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FOREST INCOMES AFTER UGANDA'S FOREST SECTOR REFORM

Are the Rural Poor Gaining?

Pamela Jagger, Indiana University

CGIAR Systemwide Program on Collective Action and Property Rights (CAPRi)
C/- International Food Policy Research Institute, 2033 K Street NW, Washington, DC 20006–1002 USA
T +1 202.862.5600 • F +1 202.467.4439 • www.capri.cgiar.org

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ABSTRACT

Forest sector governance reform is frequently promoted as a policy tool for achieving favorable livelihood outcomes in the low income tropics. However, there is a dearth of empirical evidence to support this claim, particularly at the household level. Drawing on the case of a major forest sector governance reform implemented in Uganda in 2003, this study seeks to fill that gap. The research employs a quasi-experimental research design utilizing pre and post reform income portfolio data for a large sample of households surrounding three major forests in western Uganda; a control group is included in the design.

On private forest land overseen by the decentralized District Forestry Service there has been no significant change in average annual household income from forests, and the share of total income from forests has only slightly increased. For households living adjacent to Budongo Central Forest Reserve, overseen by the parastatal National Forestry Authority, there have been significant gains in average annual household income from forests, as well as the share of total income from forests. However, increases are limited to households in the highest income quartile and are primarily attributed to the sale of illegally harvested timber. The findings from this study challenge the view that governance reforms result in favorable livelihood outcomes for the poorest. Policy makers should carefully consider the incentives facing both forestry officials and local resource users with particular attention to increasing awareness of the value of trees and forests, and facilitating legal opportunities for rural smallholders across all income categories to sustainably engage in forest product harvesting and value addition.

Keywords: Uganda, forest sector reform, decentralization, livelihoods

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Pamela Jagger [1]

1. INTRODUCTION

Recent estimates suggest that governance reforms transferring rights and responsibilities for natural resource management to local governments or local resource users are currently underway in approximately 60 developing countries (Agrawal 2001; WRI 2003). Reforms are generally motivated by the failure of centralized states to provide basic infrastructure and services, high levels of corruption within centralized systems, and the desire to foster democratic institutions that take into account the needs of a diverse citizenry (Vedeld 2003; Wunsch and Olowu 1990). Improved livelihoods for rural people living in or near forests is one of the most commonly cited expected outcomes of forest sector governance reforms (Agrawal and Gibson 1999; Agrawal and Ostrom 2001; Fisher et al. 2005; WRI et al. 2005; Meinzen-Dick and Knox 2001). However, there is a dearth of empirical data regarding whether and under what conditions favorable livelihood outcomes are achieved (Bardhan 2002; Meinzen-Dick et al. 2004).

This paper explores changes in the role of forest income in rural livelihood portfolios that have resulted from a major forest sector governance reform implemented in Uganda in 2003. The reform involved changes in the ownership and management of 85 percent of Uganda's forested land. A new forest policy, a strategic forest sector plan, and new legislation were developed during the forest sector review process (Government of Uganda 2001, 2004; MWLE 2002). The centralized Forest Department was dismantled, and the decentralized District Forestry Service (DFS) and the for-profit parastatal National Forestry Authority (NFA) were created. Though significant institutional change has taken place, there is limited empirical evidence to indicate how the benefits associated with forests have been re-oriented to local resource users.

A strong case can be made for choosing Uganda to evaluate the effect of forest sector reforms on rural livelihoods. First, Uganda is ranked second in sub-Saharan Africa (after South Africa) with respect to progress on government wide decentralization initiatives that encompass democratic processes and foundations (Ndegwa 2002). Second, Uganda is a leader in sub-Saharan Africa with respect to forest sector reforms. Major forest sector reforms have been undertaken in Cameroon, Ghana, Malawi, South Africa, and Senegal, and more recently in Kenya, Mali, Tanzania, and Rwanda. Both Kenya and Rwanda have predicated their own forest sector reform processes on the Ugandan experience. Third, forest-based livelihood improvements for the rural poor are a major focus of the new Uganda

[1] Corresponding author: pjagger@indiana.edu.

Forestry Policy as well as the National Forest Plan (Government of Uganda 2001, 2002). Finally, much of the impetus for the forest sector reform was related to the fact that Uganda's forests are under serious threat (MWLE 2001a). Rapid changes in forest cover and quality pose a significant threat to rural livelihoods.

The research employs a quasi—experimental research design comparing both pre and post reform income portfolio data for a large sample of households surrounding three major forests in western Uganda. Outcomes for two treatment groups are considered. The first group is comprised of households living in or near privately held forests managed by the decentralized District Forestry Service. The second treatment group includes households living adjacent to Budongo Central Forest Reserve that were affected by the transition from the Forest Department to the for-profit parastatal National Forestry Authority. A control group comprised of households living adjacent to Rwenzori Mountains National Park, managed by the centralized Uganda Wildlife Authority, is included in the design.

Empirical results are reported in the fifth section. Finally, the findings of the study are summarized, and policy implications presented.

The paper is organized as follows: in the next section the literature related to governance reform and livelihoods is reviewed. Background information on Uganda's forest sector reform and a summary of institutional changes and motivations for livelihood outcomes are presented. The fourth section describes the research design, study area, and methods used.

LITERATURE REVIEW

Improvements in livelihoods are a primary rationale for governance reform, particularly those that involve devolution of authority to local governments or local resource users (Meinzen-Dick and Knox 2001). Natural resource focused governance reforms have the potential to affect household assets in two ways: they have the potential to increase household assets and the returns to those assets; and they may increase access to assets not owned by the household (World Bank 2008). Reforms are expected to allow poor people to make their assets more productive via the mechanism of government policies that support local organization and decision—making around forest use, and greater participation of local forest users in markets for forest products. Improved property rights for local resource users to forests, specific forest resources and forest product markets is the most common mechanism through which returns to assets are improved (Ribot 2002; Ribot and Peluso 2003). Having a larger and more diverse portfolio of rights as well as short and long run decision making authority over resources facilitates opportunities to utilize forest resources in a variety of different ways, including: supporting current consumption; use in times of need (as safety nets); and as pathways out of poverty. In particular, the right to access and withdraw high value forest products has the potential to lift households out of poverty (Angelsen and Wunder 2003). Clear and secure rights are a crucial aspect of reform implementation if reforms are to be successful in improving the asset base of rural households. Secure land rights allow households to obtain credit, reduce risk associated with investment, and provide incentives to sustainably manage resources (DFID 2007; FAO 2002; Deininger 2003; SIDA 2007).

There is a strong link between the democratic decentralization literature and the community based natural resource management (CBNRM) literature. Often reforms involve the state sharing management or enforcement responsibilities with local communities, or provide new opportunities or incentives for community based initiatives. When CBNRM is successful, it may lead to improved natural resource management (World Bank 2008). When local resource users are involved in the formation of rules regarding the use of forests, they are expected to respect and enforce rules to a higher standard then when they are not involved in rule formulation (Gibson, McKean, and Ostrom 2000). It is also argued that local resource users have a much greater knowledge of local conditions and are therefore better equipped to identify and prioritize environmental problems (Larson 2002). Finally, both the financial and transaction costs of sustainable management, which ensures medium to long run income flows, should be lower when local resource users are integrated into the management of forests (Kaimowitz et al. 1998)

Reforms often alter the organizational or administrative structure that oversees forest management. Organizations and their employees have underlying incentive structures that motivate the way in which policies are implemented. If authorities are unwilling to substantively relinquish property rights or alter power relationships, then reform are at best partial and the opportunities for rural livelihood improvements and sustainable management are limited (Agrawal and Ostrom 2001; Crook and Manor 1998; Ribot 1999).

