitation of some of the national forests due to insecurity of tenure (Kamugisha, 1993). In 1967, statutory instrument No. 67 abolished local forest reserves and converted those established hitherto into central forest reserves (Hamilton, 1984). Thereafter, Local Administrators were no longer allowed to undertake any forestry work, except maintaining a few village forests, which were not affected by the statutory instrument. Up to that time, the central government and local administration forest services had developed parallel organisations. This change in legislation was welcomed by everyone interested in forestry, including most of the staff of the former District Administration forestry services. They believed that this would ensure efficient and rational development of forestry resources throughout the country.

Since 1986, the government of Uganda has been actively advocating for decentralised governance of natural resources, including forestry (Bazaara, 2001; MWLE, 2001a). The government recognises local organisations as key players in the development of the forestry sector. Accordingly, the local government has been mandated to manage a small portion of the forest estate designated as local forest reserves (Government of Uganda, 1998). The aim is to empower local governments to outsource funding for forestry, and to encourage more farmers, communities and private individuals to participate in sustainable management of forest resources. Scott (1998) and Bazaara (2001) have reported that the Forest Department can help to build partnerships with other stakeholders in the management of forest resources.

Given the shift in institutional changes within Uganda's forestry sector, the role of the Forest Department in the implementation of forestry activities is essential. However, its role in facilitating decentralised forest governance has not been documented. In addition, there is limited information on the strategies used by the Forest Department to empower local organisations in effecting decentralisation of forests. The key question is whether the Forest Department supports the need for change from centralised to decentralised forest management and what is its role in the process. The overall objective of this study was to assess the extent

and role of the Forest Department as a central government agency in fostering local forest governance.

The study was guided by the following research questions:

(i) How effective is the Forest Department in providing support and advice to established local organisations in the implementation of decentralised forestry?

(ii) Is the Forest Department supporting the need for change from central to decentralised governance of forest resources?

(iii) Are there partnerships or linkages between the Forest Department and local organisations geared towards the sustainable management of forest resources?

(iv) Are there conflicting roles between the Forest Department and local organisations involved in decentralised forest management?

4.2 Methods

4.2.1 The study area

The study was conducted between August 2002 and February 2003 in Mpigi, Mukono, Rakai, Hoima, Jinja and Tororo districts, constituting 11% of the total number of districts in Uganda (Figure 1.1). The biophysical and demographic characteristics of the study districts are presented in Table 1.3.

4.2.2 Data collection

In each district, four Forest Department staff were randomly selected from a staff list provided by the District Forest Office and interviewed for this study, thus making a sample total of 24 Forest Department staff i.e. 49% of the total number of forestry officials in the study districts. The Forest Department staff were interviewed using a questionnaire (Appendix 4.1). Interviews focused on the ways in which the Forest Department involves local community organisations in decentralised forest management, the Forest Departments' strategies to empower local actors, and opportunities and constraints for the implementation of decentralised forestry activities. In-depth key informant interviews were held with staff from local organisations involved in forestry related activities and operating at the district and sub-county levels to ascertain the ways on how they work with the Forest Department in the implementation of the forest policy under decentralisation. The Forest Department records as well as policy and legal documents on forest resources management in Uganda were reviewed

to confirm budgets, institutional conditions and framework for the implementation of decentralised forest governance.

4.2.3 Data analysis

Questionnaire responses were collated and summary statistics calculated for all variables using SPSS version 10.0 (SPSS, 2000). Chi-square tests were performed to establish the relationship between the educational qualification of respondents, the position they occupy in the Forest Department and their attitudes towards devolution of forest management. Chi-square tests were used to show the relationship between the occurrence of conflicts and the district where the respondent work and the duration of service by respondents. The significance of the explanatory variables was assessed by the likelihood ratio statistics (Pearson chi-square distribution) and significance tested at 5%.

4.3 Results

4.3.1 Profile of the respondents

Of the 24 respondents, 33% were Forest Officers, 50% Forest Rangers and 17% Assistant Forest Officers. All the respondents had had formal forestry training. About 50% of the respondents were diploma holders, 37.5% had degrees, while 12.5% had certificates in forestry. The majority of the respondents (79.2%) had undergone refresher courses in participatory forestry techniques, while 20.8% had only forestry training. The high number of respondents that have knowledge of participatory forestry suggested that they understood the implications of devolution of forest management. The number of years served ranged from one year to 10 years, with an average of 5.4 years. The average period that respondents had served in the study districts was thus considered enough for them to understand the socio-economic and political situation in relation to decentralisation of forest resources.

4.3.2 Forest Department's interventions for decentralised forest governance

The traditional forestry activities of forest resource monitoring and tree nursery establishment and management were mentioned by respondents as the major activities undertaken by the Forest Department (Table 4.3.1). Other activities such bee-keeping, energy conservation and tourism development that are meant to alleviate poverty received less attention.

Table 4.3.1 Responses to the question about roles and responsibilities of the Forest Department staff in implementing decentralised forest governance in Uganda (N=24)

Roles and responsibilities	% Response
Forest resource monitoring (patrols)	95.8
Tree nursery establishment and management	87.5
Environmental education and awareness	83.3
Promotion of tree planting (agroforestry) with households, schools, and private institutions	79.2
Maintenance of forest boundaries	79.2
Collection of revenue from forests	58.3
Promotion of collaborative forest management	50.0
Training of local authorities in forestry planning (development of work plans)	41.7
Promotion of ecotourism and biodiversity conservation	41.7
Promotion of energy conservation technologies	37.5
Promotion of bee keeping	12.5

Note: Percentages may total over 100 due to multiple responses.

4.4.3 Linkages to manage decentralised forest resources

The most important linkages mentioned by respondents were provision of technical advice on forest management matters (87.5%), sharing of information about forest management (70.8%), supply of forestry inputs (41.7%), and joint planning of forestry activities (29.2%). The most common collaborators mentioned by the respondents were district local governments (94.4%), non-governmental organisations (83.3%), community based organisations (72.2%), and sub-county local governments (38.9%). About 23% of the respondents mentioned state departments, private entrepreneurs, research institutes, and cultural and religious organisations as collaborators.

4.4.4 Incentives for the Forest Department to work with local organisations

The most important factors mentioned by respondents that motivate the Forest Department to work with local organisations in the implementation of decentralised forestry were similar interests in conservation, available financial resources in local organisations and sharing of a common vision to fight poverty (Table 4.3.2).

Table 4.3.2 Incentives listed by respondents as reasons for collaboration between the Forest Department and local organisations in the implementation of decentralised forestry in Uganda (N=24)

Incentive (s)	% Response
Similar interests in conservation of forests	91.6
Financial support from local organisations	83.3
Sharing of a common vision for fighting poverty amongst communities	79.2
Moral support found in local organisations	54.2
Availability of security personnel in local organisations	45.8
In kind support from local organisations	37.5
Presence of shared facilities in local organisations	25.0

Note: Percentages may total over 100 due to multiple responses.

Most of the operational funds for the District Forest Offices were provided by the district local government (Table 4.3.3).

Table 4.3.3 Financial allocation (Uganda Shillings)* for decentralised forestry by the local and central government in Uganda for the financial year 2002/2003

District	District government's contribution	Central government's contribution	Total allocation
Hoima	56,545,372	200,000	56,745,372
Mukono	34,699,000	200,000	34,899,000
Mpigi	28,255,000	150,000	28,405,000
Jinja	2,000,000	200,000	2,200,000
Rakai	3,720,000	100,000	3,830,000
Tororo	2,707,021	100,000	2,807,021

*1US$=1900 Uganda shillings in 2003.

The central government allocated less than 1% of funds to the District Forestry Offices in the financial year 2002/2003.

4.3.5 Devolution of decision-making powers for decentralised forest management

The monitoring of forest resources against illegal forest users and formulation of forest byelaws were mentioned by respondents as the most important decision-making powers devolved to local organisations for decentralised forest governance (Table 4.3.4).

Table 4.3.4 Responses on decision-making powers devolved to local organisations for managing decentralised forestry resources in Uganda (N=24)

Activity (s)	% Response
Monitoring the forest resource	62.5
Making of forest byelaws	50.0
Apprehending forest offenders	33.3
Impounding equipment and tools from offenders	33.3
Issuing permits to forest users	8.3
Prosecuting forest offenders	8.3

A few respondents (8.3%) said that powers to issue permits and prosecution of forest offenders were decentralised to local organisations.

4.3.6 Attitudes of the Forest Department staff towards decentralised forest governance

More than half of the respondents (58.3%) thought that local organisations have no capacity to manage decentralised forest resources, while 41.7% felt otherwise. The reasons given by respondents for and/or against the decentralisation of forest management to local organisations are summarised in Table 4.3.5. The lack of technical knowledge in forestry matters amongst local organisations was given by respondents as the main reason why they do not support decentralisation of forest management.

Table 4.3.5 Reasons given by respondents for their support or lack of support for the devolution of forest management in Uganda

Reason (s)	% Response
Reasons given against devolution of forest management (N=14)	
Lack of technical knowledge on forestry matters in local organisations	85.7
Lack of adequate financial resources in local organisations	78.6
Overexploitation of forest resources to generate revenue in local organisations	71.0
Lack of adequate physical infrastructure and facilities in local organisations	64.3
Reasons given in support of devolution of forest management (N=10)	
There is financial support to the Forest Department from local organisations	80
Ability to employ staff in local organisations	40
Forests can generate revenue for the local governments and sustain themselves	30
Available security personnel for monitoring forests in local organisations	30

Note: Percentages may total over 100 due to multiple responses.

The positions held by the respondents in the forestry sector influenced their opinions on the decentralisation of forest management (χ^2=10.63, df=1, $p<0.05$). A larger number of the forest staff at the level of Forest Officers (80%) supported decentralised forest management than those at Assistant Forest Officer level (10%) or Forest Ranger level (10%). The educational qualification of the respondents influenced their support for decentralised forest management (χ^2=13.53, df=2, $p<0.05$). The majority of the respondents holding degrees in forestry (90%) supported decentralised forest management. In addition, attendance of in-service forest training significantly influenced respondent's support for decentralisation of forest governance (χ^2=4.51, df=1, $p<0.05$). More than half of the respondents (52%) who had attended participatory forestry management training showed support for decentralised forest management.

4.3.7 Conflicts in implementing decentralised forest governance

Nearly two-thirds of the respondents (62.5%) said that there were conflicts between the Forest Department and local community organisations in the management decentralised forest resources. The major conflicts mentioned by respondents were collaboration between the local politicians and illegal forest users to plunder forests and unequal sharing of revenue from forest produce between the local authorities and the Forest Department (Table 4.3.6). The conflicts between the Forest Department and other actors over decentralised forest governance varied significantly among the districts of the respondents (χ^2=10.13, df=5, p<0.05). More respondents from the districts of Tororo and Rakai (26.7%) reported conflicts than from the districts of Mukono (20%), Mpigi (13.3%), Jinja (6.7%) and Hoima (6.7%).

Table 4.3.6 Conflicts said by the respondents to exist amongst stakeholders involved in decentralised forest governance in Uganda (N=15)

Type of conflict (s)	% Response
Politicians collaborating with forest offenders	86.7
Inequitable sharing of revenues from forest produce	66.7
Lack of clear tenure of forest produce from private forests and trees growing on private land	53.3
Overlapping authority and unclear chain of command between local councils and the Forest Department staff	33.3

The position held by the respondent was associated with conflicts (χ^2=4.80, df=2, p<0.05). Furthermore, respondents that had served for more than five years in a district reported more conflicts (93.3%) than those that had served for a shorter period (6.7%)(χ^2=5.4, df=2, p<0.05). Respondents at the level of a Forest Ranger were more likely (46.7%) to indicate conflicts between the Forest Department and other actors over decentralised forest governance than staff at the level of Forest Officer and Assistant Forest Officer (26.7%), respectively. Unequal distribution of forest resources is reflected in the sharing of the revenue generated in the financial year 200/2002. The central government took 60%, while local governments were left with 40% of the total revenues (Table 4.3.7).

Table 4.3.7 Distribution of revenue (Uganda shillings)* generated from forestry between the districts and central government in Uganda for the financial year 2001/2

District	Total revenue	Central government share (60%)	Local government share (40%)
Hoima	133,958,368	80,375,021	53,583,347
Mukono	83,605,782	50,163,469	33,442,312
Mpigi	42,273,126	25,363,876	16,909,250
Jinja	6,098,683	3,659,210	2,439,473
Rakai	1,384,153	830,492	553,661
Tororo	8,593,616	5,156,170	3,437,446

Source: Forest Department (2002). *1US$=1900 Uganda shillings in 2003.

4.4 Discussion

4.4.1 The role of the Forest Department in decentralised forest governance

The implementation of state-centred forest management policies that primarily target increasing revenue through commercial timber exploitation and protection of the country's forest estate from illegal users dominate the activities of the Forest Department. The incorporation of social and economic needs of local users through collaborative forest management, agroforestry, tree planting and ecotourism development was still at the infant stage (see Table 4.3.1). Collaborative forest management through partnerships with local forest users were at pilot stage in the Nabbanga and Mabira Forest Reserves in the Mukono District, the Sango Bay Forest Reserve in the Rakai District, the Mpanga Forest Reserve in the Mpigi District, and the Tororo Plantation Forest Reserve in the Tororo District (Republic of Uganda, 2002). Furthermore, the Forest Department promoted ecotourism in some forest reserves to provide alternative sources of income for local people. These included the Mabira Forest in the Mukono District, the Mpanga Forest in the Mpigi District, the Musumbwa Islands in the Rakai District, and the Itanda Falls in the Nile Bank Forest Reserve in the Jinja District. The findings imply that there is some effort from the Forest Department to invest in activities that have the potential to improve the livelihoods of local people, while at the same time protecting forest resources. According to Scott (1998), collaborative forest management can promote equitable sharing of benefits from the management of the resource and helps to build community support in the management of forest resources.

The Forest Department provides technical backstopping in private tree planting in degraded forest reserves, and in the establishment of peri-urban fuelwood plantations at a nominal fee. The trees belong to individuals while the Forest Department owns the land as outlined in the Uganda Forest Policy of 2001 (MWLE, 2001a). The policy mandates the Forest Department staff to build partnerships with local organisations in private tree planting as a way of reducing pressure on natural forest resources. Environmental education is an important programme of the Forest Department aimed at creating awareness amongst various forest stakeholders about the importance of forest resources to people's livelihoods (MWLE, 2001b). The Forest Department trains local people in the use of efficient fuelwood cooking devices and in the efficient use of woodfuel in anticipation of the future woodfuel deficit in the country. As suggested by Kaarhus *et al.* (2003), awareness campaigns through public education often create public interest in the efficient use and management of forest resources.

4.4.2 Linkages between the Forest Department and local organisations for decentralised forest governance

A range of organisations are linked to the Forest Department to manage decentralised forest resources by providing inputs such as seed, seedling, and nursery equipment, and technical advice and information (see Subsection 4.3.3). The Uganda's Forest Policy of 2001 (MWLE, 2001a) and the National Forest Plan of 2002 (MWLE, 2002) emphasise collaboration between the Forest Department and actors in the management of forest resources to maximise resources and to enable local communities benefit from community conservation programmes. Information is exchanged through meetings, field visits, and workshops. Linkages facilitate the development of integrated forestry activities through commitment of technical and financial resources amongst actors. A recent study by Andersson (2003), indicate that linkages amongst organisations can provide opportunities for enhancing staff skills and exchange of technologies and also reduce operational costs. However, efforts to plan and jointly implement forestry activities between the Forest Department and local organisations in Uganda are minimal. Successful implementation of decentralised forest management needs collaborative and integrated planning by the Forest Department and local organisations (Edmunds and Wollenberg, 2003).

This study has shown that financial support from local organisations is an important incentive motivating collaboration between the Forest Department and local organisations in implementing forestry activities. For example, the District Forest Offices received most funding from district governments (Table 4.3.3). Furthermore, local organisations, particularly NGOs, are considered by the Forest Department to be well funded and to have better facilities than State Forest Department (Byarugaba, 2002). Thus resources from local governments complement the activities of the Forest Department such as tree planting and mobilising forest users and community members to participate in forestry activities.

4.4.3 Powers devolved to manage forest resources

Although the interviewed respondents indicated that decentralisation has given local governments and community based organisations decision-making powers over forest resources, the findings from this study show that Local Councillors rarely participate in key activities such as revenue collection from forest resources (Table 4.3.4). According to the National Forest and Tree Planting Bill of 2003 (Government of Uganda, 2003), Local Councillors at the district and sub-county governments are mandated to apprehend illegal

forest users. They are also empowered to refer persons requiring permits and licenses to exploit forest resources to the district forest officers. The results demonstrate that most powers devolved to local organisations were limited to helping the Forest Department to monitor and enforce rules governing forest resource exploitation, while control of tenurial rights to forest resources had remained in the hands of the Forest Department. Giving local authorities responsibilities to monitor the forests, but limited powers to make decisions on tangible financial returns undermines their capacity to sustainably manage forest resources (Ribot, 2002, 2003). This partly explains why forests have continued to be illegally exploited. For effective local forest governance, local authorities and forest users should not be seen simply as informants, but must have rights to make decisions on how the forests are used (Ghimire and Pimbert, 1997).

According to Ahmed and Mahmood (1998) and Fisher (1999), the power to make decisions over valuable resources is an important factor that makes local organisations and representative bodies effective in the management of natural resources. Studies conducted in India (e.g. Hobley, 1996; Poffenberger, 1996; Conroy *et al*., 2002) and in various other countries, such as Nepal, Thailand and the Philippines (Arnold, 1998) also suggests that giving rights to local community organisations to make decisions over the management of forest resources makes them take collective responsibility in regulating forest resource use. Thus the Forest Department needs to recognise the rights of local authorities and their independence from the central government to make decisions over the use of forests if devolution is to be meaningful. This builds confidence and also creates incentives for them to invest in forestry.

4.4.4 Attitudes of forestry staff towards decentralised forest governance

While the Forest Department staff appreciate the purpose for decentralising forest governance, they consider local organisations as weak in implementing decentralised forest governance. They believe that local organisations lack adequate funds, technical staff and knowledge in forestry governance and that they will promote excessive forest exploitation to generate more revenues if forests are decentralised (Table 4.3.5). Such self-serving motives and personal interests from the Forest Department staff in maintaining control of forest resources as a State property are likely to fail the delivery of services to local communities and community organisations involved in the management of forest resources (Castro and Nielsen, 2001).

Following decentralisation, the legitimacy of interests and rights of the Forest Department to control forests remained unchanged. The same traditional foresters, without any reorientation in participatory forest management, are responsible for implementing decentralised forest governance. These findings reveals that many of the Forest Department staff are unaware of the relatively new policy changes and the concept of forest user participation in decentralised forest governance under the Uganda Forest Policy of 2001 (MWLE, 2001a). Thus, changes in attitudes of the Forest Department field staff are needed and this must involve retraining and modification of their work from directive activities to the stimulation of user participation and the recognition of local organisations as active participants in decision-making over forest resources. According to Ghimire and Pimbert (1997), successful implementation of decentralised forest management depends on the behaviour and attitudes of the forestry staff. Thus, mutual trust between the Forest Departments and local community organisations must be built and the Forest Department must consider the stake that local communities have in the management of their forest resources for effective implementation of decentralised forestry (Headley, 2003). This will help the Forest Department to overcome scepticism about local community involvement in forest management. It also enables the Forest Department to further develop and strengthen partnerships with community based organisations in the management of forest resources.

4.4.5 Conflicts in the implementation of decentralised forest governance

The findings from this study show that a political culture has infiltrated the management of decentralised forest resources (Table 4.3.6). It was noted that local politicians exert pressure on the Forest Department staff to grant permits and licences to indigenes, who are easy to manipulate. The overlapping authority between the Local Councillors of the local governments and the Forest Department staff affect the Forest Department in regulating forest resource use. The situation often worsens during elections because politicians protect forest offenders from being prosecuted as a strategy to mobilise votes from their constituencies. Overexploitation of forest resources with consent of State agents has also been noted in India (Robbins (2000) and elsewhere (Kaimowitz, 2003). Some Forest Department staff mentioned increased pressure from Local Councillors to increase revenue, hence more pressure to exploit forest resources. This situation makes the District Forestry Staff more vulnerable should they go against the wishes of the local politicians.

Another conflict arises from unequal sharing of revenue generated from forest resources between the Forest Department and local governments. As noted in Table 4.3.7, a greater

proportion of the revenue generated from the sale of timber and other forest produce are taken by the central government. The same problem was also mentioned by local government authorities (see Subsection 2.3.9). Records from the Forest Department show that in the financial year 2001/2002, the central government took 60% of the total revenue generated from central forest reserves (CFRs) in the financial year 2001/2 (Forest Department, 2002). Only 40% of the revenue was given to the local governments. Records available from District Forest Offices indicate that licensed timber dealers are not local residents, implying that exploitation of forest produce favours people outside the districts instead of the local people. This situation creates local resentment and makes local forest users become poachers instead of protectors of resources (Soetarto *et al*., 2001). According to Conroy *et al*. (2002), local organisations need a fair share and rights to forest revenue for them to participate in the protection of the forest resources. It also instils a sense of confidence and trust among local forest users and forest agencies.

Another source of conflict identified by respondents was lack of clear tenure over forest resources whereby commercial harvesting of forest produce from private forests, and other trees growing on farmers' land, requires a licence from the Forest Department (Table 4.3.6). Lack of secure ownership of trees and the fact that land owners have to acquire permits and licences for the use of forest produce on their own land discourages the participation of local communities in forestry programmes. As noted by Banana and Gombya-Ssembajjwe (1995) and Meijerink (1997), secure forest tenure is an important incentive that stimulates individuals and private sector involvement in forestry. Discussion with the Forest Department staff revealed that local communities are sceptical about investing money and time in forestry because they are not sure of their rights to control the use of forest products. This is a critical challenge to the Forest Department staff in the implementation of private tree planting under decentralisation. Well-defined property rights with respect to forest use motivate producers to make long-term investments and use harvesting techniques that permit sustained production of forest products and services (Ostrom *et al.*, 1993; Arnold, 1998; Watts, 2002).

4.6 Conclusions and recommendations

4.6.1 Conclusions

Based on the findings of this study, the following conclusions can be drawn:

1) Technical support to local authorities in forest management planning and collaborative forest management, tree planting, and forestry extension and environmental

awareness, supply of inputs, sharing of information and joint implementation of activities with local organisations are the approaches used by the Forest Department in facilitating decentralised forest governance.

2) Traditional forestry activities that primarily target increasing revenue from forest resources are still the most important activities promoted by the Forest Department.
3) There are negative attitudes towards devolution decision-making powers over forest management among the Forest Department staff due to their desire to retain State control of forest resources prompted by personal interests as well as professional scepticism about the ability of local organisations to accomplish decentralised forest governance.
4) Lack of secure forest and tenure, political patronage and corruption amongst actors who are charged with forest law enforcement hinder the Forest Department in facilitating decentralised forest governance.

4.6.2 Recommendations

1. There is a need for the Forest Department to retrain and reorientate its staff with participatory forest management skills that enable them work from directive to stimulative for successful implementation of decentralised forest governance.
2. There is also a need to clarify and reconcile the role of the Forest Department staff and local politicians in revenue collection, policing and regulation of forest resources. This would give local authorities some confidence to arrest and apprehend forest offenders as well as making budgetary commitment to forestry.
3. The existing collaboration between local organisations and the Forest Department need to be further strengthened and institutionalised. This would enable less endowed organisations to benefit from resource endowed organisations. It will also facilitate flow of forestry information amongst stakeholders.

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CHAPTER FIVE

STRUCTURE AND COMPOSITION OF THE FORESTS UNDER PRIVATE, LOCAL AND CENTRAL GOVERNMENT OWNERSHIP IN THE MPIGI DISTRICT, CENTRAL UGANDA

5.1 Introduction

An understanding of the plant community composition and ecological integrity of forests is central to sustainable forest management. As such, forest owners, private individuals, forest managers, and policy makers need to be fully informed about the floristic and structural composition, and ecological characteristics of the forests being managed not to compromise local, national and global biodiversity goals (Stork *et al*., 1997; Noss, 1999; Ehrlich and Kremen, 2001). A primary requirement is to have data on the condition of the forests. The condition of the forests can best be described by differences in physiognomic features, floristic composition and species diversity (Kent and Coker, 1992; Geldenhuys and Pieterse, 1993; Phillip, 1994; Toniato and Oliveira-Filho, 2004). According to Friedland *et al*. (2004), the floristic composition, structure and diversity of forests within a specific habitat vary from forest to forest depending on the degree of success by the management institution, the decisions from policy makers and the pressures of human resource use.

Studies on the management of common property resources (e.g. Ostrom, 1999; Braedt and Schroeder, 2003) noted that the regulation of forest resource use differs from one forest ownership regime to another. They further noted that harvesting operations applied in some forest ownership regimes are often more destructive and unregulated than in others because of differing rules and regulations applied by the forest agencies. Recent studies conducted in other parts of the tropics, for example, Huang *et al*. (2003) and Webb and Sah (2003) showed that forest management interventions that allow unregulated forest resource harvesting directly affect forest diversity and the vegetation structure, and influence the outcome of forest succession. Disturbances may lead to either increase or decrease in species diversity depending on the severity and the time since the disturbance occurred (Huston, 1994). For example, though massive disturbances can result in significant reduction of species diversity, there is strong evidence that frequent, less severe disturbances are necessary for the maintenance of diversity in some systems (Smiet, 1992; Kappelle *et al*., 1996). According to McIntyre and Lavorel (1994) and Wapstra *et al*. (2003), diversity and richness of a plant community change following human disturbances. Human consumptive activities may result

in depletion of specific plant species and leads to forest change (Norton, 1986; Myers, 1988; Repetto, 1988; Reid and Miller, 1989). Other studies (Geldenhuys, 2004) have shown human activities facilitate the regeneration of useful light demanding species, such as *Ocotea bullata*, *Prunus africana* and *Rapanea melanophloeos*, that otherwise would not be able to regenerate under the canopy of protected forests.

A multitude of management authorities, namely the National Forestry Authority (NFA), formerly the Forest Department, local government, cultural institutions and the private individuals currently control the management of the Mpigi forests in Uganda. Local governments are mandated to manage local forest reserves, while NFA controls central forest reserves and private forests are under private owners. As noted by Winter (1998), the goal of public forestry agencies, whether decentralised or centralised, is to control access and to regulate competition over forest resources. Without proper institutions to provide these plural functions of forest governance, the forest resource takes on the characteristic of an open access common pool resource.

In the Mpigi District, the rate at which forest resources are disappearing is of great concern to conservationists, policy makers, forest managers and local governments given that these forests serve as watershed protection areas for the water draining into Lake Victoria. They are also a habitat for two tree species unique to the district namely *Brucea antidysenterica* and *Psychotria succulenta*, and one species (*Rhytigynia beniensis*) endemic to the Albertine Rift (MWLE, 2002). The forests are under tremendous pressure from forest users for timber, fuelwood, building poles and non-timber forest products, and from agricultural encroachment, as well as demand for forest produce in the nearby Kampala City (Banana *et al*., 2001). These activities do not sustain forest potentials due to their negative impact on the conservation of the biological resources. Human interventions actively transform natural primary forests into secondary and managed ecosystems, and the like.

Previous biological inventory by Davenport *et al*. (1996) provide baseline data for the conservation of the Mpigi forests. Other studies (e.g. Gombya-Ssembajjwe, 1996; MWLE, 2002) have largely focused on timber exploitation and institutional changes. However, little attention has been paid to the impact of different ownership regimes on forest composition, structure and species diversity. In most of the Mpigi District forests, precise information is lacking on the impact of forest ownership on the floristic composition and diversity of plant communities and their ecological characteristics despite the fact that such information is

crucial for effective conservation of forest resources. The objective of this study is to assess the differences in floristics, composition and stand structure of the forests under private, local and central government management regimes. It was hypothesised that forests under private and local government management have high diversity and species richness compared to forests under central government management because of effective monitoring and rule enforcement. The key question addressed is whether local governments are capable of maintaining the condition (floristics and structure) of forests under their jurisdiction compared to private and central government agencies. This information is essential to plan effective management of decentralised forest resources in Uganda.

5.2 Methods

5.2.1 The study site description

Katabalalu and Makokolero central forest reserves, Wabirago and Kaswera local forest reserves, and Kaziro and Kasisira private forests belong to the Lake Victoria Crescent agro-ecological zone, in the Mpigi District, central Uganda (Figure 5.1). They lie between latitudes $0^{o}9'$S and $0^{o}24'$N and longitudes $31^{o}22'$ E and $32^{o}06'$E within a radius of approximately 120 km from Kampala, Uganda's Capital City. The criteria for selecting the forests took into account the following factors: (i) existence of some documented information such as maps and work plans on past and present management practices in the forests; (ii) personal communication from the Forest Department staff about the previous and current management practices of the forests; (iii) differing ownership to capture the history of governance and property regimes under which forests are held in Uganda i.e. private, local and central government ownership; (iv) agro-ecological zone to which the selected forests belong; (v) and the Mpigi District being among the districts that pioneered decentralised delivery of services in Uganda (MLG, 1997).

The study forests are broadly classified as tropical moist evergreen forests with closed canopies (Barbour *et al.*, 1987; Howard, 1991). They are also locally categorised as medium altitude *Piptadeniastrum-Albizia-Celtis* forests after the three typically dominant tree species in the area. According to Webster (1961), the dominant tree species were *Celtis africana, Celtis durandii*, *Parinari excelsa*, *Aningeria altissima*, *Morus lactea*, *Holoptelea grandis*, *Alstonia bonei*, and *Antiaris toxicaria*. The common upper storey trees are *Maesopsis eminii* and *Albizia sp*, while *Antiaris toxicaria* and *Aningeria altissima* are common emergent trees. *Trilepisium madagascariensis, Teclea nobilis* and *Funtumia africana* are the common under

storey trees, while *Leptapsis cochleata, Acalypha volkensii* and *Dracaena fragrans* are the dominant under storey herbs and shrubs (Webster, 1961).

