CGIAR Systemwide Program on
Collective Action and Property Rights

Secretariat:
International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.

ENVIRONMENT AND PRODUCTION TECHNOLOGY DIVISION AUGUST 2005

CAPRi Working Paper # 41

WHO KNOWS, WHO CARES? DETERMINANTS OF ENACTMENT, AWARENESS AND COMPLIANCE WITH COMMUNITY NATURAL RESOURCE MANAGEMENT BYLAWS IN UGANDA

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ACKNOWLEDGMENTS

The authors are grateful to the Trust Fund for Environmentally and Socially Sustainable Development for providing financial support to this research; to the World Bank, Makerere University Institute of Statistics and Applied Economics, the Uganda Bureau of Statistics, the National Agricultural Research Organization of Uganda, and the Agricultural University of Norway for partnership with IFPRI on this project; and to the many farmers and community leaders who participated in the survey upon which this study is based. Any errors or omissions are solely the responsibility of the authors.

ABSTRACT

Community-based Natural Resource Management (NRM) is increasingly becoming an important approach for addressing natural resource degradation in low income countries. This study analyzes the determinants of enactment, awareness of and compliance with by-laws related to Natural Resource Management (NRM) in order to draw policy implications that could be used to increase the effectiveness of by-laws in managing natural resources sustainably.

We found a strong association between awareness and compliance with NRM bylaws. This suggests the need to promote environmental education as part of the strategy to increase compliance with NRM bylaws. Econometric analysis of the survey data indicates factors that are associated with enactment of local NRM bylaws, and awareness of and compliance with NRM requirements:

- Local NRM bylaws are more likely to be enacted in communities where there are programs and organizations focusing on agriculture and environment, but less likely where the land tenure system is customary than where other land tenure systems are predominant.

- People are more aware of requirements related to bush burning in communities that are closer to an all-weather road and have better access to credit. People are more aware of requirements related to tree planting and protection closer to roads, and where there are more programs and organizations with focus on agriculture and the environment

- People are more likely to comply with a bylaw enacted by the local council than otherwise. People are more likely to comply with requirements related to tree planting and protection in communities where agricultural potential is high, where income poverty is lower, where adults are more educated and where there are more credit organizations.

These findings imply that improving awareness of NRM requirements is critical to increase compliance with such requirements. Awareness is greater in areas closer to all-weather roads, probably due to better access to information in such areas. Development of roads and communication can thus facilitate better community NRM. Other low cost options to increase awareness could include use of radio programs, environmental education in schools, resource user seminars, brochures, and district level training workshops.

Devolution of responsibility contributes to greater compliance with NRM requirements, given that compliance is greater with bylaws enacted by local councils than with laws enacted at a higher level. Involvement of locally accountable and representative authorities in enacting and enforcing NRM requirements appears critical for the legitimacy and success of such regulation. Involvement of external programs and organizations focusing on agriculture and environment issues can help to promote such local enactment.

Several dimensions of poverty, including greater income poverty, poor education, and poor access to credit are associated with lower compliance with tree planting and protection requirements. This supports the hypothesis of a poverty-natural resource degradation trap, and suggests that measures to reduce poverty can have "win-win" benefits helping to improve NRM as well.

Keywords: bylaws, Uganda, natural resource management, customary institutions, compliance, awareness, enactment.

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1. INTRODUCTION

Uganda is one of the poor countries that have achieved remarkable economic growth and poverty reduction in the past decade. Absolute poverty declined from 56 percent of the population in 1992 to 34 percent in 1999/2000 (Appleton, 2001). However, the country's economic development is faced by a number of challenges, one of which is land degradation. Soil erosion and soil nutrient mining are the leading causes of land degradation in Uganda (NEMA, 2001; Zake, et al. 1997). Degradation of other natural resources in Uganda is also severe. About 9 percent of the central forest reserves and 43 percent of local forest reserves areas are degraded (Forest Department, 2002). Wetlands, which cover 30,000 km^2 or 13 percent of Uganda's land surface are mostly open access resources at the community level, leading to rampant encroachment and over harvesting (Bakema and Iyango, 2004). About 3 percent of the total wetlands area has been reclaimed. Water and fishery resources also suffer significant degradation due to surface water pollution and siltation, fish over-harvesting, illegal fishing, and eutrophication. The near-term consequences of the water and fishery resource degradation have been devastating. For example, using poison to fish led to an eighteen month ban on fish

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exports to Europe, which in turn caused loss of about US$30 million (Keizire, 2001; MFPED, 2003).