Bardhan (2002) argues that empirical evidence as to whether or not decentralization reforms lead to significant changes in incomes or other measures of livelihoods are absent from the literature. However, several recent studies consider the linkage between livelihood outcomes and forest sector governance reforms. There is evidence that rural households experience gains in income from forests as a result of reforms. Studies from Malawi (Jumbe and Angelsen 2006) and Ethiopia (Jagger, Pender, and Gebremedhin 2005) found that devolved forest management led to increases in income from forests for rural smallholders. However, both studies found a high degree of variation across communities and households affected by the reform. Studies that examine governance reforms in cases where the communities are involved in the distribution of timber concessions find that communities and households are better off after decentralization reforms (Oyono 2005; Palmer and Engel 2007), though again with a high degree of variation between communities and households. Communities often benefit from in kind payments that support the development of rural infrastructure including schools and health centers, or receive direct cash payments from small scale timber concessions.

Political connectedness emerges as an important variable influencing reform outcomes for the poor. Recent studies from Vietnam (Sikor and Nguyen 2007) and Indonesia (McCarthy 2004) found that while devolution does generate benefits for the local poor, local power relations and the institutions regulating access to higher value forest resources are excluding the very poor from benefiting from these reforms. Crook and Sverrison (2001) in a cross country study on the welfare impacts of decentralization reforms pointed out that central government commitment to pro—poor policies and engagement with local elites to ensure unbiased implementation of reforms are important for livelihood gains. There are numerous examples of local elites, NGOs and other special interests dominating

local decision making processes regarding the assignment of rights, which may undermine outcomes for the rural poor (Agrawal 2001; Platteau and Abraham 2002; Ribot 1999). A key finding from the synthesis research on the topic of decentralization is that if reforms are to have welfare enhancing effects at the level of the rural household, attention needs to be paid to the structural inequities that emerge across the various landscapes in which reforms are implemented (Larson et al. 2007; Ribot 2003; WRI et al. 2005).

UGANDA'S FOREST SECTOR GOVERNANCE REFORM

The Forest Sector Umbrella Program (FSUP) initiated in 1999 was the Government of Uganda's approach to reforming the forest sector. FSUP was a multi—donor program, led by the Government of Uganda through the Ministry of Water, Lands and Environment (MWLE), and coordinated by the Forest Sector Co—ordination Secretariat (now the Forestry Inspection Division within the MWLE). The goals of FSUP were two—fold: to create a positive, effective, and sustainable policy and institutional environment for the forest sector in Uganda, and, through this, to increase economic and environmental benefits from forests and trees, particularly for the poor and vulnerable (MWLE 2004a). Uganda's forest sector governance reform was part of a larger government—wide restructuring motivated by the 1995 Constitution and the 1997 Local Government Act intended to downsize the public service, rationalize government functions, and improve the effectiveness and efficiency of public service provision (MWLE 2006).

The FSUP supported a number of processes in the reform of the sector, including: a forest sector review; and the development of the Uganda Forest Policy (MWLE 2001), the National Forest Plan (MWLE 2002), and the National Forestry and Tree Planting Act (Government of Uganda 2004). A major outcome of the reform process was the abolition of the centralized Forestry Department and the creation of the decentralized District Forestry Service and the for-profit parastatal National Forestry Authority. The Uganda Wildlife Authority continues to manage the 15 percent of Uganda's forests and woodlands in national parks and game reserves (Table 1).

Table 1: Forested land under different categories of ownership or management, percent

Forest Type	Pre 2003 Reform		Post 2003 Reform		
	Forestry Department (Central and Local forest reserves; private and customary land)	Uganda Wildlife Authority (National Parks and Game Reserves)	District Forestry Service (private and customary forest land; Local Forest Reserves)	National Forestry Authority (Central Forest Reserves)	Uganda Wildlife Authority (National Parks and Game Reserves)
Tropical high forest	71.1	28.9	38.0	33.1	28.9
Woodland	88.3	11.6	78.0	10.3	11.6
Plantation	93.7	6.1	33.1	60.6	6.1
Total	85.1	14.8	70.2	14.9	14.8

Notes: Local Forest Reserves account for less than 1percent of the total forest area of Uganda.
Source: Adapted from MWLE (2001), data from National Biomass Survey, 1999.

The three forest management authorities are characterized in Table 2. The District Forestry Service is an example of democratic decentralization to local governments. As noted in Table 1, 70 percent of Uganda's forests are currently managed by local governments. An important distinction is that prior to the reform, forests outside of protected areas and central forest reserves were ungazetted public land. Since the promulgation of the 1998 Land Act and the 2003 National Forest and Tree Planting Act, forests outside of protected areas and central forest reserves are now considered privately owned. The National Forestry Authority took over Central Forest Reserves where the majority of Uganda's high value timber and forest biodiversity is concentrated. In addition to the development of the District Forestry Service and the National Forestry Authority, the Forestry Inspection Division (FID) was created. The FID, housed in the Ministry of Water, Lands and Environment, is responsible for policy and regulation in the forestry sector overseeing the activities of both the NFA and DFS. It is noteworthy that FID has been the most poorly funded of the three newly created institutions, and thus has had very limited capacity for bureaucratic oversight and support to either the District Forestry Service or the National Forestry Authority.

Table 2: Characterization of Forest Governance Organizations in Uganda

	District Forestry Services	**National Forestry Authority**	**Uganda Wildlife Authority**
Governance type	Democratic decentralization to local government	For profit parastatal	Central government
Source of budgetary support/revenue	Forest product transportation and sale permits; Timber harvesting and charcoal burning permits	Donors (years 1–4); Lease of reserve forests or sale of trees for timber harvesting; Auction of illegally harvested timber; Leasing of reserve land for plantation development; Contract services (mapping; seed sales; technical advice)	Gate receipts concessions; Central government; Donors; NGOs
Employment characterization	Local government employees	Contractors	Central government employees
Level of staffing	Inadequate for mandate	Adequate for mandate	Adequate for mandate

Notes: A parastatal is an organization which has some political authority and serves the state indirectly. While clearly defined as a parastatal in the policy documents, NFA also has a revenue generating function. The NFA Start—up Fund was supported by the European Union (EU), and the governments of Norway (NORAD) and the United Kingdom (DFID) who provided funds to meet initial capital investment and start—up operational costs. The EU provided financial assistance through the Forest Resources Management and Conservation Program (FRMCP) (MWLE 2006).

Sources: Data sources include author's primary research, MWLE (2006), MWLE (2002), and UWA (2004).

During the reform process several mechanisms were identified for promoting favorable livelihood outcomes. Opportunities for achieving outcomes are different for forests on private and customary lands vs. gazetted forests in Central Forest Reserves. Similarly the incentives and constraints for achieving outcomes vary with the capacity of the organizations charged with implementing policies, and also with the incentives and constraints of local and non-local resource users. Mechanisms identified as opportunities for catalyzing favorable livelihood outcomes are summarized in Table 3.

Table 3: Reform Mechanisms for Catalyzing Favorable Livelihood Outcomes

District Forestry Service	Small business development in the forestry sector
	Security of land and tree tenure
	Use of appropriate technologies to enhance food security (for example, improved stoves)
	Promoting tree planting and forest conservation for soil fertility
	Establishment of community forests
National Forestry Authority	Increased access to forest resources for subsistence use especially wild foods, building materials and medicines
	Sell seed and provide technical advice to land owners that want to establish plantations
	Ecotourism cash or in kind contributions to communities
	Provisions for the development of Collaborative Forest Management Agreements between CFR adjacent communities and the National Forestry Authority

Source: MWLE (2002).