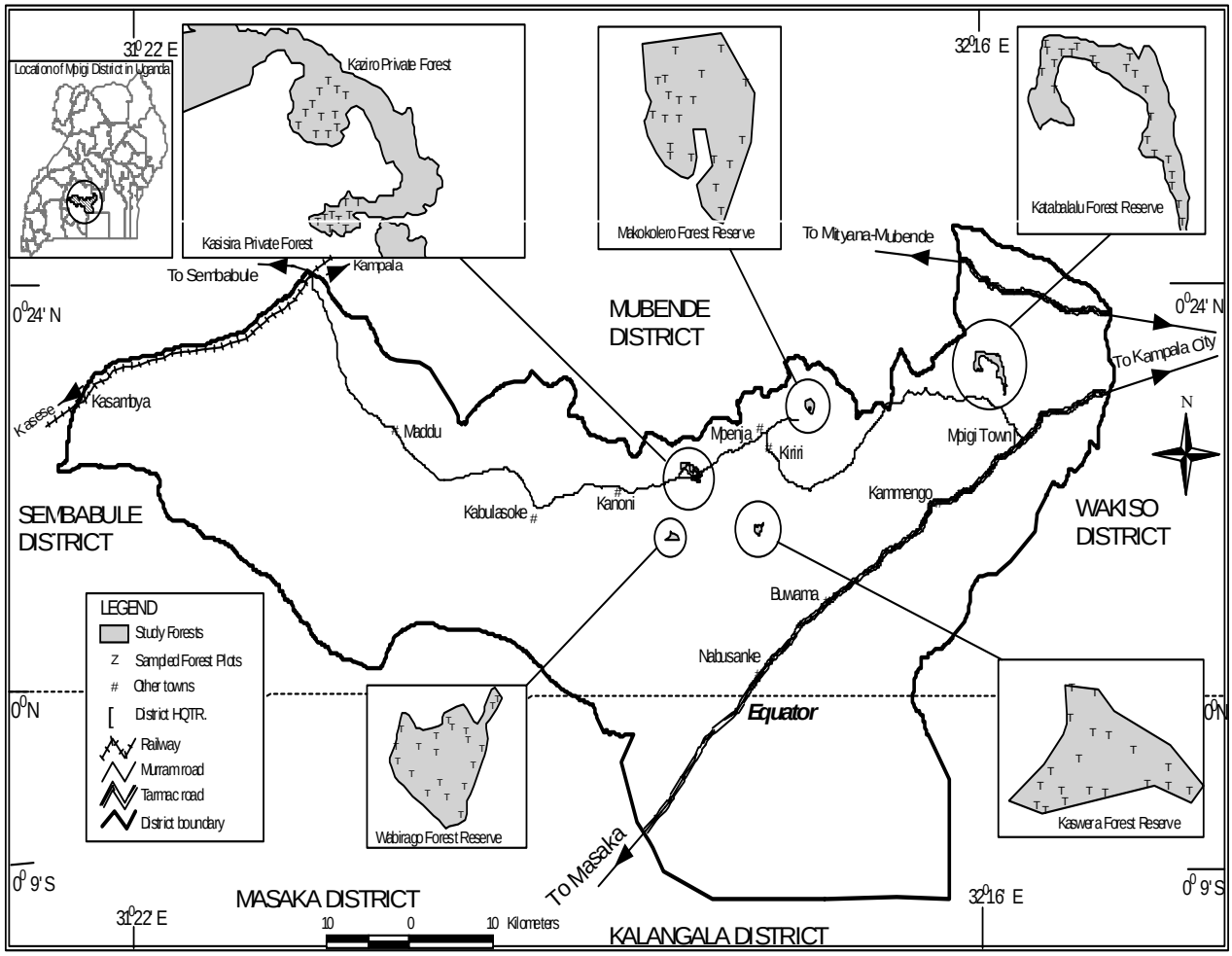


Figure 5.1 Mpigi District showing study forests**.**

The scenery of Mpigi is characterised by numerous flat-topped hills of moderate height sloping gently to narrow valleys with a regular undulating pattern from hilltop to valley bottom and back to hilltop, typical of a Buganda catena. The study forests occupy valley bottoms and adjacent slopes of the typical Buganda landscape with an altitudinal range of 1110-1250 m above sea level. About 89% of the forest area has slopes of less than 5^{o}. It has red soils of incipient laterisation on the slopes, with black clays in the bottomlands, the former being extensive (Milne, 1936). The soils are generally acidic. The climate is tropical with two rainfall peaks from March to May and September to November. The dry months are January and February, and July and August. The mean annual rainfall is 1320 mm although in many areas of the Lake Victoria zone it is between 1750 mm and 2000 mm. The minimum annual surface temperature is 11^{o}C, while the maximum is 33.3^{o}C. These forests are in various

degrees of degradation, mainly due to agricultural encroachment, easy accessibility, and high demand for timber, fuelwood, building poles and non-timber forest products in the area (MWLE, 2002). Eighty percent of the population in the Mpigi District is rural with agriculture being the main source of their livelihood. The major crops are bananas and coffee.

5.2.2 Management history of the study forests

Systematic management of the studied local and central forest reserves begun in 1944 when the colonial government recruited its technical staff (Uganda Protectorate, 1949). The initial gazettment took place between 1932 and 1948 (Webster, 1961) (Table 5.1). These forests are characterised by similar historical management patterns i.e. they have been used for similar purposes and subjected to similar forestry practices over the years.

Table 5.1 Biophysical characteristics and management history of the study forests

	Private forests		Local forest reserves		Central forest reserves	
	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Area (ha)	8	20	54	65	1225	104
Year when 1st gazetted	na	na	1932	1932	1932	1948
Period when 1st exploited	na	na	1942-52	1944-46	1952-58	1953-57
Area degraded (ha)	na	na	18	17	152	8
Area deforested (ha)	na	na	39	49	146	na
Elevation range (m)	1120-1170	1120-1160	1110-1195	1110-1250	1110-1180	1110-1220
Slope (degrees)	1-4	1-4	1-6	1-14	1-7	1-8

Source: Webster (1961) and NBS (2003).
Note: na denotes data not unavailable.

Historically, local residents were allowed to utilise forest resources, other than reserved trees, for only their domestic use. Commercial exploitation of forest produce from local and central forest reserves began in the 1940s and early 1960s with saw-millers and pitsawyers mostly targeting high value timber species, such as *Entandrophragma angolense* and *Lovoa trichiliodes*. Most of these valuable trees were heavily exploited during the period of political instability in Uganda between 1980 and 1993. There are, however, low stocks of *Antiaris toxicaria*, *Celtis durandii, Maesopsis eminii, Funtumia africana* and *Mitragyna stipulosa*, where low impact timber extraction can be carried out (MWLE, 2002). Encroachment by peasant farmers was also reported around 1948 on a small-scale, but this intensified in the 1970s, when agricultural encroachment was regarded as a major problem. Agricultural encroachment has continued to the present day though at a relatively small-scale.

Kaziro and Kasisira private forests are ungazetted forests owned and managed by Paul Kaziro and Late Mzee Kasisira respectively, using family members. The forests are found in Nsabwe Parish, Kyegonza sub-county on the Mpigi–Maddu road, about 48 km from Mpigi district

forest office (Figure 5.1). The history of management of the private forests is difficult to deduce due to lack of historical information. However, Kaziro inherited the forest from his late father Peter Ssemugalu, who had acquired the land from the Kabaka of Buganda, and has managed the forest for the last 60 years (Kaziro, 2003). The family of late Kasisira has managed the Kasisira Private forest for the last 50 years. The forests were inherited from their grandparent, Mzee Kiwalabye, who had acquired the land from the Kabaka of Buganda as a token for successfully defending the Buganda Kingdom against attacks from other kingdoms. The private forest owners reserve the permission for collection of non-timber forest products by communities living adjacent to these forests. They are also supposed to get technical advice, particularly planning, from the Forest Department (Government of Uganda, 2003). Exploitation of timber and burning of charcoal requires permission from the Forest Department (Kamugisha, 1997), which has been a major disincentive to private forest investment (Birakwate, 2003). However, there is a general lack of information on the previous management practices applied to private forests and amount of resources harvested from these forests over time.

5.2.3 Vegetation sampling

Prior to the forest survey, a reconnaissance visit was carried out to establish the exact location of each forest and to survey the forest external boundaries. Furthermore, the reconnaissance also helped to familiarise with local leaders and local guides conversant with the forest who later on helped in cutting trails and locating of key areas and points in the study forests.

A boundary map of each forest was secured from the Forest Department, while for the private forests, a sketch map was prepared for use in locating forest plots in each forest. The location of the forest plots was accomplished by placing a predefined grid over the map of each of the forests and then a pair of random numbers was used to select the north/south co-ordinates of a "random point" in the forest. A simple grid was then xeroxed onto a transparent paper for use in the field. These grid cells were 100 m x 100 m. After selecting the plot coordinates, other established landmarks such as streams, roads and trails were used to locate the random valid points in the forest. In cases where the site permitted easy movement, the research team moved from one plot to another by taking compass bearings and walking directly to the next plot. The positional data regarding these forest plots (Figure 5.1) were recorded using Geographical Positioning System (GPS). This enabled obtaining of accurate locational data points for each land use and forest cover types in and around the study forests.

A two-step sampling procedure was used to determine the acceptable number of plots to sample the forest. In this approach, an initial sample using a small set of plots was taken during the pilot survey of each forest. The additional number of plots was then computed to achieve statistically reliable information based on the mean variation of the trees in the initial sample (Freese, 1980; IFRI, 1998). Total sample sizes and survey area in each forest for the different growth forms for each forest was computed based on the variation in the mean number of trees computed for the pilot data. A total of 13 plots were sampled from Kasisira, 18 from Kaziro, 31 from Kaswera and Wabirago, 33 from Makokolero and 30 from Katabalalu forests, making a total of 156 forest plots for the present study. Nested sample plots recommended as standard quadrat areas for work on various vegetation types (Kent and Coker, 1992) were used in this study at each sampled point (Figure 5.2).

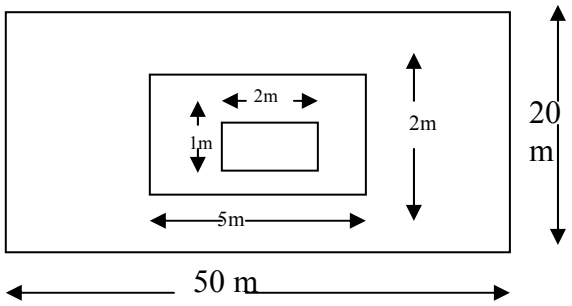


Figure 5.2 Nested plots used for vegetation sampling: (2 x 1 m) for ground flora, (5 x 2 m) for saplings and (20 x 50 m) for trees.

Ground flora (seedlings and herbs) were recorded in the 2 m x 1 m subplots, and saplings in the 5 m x 2 m subplots. In this study, the approach by International Forestry Resources and Institutions (IFRI) (1998) was adopted: shrubs and young trees less than 1 m tall and with a diameter at breast height (DBH) <2.5 cm were considered as seedlings; shrubs and young trees with a stem diameter ≥2.5 cm but <10 cm DBH were considered as saplings; and plants with a DBH ≥10 cm were recorded as trees. Seedlings were recorded by the number of stems and percentage area covered by each species and the herbs by the percentage area covered by each species. Cover was estimated visually as a percentage of all plant species within the subplot (Kent and Coker, 1992). In the 20 m x 50 m plots, trees were recorded by species, DBH and height. The diameter at breast height of saplings and trees was measured using a caliper and a diameter tape for very large trees. In cases where some trees had some irregularities such as buttresses, diameter was taken above the buttresses. The diameter of trees and saplings was used to compute the basal area. Plants were identified using the existing guides (e.g. Eggeling and Dale, 1951; Hamilton, 1991; Katende *et al*., 1998). Initial plant species identification was done in the field with the help of a botanist hired from

Uganda Forestry Resources and Institutions Centre, Makerere University. Unidentified plant species were collected and pressed for later identification in the Makerere University Herbarium.

5.2.4 Anthropogenic and physical factors affecting forest conditions

Campbell (1988) emphasised the measurement of environmental factors as integral to forest ecology. In this study, some anthropogenic and environmental factors that were thought to influence the ecology of plants had to be measured (Table 6.1, Chapter 6). These included slope, aspect and elevation. Slope was measured using a clinometer, elevation by the use of an altimeter and aspect by use of a compass.

Evidence of various types of human disturbance indicators e.g. timber cutting, harvesting of firewood, poles, charcoal, medicine, livestock grazing and agricultural encroachment was visually enumerated to establish whether the forest has been modified in some way. These variables were assigned a categorical value of one for presence of signs or zero for absence of signs in a given forest plot. Only recent human disturbances based on fresh tree stumps, crops growing, fresh livestock dung and animal grazing. The age of disturbance estimated on subjective judgement (at least last five years) based on when decentralisation was effected in 1998 were noted. In addition, occurrences of species that were a result of human disturbances were recorded for each plot.

5.2.5 Limitations of the study

There was inadequate historical information on the management of the study forests. For example, the forest management plans were not readily available, while those available were prepared in the 1950s and 1960s. These were unable to provide adequate information on forest management prescriptions, such as information on the amount of timber and species harvested from each forest. I relied on information from forest users and forest staff charged with management of these forests. In addition, monitoring forest use both in local and central forest reserves was implemented by the same Forest Department staff despite the fact that local forest reserves were decentralised. This complicated the differentiation between local and central forest reserves.

5.2.6 Data analysis

Similarity between plots and species for each forest was performed by a Two Way INdicator SPecies ANalysis (TWINSPAN) (Hill, 1979) using number of stems of trees (diameter at breast height, DBH≥10 cm) per plot. It helped to group together samples (plots) and species that are similar, and to separate plots and species that are distinct from each other. The Pseudo-species (a type of differential species based on predetermined abundance levels) cut levels for TWINSPAN were 0, 1, 2, 3, 4, and 5, whereby 0 implied absence of a species, 1(1-2 stems), 2 (3-5 stems), 3 (6-10 stems), 4 (11-20 stems) and 5 (>20 stems).

Plant species diversity was quantified by means of two indices, Shannon Wiener diversity index (H') and Pielou's evenness (equitability) index (Pielou, 1975; Magurran, 1988). The Shannon diversity index was calculated using the equation:

$H' = -\sum p_i \log(p_i)$, where p_i = the proportion of individuals or the abundance of the i^{th} species expressed as a proportion of total abundance and where the logs are to base e. The assumption was that samples were randomly collected from the forest. Pielou's evenness index was computed using the equation: $J' = \frac{H'}{H_{max}} = \frac{H'}{\ln S}$

Where, $H' = H_{max} = \ln S$, where H'_{max} is the maximum possible diversity, which would be achieved if all species were equally abundant (=lnS). Species richness was estimated by computing species density as the number of species per specified collection area (Magurran, 2004) and the Margalef's diversity index (Clifford and Stephenson, 1975). Margalef's diversity index was calculated using the equation: $D_{Mg} = \left(\frac{S-1}{\ln N}\right)$

Where D_{Mg} is the Margalef's index, S is the number of species recorded at the sampled area and N is the total number of individuals (Magurran, 2004).

Differences in floristic composition (species diversity, richness and evenness) were examined using PC-ORD version 4.17 (McCune and Mefford, 1999). The indices were computed for all plant species in various growth forms (trees, saplings, seedlings and herbs) in each forest community and forest. The mean values for these indices were compared by one-way analysis of variance (ANOVA) to test the significance of these variables for each forest and ownership regime. This was followed by the Tukey's honestly significant difference test (HSD), a multiple comparisons procedure to identify differences between the means for these indices in each forest community (Zar, 1996). Values of the diversity and the evenness

indices were transformed (1/log) to homogenise (test of levene) before the ANOVA was carried out.

To describe the observed patterns in species abundance among the study forests, rank and/or abundance per plot of plant species were plotted on a logarithmic scale against the species rank, ordered from the most abundant to the least abundant species (Kent and Coker, 1992; Clarke and Warwick, 1994; Magurran, 2004). Dominance-diversity curves were produced to show the kind of distribution exhibited by plant species in each forest ownership category. A frequency distribution model of plant species was determined by a plot of their relative abundance values against their ranks for the most common to most rare species (Ludwig and Reynolds, 1988). The expected distributions included the broken stick and lognormal.

Density, DBH, basal area and tree height were computed to describe the population structure of the plants in each plot and forest community. Values of mean DBH, basal area and stand density (stems ha^{-1}) were calculated for the tree size class (DBH>10 cm) in each plot and study forest. Stand density was computed as $D = \frac{S}{A}$ where, D=No of stems ha^{-1}; S= the number of stems; A is the total area sampled. The diameter at breast height (DBH) was used to compute basal area of trees in each forest. Basal area per stem for the trees was obtained as $\frac{\Pi(DBH)^2}{4}$, on the assumption that stem cross-section area is a circle (Husch *et al.,* 1982). The density of plants (trees, saplings and seedlings) as the number of stems per species per community was calculated by counting the number of individuals of a species and dividing it by the total area of plots. Mean values of species cover (stems ha^{-1}, DBH, basal area and height) and calculated indices were compared by means of ANOVA for each forest community category. The *a priori* expectation was that there would be higher richness and diversity of plant species, density, DBH, basal area and height of trees for forest plots under a well managed forest. The classification of key tree species based on its demand from forest users followed the Forest Department guides (Forest Department, 1999). The Forest Department broadly classify trees into three timber classes, depending on the commercial value of the species. Accordingly, Class 1 is considered more highly valued and marketable timber than Class 2, while Class 3 has the least commercial value. Thus, most forest users primarily target Class 1 trees that they can easily market for cash. All statistical analyses were carried out using STATISTICA (StaSoft, Inc, 2003).

5.3 Results

5.3.1 Floristics and diversity

A total of 10,122 individuals were recorded in the sampled forests representing 212 plant species, in 63 families and 168 genera (Appendix 5.1). In terms of size class, 5,731 individuals represented mature trees (DBH≥10 cm), 921 were saplings (DBH≥2.5 cm <10 cm), while 3,470 were seedlings. Overall, four families had more than 10 species: Moraceae (25 species), Euphorbiaceae (19 species), Fabaceae (12 species) and Rubiaceae (12 species). The family Moraceae (with 25 species) was the most species rich. Twenty-eight families (44.5%) were represented by one species each.

Out of the 212 species, 45 species (21.2%) occurred in all six forests, 16 (7.5%) occurred in five forests, 20 (9.4%) occurred in four forests, 28 (13.2%) occurred in three forests, 36 (17.0%) occurred in two forests, while 67 (31.6%) occurred in one forest (Appendix 5.1). Of the species occurring in one forest, 22 were recorded in the Katabalalu Central Forest Reserve, 14 in the Wabirago and seven in the Kaswera local forest reserves, respectively, six in the Kaziro and only two in the Kasisira private forests, respectively.

5.3.2 Classification of sites for the Mpigi forests

Using a Two Way INdicator SPecies ANalysis (TWINSPAN), 156 samples from the six forests were classified into 10 different forest communities (Appendix 5.2; Figure 5.3). At the first division, species were sharply divided (Eigenvalue 0.293). The characteristics of indicator species for the first division seem to indicate that the division is based on the water regime of the site. The positive indicator species (grouping to the right), *Macaranga schweinfurthii* and *Pseudospondias macrocarpa,* are species characteristic of swampy and/or waterlogged sites. The positive preferential species were *Alangium chinense*, *Beilschmedia ugandensis*, *Mitragyna stipulosa*, *Symphonia globulifera*, *Phoenix reclinata* and *Pycnanthus angolensis*. The negative preferential species (grouping to the left) were *Antiaris toxicaria* and *Chaetacme aristata*, which prefer drier and well drained sites. The associated species were *Blighia unijugata*, *Celtis africana*, *Lovoa trichiliodes*, *Prunus africana*, *Scolopia rhamnophylla*, *Teclea nobilis*, *Xymalos monospora* and *Trilepisium madagascariensis*.

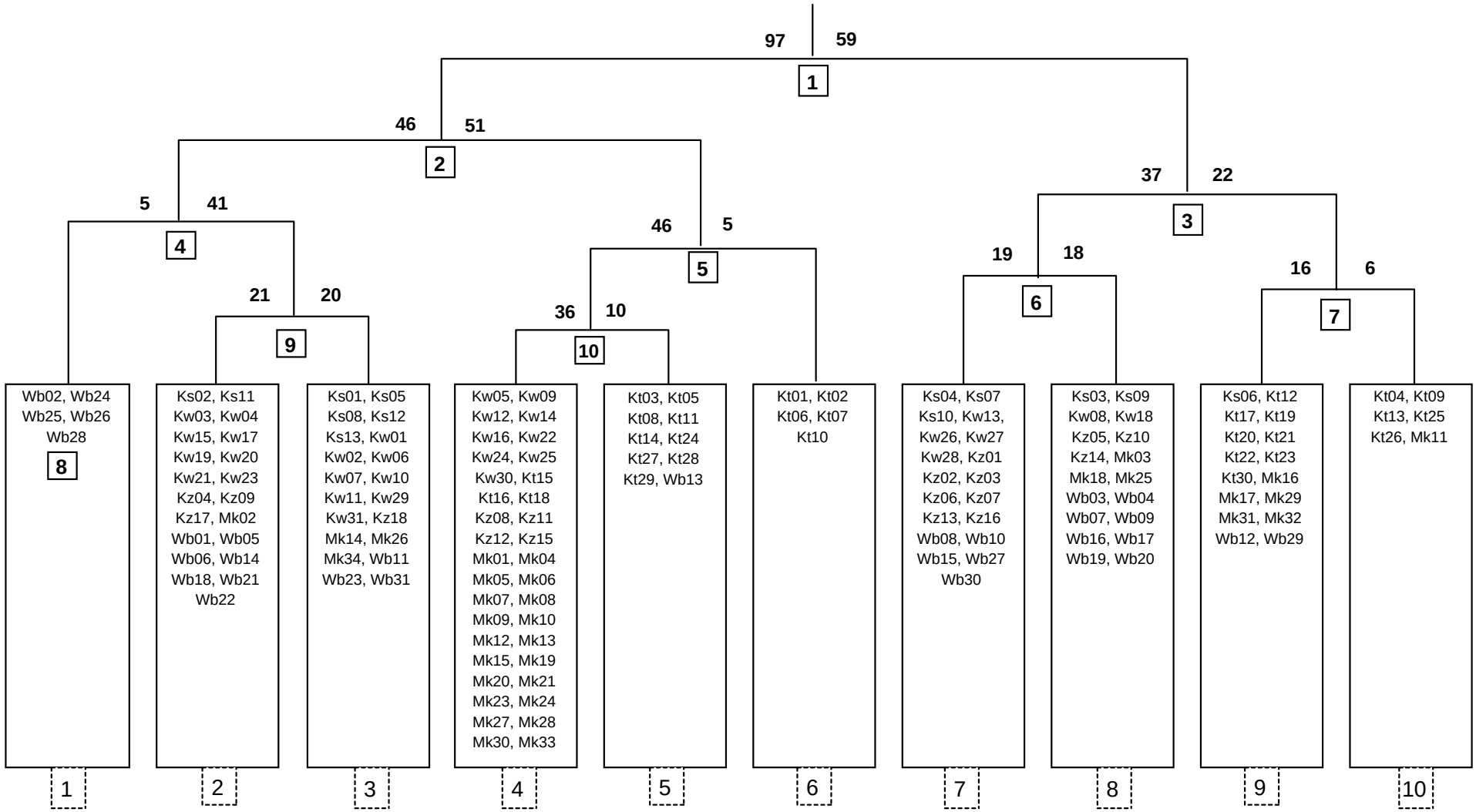


Figure 5.3 Dendrogram of the 10 communities identified with the TWINSPAN classification of the Mpigi forests, Uganda. The order of the divisions is shown with the number in the square with the solid lines. Each subdivision is shown with the number of plots to the left (negative) and number to the right (positive) of the division. The number of the community is shown at the bottom of each block in a square with a dotted line. The plots in each community are shown inside the large rectangle.

At the second division, the indicator species for the positive side were *Macaranga monandra, Ficus exasperata, Xymalos monospora* and *Pycnanthus angolensis*. The preferential species for the positive side were *Alangium chinense*, *Albizia ferruginea*, *Artocarpus heterophyllus*, *Ficus sur* and *Parkia filicoidea*. The negative indicator species were Sapium *ellipticum, Scolopia rhamnophylla* and *Celtis africana,* while *Blighia unijugata*, *Oxyanthus speciousus*, *Phoenix reclinata*, *Prunus africana* and *Trichilia drageana* were the associated species. Both positive and negative indicator species for this division constitute forest edge and riverine species. They also have species that prefer woodland habitats, for example, *Ficus sur* and *Prunus africana* and those that prefer the interior forest habitats such as *Albizia ferruginea* and *Oxyanthus speciosus*. The only striking difference is that *Scolopia rhamnophylla* and *Celtis africana* on the negative side are species characteristic of drier sites.

The indicator species for the third division were, on the positive side, *Alangium chinense Symphonia globulifera, Ficus sur, Macaranga monandra* and *Celtis durandii*. The associated preferential species were *Beilschmedia ugandensis*, *Lovoa trichiliodes*, *Piptadeniastrum africanum*, *Spondianthus preusii*, *Syzygium guineense*, *Trichilia rubscens* and *Trilepisium madagascariensis*. The indicator species on the negative side were *Phoenix reclinata*, with *Albizia globerima*, *Blighia unijugata*, *Phyllanthus discoideus*, *Polyscias fulva*, *Sapium ellipticum*, *Macaranga schweinfurthii* and *Pseudospondias macrocarpa* as the associated species. At this division, species were not sharply divided (Eigenvalue = 0.268). The negative side is characterised by riverine and swamp species, while the positive indicator species are characteristic of well drained forest habitats.

At the fourth division, the positive indicator species was *Trilepisium madagascariensis*. The positive preferential species were *Antiaris toxicaria*, *Blighia unijugata*, *Celtis africana*, *Celtis durandii*, *Chaetacme aristata*, *Cola giganteum*, *Lovoa trichiliodes*, *Macaranga schweinfurthii*, *Oxyanthus speciosus*, *Phoenix reclinata*, *Pseudospondias macrocarpa*, *Teclea nobilis*, *Funtumia africana* and *Scolopia rhamnophylla*. The indicators species for this division are forest dependent species characteristic of mixed forest with closed canopy habitats, where *Trilepisium madagascariensis* occurs as an understorey species. The negative indicator species for the division were *Albizia coriaria*, while the associated preferential species were *Bridelia micrantha*, *Canarium schweinfurthii*, *Ficus sur*, *Grewia mollis*, *Harungana madagascariensis*, *Morinda lucida*, *Pittosporum manii*, *Polyscias fulva*, *Rothmannia urcelliformis*, *Syzygium guineense*, *Piptadeniastrum africanum* and *Sapium ellipticum*. At this division, the negative preferential species such as *Albizia coriaria*,

Morinda lucida, Polyscias fulva, Pittosporum manii, Ficus sur and *Bridelia micrantha* are colonising species characteristic of forest edge, woodland, and grassland and bush or thicket habitats.

The fifth division, *Maesopsis eminii* was the positive indicator species. The associated preferential species were *Artocarpus heterophyllus*, *Canarium schweinfurthii*, *Sapium ellipticum* and *Trema orientalis*. *Maesopsis eminii* is an upper-storey colonising species, while *Canarium schweinfurthii* occasional occur with *Maesopsis eminii* as an emergent species. *Celtis durandii* and *Trilepisium madagascariensis* were the negative indicator species. The negative preferential species were *Alangium chinense*, *Albizia ferruginea*, *Albizia globerima*, *Blighia unijugata*, *Chaetacme aristata*, *Lovoa trichiliodes*, *Macaranga monandra*, *Oxyanthus speciosus*, *Parkia filicoidea*, *Phyllanthus discoideus*, *Piptadeniastrum africanum*, *Teclea nobilis*, *Xymalos monospora*, *Pseudospondias macrocarpa* and *Funtumia africana*. The indicator species on the negative side are characteristic of the typical mixed colonising forest on well-drained sites.

The positive indicator species for division six were *Phoenix reclinata* and *Macaranga schweinfurthii*. The positive preferential species were *Alangium chinense*, *Erythrina excelsa*, *Mitragyna stipulosa*, *Voacanga thouarsii*, *Scolopia rhamnophylla* and *Macaranga schweinfurthii*. The positive indicators are species that prefer waterlogged and/or swampy sites. The negative indicator species for the division was *Phyllanthus discoideus*, and the associated preferential species were *Blighia unijugata*, *Trilepisium madagascariensis*, *Celtis durandii*, *Ficus sur*, *Harungana madagascariensis*, *Lovoa trichilioides*, *Maesopsis eminii*, *Oxyanthus speciosus*, *Polyscias fulva*, *Spathodea campanulata*, *Parkia filicoidea* and *Pseudospondias macrocarpa*. These are species that prefer the forest interior habitats with a good water source.

At the seventh division, *Mitragyna stipulosa* was the indicator species on the positive side, with *Canarium schweinfurthii*, *Cola giganteum*, *Parkia filicoidea*, *Rauvolfia vomitoria* and *Alangium chinense* and *Macaranga schweinfurthii* as the associated preferential species. These are species characteristic of wetter sites. *Trilepisium madagascariensis* was the indicator species on the negative side of the division, with *Antiaris toxicaria*, *Fagara leprieurii*, *Sapium ellipticum*, *Syzygium guineense*, *Tabernaemontana holstii*, *Funtumia africana*, *Treculia africana*, *Beilschmedia ugandensis*, *Trema orientalis* and *Xymalos*

monospora as the associated preferential species. The indicator species on the negative side are species characteristic of colonising mixed closed forest on well drained sites.

The positive indicator species for division eight was *Harungana madagascariensis*. The associated preferential species *Canarium schweinfurthii*, *Pittosporum manii* and *Polyscias fulva*. The negative preferential species for the division were *Bridelia micrantha* and *Rothmannia urcelliformis*. There is no sharp division of samples at this level because both positive and negative preferential species have species characteristic of forest edge, riverine, and bush and thicket habitats. This division was not adopted for the community description because there were too few plots in this group. It required more plots in this group to describe the two communities adequately.

Teclea nobilis, *Celtis africana* and *Celtis durandii* were the indicator species on the positive side for division nine. The positive preferential species were *Chaetacme aristata*, *Artocarpus heterophyllus*, *Markhamia lutea*, *Piptadeniastrum africanum* and *Entandrophragma angolense*. These are species characteristic of a mixed closed forest on poor and drier sites. On the negative side, the indicator species were *Pseudospondias macrocarpa* and *Funtumia africana*, while *Albizia ferruginea*, *Macaranga schweinfurthii*, *Measopsis eminii* and *Pycnanthus angolensis* were the negative preferential species. These species are characteristic of a mixed closed forest on wetter sites.

At the last division, *Tabernaemontana holstii*, *Pycnanthus angolensis* and *Aningeria altissima* were the positive indicator species. The associated positive preferential species were *Alangium chinense*, *Markhamia lutea*, *Cola giganteum*, *Fagariopsis angolensis* and *Afrosersalisia ceracifera*. These are species that prefer wetter habitats. On the negative side, *Celtis durandii*, *Macaranga monandra* and *Lovoa trichilioides* were the indicator species, while *Teclea nobilis*, *Funtumia africana*, *Sapium ellipticum*, *Chaetacme aristata*, *Beilschmedia ugandensis*, and *Trilepisium madagascariensis* were the associated negative preferential species. The negative indicator species are characteristic of a mixed closed colonising forest on well drained and raised sites.

5.3.3 Composition of forest communities in the Mpigi forests

The five most abundant species in the tree, sapling and seedling size classes in each of the 10 communities are summarised in Table 5.2.