In response, the government of Uganda has formulated a number of policies and passed several statutes to address the degradation of natural resources. Accordingly, the local governments at district and lower administrative levels have designed strategies and enacted bylaws to implement the national policies and statutes. This study was carried out with the broad objective of examining the determinants of enactment, awareness of and compliance with NRM regulations enacted at the community level. This knowledge will help the government and its partners to design policies for sustainable management and utilization of natural resources for the present and future generations.

Community based management of natural resources has become an increasingly acceptable approach for environmental management.[4] Empirical evidence shows that community resource management can increase efficacy, legitimacy, and sustainability of natural resource management (Western and Wright 1994). There is still relatively little empirical work that has analyzed the factors that determine participation in community resource management (Zantell, ad Knuth, 2004). The approach of this paper differs from most related studies since it analyzes the determinants of enactment of bylaws at the community level and compliance with these bylaws at privately owned natural resources. Most related works have analyzed collective action for management of common resources such as community forests (e.g. Agrawal and Yadama 1997; Poteete and Ostrom, 2004; Poteete and Ostrom, 2003; Ostrom 1999; Agrawal, 2000; Gebremedhin, et al., 2003). Since awareness and legal education are key to compliance with legal

[4] However, Agrawal and Gibson (1999) caution that community NRM may not be a panacea to address all the problems of natural resource degradation.

instruments (NEMA 2001), we also analyze the determinants of awareness of legal instruments. Enactment and enforcement of bylaws vary considerably across communities, and this leads to major differences across communities in natural resource conservation or degradation. Understanding the differences in enactment and compliance with such bylaws and the reasons for these differences is the main purpose of this study.

The rest of the report is divided as follows. The first section briefly reviews NRM policies in Uganda in order to understand the country's NRM strategies and priorities. Detailed discussion of the decentralization policy will be given since this policy has profound effect on community level NRM. We then discuss the regulatory instruments that the government uses to support its NRM policies and the customary institutions and laws that influence NRM. This is followed by the theory and conceptual framework section that will discuss the possible determinants of enactment, awareness of and compliance with regulatory instruments related to NRM. This section is followed by a discussion on research methodology, including data collection and analysis methods. Discussion of results will follow and lastly conclusions and policy implications of the results will be presented.

2. GOVERNMENT POLICIES AFFECTING NATURAL RESOURCES MANAGEMENT

The government of Uganda recognizes the important role that natural resources play in the livelihoods of Ugandans. The country has designed policies and strategies with a broad goal of ensuring that natural resources contribute to poverty reduction in a sustainable manner. Chapter 17, article 278(1) of the Constitution of Uganda (1995) states, "Parliament shall by law provide for the measures intended to protect and preserve

the environment from abuse and degradation and to manage the environment for sustainable development." Pursuant to this, a number of policies have been passed by the legislature to implement the constitutional directive. A National Environmental Action Plan (NEAP) was established to guide the sustainable use of the country's natural resources. A National Environmental Management Authority (NEMA) was created to spearhead the implementation of this plan. NEMA's objective is to ensure sustainable social and economic development, which maintains environmental quality and resource productivity, meeting the needs of the present generation without compromising the needs of future generations (NEMA 2001). Several districts have formulated their own district environmental policies that take into account the district environmental concerns. Likewise, several sectoral policies have been formulated.[5] We particularly focus our policy review on decentralization since this is the most important policy that has shaped the local institutions that we are analyzing in this research.

To address the lack of involvement of local communities in decision making on local issues such as managing natural resources, the government of Uganda decentralized its central government executive powers in 1992. Among other causes, lack of local community involvement in NRM has contributed to natural resource degradation. For example, Muhereza (2002) noted that one of the reasons for encroachment upon forests and illegal hunting is the lack of involvement of communities in managing wildlife and forest resources, thus limiting community members' sense of ownership or responsibility for centrally managed natural resources. The forestry sector, however, has not fully

[5] Some of the important sectoral policies are: agriculture and livestock policy, decentralization, national policy for the conservation and management of wetland resources, the draft national soils policy, water policy, wildlife policy, forest policy, and fisheries policy.

decentralized the delivery of services to the district and local councils. Only 5,000 ha of small forests gazetted in the 1940s as "local forest reserves" have been legally transferred to the districts and local councils (NEMA, 2004). The large gazetted "central government forest reserves" have been retained under the authority of the central government (Muhereza, 2002).