While the mechanisms for achieving improved livelihoods are clearly spelled out in strategy and legislative documents that accompanied the reform, there remains very limited capacity on the part of the District Forest Service to carry out activities such as promoting business development and facilitating tree planting. A major challenge for the District Forestry Service has been continued contestation of land tenure and security. Though provisions exist with the new Constitution (1995), the Land Act (1998), and the National Forestry and Tree Planting Act (2004), to clearly define tenure rights, historical land conflicts between the Buganda and Banyoro ethnic groups, and in—migration and rapid land clearing to establish de facto property rights by migrant communities from both southwestern and northern Uganda have contributed to continued deforestation and forest fragmentation. The District Forestry Service has neither the mandate nor the capacity to address larger scale issues of land tenure in rural Uganda. The National Forestry and Tree Planting Act (2004) clearly articulates' provisions for establishing community forests. However, given relative land values (that is, agricultural land is typically 2 to 3 times more valuable than forested land), and the high demand for agricultural land incentives for communities to seek opportunities to establish community forests in the absence of a high degree of extension focused on the potential long—term benefits are weak.

The National Forest Authority has the budgetary and human resource capacity to implement their mandate; however attaining fiscal self sufficiency has directed the focus of their work toward large scale business opportunities such as

plantation establishment, and revenue generating enforcement such as the confiscation of illegally harvested timber. Significant stakeholder engagement and planning went into the development of guidelines for establishing collaborative forest management agreements (CFMAs) between the National Forestry Authority and villages adjacent to Central Forest Reserves (MWLE 2003b). However, the process is complex and bureaucratic, and few NFA employees are effectively trained in initiating and negotiating CFMAs.

METHODS

Research Design

To make claims about causal relationships between governance reforms and various outcomes a quasi—experimental research design is required. To understand how the reform has affected a particular unit of observation, be it a demographic group such as the rural poor or specific forest area, it is necessary to have data from before the reform was implemented to compare with data collected some time after implementation has taken place (Bardhan 2002). In addition, it is necessary to have a counterfactual, or a control group, to account for changes that occur due to other factors. The control group serves as an indicator of what would have happened in the absence of the reform (World Bank 2008). This study employs a quasi—experimental research design called the nonequivalent comparison group design (Shadish, Cook, and Campbell 2002). Households in forest sites affected by the reform (that is, treatment groups) are compared with households in a forest site that was not affected by the reform (control group).[2] In this case the pre—reform and post—reform samples are independent. Household level data from the first and second time period are analyzed together as a pooled cross section.

Site and Sample Selection

The baseline data for this study were collected in 2003 in four major forest areas purposively selected by the Wildlife Conservation Society as representative of forest types and management regimes in Uganda (Table 4). Data collection for the follow-up study took place in three major forest sites in western Uganda. As the focus of the study is Uganda's forest sector reform, the objective of the forest site selection process was to maximize institutional variation and minimize variation of other important exogenous variables such as forest type. Kasagala Central Forest Reserve was not included in the follow-up study; Kasagala Central Forest Reserve has the same pre and post reform governance structure as the Budongo forest site but is a woodland site, a clear outlier among forest types represented in the baseline study. In each of the study areas there are multiple forest authorities present. However, each site has a dominant forest management authority that local resource users

[2] The non-equivalent comparison group design is among the most common of quasi-experimental designs. Variants include treatment groups and untreated comparison or control groups with dependent (that is, pre and post test data collected on the same units) and independent samples. Due to the non-equivalency of the comparison and control groups, selection bias is assumed to be present. Several methods are available to test for both the external and internal validity of the research design (Shadish, Cook, and Campbell 2002).

perceive as controlling forest access, harvesting, and marketing of various forest products.

Table 4: Forest Areas Included in Baseline (WCS) Study

Forest Site	Forest Type	Jurisdiction Pre—Reform	Jurisdiction Post—Reform
Rwenzori Mountains National Park	Afromontane forest	Uganda Wildlife Authority	Uganda Wildlife Authority
Bugoma Central Forest Reserve	Tropical high forest	Forest Department	District Forestry Service
Budongo Central Forest Reserve	Tropical high forest	Forest Department	National Forestry Authority
Kasagala Central Forest Reserve	Woodland	Forest Department	National Forestry Authority

The forest sites are located in the northernmost section of the Albertine Rift; the area stretching between Lake Albert and Lake Edward.[3] The Albertine Rift is one of the most diverse ecosystems in Africa with more than 7,500 species of animals and plants, including many endemics. Western Uganda has the highest incidence of tropical high forest in Uganda (50 percent or approximately 500,000 hectares). According to data collected during the National Biomass Study published in 1999, well over 80 percent of tropical high forest in western Uganda was fully stocked (MWLE 2001a). This is in contrast to Uganda's central region which has approximately 300,000 hectares of tropical high forest, the majority of which is degraded. The characteristics of the forest sites included in the follow-up study are highlighted in Table 5.

[3] The Albertine Rift has been identified as an Endemic Bird Area by Birdlife International, an Ecoregion by the World Wildlife Fund, and a Biodiversity Hotspot by Conservation International http://albertinerift.org/arift-home/arift-whatis. Accessed 30 October 2007.

Table 5: Characterization of Forest Sites

	Rwenzori Forest Site (Control)	Bugoma Forest Site (Treatment 1)	Budongo Forest Site (Treatment 2)
Dominant forest authority	Uganda Wildlife Authority	District Forestry Service	National Forestry Authority
Forest type	Afromontane	Tropical high (partially degraded); Forest savannah mosaic	Savannah (Buliisa) Tropical high (Buliisa and Masindi)
Major forest products harvested by rural households	Fuelwood Timber Wild foods (including meat) Ropes Bamboo Medicinal plants	Fuelwood Wild foods Building materials (poles and ropes)	Timber Fuelwood Building materials (poles and ropes) Thatch
Major forest products harvested by nonlocal extraction specialists	Prunus Africana (medicinal plant)	Timber	Rattan
Districts (number of study villages in each)	Bundibugyo (1) Kabarole (2) Kasese (3)	Hoima (1) Kibaale (5)	Buliisa (2) Masindi (4)
Dominant ethnic groups	Bakonjo	Banyoro Bakiga	Banyoro Alur
Agro ecological	Montane system characterized by high rainfall	Western banana, coffee, cattle system characterized by moderate rainfall	Banana, millet, cotton (Buliisa), low rainfall; and Western banana, coffee, cattle system (Masindi), moderate rainfall
Altitude (m.a.s.l.)	1500–1750	1000–1500	900–1200
Common agricultural crops	Banana; sweet potato; cassava; Irish potato; Arabica coffee; barley (at high altitudes);	Banana; coffee; maize; sweet potato; cassava	Millet, sorghum and maize (Buliisa); Banana; coffee; maize; sweet potato; cassava (Masindi)
Livestock production	Small ruminants and poultry usually fed crop residues	Cattle, small ruminants and poultry pasture system	Both intensive and extensive cattle production; small ruminants and poultry

Sources: Author's primary data, MAAIF (1995), and Nzita and Niwampa (1993).

Baseline Data

The baseline data for this study were collected in late 2003 immediately prior to the implementation of the forest sector reform. The baseline study was conducted by the Wildlife Conservation Society, Albertine Rift Program with support from the European Union Forest Resources and Conservation Management Program (Bush et al. 2004). The primary objective was to quantify the contribution of forest products to household income portfolios. The data collection involved a household survey

designed to collect information on both subsistence and cash income generating activities.