Table 5.2 The five most abundant plant species (individuals per hectare and relative abundance (RA)) of trees, saplings, seedlings and herbs recorded from private, local and central forest reserves in the Mpigi District, Uganda

Community	Trees	No.of indiv	RA (%)	Saplings	No.of indiv	RA (%)	Seedlings	No.of Indv/ha	RA (%)
1	*Sapium ellipticum*	78.0	34.2	*Pittosporum manii*	1600	23.5	*Teclea nobilis*	80000	53.8
	Albizia coriaria	40.0	17.5	*Phyllanthus discoideus*	1200	17.6	*Coffea canephora*	12000	7.9
	Pittosporum manii	26.0	11.4	*Maesa lanceolata*	600	8.8	*Clausena anisata*	11000	7.3
	Celtis africana	10.0	4.4	*Sapium ellipticum*	600	8.8	*Lovoa trichilioides*	7000	4.6
	Harungana madagascariensis	10.0	4.4	*Chaetacme aristata*	400	5.9	*Pittosporum manii*	7000	4.6
2	*Funtumia africana*	53.8	14.2	*Trilepisium madagascariensis*	762	14.0	*Teclea nobilis*	41666	29.8
	Trilepisium madagascariensis	45.2	11.9	*Blighia unijugata*	476	8.8	*Coffea canephora*	16190	11.6
	Pseudospondias macrocarpa	44.3	11.7	*Funtumia africana*	476	8.8	Trilepisium madagascariensis	11666	8.3
	Macaranga schweinfurthii	25.2	6.6	*Oxyanthus speciosus*	428	7.9	Ficus asperifolia	7619	5.4
	Blighia unijugata	21.0	5.5	*Pseudospondias macrocarpa*	285	5.3	*Clausena anisata*	5476	3.9
3	*Trilepisium madagascariensis*	60.5	16.8	Trilepisium madagascariensis	650	11.4	*Teclea nobilis*	66250	40.1
	Teclea nobilis	41.5	11.5	*Solanum giganteum*	650	11.4	*Trilepisium madagascariensis*	16250	9.8
	Chaetacme aristata	40.5	11.2	*Teclea nobilis*	600	10.5	*Coffea canephora*	9000	5.4
	Celtis africana	32.0	8.9	*Blighia unijugata*	450	7.9	*Lovoa trichiliodes*	8500	5.1
	Celtis durandii	28.0	7.8	*Trichilia drageana*	400	7.0	*Solanum giganteum*	7250	4.4
4	*Trilepisium madagascariensis*	46.4	13.4	*Solanum giganteum*	722	13.8	*Teclea nobilis*	13472	18.1
	Funtumia africana	31.7	9.2	*Funtumia africana*	611	11.6	*Coffea canephora*	9305	12.5
	Celtis durandii	28.6	8.3	*Lovoa trichilioides*	583	11.1	*Trilepisium madagascariensis*	7777	10.5
	Macaranga monandra	27.5	7.9	*Trilepisium madagascariensis*	388	7.4	*Blighia unijugata*	6527	8.8
	Pseudospondias macrocarpa	24.2	7.0	*Harungana madagascariensis*	194	3.7	*Ficus asperifolia*	3611	4.9
5	*Trilepisium madagascariensis*	35.0	11.2	*Solanum giganteum*	1100	14.9	*Solanum giganteum*	29500	26.8
	Tabernaemontana holstii	22.0	7.0	*Lovoa trichiliodes*	700	9.5	*Coffea canephora*	27500	25.0
	Xymalos monospora	22.0	7.0	*Coffea canephora*	500	6.8	*Blighia unijugata*	8500	7.7
	Pseudospondias macrocarpa	18.0	5.7	*Tabernaemontana holstii*	500	6.8	*Tabernaemontana holstii*	6000	5.5
	Antiaris toxicaria	17.0	5.4	*Funtumia africana*	400	5.4	*Funtumia africana*	4000	3.6
6	*Artocarpus heterophyllus*	70.0	25.7	*Artocarpus heterophyllus*	800	14.8	*Maesopsis eminii*	62000	35.2
	Maesopsis eminii	34.0	12.5	*Macaranga schweinfurthii*	600	11.1	*Coffea canephora*	51000	29.0
	Sapium ellipticum	22.0	8.1	*Pseudospondias macrocarpa*	600	11.1	*Chaetacme aristata*	12000	6.8
	Antiaris toxicaria	18.0	6.6	*Tabernaemontana holstii*	600	11.1	*Tabernaemontana holstii*	10000	5.7
	Macaranga monandra	14.0	5.1	*Bridelia micrantha*	400	7.4	*Pittosporum manii*	5000	2.8
7	*Pseudospondias macrocarpa*	84.7	24.3	*Trilepisium madagascariensis*	1052	16.5	*Teclea nobilis*	36315	23.3
	Funtumia africana	46.8	13.4	*Funtumia africana*	736	11.6	*Coffea canephora*	19210	12.3
	Macaranga schweinfurthii	33.2	9.5	*Oxyanthus speciosus*	631	9.9	*Lovoa trichilioides*	15263	9.8
	Trilepisium madagascariensis	27.9	8.0	*Pseudospondias macrocarpa*	631	9.9	*Blighia unijugata*	14210	9.1
	Sapium ellipticum	25.3	7.2	*Antiaris toxicaria*	262	4.1	*Trilepisium madagascariensis*	8157	5.2
8	*Macaranga schweinfurthii*	168.9	34.8	*Mitragyna stipulosa*	722	13.4	*Macaranga schweinfurthii*	7500	13.4
	Pseudospondias macrocarpa	58.3	12.0	*Macaranga schweinfurthii*	666	12.4	*Coffea canephora*	6944	12.4
	Phoenix reclinata	56.7	11.7	*Trilepisium madagascariensis*	555	10.3	*Albizia globerima*	5277	9.5
	Funtumia africana	46.1	9.52	*Eucalyptus grandis*	388	7.2	*Phoenix reclinata*	4444	8.0
	Sapium ellipticum	25.0	5.2	*Funtumia africana*	388	7.2	*Euadenia eminens*	4166	7.5
9	*Pseudospondias macrocarpa*	44.4	11.0	*Solanum giganteum*	1375	19.3	*Spondianthus preusii*	17500	19.1
	Trilepisium madagascariensis	42.5	10.5	*Trilepisium madagascariensis*	437	6.1	*Blighia unijugata*	15312	16.7
	Macaranga schweinfurthii	37.5	9.3	*Cola giganteum*	312	4.4	*Alangium chinense*	8125	8.9
	Funtumia africana	34.4	8.5	*Funtumia africana*	312	4.4	*Symphonia globulifera*	6250	6.8
	Macaranga monandra	29.4	7.3	*Lovoa trichilioides*	312	4.4	*Trilepisium madagascariensis*	4687	5.1
10	*Macaranga schweinfurthii*	68.3	20.3	*Alangium chinense*	666	11.1	*Symphonia globulifera*	5833	13.7
	Pseudospondias macrocarpa	33.3	9.9	*Argomuellera macrophylla*	666	11.1	*Argomuellera macrophylla*	5000	11.8
	Alangium chinense	26.7	7.9	*Pseudospondias macrocarpa*	666	11.1	*Ficus asperifolia*	5000	11.8
	Mitragyna stipulosa	23.2	6.9	*Macaranga schweinfurthii*	500	8.3	*Milicia excelsa*	4166	9.8
	Macaranga monandra	21.7	6.4	*Solanum giganteum*	500	8.3	*Rauvolfia vomitoria*	3333	7.8

Overall, *Pseudospondias macrocarpa* was the most abundant tree species in the tree size class constituting 10.1% of the total individual stems, while *Solanum giganteum* and *Trilepisium madagascariensis* were the most abundant species in the sapling size class (DBH ≥2.5 cm <10 cm) constituting 9.2% of the total sapling stems. In the seedling size class, *Teclea nobilis* was the most abundant constituting 22.4% of the total seedling stems. Three species dominated the seedling size class in all 10 communities: *Teclea nobilis*, *Coffea canephora* and *Trilepisium madagascariensis*. These species accounted for nearly 40% of all individuals in the study forests. The first community was dominated by *Sapium ellipticum, Pittosporum manii* and *Teclea nobilis* in the tree, sapling and seedling size classes, respectively. It also has in abundance *Albizia coriaria, Phyllanthus discoideus, Maesa lanceolata, Celtis africana, Clausena anisata, Bridelia micrantha, Grewia mollis, Scolopia rhamnophylla* and *Polyscias fulva* in the tree, sapling and seedling size classes. Nearly all species in community one are colonising species that prefer forest edge, woodland, grassland, and open habitats and drier forest sites. Community two was dominated by *Funtumia africana* and *Trilepisium madagascariensis* in both tree and sapling size class and *Teclea nobilis* in the seedling size class. These are understorey species characteristic of mixed closed forest on well-drained forest habitats. In community three, species characteristic of mixed forest on dry sites such as *Teclea nobilis*, *Chaetacme aristata* and *Celtis africana* were the most abundant. In this community, *Trilepisium madagascariensis*, an understorey species, occurs at higher abundance in the tree, sapling and seedling size classes. Species characteristic of disturbed sites such as *Solanum giganteum* was also abundant in both sapling and seedling size classes.

Community four was dominated by *Trilepisium madagascariensis*, *Funtumia africana*, *Celtis durandii* and *Macaranga monandra* in the tree size class, *Lovoa trichiliodes* in the sapling size class and *Teclea nobilis* and *Coffea canephora* species in the seedling size class. These are species characteristic of a mixed closed forest on well drained and rich sites.

In community five, mixed closed forest species were the most abundant in the tree, sapling and seedling size classes. These include species such as *Tabernaemontana holstii*, *Coffea canephora*, *Funtumia africana* and *Xymalos monospora*, while *Trilepisium madagascariensis* occurred as a dominant understorey species in the tree size class. Species characteristic of human disturbance such as *Solanum giganteum* and *Artocarpus heterophyllus* occurred at high abundance in the sapling and seedling size classes. Other species typical of human disturbances recorded from the community were *Manihot esculenta* and *Physalis peruviana*.

Artocarpus heterophyllus and *Measopsis eminii* were the most abundant species in both tree and sapling size classes for community six. *Maesopsis eminii* is a typical colonising upper storey species, while *Artocarpus heterophyllus* is non-forest dependent species that occurs as colonising species on disturbed sites that are frequently used by man and primates that feed on its fruits. The community also had forest edge species such as *Sapium ellipticum*, *Bridelia micrantha* and *Pittosporum manii* at higher abundance. Community seven was dominated by species characteristic of mixed moist and/or wet closed forest habitats such as *Pseudospondias macrocarpa*, *Funtumia africana* and *Trilepisium madagascariensis* in the tree and sapling size class, and *Teclea nobilis* in the seedling size class. Some agricultural crops like *Manihot esculenta* was recorded in this community.

Community eight was characterised by riverine and swamp species such as *Macaranga schweinfurthii*, *Phoenix reclinata* in the tree and seedling size classes, and *Mitragyna stipulosa* in the sapling size class. Other species characteristic of water logged areas such as *Voacanga thouarsii*, *Parkia filicoidea* and *Erythrina excelsa* were common in this community. *Eucalyptus grandis*, a non- forest species associated with human influence occurred at high abundance in the sapling size class.

Communities nine and 10 were dominated by mixed forest species that prefer both forest interior, forest edge, riverine and swamp habitats in the tree, sapling and seedling size classes. The only difference is that some species in community nine such as *Macaranga monandra* prefer well- drained and raised sites, while species in community 10 such as *Mitragyna stipulosa*, *Macaranga schweinfurthii* and *Symphonia globulifera* are characteristic of poorly drained and/or swampy sites. *Solanum giganteum*, a species characteristic of human disturbance was abundant in both communities in the sapling size class. Agricultural crops like *Dioscorea* species were recorded in community nine.

5.3.4 Patterns of species abundance for forest communities in the Mpigi forests

Rank-abundance (dominance-diversity) curves for the forest communities identified by TWINSPAN show a general successional stage that is close to lognormal (Figure 5.4.).

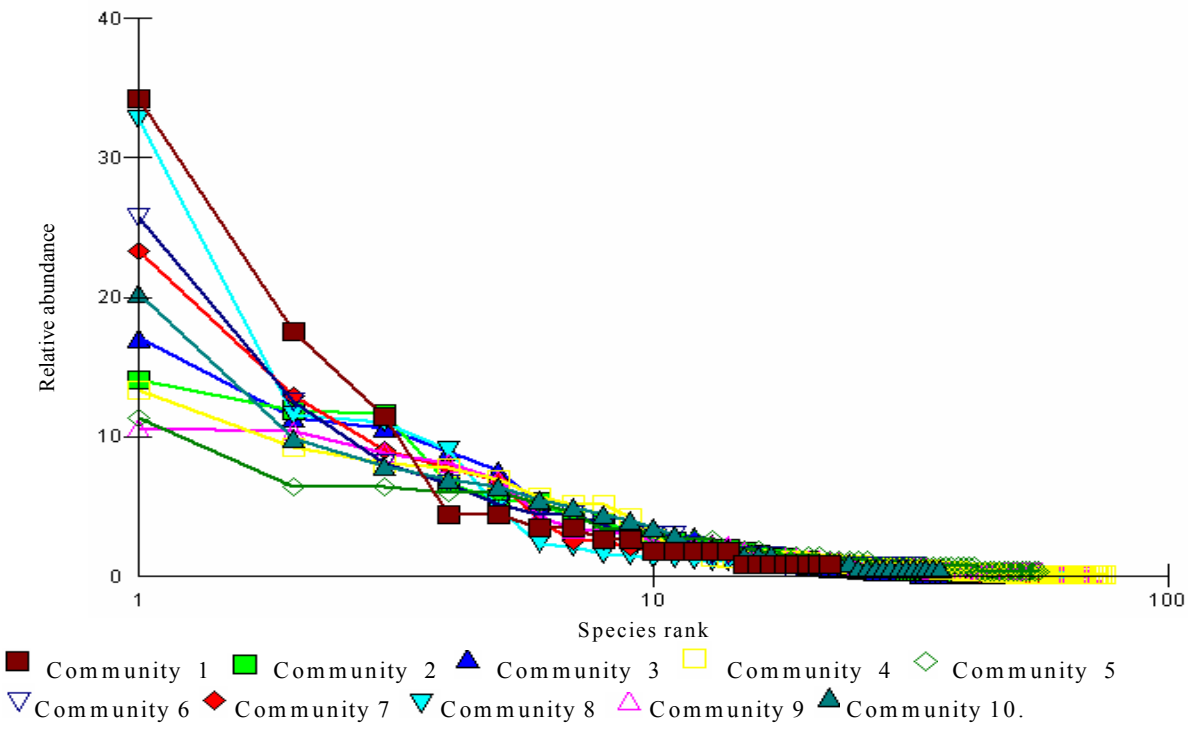


Figure 5.4 Rank-abundance curves showing trees species dominance across communities in Mpigi forests

The forest communities one and eight exhibited the highest species dominance. This is a characteristic of species on poor sites. In the forest communities six, seven and 10, rank-abundance curves were intermediate, characteristic of sites in the sub-climax stage. The forest communities two, three, four, five and nine had the lowest species dominance typical of species rich sites.

5.3.5 Diversity and richness of plant species across forest communities in the Mpigi forests

Species diversity traits (Shannon diversity, evenness, species richness and species density) of trees (DBH≥ 10cm) differed significantly among the 10 communities identified by TWINSPAN (one-way ANOVA, $p<0.001$) (Table 5.3). The mean Shannon diversity was significantly higher in forest communities two, four, five and nine than in other communities (Tukey's HSD test, $p<0.05$). The mean species density (S) and Margalef's species richness index were significantly higher for communities four, five and nine than in all other communities (Tukey's HSD test, $p<0.05$). Overall, forest plots in community one were the least species rich and diverse for the tree size class. The mean evenness index of the tree size class was significantly lower in community eight than in all other communities (Tukey's HSD test, $p<0.05$).

Table 5.3 Mean values for Shannon's diversity index (*H'*), Margalef's species richness index (D_{Mg}), Species density (total species) (*S*) and Pielou's evenness index (*J'*) of tree species (DBH≥ 10 cm) recorded from 10 communities (156 samples and 124 species) within the private, local and central forest reserves in the Mpigi District, Uganda

	Community type											
Diversity trait	1 (n=5)	2 (n=21)	3 (n=20)	4 (n=36)	5 (n=10)	6 (n=5)	7 (n=19)	8 (n=18)	9 (n=16)	10 (n=6)	F	p-value
Trees												
Shannon diversity	1.72±0.40	2.26±0.29	2.19±0.37	2.43±0.30	2.56±0.33	2.01±0.53	2.10±0.32	1.97±0.34	2.52±0.29	2.35±0.34	7.117	0.000
Evenness (*J'*)	0.85±0.07	0.87±0.05	0.88±0.06	0.89±0.04	0.93±0.04	0.84±0.02	0.84±0.04	0.80±0.09	0.89±0.05	0.90±0.03	5.842	0.000
Margalef's index	2.30±0.68	3.58±0.90	3.31±0.90	4.13±0.92	4.70±1.09	3.26±1.01	3.24±0.80	2.90±0.87	4.42±0.96	3.72±1.22	7.108	0.000
Species density	8.20±3.27	13.76±3.7	12.80±3.9	15.40±3.9	16.90±5.64	11.40±4.20	12.53±3.69	12.10±3.32	17.18±4.00	14.00±4.48	4.666	0.000
Saplings												
Shannon diversity	1.35±0.50	0.93±0.60	0.99±0.62	1.16±0.55	1.09±0.50	1.09±0.77	0.99±0.55	1.22±0.49	1.29±0.57	0.92±0.44	0.870	0.550
Evenness (*J'*)	0.94±0.08	0.78±0.34	0.74±0.39	0.85±0.31	0.91±0.11	0.71±0.40	0.78±0.35	0.85±0.23	0.87±0.26	0.83±0.13	0.609	0.788
Margalef's index	1.91±0.85	1.29±0.90	1.49±0.90	1.78±0.74	1.57±0.77	1.57±1.18	1.64±0.53	1.69±0.80	1.97±0.78	1.31±0.66	1.088	0.375
Species density	4.40±1.82	3.29±2.10	3.40±1.76	3.83±1.79	3.80±2.35	4.20±2.68	3.42±1.78	4.22±1.83	4.38±1.99	3.50±2.07	0.682	0.723
Seedlings												
Shannon diversity	1.53±0.14	1.89±0.35	1.92±0.38	1.83±0.45	2.13±0.29	2.02±0.44	1.78±0.42	1.84±0.49	1.85±0.43	1.67±0.23	1.236	0.278
Evenness (*J'*)	0.66±0.09	0.79±0.07	0.79±0.09	0.76±0.13	0.86±0.08	0.83±0.08	0.76±0.11	0.77±0.12	0.76±0.11	0.72±0.06	1.920	0.053
Margalef's index	2.12±0.46	2.22±0.69	2.45±0.78	2.28±0.71	2.49±0.56	2.32±0.76	2.07±0.63	2.23±0.90	2.27±0.80	2.05±0.57	0.520	0.856
Species density	10.80±2.59	11.24±3.40	12.20±3.64	11.47±3.23	12.20±2.97	11.60±3.58	10.68±3.33	11.33±4.56	11.63±3.91	10.67±	0.315	0.969

All values are mean±SD (standard deviation).

Table 5.4 Mean values for density, DBH, basal area and height of tree species (DBH≥ 10 cm) recorded from the 10 communities (156 samples and 124 species) for private, local and central forest reserves in the Mpigi District, Uganda

Stand parameter	Community type											
	1 (n=5)	2 (n=21)	3 (n=20)	4 (n=36)	5 (n=10)	6 (n=5)	7 (n=19)	8 (n=18)	9 (n=16)	10 (n=6)	F	p-value
Sample area (ha)	0.5	2.1	2.0	3.6	1.0	0.5	1.9	1.8	1.6	0.6		
Stems ha^{-1}	45.6±22.9	18.07±4.89	18.17±5.74	9.63±2.61	31.30±14.39	54.40±30.54	18.50±6.35	27.13±9.00	25.23±6.67	56.1±16.65	28.106	0.0000
Mean dbh (cm)	15.01±4.41	21.54±11.9	22.52±12.5	21.01±13.0	20.65±15.2	19.12±9.17	25.72±15.8	22.08±11.0	22.13±14.3	23.79±14.5	11.912	0.0000
Mean basal area ($m^2 ha^{-1}$)	4.38±0.03	18.04±0.03	18.78±0.04	16.56±0.02	16.20±0.013	9.59±0.08	25.03±0.05	23.19±0.03	22.03±0.06	19.27±0.02	61.31	0.0000
Mean height	7.76±1.88	11.27±4.23	11.40±4.86	11.16±4.80	10.37±4.82	10.14±3.72	12.26±4.51	11.66±3.69	11.63±4.74	11.69±4.81	15.15	0.0000

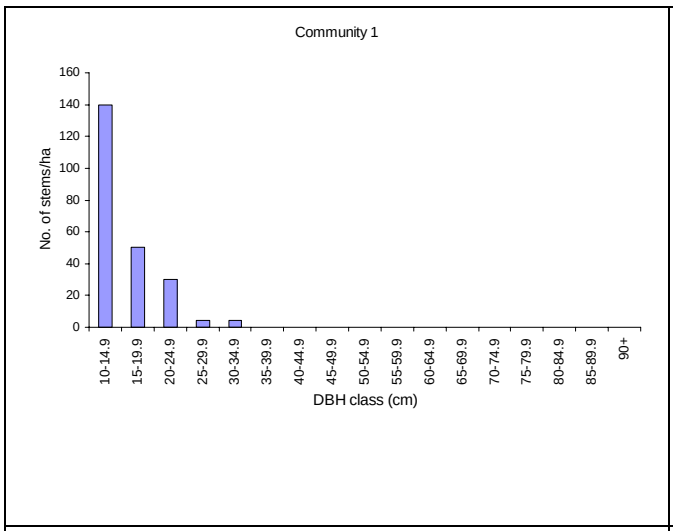
All values are mean±SD (standard deviation).

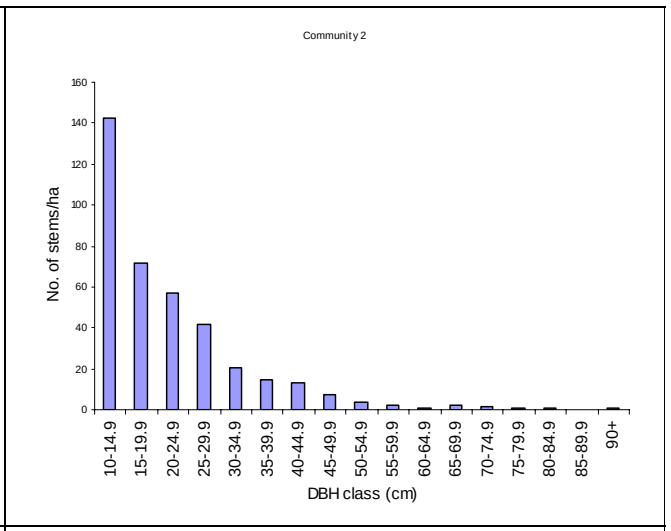
The mean Shannon diversity index, evenness, species richness and species density of the sapling and seedling size classes did not differ significantly among the 10 forest communities (one-way ANOVA, $p>0.05$).

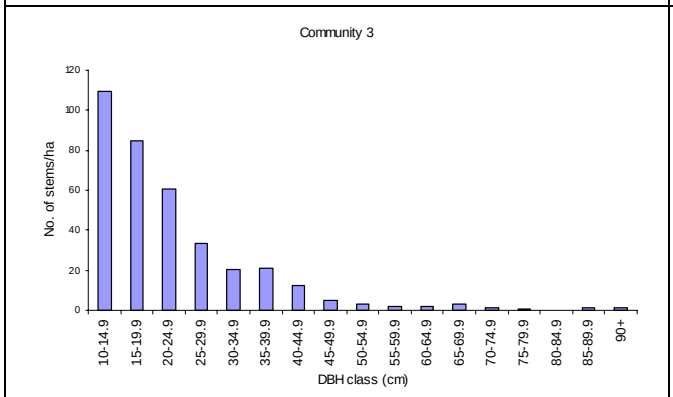
5.3.6 Structure of forest communities in the Mpigi forests

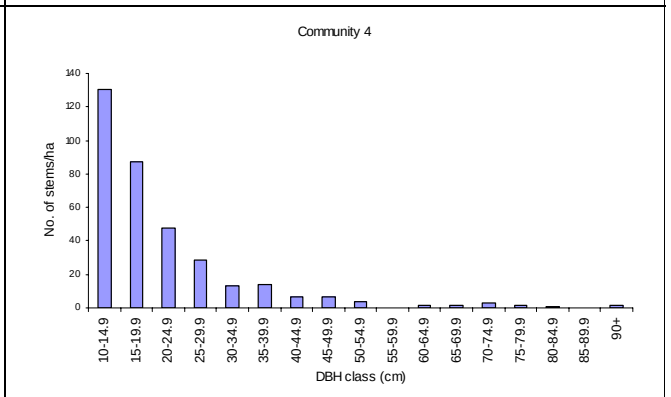
The size class distribution of all tree species ($\geq$10cm DBH) in the 10 forest communities identified by TWINSPAN are summarised in Figure 5.5. A summary of structural data is shown in Table 5.4. In all communities, the smallest size classes (DBH, 10-30 cm) were the most abundant. Structural attributes (density, DBH and basal area) of trees varied significantly among the 10 forest communities (one way ANOVA, $p<0.001$) (Table 5.4). The mean density (stems ha^{-1}) of all trees was significantly lower in forest communities two, three, four, seven, eight and nine than in all other communities (Tukey's HSD test, $p<0.05$). The mean DBH and basal area (m^2 ha^{-1}) of all trees were significantly higher in forest communities two, three, four, five, seven, eight, nine and 10 than in forest communities one and six (Tukey's HSD test, $p<0.05$), while the mean height was significantly higher in forest communities two up to 10 than in forest community one (Tukey's HSD test, $p<0.05$).

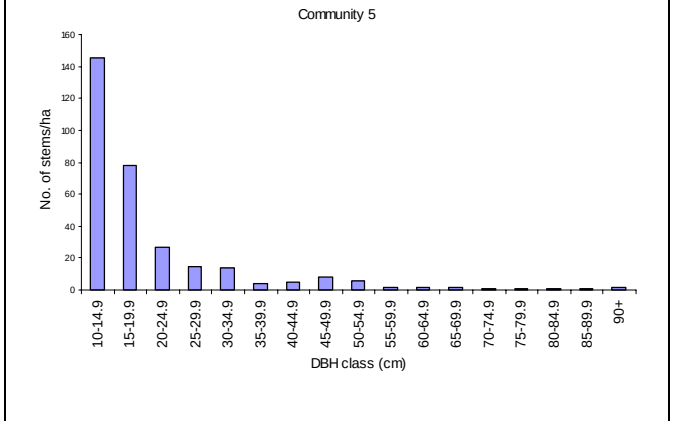
Inverted J-shaped curves of frequency of individuals in diameter size classes were obtained for tree species in communities two, three, four, five, seven and nine. In these communities, all size classes were well represented in small and intermediate sizes and decreased uniformly towards larger classes (>50 cm DBH). In contrast, communities one, six, eight and 10 exhibited a non-linear reduction in the density of trees across the size classes and with some size classes without standing trees (Figure 5.5). All the individuals of tree stems in community one occurred in smaller sizes (DBH 10-35 cm), while larger size trees (>50 cm DBH) were in most cases missing in communities six, eight and 10. The results from size class distribution indicate that communities two, four, seven and nine have a generally stable population structure, communities three, five and eight are intermediate, while communities one, six and 10 have unstable population structure and/or are degraded. The size class diameter distribution for community seven exhibited the characteristic of a typical undisturbed primary forest.

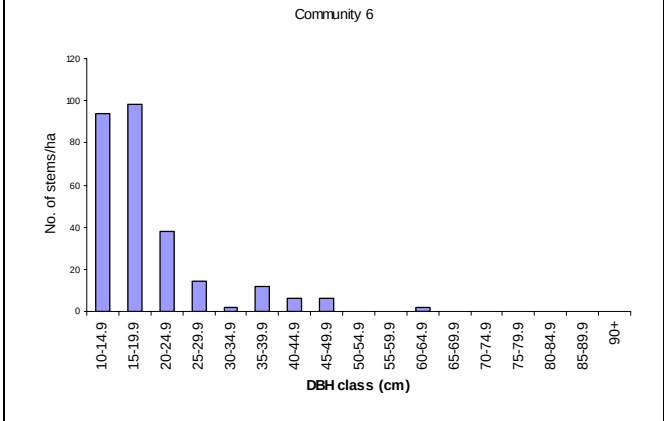

Community 1
No. of stems/ha
0
20
40
60
80
100
120
140
160
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)

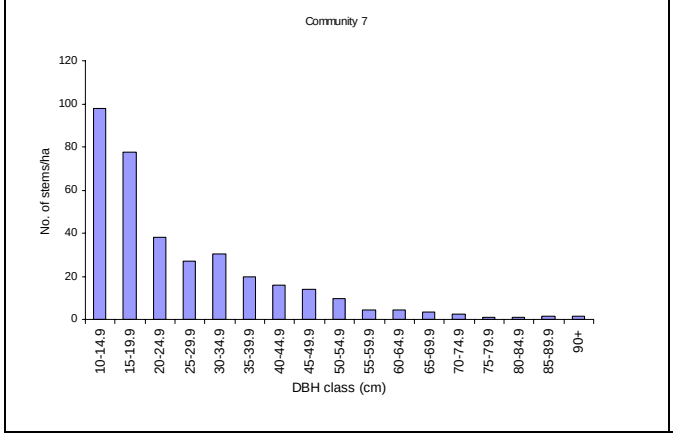

Community 2
No. of stems/ha
0
20
40
60
80
100
120
140
160
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)

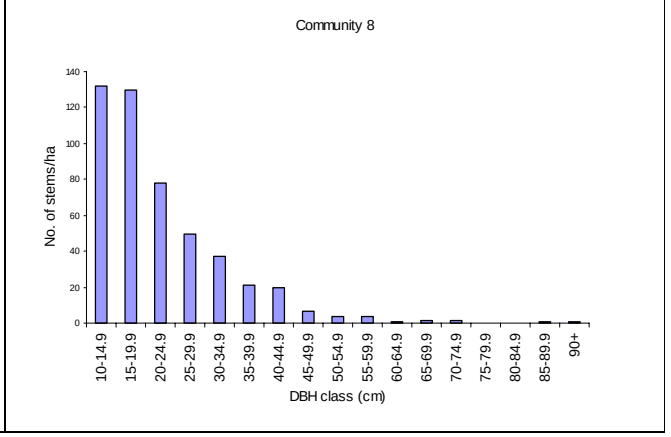

Community 3
No. of stems/ha
0
20
40
60
80
100
120
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)


Community 4
No. of stems/ha
0
20
40
60
80
100
120
140
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)


Community 5
No. of stems/ha
0
20
40
60
80
100
120
140
160
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)


Community 6
No. of stems/ha
0
20
40
60
80
100
120
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)


Community 7
No. of stems/ha
0
20
40
60
80
100
120
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)


Community 8
No. of stems/ha
0
20
40
60
80
100
120
140
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+
DBH class (cm)

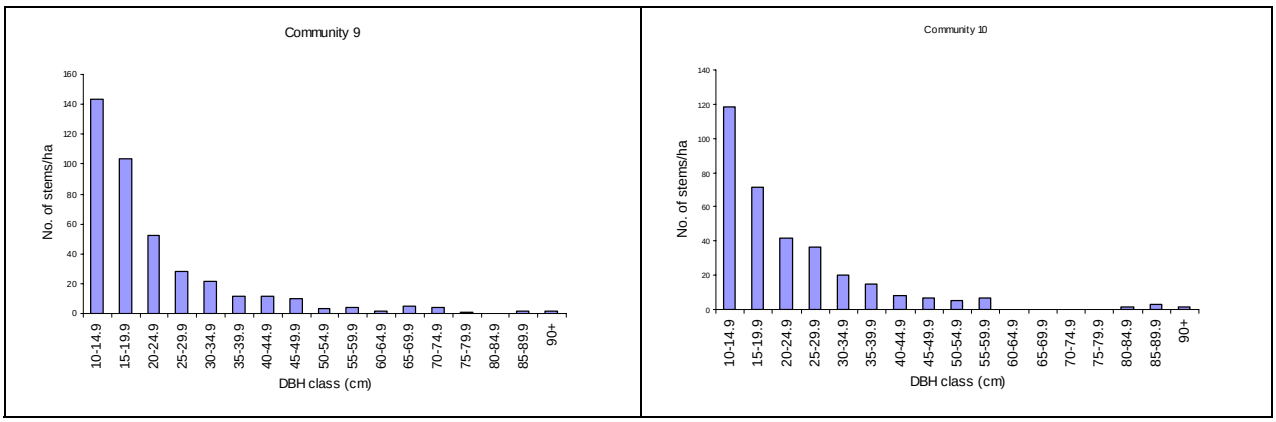
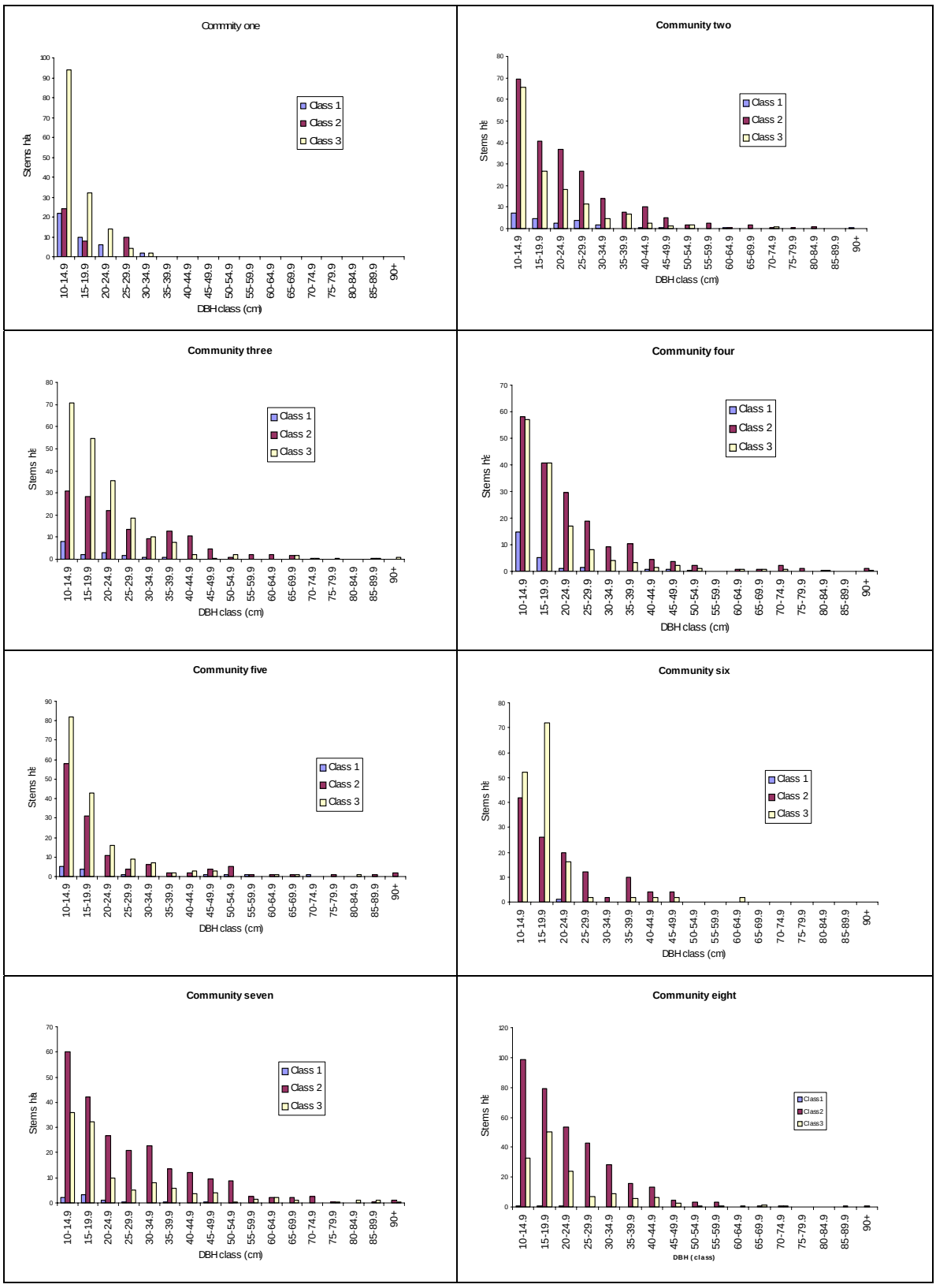


Figure 5.5 Size class distribution of all trees for the 10 forest communities in the private, local and central forest reserves of the Mpigi District, Uganda.