In each of the four forests WCS visited 11 or 12 villages, for a total sample of 46 villages and roughly 640 households. WCS employed a multiple stage stratified random sampling process to select the villages included in the baseline study. As the focus of the study was communities adjacent to forests, the sampling was constrained to parishes (the second lowest administrative unit in the Ugandan local government structure) immediately adjacent to the forest. In order to get good spatial representation around the perimeter of each forest site, parishes were divided into 12 units with equal number of parishes. From each of the 12 units, one parish was randomly selected. Within each selected parish a list of villages was compiled and one village was randomly selected from each parish. Within each village participatory rural appraisal techniques including a wealth ranking exercise were used to categorize each household within the village as poor, average, or wealthy. From each group five households were randomly selected for the household interview in the baseline study (Bush et al. 2004).[4]

Follow-up Data

The nested research design of forest sites, villages, and households was limited to the three selected forest sites that were included in the WCS baseline survey. From each forest site the number of villages included in the sample was reduced from 12 to 6, largely due to financial and logistical constraints.[5] However, the number of households surveyed in each village was increased to provide a representative sample of households within each village.

The 6 villages were randomly selected using a stratified random sampling method that took into consideration the distribution of the baseline survey villages by forest site and by district in order to maximize variation across the seven districts in the study (n=18 villages).[6] After the random selection was completed the location of the villages was checked to ensure sufficient geographic distribution around each forest site. The random selection process yielded relatively uniform distribution of villages around each of the three forest sites (Figure 1).

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[4] Household level data for the baseline study are not a random sample of the population of households. Ideally 1/3 of the sample would be drawn from each of the three wealth categories. The distribution of households in the baseline dataset across the three wealth categories is: 28 percent poor; 34 percent average; 38 percent wealthy.

[5] Difference-of-means tests were conducted on total average household income, total average forest income, and the share of income from forests to compare the 34 villages included in the WCS study with the 18 villages selected for the follow-up study to ascertain the representativeness of the villages selected. There was no significant difference of means for the variables total household income and share of total income from forests. However, total household income from forests was significantly different for households falling with the larger sample of 34 villages and the sub-sample of 18 villages included in the follow-up study.

[6] At the time of the WCS study all of the villages within the Budongo forest site fell within Masindi District. In July 2006 Buliisa District was created. The villages for the Budongo site were not selected proportionally according to the new districting, but rather randomly from among the 12 villages in the Budongo forest site.

Figure 1: Map of villages included in both the baseline and follow-up studies

Thirty households were randomly selected from each village (n=540 households). A list of households residing in each village was compiled, drawing upon information from village registers, lists provided by village leaders, and information from key informants. Polygamous households were listed according to the wife's name; each wife was considered a separate household unless key informants indicated that wives jointly undertook important livelihood activities such as cooking and cultivating. Lack of household level identifiers such as household names or Global Positioning System coordinates in the baseline study made it impossible to study the same households over time. This has implications for the type of analysis possible and the interpretation of results.

The field work for the follow-up study was undertaken between October 2006 and August 2007. Each household was visited quarterly. During each visit data on the household's income portfolio, expenditures, and time use were collected. In addition, each quarterly survey had a short section that was administered only during that quarter. Data were collected on household demographics; assets and

resource use; general household welfare during the past five years; perceptions of access rights to forests; household access to forests, forest products and forest product markets; and perceptions of changes in forest cover and quality during the past five years.

Analysis

The effect of the forest sector reform on rural income portfolios is evaluated using three measures: annual total household income, annual household forest income, and the share of annual household income from forest products.[7] While income is an imperfect measure of overall household welfare, it is relatively easy to measure and can be used as a reasonable proxy for welfare (Angelsen and Wunder 2003).

In order to be able to compare incomes across households a standardized unit of measure is required. Interhousehold variations in size and demographic composition are taken into account following Cavendish (2002).[8] Equivalence scale adjustments are typically comprised of three components: a time weighting equal to the proportion of the year each household member spends in the household; a nutritional weight allocated according to the age and gender of each household member; and an economy of scale weight (Ibid). Unadjusted estimates of total income were divided by the household size in adjusted annual equivalents to produce total household income per adjusted adult equivalent units.[9] Adjusted annual incomes from the baseline data were adjusted to real values by multiplying incomes in 2003 by 6.38 percent which was the average rate of inflation in Uganda during the period 2003 through 2007.[10]

A major challenge for this study is that we do not have a true panel dataset with the same households both before and after the reform. The regression analysis combines the baseline data with the follow-up data to create a pooled cross section over time.[11] This data structure fits with the research design in that it assumes that during each year of data a new random sample is taken from the relevant population. While pooled cross sectional data is treated as a cross sectional dataset

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[7] The paper follows the standard income definition. Agricultural and forest income, for example, is gross value of products sold or consumed minus input costs. Following this, the value of family labor is not deducted, while the costs of hired labor are.

[8] See Cavendish (2002) page 56 for a detailed discussion of adjusting crude income to adult equivalent units.

[9] Because the study area does not have a significant proportion of households with migrant laborers we assumed all individuals to be time weighted with 100 percent of their time in the household.

[10] Uganda Revenue Authority. 2007. *http://www.ugrevenue.com/exchange_rates/previous.php?date=January+2008&Submit=Show*. Accessed 28 January 2008.

[11] Given that this study does not use panel data (that is, tracks the same households over time) – but rather uses pooled cross sectional data from two independent random samples, the potential effect of attrition due to factors including harassment from forest officials, economic opportunity elsewhere etc. cannot be ascertained. Data on the high proportion of households that have been in the village for greater than 10 years provides relative assurance that the sample drawn for the follow-up study is relatively representative of the population of households in the 2003 baseline study conducted by the Wildlife Conservation Society. Approximately 80 percent of household heads in the follow-up sample have lived in their current village for greater than 10 years.

for analysis purposes, it is important to include a dummy variable for year to account for aggregate changes over time (Wooldridge 2002).

The effect of the forest sector governance reform on forest income is evaluated using a program evaluation technique known as the "difference—in—difference" (DID) method. The difference—in—difference method allows for the consideration of both group specific and time specific effects. Effects can be estimated using descriptive statistics (that is, double difference mean statistics) and also econometrically (Wooldridge 2002). Table 6 summarizes the variables required to estimate the effect of the reform on livelihood outcomes.

Table 6: Variables Required to Estimate Double-Difference Mean Statistic

	Bugoma Forest Site (Treatment 1)	Budongo Forest Site (Treatment 2)	Rwenzori Forest Site (Control)
Before	T_{1B}	T_{2B}	C_B
After	T_{1A}	T_{2A}	C_A

The double difference of the means of the treatment effect is modeled as follows:

$$Treatment\ effect_{1\ (District\ Forestry\ Service)} = (T_{1A} - T_{1B}) - (C_A - C_B) \quad (1)$$

$$Treatment\ effect_{2\ (National\ Forestry\ Authority)} = (T_{2A} - T_{2B}) - (C_A - C_B) \quad (2)$$

Alternatively the difference-in-difference estimator can be used to model outcomes econometrically as follows:

$$Y_i = \beta_0 + \beta_1 treatment_dfs + \beta_2 treatment_nfa + \beta_3 time + \beta_4 treatment_dfs*time + \beta_5 treatment_nfa*time + \varepsilon_i \quad (3)$$