The size class distribution of all tree species (≥10cm DBH) based on the commercial value and/or timber Class categories (1, 2 and 3) in the 10 forest communities identified by TWINSPAN are summarised in Figure 5.6. The typical J-shaped diameter distributions were evident for the undisturbed and lightly disturbed communities. The large and valuable Class 1 and 2 tree species targeted for commercial timber exploitation occurred at low abundance in most communities. Forest communities six and eight exhibited the lowest abundance of commercially valued Class 1 tree species both in small and large size classes.


Commnity one
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community two
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community three
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community four
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community five
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community six
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community seven
Stems ha
Class 1
Class 2
Class 3
DBH class (cm)
Community eight
Stems ha
Class1
Class2
Class3
DBH (class)
10-14.9
15-19.9
20-24.9
25-29.9
30-34.9
35-39.9
40-44.9
45-49.9
50-54.9
55-59.9
60-64.9
65-69.9
70-74.9
75-79.9
80-84.9
85-89.9
90+

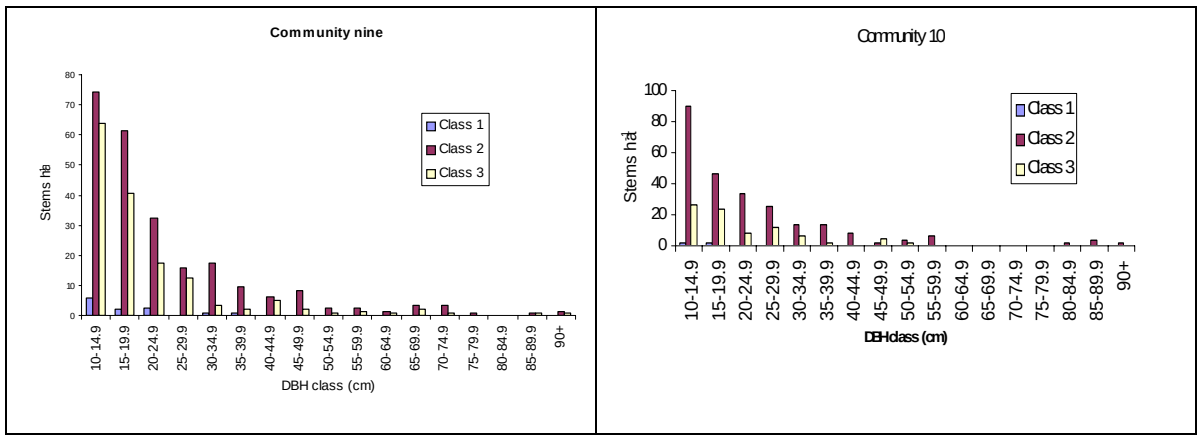


Figure 5.6 Size class distribution of trees (based on class of timber) for the forest communities in the private, local and central forest reserves of Mpigi District, Uganda.

5.3.7 Human disturbances in forest communities of the Mpigi forests

The most frequent human activities recorded from each forest community are presented in Table 5.5. Signs of livestock grazing occurred only in 5.3% of the samples in community seven. Harvesting of medicinal plants was only recorded in 20% of the samples in forest community six.

Table 5.5 Percentage distribution of plots with human activities recorded in forest communities for the private, local and central forest reserves in the Mpigi District, Uganda

		Percentage of sampled plots						
Community	No.of plots	Timber cutting	Charcoal burning	Pole harvesting	Firewood harvesting	Cultivation of crops	All disturbances combined	Status
1	5	-	20.0	20.0	20.0	20.0	80.0	Degraded
2	21	57.0	19.0	23.8	9.5	4.8	81.0	ND
3	20	25.0	5.0	25.0	35.0	-	75.0	ND
4	36	38.9	2.8	5.6	11.1	2.8	50.0	ND
5	10	40.0	2.5	20.0	15.0	2.5	90.0	Recovering
6	5	60.0	40.0	40.0	40.0	20.0	100	Degraded
7	19	15.8	15.8	26.3	21.0	10.5	58.0	ND
8	18	50.0	5.6	27.8	5.6	5.6	70.6	Degraded
9	16	37.5	12.5	25.0	37.5	12.5	68.8	Recovering
10	6	50.0	-	-	-	-	57.1	Recovering

Note: ND=Not disturbed

The signs of human disturbances were some of the indicators used in this study to characterise a well and/or a poorly managed forest reserve. The frequency of occurrence of human disturbances did not differ significantly among the forest communities (χ^2=13.65, df=9, p>0.05). Over 80% of all samples in forest communities one, two, five and six were affected by human activities (Table 5.5). Only community four had the lowest percentage (50%) of the samples with signs of human disturbances. The percentage distribution of plots with signs

of various human activities for each forest community in the Mpigi forests is summarised in Tables 5.6 to 5.10.

Table 5.6 Percentage distribution of plots with evidence of timber harvesting for forest communities in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
Community	No. of plots	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
1	0	-	-	-	-	-	-
2	12	-	-	66.7	25.0	-	8.3
3	5	-	-	80.0	20.0	-	-
4	14	-	7.1	35.7	-	-	57.1
5	4	-	-	-	-	100	-
6	3	-	-	-	-	100	-
7	3	-	-	33.3	66.7	-	-
8	9	-	-	-	77.8	-	22.2
9	6	-	-	-	16.7	16.7	66.7
10	3	-	-	-	-	100	-

Generally, most plots with signs of timber harvesting were recorded in the Wabirago, Kaswera and Katabalalu forests (Table 5.6). More than half of the samples in forest community six showed signs of timber harvesting, while forest community one had evidence of timber harvesting. Signs of charcoal making were highest for communities with majority of the samples in the Wabirago and Kaswera local forest reserves (Table 5.7).

Table 5.7 Percentage distribution of plots with signs of charcoal making for forest communities in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
Community	No.of plots	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
1	1	-	-	-	100	-	-
2	4	-	-	25.0	50.0	-	25.0
3	1	-	-	100	-	-	-
4	1	-	-	-	-	-	100
5	1	-	-	-	-	100	-
6	2	-	-	-	-	100	-
7	3	33.3	33.3	33.3	-	-	-
8	1	-	-	-	-	-	100
9	2	-	-	-	-	50.0	50.0
10	0	-	-	-	-	-	-

The signs of pole and firewood harvesting were highest for forest communities with majority of samples in the Katabalalu, Wabirago and Kaswera forests (Tables 5.8; 5.9). Only forest community 10 had no signs of charcoal making. Nearly all the samples with signs of crop growing were in the Wabirago and Kaswera local forest reserves (Table 5.10). The overall assessment shows that samples from the Kaswera, Wabirago and the Katabalalu forest reserves registered more human disturbances. The forest communities from the Kasisira and Makokolero forests registered moderate number of human disturbances, while forest communities with majority of the samples from the Kaziro private forest had the least human disturbances.

Table 5.8 Percentage distribution of plots with evidence of pole harvesting for forest communities in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
Community	No. of plots	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
1	1	-	-	-	100	-	-
2	5	-	-	20.0	60.0	-	20.0
3	5	40.0	-	20.0	40.0	-	-
4	2	-	-	50.0	-	50.0	-
5	2	-	-	-	-	100	-
6	2	-	-	-	-	100	-
7	5	40.0	20.0	-	40.0	-	-
8	5	20.0	-	-	60.0	-	20.0
9	4	-	-	-	25.0	50.0	25.0
10	0	-	-	-	-	-	-

Table 5.9 Percentage distribution of plots with evidence of firewood harvesting for forest communities in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
Community	No. of plots	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
1	2	-	-	-	100	-	-
2	2	-	-	50.0	50.0	-	-
3	7	14.3	-	42.9	42.9	-	-
4	4	-	25.0	-	-	25.0	50.0
5	6	-	-	-	-	100	-
6	2	-	-	-	-	100	-
7	4	25.0	50.0	-	25.0	-	-
8	1	100	-	-	-	-	-
9	6	-	-	-	16.7	83.3	-
10	0	-	-	-	-	-	-

Table 5.10 Percentage distribution of plots with evidence of cultivation of crops for communities in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
Community	No.of plots	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
1	1	-	-	-	100	-	-
2	1	-	-	-	-	-	100
3	0	-	-	-	-	-	-
4	1	-	-	100	-	-	-
5	1	-	-	-	-	100	-
6	1	-	-	-	-	100	-
7	2	-	-	50.0	50.0	-	-
8	1	-	-	-	-	-	100
9	2	-	-	-	50.0	-	50.0
10	0	-		-	-	-	-

5.4 Discussion

5.4.1 Relationship between forest ownership and forest composition

The Two Way INdicator SPecies ANalysis (TWINSPAN) divided species within the study forests into those that prefer waterlogged and dry sites and/or habitats. The species that prefer dry sites were further grouped into forest edge and woodland species, mixed dry forest species and mixed closed forest species with relatively good water source. The species that prefer wet sites were also further grouped into seasonal swamp species and permanent swamp species, making a total of 10 meaningful ecological forest communities. The groups indicate that water regime is an important factor in determining the distribution of species in the Mpigi forests. However, there was species overlap within the divisions and forest communities, with most species occurring in both wet and dry sites and/or habitats.

There was variation in the species dominance among the forest communities. Species dominance was high in forest communities one and eight with five individuals in each constituting more than 70% of all individuals (see Figure 5.4). Most of the individual stems belong to a relatively small number of species. The high species dominance is a characteristic of species poor sites and forest habitats that frequently occur in undisturbed forests. Over 90% of plots from communities one and eight were from the Wabirago local forest reserve. The high species dominance in forest communities one, six and eight is partly due to the inherent site and/or environmental conditions and human disturbances. Samples in forest community one constitute species that prefer dry and forest edge sites as well as colonising species, while samples in community eight prefer waterlogged habitats, where survival of species is also affected by impeded drainage. The forest resources in samples close to the forest edge are easily accessed and harvested by forest users. As a result, tree species in these sites cannot easily recover because of continuous human use. The composition of species in community eight could partly be affected by unfavourable wet conditions that limit the survival of colonising species that prefer well drained sites. Furthermore, waterlogged sites receive inadequate supervision and monitoring from the Forest Department staff and forest users take advantage to over-harvest trees. The forest communities in relatively wetter and well drained sites, the dominance-diversity curves showed that the majority of plant species occur at lower abundance. The plots constitute species which are characteristic of forest interior species as well as colonising species. There are favourable conditions for survival of species within communities. The finding is in agreement with Magurran (1998), that there is no community consisting of species of equal abundance.

The most remarkable difference in floristic composition among the studied forests was reduced abundance of primary dominant *Albizia-Piptadeniastrum-Celtis* species (Langdale-Brown, 1964). The current study shows *Trilepisium madagascariensis, Funtumia africana, Pseudospondias macrocarpa* and *Macaranga schweinfurthii* as the dominant species. *Trilepisium madagascariensis* and *Funtumia africana* are colonising species. Only *Celtis* occurred at higher abundance within forest communities three and four, which are basically the Kaswera local forest reserve and Makokolero central forest reserve. The genera *Celtis* and *Albizia* accounted for up to 4.0% and 2.2% of the total abundance of trees, while *Piptadeniastrum africanum* accounted for 0.83% of the total tree abundance.

Commercially desired Class 1 timber tree species occurred at low abundance in most communities because forest users selectively target high value species when harvesting timber (Figure 5.6). However, forest communities six, eight and 10 tended to exhibit substantially lower densities of most Class 1 species. These communities are mainly from the Katabalalu central forest reserve and the Wabirago local forest reserves. The loss of the dominant and commercially valuable tree species in Mpigi forests is not surprising because they are among the valuable species which are commercially exploited for timber (Forest Department, 1999). As noted by Ehrlich and Kremen (2001) and Putz *et al*. (2001), removal of high-grade commercial and valuable species dramatically alters the composition of forests.

This study has shown that unique species which are characteristic of human disturbance such as *Artocarpus heterophyllus*, *Solanum giganteum* and *Eucalyptus grandis* occurred at higher abundance in forest communities highly degraded and sites undergoing succession. Other species associated with human disturbances such as *Senna spectabilis, Carica papaya*, *Mangifera indica, Physalis peruviana*, *Manihot esculenta*, *Amaranthus sp.*, *Gynandropsis sp.*, and *Dioscorea sp.*, were recorded in forest communities. Agricultural encroachment is also a threat to the composition of the Mpigi forests because agricultural crops such as *Cannabis sativa, Musa sp*., sugar cane, yams and beans were observed growing in the study forests. Human disturbances, particularly timber cutting, agricultural encroachment, livestock grazing and non-timber forest product removal from the forest can alter forest composition and replace primary species with pioneer and early successional species (Whitmore, 1984; Kuusipalo *et al*., 1996; Stork *et al*., 1997; Ehrlich and Kremen, 2001). These findings demonstrate that the composition of the Mpigi forests is affected both by environmental and human factors, with the latter being more pronounced.

5.4.2 Relationship between forest ownership and forest diversity

Diversity and richness indices calculated for the trees show significant differences in species diversity, evenness and richness among the forest community categories with highest values in communities with majority of samples in the central forest reserves and private forests (see Table 5.3). Several authors (e.g. Ferris-Kaan *et al*., 1998; Zumeta and Ellefson, 2000; Larsson and Danell, 2001) argue that high plant species diversity and composition are better indicators of a successful forest management practice by the forest agency. The study has shown forest communities two, four, five and nine to be more diverse and rich. Similarly, these communities exhibited a more even mix of species. The communities with highest diversity in tree size class occurred in forest communities that constituted plots mainly in the Katabalalu and Makokolero central forest reserves. In contrast, forest communities with most samples in the Wabirago and Kaswera local forest reserves had the lowest diversity, while forest communities with most samples in the private forests registered intermediate diversity. Forest communities with high diversity and richness of trees may be in their mid-stage of succession, while those with low diversity are in the later stages of succession (Connell, 1978; Huston, 1979). The study forests are used for production of timber, poles, firewood, charcoal and cultivation of crops. As a result, harvesting of forest products destroys many non-target trees, creates new habitats, and makes remaining species vulnerable to stress in highly disturbed sites. However, the diversity and richness of species in the sapling and ground flora size classes did not differ among the forest communities.

According to Huston (1979), disturbances can result in significant reduction of species diversity and/or maintain high diversity in some systems. Plant species diversity generally increases during the early stages of succession and decreases during the later stages, with maximum diversity during mid-succession. This is common within the forest communities in the Mpigi forests. For example, occurrence of human disturbance was high in forest communities five and 10, but the diversity was high, while forest community seven showed few signs of human disturbance and subsequent low species diversity. In forest communities one and eight, species diversity declined with increase in disturbance, implying that these sites were unable to recover from the stress created by forest exploitation.

Many studies have found that highest species diversity occurs at intermediate frequencies of disturbance, with low diversity at both very high and very low frequencies (Connell, 1978; Huston, 1979). At the intermediate levels of disturbance, the diversity and richness of plants

in tropical forests is considered to be higher due to environmental heterogeneity created in the canopy gaps (Connell, 1978; Huston, 1994; Laska, 1997). The forest community seven had the highest DBH and basal area but with low diversity. This is a typical undisturbed site and low diversity could partly be due to competitive exclusion as dominant species eliminate poor competitors (Hutchinson, 1941, 1953; Connell, 1978; Huston, 1979; Sousa, 1980).

5.4.3 Relationship between forest ownership and stand structure

The size class distribution of trees in forest communities with the majority of samples from the Wabirago and Kaswera local forest reserves and the Katabalalu central forest reserve exhibited unstable population structure (see Figure 5.5). There was a high concentration of many small-sized individual trees as well as a high rate of decline in tree population from small to large trees and then having an unexpectedly high number of stems above 70 cm DBH. The observed trends in the study forests can be attributed to human activities. The exploitation of forest produce from samples within these forest communities may have been disproportional targeting mostly large trees, such that the larger diameter classes of valuable trees was depleted. This demonstrates that these communities have been modified through human disturbances. All other communities in studied forests showed a reverse-J curve with decreasing number of trees per hectare with increase in DBH. An inverse J-shaped size class-distribution curve for trees indicates many more juveniles than adults. This implies that there is high survival rate between seedling and sapling stages in these forest communities, suggesting a self–replaced population within the study forests (Hall and Bawa, 1993). A linear reduction in stem densities with increasing diameter class conforms to the characteristic of a typical primary forest (Dawkins, 1958; Phillip, 1994).

The relationships between trends of tree DBH and basal area (m^2/ha) across increasing diameter classes within the study forests were not uniform. The results show that forest communities five and six with majority of the samples from the Katabalalu central forest reserve and community one with majority samples from the Wabirago local forest reserve had the lowest DBH and basal area. As the study forests have almost similar rainfall and soil types and approximately the same elevation (Langdale-Brown *et al*., 1964), variation in the average DBH and basal area could be attributed to differences in management practices and some other unknown factors. Size-class in most cases is determined by interaction and competition of individuals in a stand depending on environmental conditions, disturbances and the biological characteristics of a particular species (Hitimana *et al*., 2004). Stem size

classes, DBH and basal area of trees in the Mpigi forests are affected by human disturbances (Gombya-Ssembajjwe, 1996; Banana *et al*., 2001).

The densities of sapling and seedling size classes were high but not significantly different among the forest communities. This implies that there has been a higher survival rate of trees between the sapling and seedling stages among the study forests. However, the overall seedling density of the most dominant species was generally low among the study forests. This is partly because of the limited conditions for seed dispersal in these forest communities during succession (Huston, 1979).

The differences in the mean density, DBH, basal area and tree height demonstrate that forest communities in the central forest reserves had better physiognomic structure than in private and local forest reserves. Private forest owners use family labour and hired informers, while the Forest Department has the technical forestry staff for monitoring the forest resources. In local forest reserves, the capacity of local government staff delegated from the central government is overstretched because they have to monitor local forest reserves in addition to the central forest reserves. As noted by Ostrom (1999), degradation of forest resources mostly occurs under open access situations once local governments and state forest departments fail to establish an effective monitoring system. The degradation in local forest reserves may also be attributed to the fact that the central government devolved them to local governments when they were already degraded (Birakwate, 2003). Furthermore, decentralised forest governance in the Mpigi District and in Uganda in general is a recent initiative that began in 1998 (Government of Uganda, 1998). Therefore, the degradation of the local forest reserves may not necessarily indicate local government failure to regulate forest use, but because of the short time period for them to adjust to the new challenges in forest governance. The success of decentralised forest governance in the Mpigi forests will greatly depend on the ability of the Forest Department to empower and build capacity of the local governments in forest management.

5.5 Conclusions and recommendations

5.5.1 Conclusions

The following conclusions can be drawn from this study:

1) Species diversity and richness of the Mpigi forests appeared to be influenced by both ecological and human factors, but human disturbances are the most important determinants of distribution and composition of species.

2) The level of degradation was not uniform across the Mpigi forests, with human disturbances more frequent in forest communities that constituted the majority of the samples in the Wabirago and Kaswera local forest reserves, intermediate in the Katabalalu and Makokolero central forest reserves and lowest in the Kaziro and Kasisira private forests. The high degradation in local forest reserves is partly attributed to the fact that they were decentralised to local governments when they were already degraded under the former custodianship of the Forest Department and because of the open access tendencies resulting from inadequate monitoring by the delegated District Forestry staff who in addition have to monitor central forest reserves.
3) Species richness and diversity were higher in forest communities with the majority of samples in the Katabalalu and Makokolero central forest reserves, intermediate in the Kaswera and Wabirago local forest reserves and lowest in the Kaziro and Kasisira private forests.
4) Stocking levels (density, DBH, basal area and height) of commercially desired Class 1 and Class 2 tree species were high in forest communities that had the majority of samples in the private forests and central forest reserves than in the local forest reserves. The stand structural characteristics demonstrate that local forest reserves are under-stocked compared to private and central government managed forests.
5) Most dominant primary species such as *Piptadeniastrum-Albizia-Celtis* had been replaced by secondary and colonising species such as *Pseudospondias macrocarpa*, *Macaranga schweinfurthii*, *Funtumia africana*, *and Trilepisium madagascariensis*.
6) Unique species which are typical indicators of human disturbance such as *Eucalyptus grandis*, *Senna spectabilis, Carica papaya Solanum giganteum*, *Mangifera indica, Physalis peruviana*, *Manihot esculenta*, *Amaranthus*, *Gynandropsis*, *Dioscorea* and *Cannabis sativa* were common in the Mpigi forests, particularly in local forest reserves.

5.5.2 Recommendations

The following recommendations can be made:

1. The strategies to improve the management and maintenance of diversity of the Mpigi forests needs to adequately recognise and better manage human impacts by forest agencies and owners. This could be through improving the capacity of the forest agencies (the Forest Department, local government and private sector) to monitor and regulate harvesting of forest resources.

2. Long term system studies in natural forests (private, local and central forest reserves) are required to fully understand the real significance of ownership on the structure and composition of these forests.

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CHAPTER SIX

PHYSICAL, SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS AFFECTING THE PRIVATE, LOCAL AND CENTRAL GOVERNMENT AGENCIES IN MAINTAINING THE CONDITION OF THE MPIGI FORESTS, CENTRAL UGANDA

6.1 Introduction

The relationship between human disturbances, physical, socio-economic, institutional factors and forest ownership on forests structure is not always known due to lack of information to quantify forest change. In most cases, forest owners and managers lack precise information on the condition of forests, and the changes that occur in forests as a result of management practises by forest owners and forest institutions. Schweik (2000) suggests the calculation of aggregate species abundance indicators such as biomass, tree density, basal area, dominance and presence of human activities as the best means to quantify forest condition and change in a forest. Tree size class structure and occurrence of human disturbances have been used as indicators in evaluating the condition of forest patches adjacent to Budongo Forest Reserve (Byamukama, 2000).

Studies conducted in Asia (e.g. Becker and León, 2000; Cooke, 2000) found that the condition of forests was in most cases a reflection of ecological (abiotic and biotic) and socio-economic factors. The socio-economic factors include population density, market of the forest resource, accessibility to the resource and the institutional arrangement that regulates the use of the forest resource. A recent study (Friedland *et al*., 2004) showed that forest foraging rates depend on interrelated economic, sociological and biological factors in and outside the area where the forests are located. Other studies (e.g. Banana *et al*., 2001; Braedt and Schroeder, 2003) showed that high population pressure and market for forest resources result in forests having many human activities, and low density, DBH and basal areas of trees. The high demand for forest produce creates competition among forest users, and reduces their ability to follow rules regulating the use of forest resources (Campbell and Byron, 1996; Little and Brokensha, 1987). The availability of markets for forest products increases harvesting levels because forest users are able to harvest resources for cash. The condition of common pool resources can be degraded as a result of high demand, and breakdown or absence of effective institutions regulating resource use (Dove, 1993; Agrawal, 1996; Varughese, 2000).

Some common property resource theorists and policy makers believe that private ownership guarantee sustainability of forest resources (Arnold, 1998). Meinzen-Dick and Knox (1999) support decentralisation of forests because rules made for managing forest resources by local authorities and leaders of traditional institutions are considered legitimate and more relevant to local situations. As noted by Beland and Plateau (1996) and Arnold (1998), forest resources under local authorities can be well maintained because they are closely monitored. Opponents of decentralisation, however, believe that devolution of forest management leads to greater levels of deforestation (Kaimowitz *et al*., 1998; Larson, 2002; Ribot, 2002). They claim that forests are better managed under state forest departments because local governments lack technical expertise and financial resources to manage forests and may promote excessive resource exploitation to expand their tax base.

In Uganda, policy and legal changes have focused on the involvement of local governments and community based organisations in the management of decentralised forest resources (Government of Uganda, 1998). The aim is to consider local governments and community organisations as forest stakeholders, rather than users of forest products. Unlike traditional forest managers, local governments and community based organisations must address a range of forest management goals, including forest protection, production and poverty alleviation (MWLE, 2001).

Systems of forest ownership and management in Uganda are very diverse. In the Mpigi District management of forest resources is currently implemented by a multitude of management authorities, namely the National Forestry Authority (NFA), formerly the Forest Department, local governments, cultural institutions and the private individuals. Local governments are mandated to manage local forest reserves, while NFA controls central forest reserves and private forests are under private owners. These agencies have often proven ineffective at managing forest resources at the local level because the population is heavily dependent on them for timber, agriculture, energy production and other non-timber forest products (MWLE, 2002). Most often, the central government forest services are perceived to be geographically and socially distant from the forest resources, and have inadequate human resources to effectively monitor forest resource use (Shepherd, 1992). To-date, few studies have examined the physical, socioeconomic and institutional factors affecting the efficiency of forest owners and local and central government agencies in regulating forest use and maintaining the condition of forests. There is thus insufficient information to determine the most appropriate forest ownership arrangement capable of maintaining the productive and

structural conditions of the Mpigi forests. It is hypothesised that private and local government owned forests are in better condition than the central government owned forests because of an effective monitoring and rule enforcement. The objective of this study is to assess the physical, socio-economic and institutional factors that affect the local government, the private sector and the central government to regulate forest resource use and maintain the condition of forests under their jurisdiction in the Mpigi District, central Uganda. The following questions were addressed to pursue this objective:

(i) What kind of human disturbances exist in forests under private, local and central government management regimes?

(ii) What are the physical, socio-economic and institutional factors that affect forest owners (private, local and central government) in regulating forest resources under their jurisdiction and what organisational capacity exists under each institutional arrangement to maintain the natural state of these forests?

6.2 Methods

6.2.1 Study site description and criteria for selection of study forests

Katabalalu, Makokolero, Wabirago, Kaswera, Kaziro and Kasisira forests are located in the Mpigi District, central Uganda (Figure 5.1; Chapter 5). They lie between latitudes $0^{o}9'$S and $0^{o}24'$N and longitudes $31^{o}22'$ E and $32^{o}06'$E within a radius of approximately 120 km from Kampala, Uganda's Capital City. The study forests are broadly classified as tropical moist evergreen forests with closed canopies (Barbour *et al.*, 1987; Howard, 1991). They are also locally categorised as medium altitude *Piptadeniastrum-Albizia-Celtis* forests after the three typically dominant tree species in the area. The factors used in selection of the forests were: (i) the existence of some documented information such as maps and work plans; (ii) the differing ownership to enable capturing of the history of forest governance and practices under which forests are held in Uganda; and (iii) the Mpigi District being a historical supplier of forest products to the capital city (MWLE, 2002). The full description of the geographical and biophysical factors of the study forests is summarised in subsections 5.2 and 5.3 (see Chapter 5).

6.2.2 Management history of the study forests

Systematic management of the local and central forest reserves used in this study began in 1944. Attempts to start artificial regeneration started in 1945 (Sangster, 1950). Initial gazetting took place between 1932 and 1948 (Webster, 1961) (Table 6.2.1). The day to day

forestry activities in the local and central forest reserves included in this investigation are currently controlled at the Mpigi District Forest Office. Private forest management started in 1949 with the formation of the Dedication Scheme under which the Forest Service of the Buganda Government was mandated to manage the private forest estate using chiefs (Forest Department, 1955). The Kaziro and Kasisira private forests are part of the land that their parent the Late Kiwalabye acquired from the Kabaka of Buganda as token for his struggle to defend the Buganda Kingdom against external aggression (Kaziro, 2003).

Table 6.2.1 Management history and biophysical factors of the study forests, Mpigi District Uganda

	Private forests		Local forest reserves		Central forest reserves	
	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Area (ha)	8	20	54	65	1225	104
Year when 1st gazetted	na	na	1932	1932	1932	1948
Period when 1st exploited	na	na	1942-52	1944-46	1952-58	1953-57
Area degraded (ha)	na	na	18	17	152	8
Area deforested (ha)	na	na	39	49	146	
Average distance from Mpigi district forest office (km)	53	53	46	74	15	48
Average distance from Kampala City (km)	88	88	83	109	45	78
Average distance from a well maintained road (km)	0.1	0.5	12	8	15	10
Number of households in villages around the forest	290	320	806	1747	1098	1141
Elevation range (m)	1120-1170	1120-1160	1110-1195	1110-1250	1110-1180	1110-1220
Slope range (degrees)	1-4	1-4	1-6	1-14	1-7	1-8

Source: Webster (1961) and NBS (2003).
Note: na denotes data not unavailable.

Forest management activities and decisions for governing private forests were made at family level. Private owners had an informal system for monitoring forest resources and their use, using family members and local paid informers. Information about the forest resource, especially the distribution of key valuable tree species within the forest is known to family members. Members of the family and adjacent communities are allowed access to forest products only for domestic use. The private forestland can be sold or transferred by the family members, and/or converted into other land uses as they wish. The private owners are supposed to receive technical advice, particularly planning, from the Forest Department (MWLE, 2002). Exploitation of forest produce for commercial purposes, however, requires permission from the Forest Department (Kamugisha, 1997), and this has been a major disincentive to private forest investment (Birakwate, 2003). Since the 1940s, the destruction of private forests to create arable and grazing land has persisted in Mpigi District (Sangster, 1950), and this has continued to the present.

6.2.3 Data collection

Various human activities were used as indicators in evaluating the capacity of the local government, private owners and the central government to regulate forest use and maintain the condition of the Mpigi forests. At each plot, data on general features of the plot such as slope and topographical position were recorded. Elevation and steepness for each forest plot was measured because human consumptive activities at higher altitudes are expected to be lower because forest users may tend to avoid such sites to reduce harvesting costs (Schweik, 2000). The procedures for sample selection and measurement of slope, elevation, local data pertaining to each plot, as well as the record of human disturbances encountered and the identification of trees in each plot are summarised in subsection 5.2.3 and 5.24 (see Chapter 5). The number of households from parishes within the proximity of the forest (up to 5 km) was recorded as a *proxy* for household pressure on the forest. This information was obtained from records available from the sub-county headquarters. The distance of the forest from the well maintained road, Mpigi District Forest Office and Kampala City and Forest Administrative Centre were estimated by taking the positional data of these areas in relation to the forest and using the Arc-Info GIS post distance function to calculate the distance of the forest from each point. The data on the forest size for local and central forest reserves were obtained from the Forest Department records, while private owners provided information on private forests. A total of 156 nested plots of 20 m x 50 m (13 in the Kasisira, 18 in Kaziro, 30 in Katabalalu, 31 in the Kaswera and in the Wabirago, respectively and 33 in the Makokolero forests) were used for sampling trees.

6.2.4 Participatory methods

Participatory rural appraisal tools such as group meetings and transect walks were conducted with communities adjacent to study forests to generate historical data on forest use, socio-economic and demographic status of communities that use these forests and how the forests are governed (Dovie, 2003). In addition, key informant interviews were held with the Forest Department staff and private forest owners to assess the resources (human, transport and communication equipment) available and the problems faced in governing these forests. This was supplemented with information from the Forest Department reports, work plans, maps, and personal communication with individuals and the Forest Department staff with experience on how the Mpigi forests are managed.

6.2.5 Data analysis

Recorded anthropogenic disturbance signs were used to distinguish study sites, and chi-square tests were used to establish the relationship between the occurrence of human consumptive disturbances and the forest ownership categories. The *a priori* expectation was that plots for forests under local government and private ownership would have fewer human consumptive disturbances than for plots under central government owned forests.

Multiple regression analysis was performed to test the hypothesis that plots for forests under local government and private ownership will have fewer signs of illegal timber harvesting compared to those plots within forests under central government ownership due to a more effective monitoring system. The presence of timber harvesting in a forest plot was selected as the dependent variable (Table 6.2.2) because it is the major commercial product illegally harvested from Uganda's forests (Hamilton, 1984; Howard, 1991; MWLE, 2002).

Table 6.2.2 Model description and expected relationships (-+) on the physical, socio-economic and institutional factors affecting the condition of the Mpigi forests, Uganda

Independent variables	Dependent variables (Signs of illegal timber harvesting in a forest plot)
Forest size	(+) Signs increase with increased forest size
Plot elevation	(-) Signs decrease with increased plot elevation
Distance from a well maintained road	(+) Signs increase with increased distance from the road
Distance from Mpigi district forest office	(+) Signs increase with increased distance from Mpigi
Distance from Kampala (administration centre)	(-) Signs decrease with increased from Kampala
Number of households adjacent to the forest	(+) Signs increase as the number of households increases

Multiple regression analysis was also performed to predict the effect of monitoring and rule enforcement by the forest agency on the condition of the forest. The presence of signs of timber cutting in a forest plot was used as *proxy* indicators (dependent variables) for effective governance. This was based on the fact that the surveyed forests had no people licensed to harvest timber. For the signs of illegal timber harvesting, the dependent variable was dichotomously grouped into 'presence' and 'absence' responses. A dummy variable as a *proxy* for the dependent variable was used with a value of '1' assigned to the presence of timber harvesting in a given plot and a value '0' assigned to absence of timber harvesting in a given forest plot. The equation for the probability of the forest plot showing evidence of illegal timber harvesting was expressed as:

$Yi = \beta O + \beta_1(Fsize) + \beta_2(Plelev) + \beta_3(Distroad) + \beta_4(DistMpigiFO) + \beta_5(DistKLA) + \beta_6(NHHs) + \beta_7(Plotori) + \beta_8(Plotsteep) + \beta_9(PVRegime) + \beta_{10}(LGRegime) + \beta_{11}(CGRegime) + \varepsilon_t$. Where, Y_1=Presence and/or absence of signs of illegal timber harvesting per plot for the *i*th observation; βO is the coefficient of the constant, β is the coefficient on each explanatory variable, and ε_t is the random error term. The independent (explanatory) variables used are presented in Table 6.2. They included: (i) plot elevation (Plelev); (ii) forest size (Fsize); (iii) average distance of the forest from a well maintained road (Distroad); (iv) average distance of the forest from the Mpigi District forest office (*proxy* for local forest administrative centre) (DistMpigiFO); (v) average distance of the forest from Kampala City (DistKLA) (*proxy* for market of forest produce and central forest administrative centre); (vi) number of households in parishes within a range of up to 5 km around the forest (NHHs) (*proxy* for population pressure); (vii); plot orientation; and (viii) plot steepness; and (ix) property regime (PVRegime, LGRegime and CGRegime) as private, local and central government ownership, respectively. The *a priori* expectation is that forests far from a forest administrative centre and in close proximity to a dense population would have many human activities because of the high demand for forest products. Property regime was converted into a continuous variable using two categories '1' if a private, local government and/or central government owned forest and'0' not private, local government or central government owned forest. Four codes were used to categorise plot orientation: 1=SW, 2=E, 3=NW, 4=NE, 5=SE, 6=W, 7=N, 8=S). All statistical analyses were carried out using STATISTICA (StaSoft. Inc, 2003).

6.3 Results

6.3.1 Human activities recorded in study forests

Evidence of human disturbance was found in all forests, mostly related to timber, polewood and firewood harvesting (Table 6.3.1).

Table 6.3.1 Distribution of human disturbances in the Mpigi forests, Uganda

	Private forests		Local forest reserves		Central forest reserves	
Disturbance (s)	Kasisira (n=13)	Kaziro (n=18)	Kaswera (n=31)	Wabirago (n=31)	Katabalalu (n=30)	Makokolero (n=34)
Timber cutting	-	-	61.3	45.2	36.7	52.9
Charcoal burning	7.7	5.6	9.7	12.9	13.3	17.6
Pole collection	46.3	16.7	16.1	35.5	23.3	14.7
Firewood collection	46.2	27.8	19.4	29.0	50.0	8.8
Agriculture	-	-	6.5	12.9	6.7	11.8
Animal grazing	7.7	-	-	3.2	-	2.9
Collection of herbs	-	-	-	-	3.3	-

Note: Numbers in the columns are percentage of the plots showing the human disturbances.

Based on stumps observed and identified, the most frequently exploited tree species in the study forests were *Funtumia africana,* recorded in 6.4% of the total number of plots, followed by *Antiaris toxicaria* (5.7%), and *Piptadenisatrum africanum* (4.5%) (Table 6.3.2).

Table 6.3.2 Tree species and plots where it was exploited in the Mpigi forests, Uganda

		Private forests		Local forest reserves		Central forest reserves	
	No. of plots	Kasisira (N=13)	Kaziro (N=18)	Kaswera (N=31)	Wabirago (N=31)	Katabalalu (N=30)	Makokolero (N=33)
Funtumia africana	10	-	5.6	3.2	16.1	-	9.1
Antiaris toxicaria	9	-	-	12.9	9.7	6.7	-
Piptadenisatrum africanum	7	-	-	12.9	3.2	3.3	3.1
Maesopsis eminii	7	-	-	3.2	3.2	16.7	-
*Phoenix reclinata**	6	15.4	-	3.2	9.7	-	-
Lovoa trichiliodes	5	-	-	12.9	-	-	6.6
Albizia coriaria	5	-	-	9.7	3.2	-	-
Parkia filicoidea	3	-	-	-	-	3.3	6.1
Trichilia drageana	3	-	3.2	3.2	-	-	-
Blighia unijugata	3	-	-	3.2	-	3.3	-
Phyllanthus discoideus	3	-	-	6.5	3.2	-	-
Albizia globerima	3	-	-	-	6.5	3.3	-
Mitragyna stipulosa	3	-	-	-	9.7	-	-
Polyscias fulva	3	-	-	-	-	10.0	-
Ficus exasperata	2		-	-	-	3.3	3.1
Celtis durandii	2		-	-	-	3.3	3.1
Trilepisium madagascariensis	1		-	3.2	-	-	3.1
Canarium schweinfurthii	1	-	-	-	3.2	-	-
Rauvolfia vomitoria	1	-	-	-	3.2	-	-
Pycnanthus angolensis	1	-	-	-	3.2	-	-
Fagara leprieurii	1	-	-	-	-	3.3	-

Note:*Harvested mainly for fencing poles, Number in columns are percentage of plots where the species was recorded.

The frequency of timber harvesting differed significantly among the study forests (χ^2=18.33, df=5, p<0.001). More forest plots in the Kaswera (61.3%) and the Makokolero (52.9%) local and central forest reserves, respectively, showed signs of illegal timber harvesting. A significant relationship existed between the occurrence of timber harvesting and forest ownership categories (χ^2=26.24, df=5, p<0.001). More than half of the sampled plots in local forest reserves (52.3%) showed signs of illegal timber cutting, compared to 46% in the central forest reserves and 1.6% in private forests. There was no sign of recent timber harvesting in the Kasisira private forest. Evidence of firewood collection was significantly higher in the Katabalalu forest than in the other study forests (χ^2=16.68, df=5, p=0.01). About half (50%) of the forest plots in the Katabalalu forest showed signs of firewood harvesting. All other anthropogenic activities recorded (polewood and medicinal harvesting, agricultural encroachment and livestock grazing) did not differ significantly among the study forests.

In general, the frequency of all human disturbances differed significantly among the study forests (χ^2=18.33, df=5, p<0.001). The number of forest plots showing signs of human disturbances was significantly higher in the Wabirago forest (87%) than in the Katabalalu (76.6%), Kaswera (74.2%), Kasisiraa (61.5%), Makokolero (58.8%) and the Kaziro forests (33.3%). On analysing data by ownership, the frequency of all human disturbances differed significantly among forest ownership categories (χ^2=12.0353, df=2, p<0.05). A high proportion of plots (80.6%) in local forest reserves showed evidence of human disturbance, as compared to 67.2% in local forest reserves and 45.1% in the private forests.

6.3.2 Factors affecting forest agencies to regulate timber harvesting in the Mpigi forests

The multiple regression analysis showed only five factors that significantly predict the presence of illegal timber harvesting (One-way ANOVA, p<0.05; Table 6.3.3). As the number of households around the forest increased, the probability of forest plots showing signs of timber harvesting increased (one-way ANOVA, p<0.001).

Table 6.3.3 Factors effecting forest monitoring and regulation of timber harvesting by forest agencies in the Mpigi forests, Uganda

Explanatory variables	Coefficient (B)	Standard Error (SE)	p-value
Forest size	0.0009	0.00023	0.0000***
Plot elevation	-0.0009	0.00132	0.5040ns
Distance of the forest from the road	0.0858	0.02029	0.0000***
Distance of the forest from the Mpigi Forest Office	-0.0571	0.02084	0.0070**
Distance of the forest from Kampala	0.0293	0.01794	0.0105**
No.of households around the forests	0.0007	0.00013	0.0000***
Property regime	-0.0372	0.09801	0.7060ns
Constant	1.2733	1.77241	0.4740ns
R^2	0.1692	0.45555	0.0000***

Note: ns= not significant, **, ***Signifanct at p<0.05, <0.001, respectively.

The probability of the forest showing signs of timber harvesting increased significantly with increase in distance of the forests from well-maintained roads (one-way ANOVA, p<0.001). Furthermore, the probability of the forest showing signs of timber harvesting increased significantly with increase in the distance of the forests from Kampala (proxy for market and central forest administrative centre) (one-way ANOVA, p<0.05). Forest size was positive and significant, indicating that timber harvesting increases with increase in forest size (one-way ANOVA, p<0.001). As the distance of the forest from the Mpigi Forest Office decreased, the signs of timber harvesting also decreased. Other variables used in the model

such as forest tenure and plot elevation did not significantly affect timber harvesting from the study forests.

6.4 Discussion

6.4.1 Human disturbances in the Mpigi forests

This study has shown that the Mpigi forests are used for production of timber, polewood, firewood, charcoal and cultivation of crops. The interaction between local people and Mpigi forests has existed since the colonial times (Sangster, 1950). The studied forests continue to support the livelihoods of local people through provision of forest products. Over-time local people have changed their strategies from use of forests for domestic to commercial production of fuelwood and other forest products. Firewood and timber extraction accounted for more than half of the human activities recorded from study forests. In most developing countries the wood requirements in both rural and urban areas are satisfied at the cost of overexploitation of forests (Schulte-Bisping *et al*., 1999). The demand for wood energy from the Mpigi forests is high and the trend does not show progress towards a positive change in the near future because fuelwood is the major source of energy for over 90% of Ugandans (Jacovelli and Carvalho, 1999). The concept of multiple use forestry that designate forests into production areas that allow controlled harvesting and strict nature reserves for conservation of resources will help to reduce degradation of the Mpigi forests (von Gadow *et al*., 2000).

6.4.2 Factors affecting forest agencies to regulate timber harvesting in the Mpigi forests

There was a strong relationship between timber harvesting from the study forests and the number of households, forest size, and the distance of the forest from well-maintained roads, Mpigi District Forest Office and Kampala City (Table 6.3.3). The increase in timber harvesting with the increase in number of households was expected. Most communities around the Mpigi forests derive their livelihoods from timber exploitation and other non-timber forest products. In common with other rural areas in Uganda, wood fuel is the major source of household energy (NEMA, 1998). Even in the urban areas, the cost of electricity is quite high and wood fuel remains the main source of energy. Subsistence agriculture is a major livelihood activity of the communities living adjacent to the Mpigi forests. The decreasing availability of new farmland coupled with the increasing population forces people

to encroach on forestland. In addition, communities adjacent to the forest believe that forest soil is fertile and capable of supporting crop production. As noted by Little and Brokensha (1987), Wade (1988) and Agrawal and Yadama (1997), forest resources are subject to open access once there is high population pressure, without alternative livelihoods.

The findings show that signs of timber harvesting decreased with decrease in distance of the forest from Mpigi District Forest Office. This implies that forests close to the Mpigi Forest Office are closely monitored. According to Shepherd (1992) and Wyckoff-Baird (1997) state forest departments are physically and socially distant from forest resources and local control offers an opportunity to better manage forest resources due to reduced distance. There was an unexpected increase in timber harvesting as the distance of the forest from the well-maintained roads and the Kampala City increased. The increase in number of plots showing signs of timber harvesting as one move farther away from Kampala is not surprising because most of the forests close to Kampala City are already depleted and forest users currently move deep in remote areas for forest products. The proximity to the road and Kampala City may be a *proxy* for two different forces, namely the effect of high level monitoring and law enforcement and of market forces. The results, however, show that the effect of the market forces was more important than the effect of monitoring and law enforcement. A study by Colchester (1994) found that strong market demand for forest produce motivates people to break laws even if strong rules are in place. In contrast, the reasons for the increase in signs of timber harvesting in local and central forest reserves located far away from the Mpigi District Forest Office, suggests that local governments and the District Forestry staff are not yet effective in regulating forest resource use. If devolution has worked and the Production and Environment Committees of local governments were in full control of the forests, then local forest reserves should not have had many signs of human activities. Similar findings have been reported in Asia (Schweik, 2000) where local governments have failed to regulate forest resource use as a result of market pressure.

The increase in signs of timber harvesting as forest size increased was expected. As common pool resources increase in size, forest agencies need more resources such as staff, vehicles, finance and time to effectively monitor the resources (Arnold, 1998). Discussions with local government and the Forest Department staff highlighted inadequate human and financial resources as the major constraints in managing decentralised forests. Most of the forest guards have limited means of transport to monitor the Mpigi forests. This confines them to monitor forest resources in areas close to their work place. Furthermore, the extent of the area

for which a single officer is responsible and the inadequate budgetary support to forestry are the other important reasons for failure in controlling illegal forest use. For example, the Mpigi District Forest Office had a limited operational budget of about US$ 14,950 (about 0.2% of the total budget in the financial year 2002/3) (see Tables 3.3.4 and 4.3.3). In addition, there is also a shortage of forest staff due to the restructuring of the civil service in the country (Kamugisha, 1997; Byarugaba, 2002). Likewise, retrenchment and the uncertainty that surrounded the transformation of the former Forest Department into the present National Forestry Authority meant low morale for the staff to monitor and regulate illegal forest activities. The lack of adequate resources implies that large forests, located far away from the Mpigi District Forest Office and Kampala Forest Department headquarters are more exposed to illegal forest harvesting. The high number of human disturbances in local forest reserves also indicates that decentralised control of forests has not yet been translated into practice in local governments.

6.4.3 Enforcement of forest rules and sanctioning offenders of the Mpigi forests

Although local and central forest reserves showed many signs of human disturbances, records available at the Mpigi District Forest Office indicate that only 35 offenders were arrested and prosecuted between January 2002 and July 2003. Of these, 15 paid cash fines ranging between 70,000 and 150,000 Uganda shillings (equivalent to US$ 40-90), 11 were cautioned and warned by the District Forestry Office, six were imprisoned for a period ranging from one week to six months, while three were committed to community work at public institutions for a period between 300 and 400 hours. The low number of offenders prosecuted shows lack of commitment to monitor and enforce forest rules at the local level.

The management of both local and central forest reserves depends on the formal rules that rest on the enforcement power of the state (Kamugisha, 1997). However, these rules and regulations are generally neither known, nor respected by forest users. In addition, the sanctions are not deterrent and thus forests continue to be illegally exploited. The presence of many signs of timber harvesting in both local and central forest reserves may be partly attributed to the low level of enforcement of rules and inadequate sanctioning of forest offenders by the local and central government authorities. As noted by Varughese (2000), forests with well-enforced rules that limit forest exploitation are more likely to be in a better condition than the forests where rules are not enforced. As such, sustainable management of both local and central forest reserves seem unattainable given the ambiguity in the current rules, lack of awareness of the existence of rules and regulations and the lack of enforcement

and control mechanisms. Similar cases have been reported in other countries (Fortmann and Bruce, 1988; Brigham *et al*., 1996). Monitoring, by itself alone does not stop illegal forest use and hence strengthening local forest institutions need to review the amount and nature of penalties given to the forest offenders (Gregersen and Lundgren, 1989; Ostrom, 1990).

The findings of this study demonstrate that the private forests are relatively well protected from human disturbances because of efficient system used by private owners to monitor the use of forest resources and sanctioning of offenders. Private forest owners have informal ways and oral arrangements for regulating forest resource use. According to the National Forest and Tree Planting Bill of 2003 (Government of Uganda, 2003), private forest owners may seek technical and policy guidance from the Forest Department. Private forest owners also constantly monitor their forests, use informers and impose heavy fines to deter offenders. The *do's* and *don'ts* as well as the boundaries of the private forests are well known to local communities. Where there is violation, local courts fine the offenders heavily to deter them from illegal forest acts (Arnold, 1998; Becker and León, 2000). This has resulted in the effective management of private resources. In case the offenders refuse to pay the fine determined by local courts, private owners appeal to the magistrates courts for further action. Since private owners bear the cost of monitoring, they often make strong sanctions obvious to the offenders so that monitoring costs are reduced. However, not all private owners are conservation minded because most private forests in the Mpigi District were being cleared for charcoal, firewood and agricultural production during the field work. Without proper legislation in place for governing and regulating forest resource use, their future survival is uncertain. As noted by Berkes *et al*. (1989) and Bromley and Cernea (1989), private owners cannot necessarily be entrusted with custodianship of Uganda's forest resources.

6.5 Conclusions and recommendations

6.5.1 Conclusions

1. Although local forest reserves are physically and geographically closer to the local governments and the local administrative office, they had more signs human disturbances than central forest reserves and the private forests. The high number of human disturbances from illegal harvesting of timber, charcoal, poles, firewood, agricultural encroachment and livestock grazing in local forest reserves, indicates that the Production and Environment Committees of local governments are not yet effective in monitoring and regulating forest resources use.

2. The involvement of local governments in the management of local forest reserves is a recent move by the central government and the management local forest reserves was thus largely carried out by delegated staff from the central government, whose capacity is overstretched because they played dual roles of monitoring both local and central forest reserves.
3. Local governments have not yet failed to regulate forest resource use in local forest reserves because it takes long for devolution of forest management to yield benefits. The more local governments are involved in the governance of forests, the more they gain confidence and skills to effectively manage forest resources.
4. The locational distance of the forest from well-maintained roads, the local and the central forest administrative office, market of the forest produce, the size of the forest, and the number of households adjacent to the forest significantly affected the capacity of private, local and central government authorities in regulating forest use in the Mpigi forests. Large forests located far away from roads and forest administrative centres and in close proximity to a dense population were more affected from illegal forest use.
5. There was little effort from private owners to conserve ungazetted forests because most of the private forests in the Mpigi District were being cleared for fuelwood and agricultural land, indicating that private ownership is not necessarily a better option for managing forest resources in Uganda.

6.5.2 Recommendations

1. There is need for translation of the Forest Policy, the Forest Reserves Declaration Order and the National Forestry and Tree Planting Act into practice so that the Production and Environment Committees of the local governments are empowered to plan, monitor, penalise and sanction forest offenders.
2. Staff deployment and allocation of fiscal resources for forestry among forest agencies needs to take into account the size of forest, population of the adjacent communities, distance of the forest from the local and central administrative office and the market of the forest product.
3. There is a need to regulate the activities of private owners and the transfer of property rights to private owners must be promoted and implemented cautiously to avoid further degradation of the remaining private forests.
4. Further research is needed to establish the effect of decentralisation on the condition of forests in other districts of Uganda.

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CHAPTER SEVEN

DECENTRALISATION AND FOREST MANAGEMENT IN UGANDA

7.1 Introduction

Since the colonial period, forest management in Uganda has largely remained under the control of the Forest Department. Policies and practices around forestry have continued to reflect the State centred visions of how forests generate revenue for the national government with little or no consideration for the needs and concerns of forest users whose livelihoods depend on forestry (MWLE, 2002). As a result, pressure on forests for timber and non-timber forest products from forest users continue to erode Uganda's forest estate. The forest cover had reduced from 10.8 million ha in 1898 to approximately 4.9 million hectares in 2003 (National Biomass Study, 2003). The loss of forest cover and conflicting relations between the Forest Department and local governments and forest users continue to challenge conservation and sustainable forest management efforts.

In the face of these challenges, the central government began the process of decentralising the management of forest resources to local governments and local community organisations in 1998 (Government of Uganda, 1998). Like other developing countries, the government of Uganda views participation of local governments, NGOs, research institutes and civil society organisations in forestry as a practical and equitable alternative to traditional top-down approaches to forest management. It is also viewed as a way to regulate forest resources use cost effectively on behalf of the Forest Department. Given the nature of the past relationship between the Forest Department and communities, neutral agencies with grassroots experience such as NGOs and CBOs mediate participation of local communities and their institutions in decentralised forestry. The Uganda Forest Policy of 2001 (MWLE, 2001) and the National Forestry and Tree Planting Act of 2003 (Government of Uganda, 2003) also encourage local governments, civil society organisations and private individuals to take part in forestry investment.

The role of local organisations in building the capacity of communities to accept community conservation programmes is widely promoted in many parts of Africa (Nhira and Matose, 1996, 1998; Barrow *et al.,* 2000), various parts of India (Hobley, 1996; Poffenberger, 1996), Vietnam (Poffenberger, 1998) and other countries, such as Nepal, the Philippines and

Thailand (Arnold, 1998). State-local collaboration has long existed in common property management, such as the Norwegian Lofoten fisheries, which originated in the late 1800s (Holm *et al*., 2000) or the council forests in Kirinyaga, Kenya which arose during the 1930s and 1940s (Castro, 1995).

In Uganda, collaborative forest management initiatives between the Forest Department and local communities are promoted to win support of local authorities in the management of forest resources (Scott, 1998). Collaboration between the Forest Department and community based organisations is a strategy used for integrating forestry into the national strategic plan and policy for sustainable development and poverty reduction in Uganda (MWLE, 2002). Through collaboration, information on the forest revenues, products and inputs is shared and this is essential for stimulating public interest in forestry. The Forest Department also leases degraded portions of central forest reserves to private individuals for tree planting so as to make the forest sector more competitive and attractive for investment (Kiyingi, 2004). In each district, there is an NGO forum that coordinates and streamlines the activities of all organisations involved in natural resource management, including forestry. However, the factors which govern whether or not local organisations will sustainably manage decentralised forest resources are as yet not well understood.

This study was initiated to examine and document the capacity of local organisations to manage forest resources in a decentralised system of governance in Uganda and to recommend relevant policy reforms (see Subsection 1.7, Chapter 1). Semi structured and key informant interviews and reviews of archival information were used to generate data. In addition, a forest inventory was conducted to assess the composition and structure of forests and evaluate physical, socio-economic and institutional factors that affect forest governance at local level. Five specific studies were conducted to examine different parts of this overall study (see Chapters 2 to 6): local organisations and decentralised forest governance; technical and institutional capacity in local organisations to manage decentralised forest resources; the role of the Forest Department in fostering decentralised forest governance; the structure and composition of the Mpigi forests under private, local and central government management; and the physical, socio-economic and institutional factors affecting the private, local and central government agencies regulating forest resource use and maintaining the condition of the Mpigi forests in Uganda. Each chapter deals with the detail results and discussion for each specific study. This chapter synthesizes information from the different studies (see

Chapters 2 to 6) and recommendations are also made for specific reforms to ensure effective decentralisation of forest management in Uganda.

7.2 General discussion

7.2.1 To what extent are local organisations involved in the implementation of decentralised forestry? Do they have the capacity to implement decentralised forestry?

Although central bureaucrats argue that programmes and policies made at the local level may not be fully in line with the national government policies, the results from this study show that local organisations support activities aimed at conservation of forest resources and restoration of degraded areas (see Table 2.3.2, Chapter 2). Local organisations also promote activities such as agroforestry, bee keeping and tourism development that help communities to improve their livelihoods without wood extraction from forest reserves. These activities are in line with provisions of the Local Government Act of 1997 (Government of Uganda, 1997), and the Forest Policy of 2001 (MWLE, 2001) and the National Forest Plan (MWLE, 2002). While it may still be too early to judge, this suggests that local organisations are taking a leading role in the decentralisation of forest governance. Furthermore, local organisations make and implement local budgets, and draw up integrated development plans that incorporate forestry activities. In addition, local organisations recognise community groups as the main stakeholders in forestry affairs through environmental education and collaborative forest management.

As reported in Chapter 2, local organisations communicate vertically with the central government authorities and horizontally with other actors at local government level involved in agriculture, forestry and environmental protection programmes. Communication amongst organisations provides an information system about forest goods and services. It also enhances the quality of decision-making amongst those involved in natural resources management (Andersson, 2003). Local organisations link up with donor agencies and other partners engaged in decentralised forestry through sharing of technical staff, information and facilities. Linkages amongst partners enable them to combine resources and learn from the experiences of other actors in solving forestry and environmental problems, staff training and in reducing the cost of monitoring forest resources. Collaboration between organisations has also been used as a tool for enhancing the capacity to provide services in forestry organisations within the southern African countries (Kowero and Spilsbury, 1997). Collaboration between local governments, NGOs and community based organisations help to

publicise forestry programmes (Barrow *et al.*, 2000; Turner and Meer, 2001). Furthermore, there is coordination in local organisations with other actors involved in forestry, which Romeo (2003) termed as interactive capacity.

Local organisations demonstrated the ability to manage finance, solve environment problems and had democratic and downwardly accountable elected members. Elected members are important in mobilising people and resources for decentralised forestry because they are closer to people and have better knowledge of the needs and expectations of their constituents than the national government, thus they make integrated plans that incorporate local priorities. According to Handy (1999) and Faguet (2004), involvement of accountable local leaders offers an opportunity to implement natural resource management programmes in local organisations and increases their capacity to solve local problems. Lewis and Hartley (2001) believe that elected leaders focus resources on initiatives deemed worthwhile to communities and provide the political help needed to motivate individuals to take part in decentralised forestry. The political will of elected leaders in local governments is thus crucial to the implementation success of decentralised forestry.

7.2.2 Are there incentives to motivate involvement of local organisations in decentralised forestry?

According to Dykstra *et al*. (1996), incentives are essential prerequisites for participation of local organisations and communities in the conservation of forests resources. This study has shown that donor and central government funds are important incentives motivating local organisations to participate in decentralised forest governance. Local governments participate in forestry as a strategy to access national funding for tree planting and afforestation programmes. The income generating potential of forest resources is also an important incentive for local participation in decentralised forestry (Larson, 2003). Local governments participate in order to access and equitably share revenue from forests. By contrast, NGOs, research institutes and CBOs are motivated by donor funds and understanding the implications of deforestation on the social well-being of local communities. Funds from donors are important catalysts that stimulate participation of local organisations in natural resources management programmes (Ashley and Roe, 1998).

7.2.3 Are local organisations entrusted with decision-making powers over decentralised forest resources?

This study has shown that only local governments formulated forest rules, monitored, and arrested forest offenders as prescribed in the National Forestry and Tree planting Act of 2003 (Government of Uganda, 2003). NGOs, research institutes and civil society organisations had no mandate to carry out forest policing. The powers of local governments are, however, limited to arresting and impounding forest produce from forest offenders, while prosecution is handled by the Forest Department (see Subsection 2.3.5, Chapter 2). Local authorities reported that offenders handed over to the Forest Department walk free and may even get back the impounded equipment and forest produce. This implies that local organisations bear the task of forest resource monitoring without any meaningful transfer of authority or decision-making. This is a disincentive to local authorities to participate in forest regulation because their effort is abused by the prosecuting authority. Empowering local authorities to prosecute offenders motivates local organisations to effectively monitor and police forest resources (Capistrano, 2004). According to Larson (2002), local actions in which national governments have not devolved decision-making powers make it almost impossible for local bodies to undertake initiatives independent from the national government. Thus, moving from centralised to decentralised forest governance requires the transformation of the centralised culture of decision-making.