While comparing difference- in-difference means for both group and time specific effects can provide useful information, equations 1 and 2 assume that the policy change is not systematically related to other factors that affect outcome variables. In most cases the model in equation 3 is extended to include additional covariates that account for the possibility that random samples within a group have systematically different characteristics across the two time periods (Wooldridge 2002). Thus, the effect of the governance reform on the three livelihood outcome variables of interest is modeled econometrically according to the following equation:

$$Y_i = \beta_0 + \beta_1 treatment_dfs + \beta_2 treatment_nfa + \beta_3 time + \beta_4 treatment_dfs*time + \beta_5 treatment_nfa*time + \beta_6 land + \beta_7 labor + \beta_8 capital + \beta_9 minforest + \beta_{10} village + \varepsilon_i \quad (4)$$

$\beta_1 treatment_dfs$ is a dummy variable that indicates where the household is in the first treatment group (that is, under the jurisdiction of the District Forestry Service), and $\beta_2 treatment_nfa$ is a dummy variable that indicates whether the household is in the second treatment group (that is, under the jurisdiction of the National Forestry Authority) . $\beta_3 time$ is a dummy variable that indicates if the household fell in the 2003 or 2007 sample. $\beta_4 treatment_dfs*time$ and

β_5*treatment_nfa*time* are interaction variables that indicate whether the household falls in the treatment group and in the after the reform time period. Coefficients for these interaction variables measure the magnitude of change in the independent variable that can be attributed to the reform. β_6*land* is a vector of variables that indicate the endowment of land for each household. β_7*labor* is a vector of variables that indicate the household's human capital and over all labor supply. β_8*capital* is a vector of variables that indicate the household's available capital assets. β_9*minforest* is number of minutes it takes to travel from the household to the nearest forest by the most common means of transportation. β_{10}*village* is a vector of variables that indicate several of the fixed conditions associated with each village. ε_i is the error term which accounts for effects that are not captured by other variables.

Models with left censored dependent variables (for example, adjusted annual household income from forests, and share of annual household income portfolio from forests) are estimated using the Tobit regression model which account for the non—linear nature of data with a significant number of zeros (Long 1997).

RESULTS

Adjusted household total income by forest site and income quartile is presented in Table 7. With one exception, there have been increases in income across all forest sites and income quartiles. In all forest sites the largest increases in income are observed in the lowest income quartile. The general trend is an equalizing of incomes over time. Relatively similar percentage change across forest sites and income quartiles in the control group and treatment groups indicates that the reform has had a limited effect on total income.

Table 7: Adjusted Annual Household Total Income by Forest Site and Income Quartile, UgShs.

Research Site	Annual Household Total Income (UgShs.)		Change (UgShs.)	% Change
	2003	2007		
Rwenzori Forest Site (Control Group)	**n=85**	**n=163**		
Adjusted (AEUS) total income, UgShs				
0–25	122 910	260 769	137 859	112.2
26–50	227 569	436 117	208 548	91.6
51–75	451 950	660 575	208 625	46.2
76–100	976 262	1 128 113	151 851	15.6
Average across all quartiles	439 119	569 902	130 783	29.8
Bugoma Forest Site (Treatment 1)	**n=85**	**n=166**		
Adjusted (AEUS) total income, UgShs				
0–25	112 484	254 597	142 113	126.3
26–50	233 245	425 750	192 505	82.5
51–75	439 966	607 328	167 362	38.0
76–100	1 255 551	1 326 027	70 476	5.6

Average across all quartiles	562 047	650 150	88 103	15.7
Budongo Forest Site (Treatment 2)	n=86	n=168		
Adjusted (AEUS) total income, UgShs				
0–25	113 083	247 308	134 225	118.7
26–50	232 714	433 286	200 572	86.2
51–75	422 618	609 373	186 755	44.2
76–100	1 106 264	1 241 129	134 865	12.2
Average across all quartiles	432 643	681 108	248 465	57.4

Notes: Pre-reform (2003) estimates calculated from data collected by the Wildlife Conservation Society in 2003. During the follow-up study the average exchange rate was 1 USD=1,817 UgShs.

Absolute income from forests and the share of total income from forests are important indicators of how the reform has affected the contribution of forests to rural livelihoods. Average adjusted annual household forest income, the share of income from forests, and the percent changes in both are presented in Table 8. It is important to note that absolute income from forests declined by a relatively small amount (roughly 23 000 UgShs. or $13 USD).[12] This indicates that the Rwenzori forest site is a relatively good control group for this study. Large changes in average household income from forests in the control group site would suggest a significant event such as a change in market access (that is, the building of a road), or a major change in enforcement capacity of the Uganda Wildlife Authority, which would make it more difficult to interpret the findings for the treatment groups.

[12] During the follow-up study the average exchange rate was 1 USD=1817 UgShs. (Uganda Revenue Authority. 2007. http://www.ugrevenue.com/exchange_rates/previous.php?date=January+2008&Submit=Show. Accessed 28 January 2008)

Table 8: Adjusted Annual Household Forest Income by Forest Site and Income Quartile, UgShs.

Research Site	Annual Household Forest Income (UgShs.)		Change (UgShs.)	Percent Change	Share of Annual Household Income from Forests, percent		Percent Change
	2003	2007			2003	2007	
Rwenzori Forest Site (Control Group)	**n=85**	**n=163**			**n=85**	**n=163**	
Adjusted (AEUS) forest income, UgShs							
0–25	27 747	50 851	23 104	83.3	19.6	19.6	0.0
26–50	60 352	74 925	14 573	24.1	27.2	17.2	-10.0
51–75	112 548	105 597	-6 951	-6.2	24.4	17.1	-7.3
76–100	307 799	204 909	-102 890	-33.4	31.4	17.1	-14.3
Average across all quartiles	124 796	101 472	-23 324	-18.7	25.8	17.9	-7.9
Bugoma Forest Site (Treatment 1)	**n=85**	**n=166**			**n=85**	**n=166**	
Adjusted (AEUS) forest income, UgShs							
0–25	24 647	36 032	11 385	46.2	23.3	14.4	-8.9
26–50	37 748	65 189	27 441	72.7	16.6	15.4	-1.2
51–75	62 257	74 974	12 717	20.4	13.4	12.4	-1.0
76–100	181 585	122 166	-59 419	-32.7	15.1	10.2	-4.9
Average across all quartiles	83 717	74 550	-9 167	-10.9	17.1	13.1	-4.0
Budongo Forest Site (Treatment 2)	**n=86**	**n=168**			**n=86**	**n=168**	
Adjusted (AEUS) forest income, UgShs							
0–25	24 313	21 852	-2 461	-10.1	22.2	8.4	-13.8
26–50	29 253	35 417	6 164	21.1	12.5	8.5	-40
51–75	25 086	60 396	35 310	140.8	5.9	10.2	4.3
76–100	105 113	231 988	126 875	120.7	9.5	18.9	9.4
Average across all quartiles	43 926	99 389	55 463	126.3	13.0	12.1	-0.9

Notes: Pre-reform (2003) estimates calculated from data collected by the Wildlife Conservation Society in 2003.
During the follow-up study the average exchange rate was 1 USD=1,817 UgShs.

Estimates of the average change in annual household income from forests for the first treatment group suggest that District Forestry Service management has had a limited effect on forest income; as with the control group, absolute income from forests for the Bugoma forest site slightly decreased (-9 167 UgShs. or $5 USD). Changes in forest income decomposed by income quartile reveal the differential effects of the reform. In the Bugoma forest site increases in income from forest products are associated with the lower three income quartiles. A similar trend is observed in the control group. Income from forests had declined among the wealthiest households in both the control group and the corresponding income group in the Bugoma forest site.