7.2.4 Is there commitment from the national government to facilitate decentralised forest governance?

As seen from Chapter 2 (Subsection 2.3.5), there is a general lack of commitment from the national government to facilitate and empower local organisations in decentralised forestry. The national government is not fully committed to relinquishing decision-making powers to manage decentralised forest resources. For example, often where locally the elected Local Councillors are responsible for implementing decentralised services, a parallel hierarchy of national government (a functional sector) with a responsibility for controlling and supporting local authorities exists. It was also noted that only small degraded local forest reserves are decentralised, while the large and economically viable central forest reserves have been retained by the Forest Department. The study further shows that local governments have no powers because decisions to degazette forest reserves are upheld by central government (Government of Uganda, 2003). This demotivates local governments to fully participate in forest management. As noted by Pfeil *et al*. (2004), local organisations and forest users need

strong and ultimate rights in return for good stewardship for them to be responsible in effecting decentralised forestry.

7.2.5 Have local organisations mobilised resources for decentralised forestry?

Most organisations receive funding from the central government in the form of conditional and unconditional grants and donations. Over 90% of the budget for most local governments is funded from central government transfers and donations (see Table 3.3.5). The revenue from forestry contributes less than 1% of the total budget of local governments. As a result, local governments plan most of their activities according to the conditions set by the national government, and this limits their autonomy to plan based on local priorities (Government of Uganda 2001). However, local governments have the power to borrow funds provided the amount does not exceed 25% of the locally generated revenue and will not infringe on the statutory requirements of the local governments (Government of Uganda, 1997). The allocation of locally generated revenue sources to the local governments enables them to collect their own revenue and fund their own priorities, hence ensuring more autonomy in budget formulation and implementation. However, local taxes are low-yielding, especially on agriculture and smaller enterprises, while others are unpopular, for example, the property tax and graduated tax[7], and hence difficult to collect (DANIDA, 2000; James and Francis, 2003). Furthermore, locally generated funds are inadequate and limit the organisations' ability to scale up decentralised forestry activities and to effect monitoring and regulation.

This study has revealed that money from aid agencies dominated funding for NGOs, research institutes and civil society organisations (Table 3.3.3). Local dependence on donor funding limits the autonomy of organisations to plan according to local priorities and does not always promote self-managed local community programmes because of the conditions frequently attached to the use of the money by local organisations. In addition, the use of donor funds is unsustainable and may affect the activities of local organisations in case donors withdraw funding before the project becomes self-sustaining as has happened in many conservation programmes in the Southern African countries (Ashley and Roe, 1998). Thus effective decentralisation of forest resources requires local organisations to devise their own internal sources of revenue. Money from development agencies in most cases should serve as a catalyst rather than long-term financial basis (Pfeil *et al*., 2004). According to OECD (2004), local organisations need skills in mobilising financial resources and also require a larger share

[7] Graduated tax is a head tax paid by every male and female person from 18 years and above, who is engaged in gainful employment or business.

of the national budget for them to effectively deliver decentralised services. Effective decentralised forest governance needs local organisations to mobilise sufficient resources. This could be met by raising taxes and levies on a wide range of forestry activities such as timber and non-timber extraction, transportation and processing of forest products. Another strategy could be through transfer of forest licensing from the central government to the district and sub-county governments.

The findings from Chapter 3 reveal that forestry is not accorded priority among the decentralised sectors. Local governments allocated less than 1% of their total budget to forestry (see Figure 3.3.1; Table 3.3.6; Chapter 3). Most funds in local governments target decentralised national priority programmes like health, education and agriculture. At the national level, forestry is also not among the priority programmes. In the financial year 2002/3 less than 1% of the national budget was allocated to the forestry sector (Republic of Uganda, 2003). In Uganda, forestry is undervalued despite the contribution to the country's gross domestic product (GDP) of up to 6% annually (MWLE, 2002). Only the quantified and monitored industrial sector appears in the GDP, while the direct and indirect economic contribution of forests to the livelihoods of forest users, and to the ecological protection of water resources and agriculture is scarcely noted, let alone measured. Decentralised forestry programmes need to be accompanied by a favourable financing strategy and policy, including all sources of finance: locally generated, private, national and international (Larson, 2002; OECD, 2004). This may require broad fiscal reforms, development of adequate incentives and changes in financial flows within the national government.

7.2.6 Is there a smooth transition from centralised to decentralised forest governance?

This study shows that decentralised forest governance has created conflicts between the Forest Department staff and Local Councillors. One of the main causes of conflicts is the issue of rights of access and equitable revenue sharing from forest resources (see Subsection 2.3.9, Chapter 2; Table 4.3.6, Chapter 4). Although the Forest Policy of 2001 and the National Forestry and Tree Planting Act of 2003 provide for revenue sharing between the local and central government, local government authorities are not satisfied with the 40% share of the revenue from forest produce. Dependence on forest resources and conflicts over their access has also been reported in many countries of sub-Saharan Africa (e.g. Turyahabwe, 1997; Turner, 1999). Discussions with local government authorities revealed that the local forest reserves that were decentralised are degraded owing to earlier forest management practices and uses and are of less economic value to the local governments and

would infringe on the already limited finances of the local government to restore them. As a result, local governments are discouraged to participate in the management of these forests because of the perceived low returns and benefits to their constituents. According to Andersson (2003), allocation of resources and enforcing formal property rights are easier where forest resources are more abundant.

Inadequate dialogue and mistrust between local organisations and the Forest Department is another cause of conflict in decentralised forestry. As reported in Chapter 4 (Table 4.4.5), the Forest Department feel that local organisations are not conversant with decentralised forest governance aspects because many of them have little or no knowledge of forestry. The Forest Department staff generally believes that the time is not right for forestry matters to be fully transferred to the district and sub-county levels because of human and financial resource limitations. The lack of trust between the Forest Department and local government actors undermines the capacity of local authorities to implement decentralised forestry services (Lane, 2003; Turner 2004). The Forest Department needs to accept the challenges associated with a shift in responsibilities to local authorities. It is important for the Forest Department to note that when adequate capacity does not exist in local organisations, it should be built during the devolution process. In practical terms, learning by doing will continue to remain one of the main ways organisations build capacity. The more local organisations get involved in the governance of forest resources, the better they build their capacity. According to Gronow and Shretha (1991), state forest department staff must recognise local organisations as active participants in decision-making over forests resources for effective decentralised forest governance. Lack of success in managing forests in a sustainable way is partly attributed to failure by the professional foresters to pay enough attention to local perspectives in forest management (Dubois, 1998). Thus, retraining of the Forest Department staff on social skills such as negotiation, use of participatory approaches and appreciating the views of forest users is essential for sustainable forest management (Ghimire and Pimbert, 1997; Bass *et al*., 1998).

Another conflict reported in this study is insecure tree tenure (see Table 3.3.8, Chapter 3). Local people are reluctant to invest in private tree planting because of insecure ownership and control of forest products on private land. Informal discussion with local authorities revealed that local people would rather invest in production sectors like agriculture where they are free to sell agricultural products. As noted by Dykstra *et al.* (1996), interventions in favour of tree production will only succeed once uncertainty that surrounds the ownership of forest

resources is clear to stakeholders interested in tree planting. Thus the National Tree Planting Act should clarify the rights of local people to own and control trees on private land if people are to invest their resources in forestry.

The results from Chapter 2 (see Subsection 2.3.7) reveal that the Forest Department staff corruptly deal with offenders or participate in direct theft of the forest resource. Discussion with local authorities in the districts of Mpigi and Mukono further revealed that some illegally impounded forest produce is sold in the nearby towns by the Forest Department staff for their personal gain. This demonstrates the failure by the Forest Department to enforce the existing legislation because of the economic benefits associated with the existing weak regulatory system. Like other civil servants in Uganda, the remuneration of the Forest Department staff is generally low compared to the value of the resource being managed. A Forest Guard is paid a monthly salary of about 60,000 Uganda Shillings (US$33) (Birakwate, 2003). As a result, they are tempted to take bribes and other non-official rewards. The involvement of the Forest Department staff for their personal gain has made local authorities lose confidence in their capacity to facilitate the decentralisation of forests. This has partly forced some local people to take advantage of the situation to illegally exploit forest produce to further their individual interests. According to Conroy *et al*. (2002), widespread bribery and corruption among forest rule enforcers make their activities susceptible to abuse and they are often not taken seriously by forest users. Adequate remuneration of the Forest Department staff and forest law enforcers is essential for sustainable forest management (Bowling, 2000).

Another factor hindering decentralised forestry is the involvement of local politicians and people connected with the State in plundering forest resources (see Subsection 4.3.7). This is common with soldiers, who coerce and threaten forest law enforcers when they are found in possession of illegally obtained forest produce. Forests also suffer from degradation during elections because local politicians support forest offenders as a strategy to win support for political positions. This undermines the work of the Forest Department and local authorities in monitoring forest resources. As noted by Shepherd (1992), self restraint involved in sustainable local forest management goes away quickly when there is lack of respect for forest enforcement agencies. Corruption and lack of respect for law undermine the work of forestry staff involved in the implementation of decentralised forest governance (World, Bank, 1997; Kaimowitz, 2003).

Decentralised forest governance is also hindered by overlapping authority and an unclear chain of command between the democratically elected leaders (Local Councillors) of the local governments and the Forest Department staff. Lack of coordination between governance actors at different levels of authority hinders decentralisation efforts (Smoke, 2003). While the District Forestry Staff are employees of the central government, they are supervised by the local government authorities. However, their accountability is more upward to the central government than horizontal to the Local Councillors who hold decentralised powers over forest resources. Local Councillors revealed that they cannot control the activities nor discipline forestry staff in case of abuse of office. This as a result has brought problems especially in the allocation of operational funds for running district forestry activities because local governments unwillingly take budgetary responsibility for forest protection since forestry is considered a central government programme.

As noted in Chapter 3, local organisations have limited strategies and/or opportunities for generating revenue to support decentralised forestry. Similarly, human resources and facilities and equipment are also inadequate, although most budgets indicated a plan to improve on these resources and facilities. The lack of facilities, fiscal and human resources is a common denominator that affects the implementation of decentralised forest management in many countries (Fizbein, 1997; Larson, 2002; Ellefson *et al*., 2003).

7.2.7 Are forests under local government ownership in better condition compared to private and central government owned forests?

The study shows that the species composition was similar amongst the study forests. Many of the species are widespread and not restricted to a single forest. This may be attributed to the fact that the Mpigi forests are characteristically mixed closed and semi-deciduous forests that occur in the same agro-ecological zone (Langdale-Brown, 1964). Generally, the study forests have the same rainfall pattern, almost similar water regime and range in altitude and topography. However, the most plant species rich families in the tropical forests such as Fabaceae, Euphorbiaceae, Moraceae, Palmae, Meliaceae, Sapotaceae and Rubiaceae were well represented in the Mpigi forests (Turner, 2001).

Species dominance was however, higher in forest communities with the majority of samples from the Wabirago and the Kaswera local forest reserves, intermediate in the Kaziro and Kasisira private forests and lowest in the Katabalalu and Makokolero central forest reserves (see Figure 5.4, Chapter 5). The high species dominance in local forest reserves indicates that

there are many individuals represented by a few species. It is also an indicator of species poor and/or degraded sites. Commercially desired Class 1 and Class 2 tree species occurred at low abundance in the local forest reserves. There is pressure on these forests for timber, firewood, poles and charcoal from local communities and the neighbouring towns of the Mpigi District, particularly Kampala City. As noted by Banana *et al*. (2001), the demand for forest produce especially for timber and fuelwood in and around Mpigi District is high. This partly explains the high species dominance because forest users selectively target commercially valuable tree species.

The study has revealed that the diversity and richness of tree species are higher for forest communities in the central forest reserves than in the private and local forest reserves. As noted in Chapter 5 (see Tables 5.3; 5.6-510), the signs of human disturbances recorded in forest communities with the majority of the samples from the central forest reserves were high and the corresponding species diversity and richness were also high. In contrast, human disturbances in forest communities for the local forest reserves were high and species diversity and richness low, while private forests had few signs of human disturbances and intermediate diversity and species richness. This implies that forest communities in the central forest reserves were in advanced stages of recovery, while communities from the local forest reserves could have been in early stages of recovery. Generally, samples for forest communities in local forest reserves were highly disturbed compared to private and central forest reserves. In private forests, there were a few signs of human disturbances, particularly harvesting of firewood and poles. According to Huston (1979), human disturbances may cause significant reduction in species diversity and/or maintenance of diversity in some systems depending on the frequency and severity of the disturbance. As noted by Struhsaker (1997) and Obiri *et al*. (2002), high disturbance increases the level of environmental stress on plant species, thus leading to low plant diversity and species richness. However, low disturbance recorded in samples for the private forests are likely to have obscured the succession process, resulting in low diversity (Huston, 1994). The presence of high and low disturbances partly explains the differences in species diversity among the study forests. Many authors (Horn, 1976; Connell, 1978; Huston, 1979) have noted that the highest species diversity is reached at intermediate frequencies of disturbances when the changing environmental conditions allows simultaneous occurrence of species typical of both early and late succession stages.

Nearly all forest communities recovered similar species in the tree, sapling and seedling size classes, with at least 50% of the top-most abundant species in the tree size classes occurring in the sapling and seedling sizes (Table 5.2). Management practices related to human disturbances lead to maintenance of diverse plant communities of different successional stages in the Mpigi forests. The sequential pattern of changing life-form from seedlings to saplings and trees observed in this study is a common pattern of secondary forests in Uganda (Gombya-Ssembajjwe, 1996) and elsewhere (Pickett, 1982; Bazzaz, 1996). The different management types lead to differences in species composition, diversity, and through occurrence of unique species. Besides the management type, the intensity of management practice leads to internal variation of a successional stage and affects the species composition and diversity. The unique species found in the Mpigi forests are especially adapted to certain management practices, and their persistence relies on human activities.

The population structure in the undisturbed and lightly disturbed forest communities exhibited an inverse J-shape stem diameter distribution (see Figures 5.5, 5.6). Population structure provides invaluable information essential for sustainable forest harvesting (von Gadow *et al*., 2000). There was a high concentration of small size stems in the diameter classes 10-35 cm in all communities. However, samples from forest communities in the private and the central forest reserves had generally more and large size individual tree stems than the local forest reserves. Similarly, forest structure of commercially desired Class 1 and Class 2 tree species was also significantly higher in forest communities with the majority of the samples in the private and the central forest reserves than in the local forest reserves. In the present study local and central forest reserves are highly subjected to illegal logging and other human consumptive activities than the private forests (see Table 6.3.1, Chapter 6). According to Smiet (1992) and Kappelle *et al*. (1996), human disturbances affect the structure of forests through removal of forest products. Other studies (e.g. Horn and Hickey, 1991; Hong *et al*., 1995) showed that anthropogenic disturbances regulate the regeneration of species and structure of forests. Studies conducted in other tropical forests (e.g. Chapman and Chapman, 1997; Whitman *et al*., 1997) found that forests manipulated through human activities, particularly, logged forests have a low density of trees compared to primary forests. In general, there was large size standing stems and DBH of trees in the private forests, intermediate in local forest reserves and lower in central forest reserves. The total basal area of trees in the Mpigi forests was in a range of 17.5-24.6 $m^2\ ha^{-1}$ and this is lower than the maximum (45-55 $m^2\ ha^{-1}$) expected from undisturbed, well-stocked tropical forests (Alder and

Synott, 1992). The low mean values of basal area are partly attributed to unsustainable forest product removal.

Multiple regression analysis using timber harvesting in a forest as an independent variable and physical, socioeconomic and institutional factors as independent variables was significant (see Table 6.3.3, Chapter 6). The result shows that the number of households, forest size, the distance of the forest from a well maintained road, the Mpigi District Forest Office and Kampala City are important factors that affect forest agencies in regulating forest resource use and maintaining the condition of the Mpigi forests (see Chapter 6). The strong relationship between timber harvesting and distance of the forest from Kampala City (*proxy* for the market) suggest a high level of commercial extraction of wood products from the Mpigi forests. Increase in the market of the forest produce has an adverse effect on the management of the resource because users increase harvesting levels for cash (Colchester, 1994). The increase in the signs of timber harvesting with an increase in the number of households was also expected because local timber extraction for cash is common among the communities adjacent to the Mpigi forests. This finding is consistent with other studies where high population results in illegal forest harvesting (Grundy, 1990, 1995; Schweik, 2000).

Although local forest reserves are physically closer to the District Forest Office and expected to be closely monitored by Local Councillors, the present study shows that these forests are more affected by human activities than the private and central forest reserves. Multiple regression results (Table 6.3.3) revealed that large forests that were far away from the Mpigi District Forest Office and Kampala City (*proxy* for market and central forest administrative centre) showed many signs of timber harvesting. This indicates the inability and lack of effectiveness of the District Forestry Staff and the Local Councillors to monitor and enforce rules effectively for large forests located farther away from the forest administrative centre. As suggested by Gregersen and Lundgren (1989) and Ostrom (1990), monitoring itself does not stop illegal forest use, instead local governments need to have powers to prosecute offenders and to review the amount and nature of penalties given to forest offenders. Without effective institutions to monitor and enforce forest rules, forests will continue to suffer from degradation. As noted in Chapter 2, inadequate devolution of decision-making over decentralised forests limits the autonomy of local governments to enforce forest regulation. Furthermore, high degradation in local forest reserves is attributed to past management practices because these forests were decentralised to local governments in 1998 after the central government realised that they were already degraded (Banana *et al*., 2001; MWLE,

2001). The observed high number of human disturbances in central forest reserves located in areas far away from the Mpigi District Forest Office also raises questions regarding the effectiveness of the central government in regulating forest resources use. According to Hardin (1969) and Ostrom (1990), regardless of the *de jure* property regime, all forests can be *de facto* open access forests, as long as forest owners and mangers have no effective mechanisms for monitoring resource use and punishing offenders.

The findings from this study revealed that decentralised forest management is occurring in Uganda only to a limited extent because the central government has not adequately devolved decision-making powers and adequate resources to actors with decentralised powers. It should also be noted that the benefits of decentralisation take time to be realised. Based on experience from Asia (e.g. Poffenberger and McGean, 1996; Kothari *et. al.*, 1996) and Latin America (Larson, 2003), the success of decentralised forest governance in Uganda greatly depends on the ability and willingness of the State to empower and legitimise local governments to make decisions over the use of forest resources, and to acknowledge the valuable contribution of support organisations such as the NGOs, CBOs, research institutes, and cultural and religious institutions.

7.3 General conclusions

The following conclusions can be drawn from this study:

1) The decentralisation of forest management is occurring in Uganda and collaborative and integrated planning, forest monitoring and legislation, tree planting, development of appropriate agroforestry technologies and environment awareness are the main strategies used by local organisations to implement the decentralisation policy.
2) The most important incentives that motivate local organisations to participate in decentralised forestry are the desire to control forest degradation, awareness of the importance of forestry in the livelihoods of communities, the need to equitably access forest products and revenue accruing from forest resources, financial support from donors and the central government and the mandate to implement the national government policy to have more land under forestry.
3) The nature of responsibilities and decision-making powers over devolved forest resources, particularly control of revenue from forests and prosecution of forest offenders were upheld by the national government, leaving local organisations as subordinates of the central government, and not as partners in sustainable forest management.

4) Local organisations demonstrated the capacity to carry out devolved forestry management functions such as forest monitoring and making of forest byelaws, drawing up of integrated plans, outsourcing funds and mobilising facilities and technical resources through collaboration and coordination with other actors at local, national and international levels. However, their technical capacity was affected by a general lack of financial and human resources, facilities and strategies for long-term sustainability of donor and central government funding for decentralised forestry.
5) There was limited autonomy to plan for decentralised forestry based on local priorities in local organisations because resources are often predetermined by the national government and donors. Forestry received low priority and financial allocation at the local level because forestry is not considered a national government priority area in the allocation of funds for decentralised services.
6) Major conflicts hindering decentralised forest management are inequitable sharing of revenue from the forests, lack of secure control over forest resources, political influence and overlapping authority amongst forest law enforcers.
7) The abundance and distribution of species in the Mpigi forests is complex but was dependent on the water regime and human use of forest resources. It was clear that human activities are changing forest structure of the Mpigi forests. Management practices related to human disturbances lead to maintenance of diverse plant communities through occurrence of unique and non-forest species in the Mpigi forests.
8) The stand composition attributes (diversity and richness) and structural characteristics (density, DBH, basal area and height) used as indicators of forest condition were higher for central forest reserves, intermediate in private and lower in the local forest reserves, owing to some regulation and control mechanisms instituted by the central government Forest Department and private individuals.
9) The effectiveness of the forest agencies to regulate forest use and maintain the condition of the Mpigi forests from human activities was significantly influenced by the size of the forest, and the distance of the forest from well-maintained roads, Mpigi District Forest Office (local forest administrative office) and Kampala City as the central forest administrative centre and main market of the forest produce, and the number of households adjacent to the forests.
10) Local governments have minimal impact on the control of forest resources and sanctioning forest offenders and the enforcement by the central government is still the most important method of regulating forest resource use in Uganda.

7.4 Recommendations

Based on these conclusions, the following are recommended to improve the effectiveness of local organisations in decentralised forest governance in Uganda:

1. There is need for clear allocation of roles, responsibilities, legitimate powers over forest resources and mechanisms for conflict resolution to local organisations for them to effectively participate in decentralised forestry. Local organisations need to be empowered to arrest and prosecute forest offenders.
2. Professional foresters need to act as technical advisors rather than as forest managers by building capacity of local governments, community organisations and other actors involved in forestry so as to improve their public image and win local support for forestry investment.
3. Local organisations need secure forest tenure as well as secure fiscal powers, and equitable access to forest resources, control of commercial rights and market access for forest produce to effectively participate in decentralised forestry.
4. There is need for top-level commitment on the part of the central government to be the driving force for successful decentralisation. It has to integrate and co-ordinate central and line-ministry interests, and facilitate a working relationship with local governments, civil society and the private sector.
5. Donor and central government funds need to strengthen local government capacity and ability to be economically independent, and to ensure that the incentives for improved local government performance are not restrained by the central governmental fiscal transfer system.
6. Local organisations also need to establish a system for basket funding, formulate exit strategies and plans for up-scaling or institutionalisation of decentralised forestry activities at an early stage in a programme before donors pull out. One way of doing this is to integrate donor-financed projects into the District Development Plans of local governments and to have a joint government-donor forum for reviewing and implementing donor and central government programmes.
7. The on-going collaboration between local governments, research institutes, civil society organisations and the Forest Department involvement in decentralised forestry needs to be strengthened. This kind of multiple channel support offers potential synergies because it simultaneously improves local governments' and strengthens the capacity of civil society groups to take advantage of the improvements from partner organisations.

8. There is a need for the central government to recognise the rights of local organisations, and equitably share benefits from forest resources because this will strengthen collective responsibility for protecting the forest as well as budgetary commitment to the implementation of decentralised forest governance amongst local organisations.
9. Focus on the management of the Mpigi forests and Uganda's tropical forests in general need to balance utilisation and conservation by forest agencies and owners. This may be through designating some areas of forests as nature reserves to allow them to recover from human consumptive disturbances. Furthermore, alternative sources of livelihoods and energy to supplement income, wood and energy requirements of the local people need to be put in place as a measure to reduce the population pressure on the forest resource. This includes energy conservation technologies, agroforestry and on-farm tree planting to reduce the pressure on the commercial and valuable forest species. This could be coupled with family planning measures to reduce population pressure.
10. An economic study need to conducted to establish the value of the forest products and services in the Uganda's national and local economies, in order to rectify the current lack of acknowledgement of the importance of the forestry sector in the allocation of funding both at local and national government levels.
11. Long-term studies need to be conducted to establish the value of species diversity and richness expected at a given site if the plant community was not subjected to any anthropogenic stress.

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APPENDICES

Appendix 2.1 List of organisations included in the study that were involved in the management of decentralised forest resources in Uganda

District	Organisation(s)	Category
Hoima	Hoima	District Local government
	Kizirafumbi	Sub-county Local government
	Kitoba	Sub-county Local government
	Kigorobya	Sub-county Local government
	Kyabigambire	Sub-county Local government
	Buhanika	Sub-county Local government
	Africa 2000 Network	NGO
	Bunyoro Kitara Diocese	Religious Institution
	Hoima District Farmers Association	CBO
	Bunyoro Kingdom Forest Service	Cultural Institution
Mukono	Mukono	District Local government
	Naggoje	Sub-county Local government
	Najjembe	Sub-county Local government
	Nama	Sub-county Local government
	Kyampisi	Sub-county Local government
	Ntenjeru	Sub-county Local government
	Forest Resources Research Institute (FORRI)	Research Institute
Mpigi	Mpigi	District Local government
	Buwama	Sub-county Local government
	Kamengo	Sub-county Local government
	Mutubagumu	Sub-county Local government
	Kibibi	Sub-county Local government
	Mpenja	Sub-county Local government
	Friends of Mpigi Forests Conservation and Development Organisation (FOMAF)	NGO
	World Vision	NGO
	Uganda Forestry Resources Institutions Centre (UFRIC)	Research Institute
	Environment Alert	NGO
Jinja	Jinja	District Local government
	Budondo	Sub-county Local government
	Buyenge	Sub-county Local government
	Buwenge	Sub-county Local government
	Butagaya	Sub-county Local government
	Kakira	Sub-county Local government
	Lake Victoria Environment Management Project (LVEMP)	NGO
Rakai	Rakai	District Local government
	Rakai	Town Council Local government
	Kabira	Sub-county Local government
	Kakuto	Sub-county Local government
	Kasaala	Sub-county Local government
	Lwanda	Sub-county Local government
	Vi	NGO
	Internal Rural Development Initiatives (IRDI)	CBO
	International Care Relief (ICR)	NGO
	Rakai District Farmers Association	CBO
	Global Environmental Facility/UNDP	NGO
Tororo	Tororo	District Local government
	Mukuju	Sub-county Local government
	Kisoko	Sub-county Local government

Appendix 2.1 (continued)

District	Organisation(s)	Category
Tororo	Rubongi	Sub-county Local government
	Nagongera	Sub-county Local government
	Molo	Sub-county Local government
	Kulika Charitable Trust	NGO
	Joint Energy and Environment Project (J EEP)	CBO
	Africa 2000 Network	NGO
	Tororo District Farmers Association	CBO

Appendix 2.2 Questionnaire for personnel in local organisations involved in decentralised forest governance in Uganda

1.0 Background information

1.1 Date of interview …….
1.2 Questionnaire No. ……...
1.3 Name of interviewer……..
1.4 Name of the respondent……...
1.5 Position of the respondent…….
1.6 Name of the organisation……..
1.7 Nature of the organisation…….
1.8 District……..
1.9 How long have you worked in this position? ……..

2.0 Activities of local organisations

2.1 Is your organisation involved in *providing* support to forest management activities of this area? Y/N
2.2 If yes, what role does your organisation play in implementation of the forest policy under decentralisation? (*Multiple answers applicable*)
2.3 What are the reasons that motivated your organisation to engage in forestry activities? (Multiple *answers applicable)*
2.4 What role does forestry play in the development of this area?
2.5 Apart from forestry, what are the other major activities supported by your organisation?

3.0 Resource allocation and mobilisation in local organisations

3.1.1 Financial resources

3.1.2 What are the major sources of funding for the activities of your organisation? (*Multiple answers applicable)*
3.1.3 What is the single most important source of financial support for your organisation?
3.1.4 What is the total financial budget of your organisation?
3.1.5 Within this financial year, has your organisation set aside some funds from its budget to cater for forestry activities? Y/N
3.1.6 If yes how much of the financial budget has your organisation allocated to forestry this financial year?
3.1.7 Which of the following service sectors do you allocate more funds? (i)Agriculture (ii) Health (iii) Veterinary (iv) Education (v) Fisheries (iv) Forestry
3.1.8 What is the largest item on which your organisation spends money?

3.2 Knowledge of forestry related issues amongst local organisation personnel

3.2.1 What is your level of education?
3.2.2 Have you attended any training in any forestry or environment related course in the past five years? Y/N
3.2.3 If yes, state the factors that motivated you for the training?
3.2.4 During the last five years, has there been any change in size of the forest cover in this Sub-county/District? (1)-Yes, increasing (2)-Yes, decreasing (3)-No change
3.2.5 If the forest area has increased, what is the primary reason for the increase?
3.2.6 If the forest area has decreased, what is the primary cause of decline?
3.2.7. Are you aware that some forests reserves were decentralised to be managed at the District/Sub-county level? Y/N

3.3 Technical staff in local organisations

3.3.1 Do you have staff trained in forestry? Y/N

3.3.2 If yes, how many of the staff have training in forestry and to what level?

3.4 Time allocation for forestry activities in local organisations

3.4.1 In the last one week, did you have time to do forestry activities for your organisation? Y/N

3.4.2 If yes how many hours do you allocate to forestry related activities in the past one week?

3.5 Material and process assets ownership in local organisations

3.5.1 What kind of assets (material and process) are owned by this organisation for governing forestry activities? *(Fill in the table)*

Type of asset	Presence = 1 Absence = 2	Number available	Total number required
Vehicles			
Motorcycles			
Telephone and fax			
Computers			

3.6 Information assets ownership in local organisations

3.6.1 What kind of information assets does your organisation have for monitoring forestry activities? *(Indicate with one for the presence of an asset and two for absence of the asset)*

Kind of asset	Presence of asset = 1 Absence of asset = 2
Maps showing forested areas	
Workplan for the forests	
Periodic reports on forest management	
Forest records products and revenues	
A copy of the Forest Policy and Forests Act	
Meeting minutes on forestry management issues	

3.7 Constraints in implementing forestry activities in local organisations

3.7.1 What principal constraints does your organisation face in implementing forestry activities?

3.7.2 What are the available means to overcome these constraints?

3.8 Linkages amongst organisations engaged in forestry related activities

3.8.1 Does your organisation have any links with Forest Department? Y/N

3.8.2 Apart from Forest Department, do you have links with other local organisations engaged in forest management? Y/N

3.8.3 If yes, name the organisations

3.8.4 How do you link up your activities with these organisations and how often do you link up ?

3.9 Powers to make rules and regulations in local organisations

3.9.1 Does your organisation make forest rules (byelaws) to monitor and govern forestry resources? Y/N

3.9.2 If no, state the reasons for not making forest rules (byelaws)?
3.9.3 If yes, what kind of rules/bye-laws has your organisation initiated to monitor forestry activities?
3.9.4 Are these forest based on the original set of rules provided by Forest Department? Y/N
3.9.5 Does your organisation have the power to modify forest rules originally set by the Forest Department? Y/N
3.9.6 Does your organisation staff monitor the application and compliance of forest rules and regulations? Y/N
3.9.7 If (no), who monitors their application and compliance?

4.0 Conflicts in the implementation of decentralised forest governance

4.1.1 Are there conflicts between the work of your organisation and that for Forest Department? Y/N
4.1.2 If yes, name the conflicts
4.1.3 Name the most important mechanism used to resolve these conflicts?

4.2 Penalties and/or sanctions imposed on offenders in local organisations

4.2.1 Are there penalties/sanctions that this organisation imposes on users if they break and or violate rules related to forest resource management? Y/N
4.2.2 If yes, give the type of penalty(s) and/or sanctions this organisation imposes on users if they break and or violate rules related forest resource management? (*Multiple answers are applicable*)
4.2.3 Does your organisation decide the kind of penalty to be imposed on forest offenders Y/N
4.2.4 If no, who decides the kind of penalty appropriate when a rule/bylaw is broken?
4.2.5 If a fine is imposed, does this organisation collect the fine? Y/N
4.2.6 If no, who collects the fine?
4.2.7 How is the fine used?
4.2.8 Do you users comply with penalties and/or sanctions imposed on them? Y/N
4.2.9 If users do not comply, what are the reasons for non-compliance with the penalties imposed on them?

5.0 Power over revenue collection from forest produce in local organisations

5.1 Does this organisation participate in collecting revenue from forest resources? Y/N
5.2 If no, who collects revenue from the forest resources?
5.3 If yes, what kind of revenue?
5.4 If yes, what amount of revenues per year do you receive from forest resources?
5.5 If yes, how does this organisation utilise the revenues obtained from the sale of forest produce?
5.6 Does this organisation issue permits and licenses for harvesting forest produce and or use of the forestland in this area? Y/N
5.7 If no, what are the reasons that prevent this organisation from collecting revenues from forest resources?
5.8 If no, who issues permits and licenses for harvesting forest products?

6.0 Capacity to manage forest resources in local organisations

6.1.1 In your opinion, do local organisations have the capacity to manage decentralised forest resources? Y/N
6.1.2 If yes, state the reasons why you think local organisations can manage decentralised forest resources
6.2 If no, state the reasons why you think local organisations cannot manage decentralised forest resources

Appendix 2.3 Observed and Expected frequencies on the roles and activities supported by local organisations in Uganda

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	222Tree nursery establishment and management 0	222Tree nursery establishment and management 1	Row Totals
DLGs	7	40	47
Row %	14.89%	85.11%	
SCLGs	22	147	169
Row %	13.02%	86.98%	
Support organisations	3	17	20
Row %	15.00%	85.00%	
Totals	32	204	236

Statistic	Chi-square	df	p
Pearson Chi-square	.1490983	df=2	p=.92816
M-L Chi-square	.1466999	df=2	p=.92928

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	221Tree Planting 0	221Tree Planting 1	Row Totals
DLGs	1	46	47
Row %	2.13%	97.87%	
SCLGs	9	160	169
Row %	5.33%	94.67%	
Support organisations	2	18	20
Row %	10.00%	90.00%	
Totals	12	224	236

Statistic	Chi-square	df	p
Pearson Chi-square	1.873048	df=2	p=.39199
M-L Chi-square	1.891134	df=2	p=.38846

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	223Environmental education	223Environmental education	Row Totals
DLGs	1	46	47
Row %	2.13%	97.87%	
SCLGs	43	126	169
Row %	25.44%	74.56%	
Support organisations	1	19	20
Row %	5.00%	95.00%	
Totals	45	191	236

Statistic	Chi-square	df	p
Pearson Chi-square	15.75686	df=2	p=.00038
M-L Chi-square	20.64155	df=2	p=.00003

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	224Energy conservation 0	224Energy conservation 1	Row Totals
DLGs	43	4	47
Row %	91.49%	8.51%	
SCLGs	96	73	169
Row %	56.80%	43.20%	
Support organisations	13	7	20
Row %	65.00%	35.00%	
Totals	152	84	236

Statistic	Chi-square	df	p
Pearson Chi-square	19.30107	df=2	p=.00006
M-L Chi-square	22.88970	df=2	p=.00001

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	225Writing project proposals 0	225Writing project proposals 1	Row Totals
DLGs	45	2	47
Row %	95.74%	4.26%	
SCLGs	164	5	169
Row %	97.04%	2.96%	
Support organisations	15	5	20
Row %	75.00%	25.00%	
Totals	224	12	236

Statistic	Chi-square	df	p
Pearson Chi-square	18.08599	df=2	p=.00012
M-L Chi-square	10.78316	df=2	p=.00456

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195NATUREORGANISATION	226Monitoring forests against illegal acts 0	226Monitoring forests against illegal acts 1	Row Totals
DLGs	20	27	47
Row %	42.55%	57.45%	
SCLGs	131	38	169
Row %	77.51%	22.49%	
Support organisations	16	4	20
Row %	80.00%	20.00%	
Totals	167	69	236

Statistic	Chi-square	df	p
Pearson Chi-square	22.62683	df=2	p=.00001
M-L Chi-square	20.93897	df=2	p=.00003

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisatio	228Bee keeping 0	228Bee keeping 1	Row Totals
DLGs	33	14	47
Row %	70.21%	29.79%	
SCLGs	131	38	169
Row %	77.51%	22.49%	
Support organisations	16	4	20
Row %	80.00%	20.00%	
Totals	180	56	236

Statistic	Chi-square	df	p
Pearson Chi-square	1.251258	df=2	p=.53493
M-L Chi-square	1.210370	df=2	p=.54598

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	229Promotion of ecotourism 0	229Promotion of ecotourism 1	Row Totals
DLGs	39	8	47
Row %	82.98%	17.02%	
SCLGs	153	16	169
Row %	90.53%	9.47%	
Support organisations	17	3	20
Row %	85.00%	15.00%	
Totals	209	27	236

Statistic	Chi-square	df	p
Pearson Chi-square	2.344226	df=2	p=.30972
M-L Chi-square	2.195416	df=2	p=.33364

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Categoryof organisations	2210 Promotion of research 0	2210Promotion of research 1	Row Totals
DLGs	43	4	47
Row %	91.49%	8.51%	
SCLGs	162	7	169
Row %	95.86%	4.14%	
Support organisations	13	7	20
Row %	65.00%	35.00%	
Totals	218	18	236

Statistic	Chi-square	df	p
Pearson Chi-square	24.23550	df=2	p=.00001
M-L Chi-square	15.69540	df=2	p=.00039

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	2211Planning 0	2211Planning 1	Row Totals
DLGs	14	33	47
Row %	29.79%	70.21%	
SCLGs	135	34	169
Row %	79.88%	20.12%	
Support organisations	6	14	20
Row %	30.00%	70.00%	
Totals	155	81	236

Statistic	Chi-square	df	p
Pearson Chi-square	53.27653	df=2	p=.00000
M-L Chi-square	52.19166	df=2	p=.00000

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisations	2212Policy formulation 0	2212Policy formulation 1	Row Totals
DLGs	25	22	47
Row %	53.19%	46.81%	
SCLGs	137	32	169
Row %	81.66%	18.93%	
Support organisations	17	3	20
Row %	85.00%	15.00%	
Totals	179	57	236

Statistic	Chi-square	df	p
Pearson Chi-square	16.59523	df=2	p=.00025
M-L Chi-square	15.04018	df=2	=.000054

Appendix 2.4 Observed and expected frequencies on the incentives motivating local organisations to participate in decentralised forest governance in Uganda

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	231Generation of revenue 0	31Generation of revenue 1	Row Totals
DLGs	24	23	47
Row %	51.06%	48.94%	
SCLGs	92	77	169
Row %	54.44%	45.56%	
Support organisations	10	10	20
Row %	50.00%	50.00%	
Totals	126	110	236

Statistic	Chi-square	df	p
Pearson Chi-square	.2691288	df=2	p=.87410
M-L Chi-square	.2688144	df=2	p=.87423

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	232Donor support 0	232Donor support 1	Row Totals
DLGs	42	5	47
Row %	89.36%	10.64%	
SCLGs	160	9	169
Row %	94.67%	5.33%	
Support organisations	5	15	20
Row %	25.00%	75.00%	
Totals	207	29	236

Statistic	Chi-square	df	p
Pearson Chi-square	80.69700	df=2	p=.00000
M-L Chi-square	51.23112	df=2	p=.00000

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisations	233Central government fiscal support 0	233Central government fiscal support 1	Row Totals
DLGs	42	5	47
Row %	89.36%	10.64%	
SCLGs	156	13	169
Row %	92.31%	7.69%	
Support organisations	18	2	20
Row %	90.00%	10.00%	
Totals	216	20	236

Statistic	Chi-square	df	p
Pearson Chi-square	.7058772	df=2	p=.70262
M-L Chi-square	.7066140	df=2	p=.70236

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	224Local government fiscal support 0	224Local government fiscal support 1	Row Totals
DLGs	41	6	47
Row %	87.23%	12.77%	
SCLGs	151	18	169
Row %	89.35%	10.65%	
Support organisations	19	1	20
Row %	95.00%	5.00%	
Totals	211	25	236

Statistic	Chi-square	df	p
Pearson Chi-square	0.895	df=2	p=.64029
M-L Chi-square	1.026552	df=2	p=.6051

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	235Control forest degradation 0	235Control forest degradation 1	Row Totals
DLGs	4	43	47
Row %	8.51%	91.49%	
SCLGs	19	150	169
Row %	11.24%	88.76%	
Support organisations	1	19	20
Row %	5.00%	95.00%	
Totals	24	212	236

Statistic	Chi-square	df	p
Pearson Chi-square	.9396756	df=2	p=.62511
M-L Chi-square	1.062032	df=2	p=.58801

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisation	236Awareness of importance of forestry 0	236Awareness of importance of forestry 1	Row Totals
DLGs	18	29	47
Row %	38.30%	61.70%	
SCLGs	48	121	169
Row %	28.40%	71.60%	
Support organisations	12	8	20
Row %	60.00%	40.00%	
Totals	78	158	236

Statistic	Chi-square	df	p
Pearson Chi-square	8.799517	df=2	p=.01228
M-L Chi-square	8.335048	df=2	p=.01549

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisations	237Availability of technical staff 0	237Availability of technical staff 1	Row Totals
DLGs	44	3	47
Row %	93.62%	6.38%	
SCLGs	163	6	169
Row %	96.45%	3.55%	
Support organisations	19	1	20
Row %	95.00%	5.00%	
Totals	226	10	236

Statistic	Chi-square	df	p
Pearson Chi-square	.7585080	df=2	p=.68437
M-L Chi-square	.6988811	df=2	p=.70508

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisations	238Rehabilitate degraded areas 0	238Rehabilitate degraded areas 1	Row Totals
DLGs	35	12	47
Row %	74.47%	25.53%	
SCLGs	152	17	169
Row %	89.94%	10.06%	
Support organisations	2	18	20
Row %	10.00%	90.00%	
Totals	189	47	236

Statistic	Chi-square	df	p
Pearson Chi-square	72.81748	df=2	p=.00000
M-L Chi-square	58.91246	df=2	p=.00000

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195Category of organisations	2310Government Policy 0	2310Government Policy 1	Row Totals
DLGs	39	8	47
Row %	82.98%	17.02%	
SCLGs	162	7	169
Row %	95.86%	4.14%	
Support organisations	18	2	20
Row %	90.00%	10.00%	
Totals	219	17	236

Statistic	Chi-square	df	p
Pearson Chi-square	14.69655	df=2	p=.00064
M-L Chi-square	12.2250	df=2	p=.00222

2-Way Summary Table: Observed Frequencies (Marked cells have counts >10)

195NATUREORGANISATION	2-Way Summary Table: Observed Frequencies (Socio-economic data 20051 Marked cells have counts > 10 2311To access Planting materials 0	2311To access Planting materials 1	Row Totals
DLG	46	1	47
Row %	97.87%	2.13%	
SCLG	164	5	169
Row %	97.04%	2.96%	
Others	19	1	20
Row %	95.00%	5.00%	
Totals	229	7	236

Statistic	Statistics: 195Category of organisation(3) x 2311To access Planting materials (2) (Sc Chi-square	df	p
Pearson Chi-square	0.4022	df=2	p=.820
M-L Chi-square	0.366	df=2	p=.23280

Appendix 2.5 Observed and expected frequencies on the information assets available in local organisations for implementing in decentralised forestry in Uganda

2-Way Summary Table: Observed Frequencies (Marked cells have counts > 10)			
	3616Forest Policy and Forests Act absent	**3616Forest Policy and Forests Act Present**	**Row**
DG	39	8	47
Row %	82.98%	17.02%	
SCG	163	6	169
Row %	96.45%	3.55%	
Support organisations	9	11	20
Row %	45.00%	55.00%	
Totals	211	25	236

	Chi-square	**df**	**p**
Pearson Chi-square	52.54339	df=2	p=.00000
M-L Chi-square	37.24805	df=2	p=.00000

2-Way Summary Table: Observed Frequencies (Socio-economic data) Marked cells have counts > 10			
	3617Minutes absent	**3617Minutes present**	**Row**
DG	10	37	47
Row %	21.28%	78.72%	
SCG	106	63	169
Row %	62.72%	37.28%	
Support organisations	10	10	20
Row %	50.00%	50.00%	
Totals	126	110	236

	Chi-square	**df**	**p**
Pearson Chi-square	25.48385	df=2	p=.00000
M-L Chi-square	26.47805	df=2	p=.00000

2-Way Summary Table: Observed Frequencies (Socio-economic data) Marked cells have counts > 10			
	Absence of Maps of forested areas	**Presence of maps of forested areas**	**Row**
DLG	45	2	47
Row %	95.74%	4.26%	
SCLG	168	1	169
Row %	99.41%	0.59%	
Support organisations	14	6	20
Row %	70.00%	30.00%	
Totals	227	9	236

	Chi-square	**df**	**p**
Pearson Chi-square	42.19601	df=2	p=.00000
M-L Chi-square	23.22116	df=2	p=.00001

2-Way Summary Table: Observed Frequencies (Socio-economic data) Marked cells have counts > 10			
	3614Periodic reports on forest management absent	**3614Periodic reports on forest Management present**	**Row**
DG	9	38	47
Row %	19.15%	80.85%	
SCG	150	19	169
Row %	88.76%	11.24%	
Support organisations	11	9	20
Row %	55.00%	45.00%	
Totals	170	66	236

	Chi-square	**df**	**p**
Pearson Chi-square	91.59496	df=2	p=0.0000
M-L Chi-square	87.46339	df=2	p=0.0000

Appendix 4.1Questionnaire about the role of the Forest Department staff in facilitating decentralised forest governance in Uganda

1.0 Background information

1.1 Date of interview……...
1.2 Questionnaire number……..
1.3 Name of the respondent……
1.4 Position……..
1.5 District……..
1.6 How long have you worked in this position? ……..
1.7. What is your highest level of education?

1.8. Have you attended any forest in-service training course? Y/N

1.9.1. If yes, what motivated you for training?

1.9.2 Are you aware that some forest reserves are decentralised to the district and sub-county local governments? Y/N

2.0 Collaboration between local organisations and the Forest Department in decentralised forest governance

2.1.1 Do you link up your activities with other organisations? Y/N
2.1.2 If yes, name the organisations?

2.1.3 If no, state the reasons that hinder you from working with local organisations?

2.1.4 If yes, how do you link up your activities with them and how often do you link up with these organisations?

2.1.5 What are the reasons that motivated you to work with other organisations?

3.0 Financial resources for decentralised forest governance

3.1.1 What is the total financial budget for running your activities?

3.1.2 How much of your budget is set aside to support local organisations engaged in forestry activities?

3.1.1 Do you get any financial support from local organisations including local government? Y/N

3.1.2 If yes, how much money did your organisation get from local organisations to support your activities in the financial year 2002/3?

3.1.3 Apart from financial support, what other kind of support do you get from local organisations?

3.1.4 What kind of resources (material, information, and process assets) does this department own and how many are allocated to local organisations to foster forestry activities?

3.2.1 Conflicts on implementing decentralised forest governance

3.2.2 Are there conflicts between your activities and those for local organisations in implementing decentralised forestry? Y/N

3.2.3 If yes, state the conflicts.

3.2.4 What mechanisms are there to resolve these conflicts?

3.3 Powers devolved to local organisations for managing decentralised forest resources

3.3.1 Does the Forest Department allow local organisations to carry out the following activities? Y/N (a) issue permits and licences (b) arrest and apprehend forest offenders (c) impound tools and timber from offenders (d) monitor forest resource use and (e) make byelaws on forests?

3.3.2 If no, state the reasons why local organisations are not allowed to undertake these activities?

3.4 Sharing of revenue from forest produce between the Forest Department and local organisations

3.4.1 Do you share revenues from forest resources with local organisations? Y/N

3.4.2 If yes, what amount of revenues per year do you provide to local organisations from the sale of forest resources?

3.4.3 How is this revenue utilised by the local organisations?

3.5 The Forest Department staff attitudes towards decentralised forest governance

3.5.1 In your own view, can local organisations including local government effectively manage decentralised forest resources? Y/N

3.5.2 If no, state the reasons to why you think local organisations cannot effectively govern decentralised forest resources?

3.6 Constraints in implementing decentralised forestry

3.6.1 What principal constraints do you face in implementing decentralised forestry?

3.6.2 What are the available means to overcome these constraints

Appendix 5.1 Plant species (individuals and growth form) and their families recorded from private, local and central forest reserves in the Mpigi District, Uganda

					Private forests		Local forest reserves		Central forest reserves	
Species code	Species	Family	Form	TC[c]	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Acac hoc	*Acacia hockii** De Wild	Fabaceae	T	2	-	-	-	1	-	-
Afro cer	*Afrosersalisia ceracifera* (Welw.) Aubrev.	Sapotaceae	T	3	-	-	-	-	6	1
Alan chi	*Alangium chinense* (Lour.) Harms	Alangiaceae	T	2	-	3	8	47	40	16
Albz cor	*Albizia coriaria* Welw.ex Oliv.	Fabaceae	T	1	-	4	9	23	-	5
Albz fer	*Albizia ferruginea* (Guill. & Perr) Benth.	Fabaceae	T	2	7	26	1	8	12	21
Albz glo	*Albizia glaberrima* Schumach.&Thonn.) Benth.	Fabaceae	T	2	1	56	8	7	3	13
Albz gra	*Albizia grandibracteata* Taub.	Fabaceae	T	2	-	-	3	-	-	2
Albz ygi	*Albizia zygia* (DC.) J.F.Macbr	Fabaceae	T	2	1	-	3	4	1	-
Allo fer	*Allophylus ferruginea* Taub.	Sapindaceae	T	2	1	-	-	-	-	2
Anin alt	*Aningeria altissima* (A.Chev.)	Sapotaceae	T	2	-	1	-	-	11	2
Anti tox	*Antiaris toxicaria* (Rump.ex Pers.)Leschen.	Moraceae	T	2	15	30	53	37	42	65
Anti lac	*Antidesma laciniatum* Muell. Arg.	Euphorbiaceae	T	3	-	-	1	-	2	2
Argo mac	*Argomuellera macrophylla** Pax	Euphorbiaceae	T	3	-	-	-	-	16	-
Arto het	*Artocarpus heterophyllus* Lam.	Moraceae	T	3	-	23	7	6	62	9
Baph par	*Baphiopsis parviflora** Bak.	Fabaceae	T	3	-	-	-	-	-	1
Beil uga	*Beilschmiedia ugandensis* Rendle	Lauraceae	T	3	-	9	12	-	19	21
Belo glo	*Belonophora hypoglauca (glomerata)** M.B.Moss	Rubiaceae	T	3	-	-	-	-	2	-
Blig uni	*Blighia unijugata* Bak.	Sapindaceae	T	2	48	46	65	66	67	65
Blig wel	*Blighia welwitschii** (Hiern) Radlk.	Sapindaceae	T	2	-	-	-	-	1	-
Brid mic	*Bridelia micrantha* (Hochst.) Baill.	Euphorbiaceae	T	3	1	1		25	4	13
Cana sch	*Canarium schweinfurthii* Engl.	Burseraceae	T	2	2	10	5	4	20	4
Cari pap	*Carica papaya** L.	Caricaceae	T	-	-	-	-	1	-	-
Cass con	*Cassipourrea congensis* DC.	Rhizophoraceae	T	3	-	-	1	-	-	7
Celt afr	*Celtis africana* Burm.f.	Ulmaceae	T	2	33	6	38	27	8	21
Celt dur	*Celtis durandii* Engl.	Ulmaceae	T	2	25	11	46	40	18	122
Celt mil	*Celtis mildbreadii* Engl.	Ulmaceae	T	2	-	1	-	-	1	1
Celt zen	*Celtis zenkeri** Engl.	Ulmaceae	T	2	-	-	-	-	1	-
Chae ari	*Chaetacme aristata* Planch.	Ulmaceae	T	3		3	94	3	28	79
Clau ani	*Clausena anisata* (Wild.) Benth.	Rutaceae	T	-	35	3	8	13	5	10
Coff can	*Coffea canephora* Pierre	Rubiaceae	T	-	62	14	11	7	122	72
Cola gig	*Cola gigantea* A.Chev.	Sterculiaceae	T	3	3	4	8	19	15	12
Cord mel	*Cordia mellenii* Bak.	Boraginaceae	T	1	1	1	1	1	-	-
Crat sch	*Craterispermum schweinfurthii* (Poir.) Benth.	Rubiaceae	T	3	1	1	-	-	-	-
Croto mac	*Croton macrostachyus* Hochst.ex Del.	Euphorbiaceae	T	3	-	1	-	-	3	1
Dict arb	*Dictyandra arborescenes* Welw. ex Benth. & Hook.f.	Rubiaceae	T	3	-	7	-	-	4	-
Dios aby	*Diospyros abyssinica* (Hiern) F.White	Ebenaceae	T	2	-	-	1	-	-	6
Dovy mac	*Dovyalis macrocalyx* (Oliv.) Warb.	Flacourtiaceae	T	3	-	1	-	-	-	5
Drac ste	*Dracaena steudneri* Engl.	Dracaenaceae	T	-	-	-	-	1	6	2
Dryp ger	*Drypetes gerrardii** Hutch	Euphorbiaceae	T	2	-	-	-	-	-	4
Dryp uga	*Drypetes ugandensis**(Rendle) Hutch.	Euphorbiaceae	T	2	-	1	-	-	-	-
Enta aby	*Entanda abyssinica** Steud.ex A.Rich	Fabaceae	T	3	-	-	-	2	-	-
Enta ang	*Entandraphragma angolense* (Welw.) C.DC	Meliaceae	T	1	-	-	7	-	11	8
Enta cyl	*Entandraphragma cylindricum* (Sprague) Sprague	Meliaceae	T	1	-	1	1	-	3	6
Eryt aby	*Erythrina abyssinica* Lam.ex DC.	Fabaceae	T	2	3	-	-	1	1	6
Eryt exc	*Erythrina excelsa* Bak.	Fabaceae	T	2	1	3	2	11	7	3
Esen ven	*Ensete ventricosum** (Welw.) Cheesman	Musaceae	T	3	-	-	-	-	6	-
Eua emi	*Euadenia eminens* (Hook.f.)	Capparidaceae	T	3	21	7	2	-	11	8

Appendix 5.1 (Continued)

Species code	Species	Family	Form	TC[c]	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Euca gra	*Eucalyptus grandis** W.Hill ex Maiden	Myrtaceae	T	2	-	-	-	11	-	-
Euph tek	*Euphorbia teke* Pax	Euphorbiaceae	T	3	-	-	-	-	5	1
Faga leu	*Fagara leprieurii* (Guill.&Perr.) Engl.	Rutaceae	T	1	-	-	1	-	7	3
Faga mac	*Fagara macrophylla* (Oliv.) Engl.	Rutaceae	T	1	3	4	-	-	9	7
Faga ang	*Fagariopsis angolensis* (Engl.) Dale	Rutaceae	T	2	2	1	2	9	4	3
Ficu asp	*Ficus asperifolia* (*urceolaris*) Welw.ex Hiern	Moraceae	T	3	17	9	35	28	10	21
Ficu bra	*Ficus brachylepis** Welw.ex Hiern	Moraceae	T	3		1	-	-	-	-
Ficu con	*Ficus conraui (stipulifera)* Hutch.	Moraceae	T	3	-	-	-	2	2	-
Ficu exa	*Ficus exasperata* Vahl	Moraceae	T	3	-	1	5	-	16	7
Ficu ing	*Ficus ingens** (Miq.) Miq.	Moraceae	T	3	-	-	-	2	-	-
Ficu muc	*Ficus mucuso* Welw. ex Ficalho	Moraceae	T	3	-	1		1	3	2
Ficu nat	*Ficus natalensis* Hochst.	Moraceae	T	3	-	1	1	-	1	2
Ficu ott	*Ficus ottoniaefolia** (Miq.) Miq.	Moraceae	T	3	-	-	-	-	2	-
Ficu ova	*Ficus ovata (brachypoda)* Hutch.	Moraceae	T	3	1	1	1	1	-	5
Ficu pil	*Ficus pilosula** De Wild.	Moraceae	T	3	-	-	-	-	-	2
Ficu pol	*Ficus polita* (Miq.)Vahl	Moraceae	T	3	-	-	-	1	1	2
Ficu pse	*Ficus pseudomangifera* Hutch.	Moraceae	T	3	-	1	-	-	-	2
Ficu sau	*Ficus saussureana (eriobotryoides)**Kunth & Bouche	Moraceae	T	3	-	1	-	-	-	-
Ficu stip	*Ficus stipulosa* Miq.	Moraceae	T	3	-	-	-	-	-	2
Ficu sur	*Ficus sur (capensis)* Forsk.	Moraceae	T	3	1	17	9	3	33	15
Ficu tho	*Ficus thorningii* Blume	Moraceae	T	3	-	2	-	1	1	1
Ficu tri	*Ficus trichopoda (congesis)* Engl.	Moraceae	T	3	-	-	-	1	2	-
Ficu val	*Ficus vallis-choudae* Del.	Moraceae	T	3	2	1	-	4	1	-
Ficu ver	*Ficus verruculosa** Warb.	Moraceae	T	3	-	-	-	-	3	-
Flac ind	*Flacourtia indica** (Burm.f.) Merr.	Flacourtiaceae	T	3	-	-	-	-	-	2
Funt afr	*Funtumia africana* (Benth.) Stapf	Apocynaceae	T	2	35	98	160	102	62	166
Glyp brev	*Glyphaea brevis**(Spreng.) Monachino	Tilaceae	T	3	-	-	-	-	-	2
Grew moll	*Grewia mollis**Juss.	Tilaceae	T	3	-	-	-	3	-	-
Grew pub	*Grewia pubescens** P.Beauv.	Tilaceae	T	3	2	-	-	-	-	-
Guar ced	*Guarea cedrata* (A.Chev.) Pellegr.	Meliaceae	T	1	2	-	2	-	-	-
Haru mad	*Harungana madagascariensis* Poir.	Clusiaceae	T	3	-	-	9	35	7	2
Holo gra	*Holoptelea grandis* (Hutch.) Mildbr.	Ulmaceae	T	1	3	7	7	-	2	2
Lept mil	*Leptonychia mildbreadii* Engl.	Sterculiaceae	T	3	-	1	-	-	3	1
Lovo tri	*Lovoa trichilioides (brownii)* Sprague	Meliaceae	T	1	36	65	68	6	21	69
Maca lan	*Macaranga barteri (lancifolia)* Pax	Euphorbiaceae	T	2	-	1	-	-	4	10
Maca mon	*Macaranga monandra* Muell.Arg.	Euphorbiaceae	T	2	9	20	14	2	54	115
Maca sch	*Macaranga schweinfurthii* Pax	Euphorbiaceae	T	2	91	53	153	164	77	84
Maer dus	*Maerua duschesnei* (De Wild) F.White	Capparidaceae	T	3	-	1	-	-	-	1
Maes lan	*Maesa lanceolata* Forsk.	Myrsinaceae	T	3	1		5	18	7	3
Maes emi	*Maesopsis eminii* Engl.	Rhamnaceae	T	2	17	3	9	32	88	12
Mang ind	*Mangifera indica** Wall.	Anacardiaceae	T	-	-	-	-	-	2	-
Manl daw	*Manilkara dawei** (Stapf) Chiov.	Sapotaceae	T	3	-	-	-	-	1	-
Mark lut	*Markhamia lutea* K.Schum	Bignoniaceae	T	2	6	1	3	15	3	1
Mili exc	*Milicia excelsa* (Welw.) C.C.Berg	Moraceae	T	1	-	-	-	1	6	-
Mim bag	*Mimusops bagswawei* S.Moore	Sapotaceae	T	3	-	-	2	-	5	-
Mitr stip	*Hallea (Mitragyna) stipulosa* (DC.) Kuntze	Rubiaceae	T	2	-	-	-	33	17	-
Mono myr	*Monodora myristica* (Gaertn.) Dunal	Annonaceae	T	3	-	-	4		2	1
Mori luc	*Morinda lucida* Benth.	Rubiaceae	T	2	-	-	-	1	1	1
Moru lact	*Morus mesozygia (lactea)* (Sim) Mildbr.	Moraceae	T	2	-	-	-	-	2	1

Appendix 5.1 (Continued)

Species code	Species	Family	Form	TC[c]	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Oure den	*Ouratea densiflora** De Wild. & Th.Dur.	Ochnaceae	T	3	-	-	-	-	-	2
Oxya spe	*Oxyanthus speciosus* DC.	Rubiaceae	T	3	19	33	31	25	5	15
Oxya uni	*Oxyanthus unilocularis** Hiern	Rubiaceae	T	3	-	-	-	-	-	1
Pari exc	*Parinari excelsa** Sabine	Rosaceae	T	2	-	-	-	-	1	-
Park fil	*Parkia filicoidea* Welw. ex Oliv.	Fabaceae	T	2	-	54	-	-	11	23
Paro gui	*Paropsia guineensis* Oliv.	Passifloraceae	T	3	-	-	1	-	3	-
Phoe rec	*Phoenix reclinata* Jacq.	Palmae	T	3	45	40	38	71	13	39
Phyl dis	*Phyllanthus discoideus* (Baill.) Muell.Arg.	Euphorbiaceae	T	2	17	13	22	28	19	14
Pipt afr	*Piptadeniastrum africanum* (Hook.f.) Brenan	Fabaceae	T	2	1	15	34	11	5	18
Pitt man	*Pittosporum manii* Hook.f.	Pittosporaceae	T	3	31	7	7	49	15	17
Poly ful	*Polyscias fulva* (Hiern) Harms	Araliaceae	T	2	7	9	9	16	8	12
Prun afr	*Prunus africana* (Hook.f.) Kalkman	Rosaceae	T	2	15	26	1	8	4	6
Pseu mac	*Pseudospondias macrocarpa* (A.Rich.) Engl.	Anacardiaceae	T	2	82	131	122	157	77	77
Pcyn ang	*Pycnanthus angolensis* (Welw.) Warb.	Myristicaceae	T	2	-	5	12	32	36	24
Raph far	*Raphia farinifera** (Gaertn.) Hylander	Palmae	T	3	-	-	-	-	4	-
Rauv vom	*Rauvolfia vomitoria* Afzel.	Apocynaceae	T	3	-	-	3	15	11	-
Rhus nat	*Rhus natalensis** Bernh.ex C.Krauss	Anacardiaceae	T	3	-	-	-	1	-	-
Rici heu	*Ricinodendron heudelotii** (Baill.) Pierre ex Pax	Rubiaceae	T	3	-	-	-	-	1	-
Roth urc	*Rothmannia urcelliformis* (Hiern) Bullock ex Robyns	Rubiaceae	T	3	-	5	-	17	-	3
Sapi ell	*Sapium ellipticum* (Hochst.ex Krauss) Pax	Euphorbiaceae	T	2	40	37	47	114	21	28
Sche vol	*Schefflera volkensii** (Engl.) Harms	Araliaceae	T	3	-	-	-	-	-	5
Scol rhm	*Scolopia rhamnophylla* Gilg	Flacourtiaceae	T	3	32	34	34	48	11	24
Senn spe	*Senna spectabilis* (DC.) H.S.Irwin &Burneby	Fabaceae	T	3	-	-	10	16	1	-
Sida cun	*Sida cuneifolia** A.Gray	Malvaceae	T	3	-	-	-	-	1	-
Sola gig	*Solanum giganteum* Jacq.	Solanaceae	T	3	4	10	16	62	87	39
Spath cam	*Spathodea campanulata* P. Beauv.	Bignoniaceae	T	2	2	1	3	3	1	-
Spon pre	*Spondianthus preusii** Engl.	Euphorbiaceae	T	3	-	-	-	-	74	-
Stro sch	*Strombosia schefflerioria** Engl.	Olacaceae	T	3	-	2	-	-	-	-
Symp glo	*Symphonia globulifera* L.f.	Clusiaceae	T	2	-	-	-	-	50	11
Syza gui	*Syzagium guineense* (Wild.) DC.	Myrtaceae	T	2	2	1	1	2	16	9
Tabe hol	*Tabernaemontana holstii**K.Schum.	Apocynaceae	T	3	-	-	-	-	86	-
Tecl nob	*Teclea nobilis* Del.	Rutaceae	T	3	103	214	304	130	17	172
Tetr tet	*Tetrapreula tetraptera**(Schum. & Thonn.) Taub.	Fabaceae	T	2	-	-	-	-	2	-
Tetr didy	*Tetrorchidium didymostemon* (Baill.) Pax & K. Hoffm	Euphorbiaceae	T	3	1	-	-	-	4	1
Trec afr	*Treculia africana* Decne.	Moraceae	T	3	-	2	4	-	7	4
Trem ori	*Trema orientalis* (L.) Bl.	Ulmaceae	T	3	2	1	3	4	11	3
Tric dre	*Trichilia dregeana* Sond.	Meliaceae	T	2	15	21	10	26	14	8
Tric pre	*Trichilia prieureana* A. Juss.	Meliaceae	T	3	-	2	-	-	2	-
Tric rub	*Trichilia rubscens** Oliv.	Meliaceae	T	3	-	-	-	-	46	-
Trim bak	*Trimeria bakeri** Gilg	Flacourtiaceae	T	3	-	-	-	-	1	-
Trilep mad	*Trilepisium madagascariensis (Bosqueia phoberos)* Baill.	Moraceae	T	3	50	158	334	109	99	122
Vang acu	*Vangueria acutiloba* Robyns	Rubiaceae	T	3	-	-	4	1	-	3
Vern dua	*Vernonia duammeri** (S.Moore)	Asteraceae	T	3	-	-	-	-	2	-
Voac tho	*Voacanga thouarsii* Roem. &Schult.	Apocynaceae	T	3	-	3	12	8	-	-
Whit elo	*Whitfieldia elongata**Beaur.	Acanthaceae	T	3	-	-	-	-	1	-
Xyml mon	*Xymalos monospora* (Harv.) Warb.	Monimiaceae	T	3	-	7	50	-	45	51
Zanh gol	*Zanha golungensis* Hiern	Sapindaceae	T	3	2	-	-	1	-	3
					973	1556	2036	1804	1855	1898