The mean share of income from forests has changed very little for households in the Bugoma forest site (-4.0 percent). Though the absolute income from forests has increased for households in the lower income quartiles, the relative importance of forests to the overall income portfolio has declined for very poor households (-9.3 percent). In the control group site the relative importance of forest income only slightly increased for very poor households (+0.8 percent). The comparison between the Bugoma forest site and the control group suggests that forests are still relatively important for the lowest income quartile in the control group site and are less important for the lowest income households in the Bugoma site. In Rwenzori the wealthiest households have the largest decline in the share of income from forests (-11.1 percent), and in the Bugoma site it is the poorest households that have the largest decline in proportion of income from forest products (-8.9 percent). These figures point to the relative importance of forests in the livelihoods of poor versus wealthy households.

In the Budongo forest site a different pattern emerges from the decomposition of forest income by wealth category. Comparisons between the second treatment group, NFA management in the Budongo forest site, and the control group indicate that average household incomes from forests have substantially increased (+55,463 UgShs., or $31 USD) since the reform was implemented. While income from forests has increased for all income categories, by far the largest gains are observed in the highest two income quartiles. Average household forest income in the wealthiest income quartile has increased by roughly 127,000 UgShs., or $70 USD.

Households in the lowest income quartile in the Budongo forest site have had the largest decline in share of income from forests (-13.8 percent) while Budongo households in the highest income quartile have had a large increase in the share of income (+9.4 percent).

In the Budongo field site the wealthiest households are making the largest gains. In the context of this study the interesting question is the contribution of forests to the overall change in income and whether that change can be linked to the reform. While income from forests is increasing, the absolute change in forest income does not account for the significant gains in total income that are observed in the both the Rwenzori and Bugoma forest sites. However, among the wealthiest households in the Budongo forest site more than two thirds of income gains between 2003 and 2007 can be attributed to forests.

Double-difference mean statistics for the Bugoma Forest Site, the case of democratic decentralization to local government, are presented in Table 9. The

results in Table 9 demonstrate the impact of the forest sector reform on total household income, annual household income from forests, and the share of income from forests. The overall change in average total household income relative to the control group is a decline of approximately 43,000 UgShs., or $24 USD. However, most of this is attributed to changes in total income in the highest income quartile group. In the lower three income quartiles, changes in average total income in the Bugoma Forest Site relative to the control group have been relatively small.

Table 9: Double Difference Estimates of Reform Impacts for Bugoma Forest Site

Research Site	Bugoma Forest Site (Treatment 1)		Rwenzori Forest Site (Control Group)		Double Difference Statistic
Annual Household Total Income (UgShs.)					
Income Quartile	2007	2003	2007	2003	
	n=166	n=85	n=163	n=85	
0–25	254 597	112 484	260 769	122 910	4 254
26–50	425 750	233 245	436 117	227 569	-16 043
51–75	607 328	439 966	620 575	451 950	-1 263
76–100	1 326 027	1 255 551	1 128 113	976 262	-81 375
Average, all quartiles	650 150	562 047	569 902	439 119	-42 680
Annual Household Forest Income (UgShs.)					
Income Quartile	2007	2003	2007	2003	
	n=166	n=85	n=163	n=85	
0–25	36 032	24 647	50 851	27 747	-11 719
26–50	65 189	37 748	74 925	60 352	12 868
51–75	74 974	62 257	105 597	112 548	19 668
76–100	122 166	181 585	204 909	307 799	43 471
Average, all quartiles	74 550	83 717	101 472	124 796	14 157
Share of Annual Household Income from Forests (percent)					
Income Quartile	2007	2003	2007	2003	
	n=166	n=85	n=163	n=85	
0–25	14.4	23.3	19.6	19.6	-8.9
26–50	15.4	16.6	17.2	27.2	8.8
51–75	12.4	13.4	17.1	24.4	6.3
76–100	10.2	15.1	17.1	31.4	9.4
Average, all quartiles	13.1	17.1	17.9	25.8	3.9

Notes: Pre-reform (2003) estimates calculated from data collected by the Wildlife Conservation Society in 2003. During the follow-up study the average exchange rate was 1 USD=1817 UgShs.

Overall, the findings show that reform has had a very limited effect on the role of forest income in rural livelihood portfolios. In general, poorer households have had slight declines in absolute forest incomes, whereas the wealthiest households have had modest increases (roughly $24 USD per household). Overall, the share of total annual household income from forests has increased by 4

percent. As with changes in absolute forest income, the relative importance of forests to total household income has declined for the poorest households. The share of total household income from forests has modestly increased for the upper three income quartiles.

Double-difference mean statistics for the Budongo Forest Site, the case of management by the for-profit parastatal National Forestry Authority, are presented in Table 10. The overall change in average total household income relative to the control group is significant - approximately 118,000 UgShs., or $65 USD. With respect to absolute average household income from forests, households in the highest income quartile have experienced very large gains in income since the forest sector reform was implemented – approximately 230,000 UgShs., or $127 USD. However, households in the bottom two income quartiles have experienced losses in total household income from forests. The share of total household income from forests has declined significantly for the poorest households, while households in the middle income quartiles have experiences modest gains in the importance of forests to their total income portfolio. However, it is the wealthiest households that show the largest gains, with an estimated 24 percent increase in the role of forests in their household income portfolios.

Table 10: Double Difference Estimates of Reform Impacts for Budongo Forest Site

Research Site	Budongo Forest Site (Treatment 2)		Rwenzori Forest Site (Control Group)		Double Difference Statistic
Annual Household Total Income (UgShs.)					
Income Quartile	2007	2003	2007	2003	
	n=168	n=86	n=163	n=85	
0–25	247 308	113 083	260 769	122 910	-3 634
26–50	433 286	232 714	436 117	227 569	-7 976
51–75	609 373	422 618	620 575	451 950	18 130
76–100	1 241 129	1 106 264	1 128 113	976 262	-16 986
Average, all quartiles	681 108	432 643	569 902	439 119	117 682
Annual Household Forest Income (UgShs.)					
Income Quartile	2007	2003	2007	2003	
	n=168	n=86	n=163	n=85	
0–25	21 852	24 313	50 851	27 747	-25 565
26–50	35 417	29 253	74 925	60 352	-8 409
51–75	60 396	25 086	105 597	112 548	42 261
76–100	231 988	105 113	204 909	307 799	229 765
Average, all quartiles	99 389	43 926	101 472	124 796	78 787
Share of Annual Household Income from Forests (percent)					
Income Quartile	2007	2003	2007	2003	
	n=168	n=86	n=163	n=85	
0–25	8.4	22.2	19.6	19.6	-13.8
26–50	8.5	12.5	17.2	27.2	6.0

51–75	10.2	5.9	17.1	24.4	11.6
76–100	18.9	9.5	17.1	31.4	23.7
Average, all quartiles	12.1	13.0	17.9	25.8	7.0

Notes: Pre-reform (2003) estimates calculated from data collected by the Wildlife Conservation Society in 2003. During the follow-up study the average exchange rate was 1 USD=1817 UgShs.

While the difference-in-difference of means or double-difference statistic is illustrative, multivariate regression analysis is used to further explore the effects of the reform.[13] The model is estimated with the addition of covariates that account for the possibility that the random samples within a group have systematically different characteristics in the two time periods. The coefficients of primary interest with respect to the understanding the governance reform and its affect on livelihoods are *treatment_dfs*time* (that is, effect for households living near forests overseen by the decentralized District Forestry Service post-reform; also Treatment 1) and *treatment_nfa*time* (that is, effect for households living near forests overseen by the parastatal National Forestry Authority post-reform; Treatment 2). Regression results are presented in Table 12.