Appendix 5.1 (Continued)

Species code	Species	Family	Form	TC[c]	Kasisira	Kaziro	Kaswera	Wabirago	Katabalalu	Makokolero
Acal orn	*Acalypha ornata* Hochst. ex A.Rich.	Euphorbiaceae	SH	-	-	1	-	-	5	-
Acal vol	*Acalypha volkensii* Pax	Euphorbiaceae	H	-	7	2	-	8	11	8
Acan pub	*Acanthus arborescens (pubescens)* (Engl.) Turrill	Acanthaceae	SH	-	9	-	-	6	-	3
Afra leu	*Aframomum leucantha*	Zingiberaceae	H	-	-	-	-	-	1	3
Afra mil	*Aframomum mildbreadii*	Zingiberaceae	H	-	1	-	-	7	8	14
Afra san	*Aframomum sanguina*	Zingiberaceae	H	-	-	-	1	3	6	3
Ager con	*Ageratum conyzoides* L.	Asteraceae	H	-	1	1	1	5	1	1
Alch cor	*Alchornea cordifolia* Muell.Arg.	Euphorbiaceae	W	-	3	-	4	16	1	1
Amar	*Amaranthus* sp.* L.	Amaranthaceae	H	-	-	-	1	-	-	-
Asp mos	*Aspilia mossambiscensis*	Asteraceae	H	-	-	-	-	3	-	1
Asple	*Asplenium sp.**	Aspleniaceae	H	-	-	-	2	-	-	-
Barl bro	*Barlalia brownii*	Acanthaceae	H	-	-	-	2	-	6	9
Base alb	*Basella alba** L.	Basellaceae	H	-	-	-	-	-	2	-
Bers aby	*Bersama abyssinica* Fresen.	Melianthaceae	H	-	2	1	2	-	1	2
Bide pil	*Bidens pilosa* L.	Asteraceae	H	-	-	-	1	1	2	2
Brac bri	*Brachiaria brizantha* (A.Rich.) Stapf	Poaceae	H	-	2	-	-	1	4	-
Cadi gra	*Cadiospermum grandflorum*	Sapindaceae	H	-	4	2	2	4	6	4
Caps ann	*Capscum annuum* L.	Solanaceae	H	-	-	-	1	-	1	-
Celo	*Celosia* sp.* L.	Amaranthaceae	H	-	-	-	1	-	-	-
Cissu	*Cissus* sp.* L.	Vitaceae	H	-	-	-	-	-	-	1
Cler cap	*Clerodendron capitatum* L.	Verbenaceae	H	-	-	-	4	-	-	3
Comm	*Commelina* sp. L.	Commelinaceae	H	-	-	1	4	4	3	3
Cyth	*Cyathea* sp.	Cyatheaceae	H	-	8	9	16	15	13	8
Cyat un	*Cyathula uncinulata**	Amaranthaceae	H	-	-	3	-	-	-	-
Cymb cit	*Cymbopogon citratus** (DC.ex Nees) Stapf	Poaceae	H	-	-	-	1	-	-	-
Cyno dac	*Cynodon dactylon** (L.) Pers.	Poaceae	H	-	-	-	1	-	-	-
Cymp bat	*Cyphomandra betacea* (Cav.) Sendtn.	Solanaceae	SH	-	1	1	11	1	1	2
Datu str	*Datura stramonium** L.var.Chalybea W.D.J Koch	Solanaceae	SH	-	1	-	-	-	-	-
Desm tri	*Desmodium triflorum*[*]*	Fabaceae	H	-	-	-	-	1	-	-
Dios	*Dioscorea* sp.* L.	Dioscoreaceae	H	-	-	-	1	1	-	-
Drac fra	*Dracaena fragrans* (L.) Ker-Gawl.	Dracaenaceae	SH	-	1	3	6	-	14	7
Drac lax	*Dracaena laxxisma* Engl.	Dracaenaceae	H	-	-	5	-	12	6	3
Glor sim	*Gloriosa simplex* L.	Colchicaceae	H	-	-	1	-	1	-	-
Gyna	*Gynandropsis* sp.*	Capparidaceae	H	-	-	-	1	-	-	-
Hibs lud	*Hibiscus ludwigii* L.	Malvaceae	H	-	-	-	1	-	-	1
Hype ruf	*Hyperrhnnia rufa* (Nees.) Stapf	Poaceae	H	-	-	-	1	2	-	-
Impa bur	*Impatiens burtonii**	Balsaminaceae	H	-	-	-	-	1	-	-
Impa nia	*Impatiens niamniamensis** Gilg	Balsaminaceae	H	-	-	-	-	-	2	-
Imper cyl	*Imperata cylindricum* (L.) Raeusch	Poaceae	H	-	-	-	-	2	-	1
Justi	*Justicia* sp.* L.	Acanthaceae	H	-	-	-	-	1	-	-
Keet	*Keetia* sp.*	Rubiaceae	H	-	-	-	-	-	-	1
Land	*Landolphia* sp.	Apocynaceae	H	-	3	-	2	-	-	3
Lant cam	*Lantana camara* L.	Verbenaceae	H	-	-	-	1	-	4	-
Lept coc	*Leptapsis cochleata*	Poaceae	H	-	-	2	28	-	19	28
Loers	*Loesneriella* sp.*	Celastraceae	H	-	-	-	-	-	-	2
Loud kag	*Loudetia kagerensis**(K.Schum.) C.E.Hubb.	Poaceae	H	-	-	-	-	1	-	-
Manh esc	*Manihot esculenta** Crantz.	Euphorbiaceae	H	-	-	-	-	1	-	-
Mara per	*Marantochloa perpurea* Ridley	Marantaceae	H	-	-	8	4		15	2
Mela seg	*Melastomastrum segregatum** (Benth.) A.Fern.&R.Fern.	Fabaceae	H	-	-	-	-	1	-	-
Momo ani	*Momordica anigosantha**	Cucurbitaceae	H	-	-	-	-	-	-	2

Momo myr	*Momordica foetida*	Cucurbitaceae	H	-	-	-	-	4	4	-
Olyr lant	*Olyra lantifoilia* L.	Poaceae	H	-	1	-	-	1	4	-
Perp	*Peperonia* sp.*	Piperaceae	H	-	-	-	-	-	-	2
Phyl num	*Phyllanthus nummulariifolius (capillaris)*	Euphorbiaceae	H	-	-	-	2	6	1	1
Phys per	*Physalis peruviana** L.	Solanaceae	H	-	-	1	-	-	-	-
Phyt dod	*Phytolacca dodecandra* L'Hér.	Phytolaccaceae	H	-	-	-	1	1	-	-
Pipe gui	*Piper guineense* Schum. &Thonn.	Piperaceae	H	-	-	17	25	26	21	31
Pipe umb	*Piper umbellatum* (L.) Jaeq.	Piperaceae	H	-	4	6	6	11	7	8
Poli con	*Pollia condensata* C.B.Cl.	Commelinaceae	H	-	-	-	-	1	-	2
Poly pan	*Polyspatha paniculata* Benth.	Commelinaceae	H	-	-	16	23	17	14	13
Psed cor	*Pseudarthria cornfertiflora* Bak.	Fabaceae	H	-	-	-	2	1	-	-
Reis ind	*Reissantia indica**(Wild.) n. Halle	Celastraceae	H	-	-	-	-	-	-	1
Rubu	*Rubus* sp. L.	Rosaceae	SH	-	1	1	2	1	1	3
Sala ele	*Salacia elegans*	Celastraceae	H	-	-	3	-	-	6	8
Sans daw	*Sanservieraia dawei**	Dracaenaceae	H	-	-	-	1	-	-	-
Sene	*Senecio* sp. L.	Asteraceae	H	-	-	-	-	-	-	1
Triu bra	*Triumfetta sp*.	Tilaceae	H	-	-	-	-	3	-	-
Urer	*Ureratrinervis* sp.*	Urticaceae	H	-	-	-	-	-	-	1
Vent afr	*Ventillago africana*	Velloziaceae	H	-	-	-	3	-	-	7

T=(trees, poles and seedlings), SH=Shrubs, H=Herbs.
* Species recorded from only one forest.
[c] TC=Timber class of the species (1-Class1, 2=Class 2 and 3=Class 3).

Appendix 5.2 Ordered Two Way INdicator SPecies ANalysis (TWINSPAN) output for species* by plots** based on tree stems (DBH>10 cm) for forest communities in the private, local and central forest reserves, Mpigi District Uganda

Communities	1	2	3	4	5	6	7	8	9	10	
Samples and	11111	1 111 111	1 11 111	11 111111111	11	1	1 1111	1 111111111	11 11 111	1	
Species	25545	94 192443333311233378	11111222490412 345	24013566900001111212223391288889990 1	5777564453	44555	7778895 1423483345	2813782441344239	00 3566222666756	467055	
	71390	472116364601967802383	15234590342264758686	73738902302451459182595768425697891 2	8123587928	56140	6570102470069173505	391401988456412925	8967467023134465	890337	
	WWWWW	MWKKKWWWKKWWWKKKKKKKK	KKKKKKKKKKKKMKMMKWWW	KKMMKKKKMMMMMMMMMKKKKKKMMMKKKKMMMMM	KKKKKKKKKW	KKKKK	KKKKKKWKKKKKKKKWWWW	KKKKMKKKWWWMWWWWWM	MMKWWKKMMMKKKKKK	KKKMKK	
	bbbbb	kbsszbbbwwbbbwwwwwwzz	sssswwwwwwwzkwkksbbb	wwkkwtttkkkkkkkkkwwwwwwkkkzzzzkkkkk	ttttttttb	ttttt	zzzzzzbsssswwwwzbbbb	sswzkwzzbbbkbbbbbk	kksbbttkkkttttttt	tttktt	
	02222	02011012220010011120 0	00110000112113230123	13122111001111222300112202301110000 2	1222120001	00010	0000012001212210113	000111010122011000	1101222233112312	022101	
Species	26845	22217181135643457904 9	15231267019841648131	40515568180239348059262447381255679 0	4789143583	12706	2136767470736838050	398088543905967473	6762923912790021	456193	
Cari pap	-----	----------1--------	----------	----------	----------	-----	----------	----------	----------	------	000000
Dryp uga	-----	----1----------	----------	----------	----------	-----	----------	----------	----------	------	000000
Enta aby	-----	------2----------	----------	----------	----------	-----	----------	----------	----------	------	000000
Mmyr ica	-----	----------111-1---	----------	----------1-	----------	-----	----------	----------	----------	------	000000
Oura den	-----	2----------	----------	----------	----------	-----	----------	----------	----------	------	000000
Senn spe	-----	-----3-2----------	----------2------	----------	----------	----1	----------	----------	----------	------	000000
Tric pri	-----	----1----------	----------	----------	----------	-----	----------	----------	----------	------	000000
Celt afr	---2-	2-3221----------1--	33222232242-22-1111-	------1122----1-1----------	----------	-----	----------	------1----------	----------	----1-	000001
Clau ani	-----	----------	----------3-----2---	----------1--	----------	-----	----------	----------	----------	------	000001
Guar ced	-----	----------	----1---1------1---	----------	----------	-----	----------	----------	----------	------	000001
Mori luc	-1---	----------	----------1----	----------	----------	-1---	----------	----------	----------	------	000001
Chae ari	-----	--------11---213--2-1	----234124--3444----	1212222-1-24132-12--2222122-------11	2-2---2---	-----	----------	----------1	-1----------2	------	00001
Dios aby	-----	----------	----------1-------	----------1----------	----------	-----	----------	----------	----------	------	00001
Ficu pil	-----	----------	----------1------	----------2----------	----------	-----	----------	----------	----------	------	00001
Mili exc	-----	------1----------	----------	----------	----------	-1---	----------	----------	----------	------	00001
Albi cor	23223	----------21--1--2	----------1-1----	-1-1-----1----------1--------111---	----------	-----	------2----------	------1-1---------	----------	------	000100
Blig uni	-----	--513-1-21-2---212122	2212---22-22-1212-1-	-121----1---21-1--11------2---------	1-1-11----	-----	-1111--221------1-1	------21----------	----------	-----1	000100
Oxya spe	-----	-2121--122-1-12--2-32	-2--1---1--1-2---222	--11--1---------------1-1---2-2---1-	1--1------	-----	----21--1-----112--	------1----------	-------1-1----1-	------	000100
Scol rha	-1--1	121-222---21-2---21--	131-121-11--31-2--2-	--1-------1---2--------1-2----------	----2-----	-----	-23----------	----1-3-2-1-------	----------3-	------	000100
Pitt man	---33	------2-----1--------	----------2--2---	---1---------1----------1----------	----2-1---	-2---	1----11----------	-1----------	-------1--------	------	000101
Prun afr	--1--	-1221-21----------	1-21-----1-1------1-	----------1-2------11	-----12-1-	-----	-1---1----------1--	----------	----------	------	000101
Lovo bro	-----	22-11---2-1--22-1311-	---112-12122-3-2----	-212121-132231312--1--11--1----1-2-2	---1----2-	-----	1---1-----1--2-----	----------	1------12--1----	-----1	00011
Mark lut	-----	----------	-2-2----------1-2-	-1--1-1----------	------1--1	----1	----------111	----------	----------	------	00011
Tecl nob	---1-	----21--------11---1-	3222322333222424----	---21-2122222231-2--------1-----1-11	----------	-----	2-1----------	-1-1--1----------	2----------2-	------	00011
Celt dur	-----	--2--2--22312-1------	12222---212221132422	-3332-2-121232-3421211123122---32222	--211----1	-----	---1------112-1---2	--1----------	-22-31-4-211--2-	-1--11	001000
Grew mol	-2-1-	----------	----------	----------	-------1--	-2---	----------	----------	----------	1-----	001000
Enta ang	-----	----------1-------	-------1-1--11-----	----12----11---1------1----------	-1----1---	-----	----------	-----1----------	--------11---1--	------	001001
Mimu bag	-----	----------	-----1----------	----------	--22------	-----	----------	----------	----------1	------	001001
Sola gig	-----	----------	-1-----1----------	-------11-1--1---------1---------1--	----------	----1	----------	----------	----------	---2--	001001
Anti tox	-----	212-3222212212111121-	--222-11--132-2-221-	1321213123221322--21-21-1-211212-21-	--22132-2-	32--2	1---------1-1---1--	----------2-1-1	---11----21-21--	------	00101
Arto het	-----	----------2	-------21----1-----1	----------1----1--------3111	------3-31	-1151	-----2----------1-	----------	1---------1-----	------	00101
Drac sta	-----	----------	----------	----------2--	----------	----3	----------1	----------	----------	------	00101
Maes emi	--11-	22--1122------2------	--1----1----------	----122--1--1--22-1--2--1----------	------11--	32222	-----11---1-----211	----------	--1-1---------1	----11	00101
Anin alt	-----	----------	----------	-----1--1----------	----------	11--21-11-	---1-	----------	----------2---	------	001100
Enta cyl	-----	----------1-	----------	-1---1---1--1----------2-------1---	--------1-	-----	----------	----------	----------	-----1	001100
Ficu exa	-----	----------	----------	1121------1--1--1-----2------1-1----	--22221---	--1-1	----------	----------	----------12--	------	001100
Xyma mon	-----	----------1	----------2----	-----3-121--2-222---------12---23-1-	21331---3-	-----	----------	----1------1------	-3---------1-3-1	------	001100
Ficu ott	-----	----------	----------	----------	-1---1----	-----	----------	----------	----------	--1---	001101
Tabe hol	-----	----------	----------	------23----------	223322--1-	-----	----------	----------	-----1----2--2-2	------	001101
Afro cer	-----	----------	----------	----------1----------	-----11---	-----	----------	----------	----------	------	001110
Celt zen	-----	----------	----------	----------	----------	----1	----------	----------	----------	------	001110
Ficu nat	-----	----------	----------1--------	----------1------1----------	------11--	---1-	----------	----------	----------	------	001110
Mang ind	-----	----------	----------	----------	----------	-2---	----------	----------	----------	------	001110
Pari exc	-----	----------	----------	----------	--------1-	-----	----------	----------	----------	------	001110
Paro gui	-----	----------	----------	----------1----------	-11-------	-----	----------	----------	----------	------	001110
Celt mil	-----	----------	----------	------1------1----------	----------	-----	----------	----------	----------	------	001111

Rici	heu	-----	----------	----------	-----1----------	----------	-----	----------	----------	----------	------	001111
Zanh	gol	-----	----------	----------	---1------1----1----------1	----------	-----	----------	----------	----------	------	001111
Cord	mel	-----	----1---1----------	----------	----------	----------	-----	----------1-	----------	----------	------	01000
Ficu	bra	-----	2----------1--	----------2-------	----------	----------	-----	----------	1-----1-------1---	----------	------	01000
Tric	dre	---1-	----2----11-2------1-	--2--------1-1113121	-------------1--------2----------	--1------1	-----	1----1---------11--	-------------1-11-	---21-------21--	-1----	01000
Cola	gig	-----	11-------1-11-----1--	---11------1---12-1-	-1-2------1----------1---------1	-----1--11	-----	--1-1----------1--	--------1---12--11	----------11----	----21	01001
Funt	afr	-2111	4333-32-1222144233433	--2----21-1-1223--2-	-22211-123332-31-2-33-234313-1221122	122111---1	-2-2-	44333242212-3312311	2143243-2224221231	-211-33343-1-3-2	-121-1	01001
Sapi	ell	24333	--2-13112121-32-2-2-1	1211--222211221-322-	---11---1-111--------1-1----1221-1--	----------	1312-	1221--42322-212---2	222111332321-121--	-311112122-1----	-----1	01001
Bosq	pho	-----	---32---3331323343232	1222244343432312-43-	233233321222222222443333213142333211	2-232422-2	----1	1-3221-1-1322222322	2-22--2-1--------2	21243221343323 21	--2--1	0101
Eryt	aby	-----	1-----1----------	---2----------	----------11----1----	----------	-----	----------	-1--2----------	----------	------	0101
Phyl	dis	---2-	-2222-1--1-1-----1-1-	1--2-1-21----------	121-111--1---11---1-21--11-1-----211	11132-1-1-	-----	211-1231212-12-12--	-1--1---1---------	--21----2----1--	-----2	0101
Maes	lan	-----	------2----------	----------	----------	------1---	--1--	----------	----------	--1----------1-	------	0110
Moru	lac	-----	----------	----------	----------1----------	----------	----1	----------	----------	-----1---------	------	0110
Pipt	afr	-2---	---------2--------1--	---111----2-----1---	-2-11---12----11---11-1-2----------	-----1--1-	-----	----------1-----	----------	21---1--12------	-----1	0110
Faga	mac	-----	----------	-1----------1---	----------1---------122-1-------	-2-2--1---	-----	----------	------1----------	--1---1--------2	------	0111
Faga	ang	-----	---------111------	----------	--------1----------1--2----------	--11------	-----	----1---1---------	----------	---1----------	------	0111
Ficu	pol	-----	----------	----------	----------1-1	----------	-----	----------	--------1---------	----------	------	0111
Maca	mon	-----	----------	----------1----	-111122223333211322-1121-2223-233321	-1-2111-1-	-3-1-	---22---1----------	-------1---3---1--	233--2-1142222-1	-2-32-	0111
Brid	mic	1-2--	1-----1----------	----------	-----1----------	----------	-----	-----11----------	----------2------	----------	------	10000
Albi	glo	-----	----2----1---------11	----------1----	-1-1-----1-----11----------11-1----2	----21----	-----	---121--------1----	---2--111-1-------	----------	------	10001
Albi	zyg	-----	----------	----------1---	----------1----------	----------	----1	------1----------	--1----------	----------	------	10001
Holo	gra	-----	1---1----1----------	----------	----------2---2----1--------	----------	11---	-21----1--1--------	----------	----------1-----	------	10001
Poly	ful	---11	------12----------11	---1----1----------	221-------3----------1---1--------	--------1-	12-2-	-----121-----1-11-1	2-------1---------	-------2-------1	------	10001
Ficu	pse	-----	----------	----------	----------	----------	-1---	--1----------	----------	----------	------	1001
Park	fil	-----	1----------11	----------	----------2---1---------1211111---1-	1-2111----	-----	22322----------	---13-21---------1	---------2-----1	----11	1001
Pseu	mac	----1	23232213242432222-332	--21---2---3-1-2-22-	-11232-11--2---2-12222222222333232-3	2-122-2212	211--	343433-444434333334	23222343433-333332	3333332333-22113	313122	1010
Albi	fer	-----	22-21------1--------1	----------1-------	--11--21--1-11--2--1----1-1111-1-11-	---1------	-----	211223--1----------	22-11-12----1-----	1-------1--21111	--11--	10110
Albi	gra	-----	----------	----------	---------1----------	----------	-----	----------	----------1	----------	------	10110
Ficu	los	-----	----------	----------	---------1----------	----------	-----	----------	----1----------	----------	------	10110
Cana	sch	---1-	----------	----------1----	-1-----11----------1-------	---1-11---	21-1-	----1--11----------	---1---------11---	-1---2---------1	-11--2	101110
Euph	tek	-----	----------	----------	----------	----1-----	-----	----------	----------	------1---------	------	101110
Ficu	lif	-----	----------	----------	----------	----------	----1	----------	----------	----------	1-----	101110
Ficu	sur	1----	----2----------1	----------	--11----------12----------111111	---221----	-1--1	12---3---------1---	-------1---------	1----111-1122121	112--2	101110
Pycn	ang	-----	1---------1111-1-----	----------1--	-----1--1-----1----2--21--2-1--121--	-11-222121	1--1-	------------11321-	--------111--12121	12-3-212---12112	2-22--	101110
Rhap	far	-----	----------	----------	----------	--------2-	-----	----------	----------	----------	----2-	101110
Cass	con	-----	----------1-------	----------	--11----------	----------	-----	----------	----1----------	11----------	------	101111
Faga	lep	-----	1----------1---	----------	----------2----------	--2--1----	-----	----------	----------	------1---1-2-1-	------	101111
Trem	ori	-----	----------	----------	---11---------1-1----------	----------	1----	-----1----------	----------	---121-------1--	------	101111
Syzy	gui	-1---	-1----------	----------	----1----21----------	----1-----	-----	1----------	----1----------	-----2--21-2-211	------	110000
Tric	rub	-----	----------	----------	----------	112--1----	-----	----------	----------	------2---1-22-3	-23---	110000
Andi	lac	-----	----------	----------	----------	----------	-----	----------	----------	----------2	------	110001
Blig	wel	-----	----------	----------	----------	----------	-----	----------	----------	----------1-	------	110001
Crot	mac	-----	----------	----------	----------	--1-------	-----	1----------	----------	---------1-2----	------	110001
Dryp	ger	-----	----------	----------	----------	----------	-----	----------	----------	12----------	------	110001
Ense	ven	-----	----------	----------	----------	----------	-----	----------	----------	----------1	------	110001
Glyp	bre	-----	----------	----------	----------	----------	-----	----------	----------	-------2--------	------	110001
Mand	wei	-----	----------	----------	----------	----------	-----	----------	----------	------1---------	------	110001
Spon	pre	-----	----------	----------	----------	--2-------	-----	----------	----------	-----2-----21-11	--3--1	110001
Symp	glo	-----	----------	----------	----------1---	----1--1--	-----	----------	----1----------	11---11111-121-1	--3221	110001
Alan	chi	-----	----------1----------	----------1-----	----------1------3--2--1--122-	-122-1---1	-----	---2----------	----21------21133-	---21111-1221211	222212	110010
Beil	uga	-----	----------1----1--	----------	---11----------1------2-11--2------2	-----1----	-----	-1----------1----	-----311----------	-----2-323-1122-	-2-1-1	110010
Lept	mil	-----	----------	----------	----------	----1-----	-----	----------	----------	------1-------1-	------	110010
Tetr	did	-----	----------	----------	--------1--1----------	----------	-----	----------	----------	----------2----	----1-	110010
Trec	afr	-----	----------	--------1----------	---1----------1----------	----------	-----	--1----------	--21----------	-----1---1-11---	------	110011
Eryt	exc	-----	----------	----------	----------1----------	------1---	-----	----------	-----211--1-1-1---	--1---1---11----	-----2	110100
Ficu	con	-----	----------	----------	----------	----------	-----	----------	----------1---	----------2---	------	110100
Mitr	sti	-----	----------	----------	----------	----1-----	-----	----------1--	--------122---122-	----------	213-21	110100
Rauv	vom	-----	----------	----------	----------	----------	-----	----------	----------3--11-	----------	21--1-	110100
Maca	sch	-----	23-1-----1---31-4-4-2	1----------	----------11-1----------1---	----1---1-	-----	-3-31123221232-3421	554455342345454232	–313324241222221	433233	110101
Ficu	cal	-----	----------	----------	-1----------121----------	----------	2---1	----------12------	-11---------1--2-	----------	1-----	11011
Dict	arb	-----	----------2-	----------	----------	----------	-----	----------1----	------2----------	----------2--	------	111000

Ficu	tho	----- 1------------------- ----------------1-- ---------- ---------- ----- ------------------- -------2---------- ---------- ----1-	111000
Haru	mad	---22 -------1--2---------- ---------- ---------- ---------- ----- ------2------2----- ----------3-- ----11---1------ ------	111000
Alch	cor	----- ---------- ----------1- ----------1---------1---- ---------- ----- ------1--1--1---1-- -1----------22--- --1---------- ------	111001
Ficu	muc	----- ---------- ----------1------- -------1---------- ---------- ----- --------------1---- ----------1-- ---------- ---1--	111001
Roth	urc	-12-- ---------- ---------- ---------- ---------- ----- 1-2---------- -------2---------- ---------- ------	111001
Spat	cam	----- ---------- ----------1- ----------1---------- --------1- ----- -1-----1-1------1-- --------1--------- ---------- ------	111001
Maer	dus	----- ---------- ----------1---- ---------- ---------- ----- 1---------- ---------- ---------- ------	11101
Stro	sch	----- ---------- ----------1-------- ---------- ---------- ----- -----1---------- ---------- ---------- ------	11101
Ficu	bra	----- ---------- ---------- ---------- ---------- ----- 1---------- ---------- ---------- ------	111100
Ficu	eri	----- ---------- ---------- ---------- ---------- ----- ---1---------- ---------- ---------- ------	111100
Baph	par	----- ---------- ---------- ---------- ---------- ----- ---------- ----------1 ---------- ------	111101
Euca	gra	----- ---------- ---------- ---------- ---------- ----- ---------- ----------2---- ---------- ------	111101
Ficu	ing	----- ---------- ---------- ---------- ---------- ----- ---------- --------1---1----- ---------- ------	111101
Ficu	ver	----- ---------- ---------- ---------- ---------- ----- ---------- -1---------- ---------- ------	111101
Maca	lan	----- ---------- ---------- ---------- ---------- ----- ---------- -----------2------ ---------- ------	111101
Voac	tho	----- ----------------1-- ---------- ---------- ---------- ----- ---------- -----212-23------- ----1---------- ------	111101
Phoe	rec	----- --131-1---------1-211 --31-----1--1-1--21- --------1-1-1-----------11--------- ---------- ----- 3-2-2--1--2-------- 42124331444-2-2431 2---------- ------	11111

00000	00000000000000000000	00000000000000000000	00000000000000000000000000000000	0000000000 00000	1111111111111111111	11111111111111111	11111111111111	111111
00000	00000000000000000000	00000000000000000000	11111111111111111111111111111111111	1111111111 11111	0000000000000000000	0000000000000000	11111111111111	111111
00000	11111111111111111111	11111111111111111111	00000000000000000000000000000000000	0000000000 11111	0000000000000000000	11111111111111111	00000000000000	111111
00011	00000000000000000000	11111111111111111111	00000000000000000000000000000000000	1111111111 00001	0000011111111111111	0000000000000111111	00000000000111111	000011
	00000000111111111111	00000000000000001111	00000000000000000011111111111111111	0000001111	0111100111111111111	0000000000001000001	0011111111000001	
	00111111000001111111	0000000000000111	00001111111111111100000000111111111	000011	000011111111	00000111111 00011	0001111100001	

*Species are represented by codes along the vertical axis (left side) of the table. ** Samples (plots) and codes for each forest are on the horizontal axis (top) (Ks-Kasisira private forest, Kz-Kaziro private forest, Kat-Katabalalu central forest reserve, Kw-Kaswera local forest reserve, Mk-Makokolero central forest reserve and Wb-Wabirago local forest reserve, respectively. Interior of the table are the abundance class defined by Pseudospecies cut levels, - (0 stems), 1(1-2 stems), 2 (3-5 stems), 3 (6-10 stems), 4 (11-20) and 5(>20 stems). The pattern of zeros and ones on the right and bottom sides of the table define the dendrogram of the classifications of species and samples, respectively (Figure 5.3).