Table 11: Descriptive Statistics for Variables Used in Regression Analysis

Variable	No. of obs.	Mean	Stand. dev.	Min	Max
Baseline Data (WCS 2003)					
Adjusted total income, UgShs.	253	468 222	453 727	43 649	2 544 500
Adjusted forest income, UgShs.	253	84 747	169 884	0	1 470 238
Share of income from forests, %	253	18.80	21.12	0	90.99
Natural forest owned, hectares	253	0.13	0.80	0	7.80
Arable land owned, hectares	253	1.42	1.81	0	12.00
Female headed households	253	8.30	27.64	0	1
Education level of household head (cf. None)					
Some or completed primary	253	64.43	48.00	0	1
Secondary or above	253	19.76	39.90	0	1
Dependency ratio	253	151	104	0	600
Household head has lived in village greater than 10 years	253	83.80	36.92	0	1
Value of assets, UgShs.	253	291 542	903 983	0	7 330 000
Value of livestock, UgShs.	253	172 237	215 707	0	1 162 100
Minutes to nearest forest	253	62.76	56.00	0	360
Follow-up data (Jagger 2007)					
Adjusted forest income, UgShs.	499	632 285	471 252	115 714	4 336 662
Adjusted total income, UgShs.	499	91 815	148 197	0	1 919 542
Share of income from forests, %	499	14.33	12.54	0	74.48
Natural forest owned, hectares	499	0.27	0.58	0	4.86

[13] Descriptive statistics for the variables used in the regression analysis as summarized in Table 11.

Arable land owned, hectares	499	1.58	1.32	0	9.31
Female headed households	499	15.83	36.54	0	1
Education level of household head (cf. None)					
Some or completed primary	499	50.10	50.05	0	1
Secondary or above	499	28.46	45.16	0	1
Dependency ratio	499	142	112	0	700
Household head has lived in village greater than 10 years	499	80.76	39.45	0	1
Value of assets, UgShs.	499	209 925	554 392	0	8 970 000
Value of livestock, UgShs.	499	291 308	889 485	0	9 130 000
Minutes to nearest forest	499	34.75	44.24	0	240
Village level fixed effects					
Altitude, meters above sea level	18	1294	307	963	1872
Households per hectare	18	0.36	0.17	0.10	0.73
Minutes to nearest market for consumption goods	18	61.11	53.81	0	195
Ethnic diversity in village (c.f. one ethnic group)					
2 or 3 ethnic groups	18	33.33	48.51	0	1
Between 4 and 10 ethnic groups	18	27.78	46.09	0	1
More than 10 ethnic groups	18	16.67	38.35	0	1

Notes: During the follow-up study the average exchange rate was 1 USD=1817 UgShs.
The dependence ratio is the number of household members under 15 years plus the number of household members over 65 years divided by the number of members between 15 and 65 years of age. The ratio is then multiplied by 100.

Table 12: Conditional Difference-in-Difference Estimates of Forest Income and Share of Income from Forests, Pooled Tobit Regression Results

	Forest Income			Share of Income from Forests		
Independent Variables	**Full model (n=751)**	**Low income quartile (n=188)**	**High income quartile (n=185)**	**Full model (n=751)**	**Low income quartile (n=188)**	**High income quartile (n=185)**
Household Level Variables						
Treatment DFS	-90 575*	9 262	-410 928**	-8.49	11.03	-28.28**
Treatment NFA	-184 205***	2 694	-604 519***	-13.83**	11.05	-38.47**
Time	-20 606	24 270***	-104 688	-7.57***	-1.91	-14.52**
Interaction DFS*Time	9 838	-17 469	55 130	3.06	-10.70*	11.58
Interaction NFA*Time	95 972***	-27 753**	293 929**	6.37**	-14.97***	25.45***
Hectares of natural forest owned by household	10 776	-3 370	-9421	0.39	-1.97	-0.52
Hectares of arable land owned by household	7 266*	248.12	15 316	-0.13	-0.96	1.21
Female headed household	-28 692	-1 863	-111 244	-1.66	0.84	-5.77
Household dependency ratio	-142.92***	-11.98	-270.82	0.00	0.00	-0.02
Education level of household head (cf. None)						
Some or completed primary	10 023	1 462	20 873	0.88	0.90	-0.60
Secondary or above	18 183	8 528	-44 072	-1.94	2.64	-6.62
Household head has lived in village greater than 10 years	-31 218**	-8 046	-53 658	-3.11**	-7.22**	-2.43
Total value of assets, UgShs.	0.0036	0.0052	0.0023	0.0000	0.0000**	0.0000
Total value of livestock, UgShs.	-0.0073	-0.0235	-0.0156	0.0000	0.0000*	0.0000
Time to nearest forest (minutes)	-400.35**	-114.85**	-921.92	-0.06***	-0.08***	-0.09**
Village Level Fixed Effects						
Village altitude (masl)	-30.26	-1.68	-210.18	0.00	0.01	-0.01
Households/hectare in village	-5 070	-4 787	-99 706	-0.25	-9.91	4.93
Time to nearest market (minutes)	284.36**	61.81	684.33	0.04***	0.01	0.09**

Ethnic diversity in village (c.f. 1 ethnic group)						
2 or 3 ethnic groups	13 978	-12 657	78 944	-2.21	-6.37	-1.85
Between 4 and 10 ethnic groups	37 999	-16 745	194 983*	-0.91	-8.52	5.55
More than 10 ethnic groups	118 820***	1 607	296 681**	6.11	-2.26	12.85
Censored observations	61	21	12	61	21	12
AIC	24.77	21.10	26.33	7.89	7.64	8.49
BIC	13 735	3056.50	3979.56	1062.28	525.69	678.78
Pseudo R-Squared	0.0049	0.0140	0.0070	0.0209	0.0397	0.0313
Log-likelihood Ratio	-9277.58	-1960.26	-2412.63	-2941.33	-694.85	-762.24

Notes: All models were checked for multicollinearity using the variance inflation factor (vif) test. The variance inflation factor is 4.68.
*** Significant at the 1percent level; ** significant at the 5percent level; * significant at the 10percent level.

Controlling for household and village level characteristics, the net effect of the reform in the Bugoma forest site (that is, democratic decentralization to local government) is relatively small.

The transition from the Forestry Department to the District Forestry Services appears to have had a negligible effect on average household income from forests (that is, an increase of 9,838 UgShs., or $5 USD). Decomposition by income quartile reveals that the poorest households have lost a modest amount of forest income (17,469 UgShs., or $10 USD); whereas wealthy households have increased income from forests by an average of 55,150 UgShs., or $30 USD. The share of income from forests has increased 3.1 percent for the average household. Regression results decomposed by income quartile indicate that the share of income from forests has declined for the poorest households (10.7 percent) and increased for the wealthiest households (11.6 percent). The decline in the share of income from forests for poor households is statistically significant at the 10 percent level. Though the variable indicating female headed household is not statistically significant it is important to note that approximately 32 percent of households falling within the Bugoma Forest Site sample in the lowest income quartile are female headed. For comparison purposes, 21 percent of households in the highest income quartile are female headed in this study site.

These findings indicate that the transition to local government control over forest management has had a limited effect on livelihoods in the treatment group. Further, forest income for the poorest households has declined, while there have been gains in forest income for the wealthiest households. Limited capacity of District Forest Officers (DFOs) operating in the two Districts that are included in the Bugoma forest site is a possible explanation for the lack of attention to improving rural livelihoods. DFOs in Hoima and Kibaale Districts devote the majority of their time to the collection of district revenues for timber and charcoal transport. Their primary connection with local resource users is via periodic locally broadcast radio programs. The majority of forest income in the Bugoma forest site is for subsistence use; local resource users are generally excluded from accessing markets for high value forest products. In addition, few are aware of the value of the timber that is being harvested on private and customary lands in this area. The desire to clear land for agriculture often means that land owners will invite timber harvesters to cut large trees on their land for no cost, or for a payment far below market value.

Findings for the Budongo forest site (that is, households living adjacent to the Central Forest Reserve managed by the National Forestry Authority) suggest that the reform has had a large and unexpected effect in this area. In the Budongo forest site the average increase in household forest income is 95,972 UgShs., or $53 USD. The differential effect of the reform on forest income for the poorest and wealthiest households is striking; households in the lowest income quartile have lost an average of 27,753 UgShs., or $15 USD per household, while households in the highest income quartile are estimated to have increased forest income by 293,929 UgShs., or $162 USD per year. The share of income from forests has increased 6.4 percent for the average household. Regression results decomposed by income quartile indicate that the share of income from forests has declined for the poorest households (15 percent) and increased for the wealthiest households

(25 percent). For all models the estimated coefficients for the variable *treatment_nfa*time* were significant at the 1 percent or 5 percent level. The findings indicate that the forest sector reform in the Budongo forest site is strongly favoring the wealthiest households. As with the Bugoma Forest Site, the largest share of female headed households fall within the lowest two income quartiles (that is, 66 percent of female headed households). Only 13 percent of households falling within the highest income quartile are female headed: the reform is likely disproportionately benefiting male headed households. This is not surprising given the significant role of timber income in the large gains observed in the highest income quartile. Timber production is typically dominated by men.

The extent to which wealthy households in the Budongo forest site are benefiting significantly from engagement in the timber business points to some serious flaws in the implementation of the reform. Currently there is no legal mechanism for smallholders living adjacent to Budongo Central Forest Reserve to harvest timber. As part of the transition to the National Forestry Authority the presence of forestry officials in the Budongo forest site has increased. However, based upon data collected for this study it appears that serious monitoring and enforcement failures are taking place; specifically, enforcement is selective and disproportionately focused on the lowest income households. Selective enforcement may be partially attributed to a change in the way forest guards are compensated. Lower pay and fewer allowances relative to management by the centralized Forest Department have created an incentive for forest guards to collude with illegal timber producers. In addition, relative wealth, which suggests sufficient capital to purchase timber harvesting equipment and to hire labor to harvest timber, and social and political capital are important determinants in the ability of households to engage in the timber business. The timber value chain is relatively short and frequently vertically integrated in the Budongo Forest Site; producers often harvest timber based upon orders placed by timber traders or wholesalers from Masindi town.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The aim of this paper is to examine how Uganda's recent forest sector governance reform has affected the contribution of forests to rural incomes. While the reform is still in the early stages of implementation, the findings point to some striking changes or, in some cases, lack of change, in the role of forests in rural income portfolios in western Uganda. Overall, for Ugandans living in or near forests on private lands, the impact of the forest sector reform on rural livelihoods is negligible. Four years after the transition from Forest Department governance to District Forestry Service governance rural households have not increased the share of their income from forests through the sale of unprocessed or processed forest products.[14] While wealthy households obtain larger incomes from forests and a

[14] Arguably 4-5 years is not a very long time period for which to evaluate the effects of Uganda's forest sector reform. However, the findings from this study point to both limited effects (that is, the case of democratic decentralization) and significant changes (that is, the for-profit parastatal National Forestry Authority) that indicate the reform is having a limited effect or an effect that is contrary to the overarching objectives of both the new forest policy and National Forest Plan. Having this

larger share of total income from forests, the values are not large, and are indicative of the subsistence nature of forest product harvesting in this area. These findings indicate that forest sector decentralization to local government in Uganda has not had the desired outcome of increasing the role of forests in rural household income portfolios.

A second story emerges from the analysis of the transition from Forest Department to National Forestry Authority in the Bugondo forest site. We found that relatively wealthy rural households living adjacent to the central forest reserve experienced large gains in income from forests, total income, and the share of income from forests. However, households in the lowest income quartiles experienced moderate losses in forest income and significant losses in the share of income from forests. The majority of forest income in the study area is from sawn wood, which is harvested and sold illegally. In this case livelihoods have been improved, but due to the institutional failure of the National Forestry Authority to regulate and enforce rules regarding timber harvesting. The transfer of responsibilities for central forest reserves to the National Forestry Authority has not had the desired effect. Forests have improved the livelihoods, but only for relatively wealthy households accessing forest products illegally.

The extent of timber harvesting and marketing that is taking place in areas where these activities are known to be illegal is significant. The degree to which these activities are being undertaken by local elites needs to be further explored. These findings are consistent with Agrawal (2001), Platteau and Abraham (2002), and Ribot (1999), who cite numerous examples of local elites, NGOs, and other special interests dominating local decision making processes regarding the de facto assignment of rights, which tend to undermine outcomes for the rural poor.

An important implication of these findings is the differential effect of the reform on relatively wealthy and relatively poor households. The findings highlight the importance of decomposing the data by income quartiles. The findings from this study are consistent with Jumbe and Angelsen (2006); Jagger, Pender and Gebremedhin (2005); and Sikor and Nguyen (2007), who found that reforms have differential effects across households and communities. Important patterns emerge from the analysis that would not be observable if average impacts across the whole sample were the focus of the analysis. Recall that the goals of FSUP were two—fold: to create a positive, effective, and sustainable policy and institutional environment for the forest sector in Uganda, and to increase economic and environmental benefits from forests and trees, particularly for the poor and vulnerable (MWLE 2004a). This research demonstrates that households in different income quartiles are differentially dependent upon forests, and that that reform has affected different income groups in different ways. This finding supports both Larson et al. (2007) and Anderson and Gibson (2006), who point to the importance of monitoring the livelihood portfolios of those living in or near forests during policy implementation to ensure the poorest households are not disproportionately disadvantaged by governance reforms.

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information at an early stage of implementation is useful to donors, policy makers, bureaucrats charged with implementing reforms, civil society organizations, and local communities affected by the reform.

Several policy recommendations emerge from this research. First, in both the case of the decentralized DFS and the parastatal NFA there are few incentives for forestry officials to ensure that rural smallholders and, in particular the poor, have improved access to high value forest resources. Facilitating legalized engagement of local resource users in the sustainable harvesting of high value forest products and small scale forest enterprise development may increase awareness of the value of trees and forested land, increase income from forests, and reduce the incentive for corrupt officials to extract bribes from illegal producers. Second, the incentives of forestry officials should be carefully evaluated. Currently, there appear to be few incentives for forestry officials to do their jobs as they were envisioned. This includes evaluating hiring practices, performance evaluation, salaries, and so on. Third, in the control group site, collaborative forest management agreements and the sharing of tourism revenues with local communities has a favorable effect on both local livelihoods and forest management. Opportunities for community engagement in forest management should be pursued, with the caveat that successful collaborative forest management initiatives generally take a very long time to negotiate. Finally, the differential effect that the reform is having on the contribution of forests to the poor versus wealthy rural households points to the necessity of collecting data that can be used to monitor the progress of reforms as they are implemented. While Uganda is still in the early stages of implementation, these findings highlight the presence and magnitude of elite capture that has been anecdotally observed in numerous studies on the topic of decentralization and livelihoods.

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