Under the decentralization policy, the central government plans to devolve management of natural resources to local communities. Natural resources will be co-managed between government institutions and local communities. Natural resource co-management is a key element in the new Forest Policy and in the NFA. The 1995 Wildlife Statute and the Protected Area System Plan for Uganda (Lamprey et al., 2000) encompass similar approaches. The NEAP and NEMA have also taken advantage of decentralization and development of local institutions to manage local natural resources and the environment in general. District and local environmental committees have been formed to enact and enforce environmental and natural resources ordinances and by-laws (Lind and Cappon, 2001; NEMA, 2001). The district councils are the highest local government political authorities within their area of jurisdiction, which exercise both legislative and executive powers (Uganda Parliament 1995). The sub-district legislative bodies are the sub-county and LC1 (village level) councils. The sub-county and LC1 councils also have both legislative and executive powers. However, bylaws passed by both have to be ratified by the district councils. The bylaws and ordinances passed by the local councils (districts, sub-county, and LC1) also have to be in accordance with the national statutes and the constitution (Onyach-Olaa, 2003).

Although the theoretical advantages of local user management of natural resources have been convincing and the impetus for devolution policies strong, the actual

outcomes of devolution programs in various sectors and countries have been mixed (Knox and Meinzen-Dick, 2001). Experience has shown that decentralization is confronted with major challenges, such as interest capture by local elites, overexploitation of natural resources driven by need to create local revenues, inadequate financing (taxation) and arbitrarily imposed fees and levies, and lack of human resource capacity at the local level to plan, manage, and implement developmental activities and policies.

INSTITUTIONS AFFECTING NRM

Community members are faced with more than one set of regulatory instruments that influence their NRM decisions. North (1990: 3) defines institutions as humanly devised constraints that structure human interactions. Formal and informal laws are the most readily understood but not the only forms of institutions. Other forms of institutions are organizations of any form, traditions, norms, superstitions, taboos, or any regulatory instrument. In this pluralistic legal environment (Griffiths 1986), each set of regulatory instruments adapts to other sets, depending on the enforcement mechanism and level of compliance with a given set of regulations (Guillet 1998). Hence these adaptations change according to the changes in the power relationships of the bearers of the regulations (Ntambirweki 1998). The socio-economic environment could also lead to changes and adaptation of the regulatory instruments. For example, Bikaako and Ssenkumba, (2003) observed that customary land tenure in Uganda is increasingly taking a gendered view in bequeathing land as parents realize the contribution of their daughters to household livelihood. The common sets of regulatory instruments in most societies are the central and local government law, customary law, religious law, project, donor or

program law, group or association law, and local norms (Meinzen-Dick and Pradhan, 2002; Byamukama, 2001). We will not attempt to take stock of all sets of instruments but our review will focus on three sets that influence NRM the most in Uganda. We review the regulations enacted by the local government and customary institutions that we later investigate further in the empirical section. However, since local government regulations are required to be compliant with the central government statutes, it is important to review the major statutes that shape community NRM institutions [6]

Central government regulatory instruments:

The Land Act of 1998 is the major statute that defines the land rights in Uganda. The statute was passed with the broad objective of ensuring land tenure security and sustainable land management. It recognizes four land tenure systems in Uganda: customary, free hold, leasehold, and mailo. Each land tenure system is associated with its own land rights and obligations and the period for which the land rights can be exercised or enjoyed (Republic of Uganda 1998).

1. *Customary land tenure* is the most common land tenure system in Uganda and is regulated by customary rules. Under customary tenure, an individual, family, or traditional institution may occupy a specific area of land as prescribed by the customary laws. The landholder under customary tenure has the right to share and use the land for the good of the community. Landholders may apply for a certificate of ownership from the District Land Board. Once such a certificate is issued, the land holder(s) may lease, mortgage, sell, sub-let, give or bequeath by will the land or part of it (Ibid).[7]
2. *Freehold land tenure* allows the landholder to own the land for an unlimited time. This system recognizes and protects the rights of lawful and *bona fide* occupants on the land as well as improvements on the land. The landholder can use the land for any lawful purpose, may sell, rent, lease, or use it as collateral

[6] For a richer review of these instruments, see Meinzen-Dick, 2002, and Spiertz, 2000.
[7] Further discussion on customary land tenure is given in the section that discusses customary institutions.

to get a loan from a bank, may allow other people to use it, may give it or bequeath it by will (Ibid).

3. *Leasehold land tenure* is a form of tenure created either by contract or by operations of law. Under this system, the landlord allows the tenant to use the land for a specific period. The lessor may change a lease ownership to freehold, can sell, sub-let, mortgage, give or bequeath by will the land for the period he or she is entitled to hold the land.

4. *Mailo land tenure* is a system where the landholder owns the land forever in the same way as a freehold owner. After receiving land titles from the colonial government in the 1900s, the *mailo* owners divided their land into smaller parcels (*kibanja*) and rented them out to *bona fide* tenants (*bakopi*). The *bakopi* were required to pay land rent and tribute (*envujjo*) in form of beer, crops, or in few cases, money (NEMA, 2001). The land act recognizes and protects the rights of lawful and *bona fide* occupants[8] of that land as well as improvements on that land. The landholder may lease, mortgage, pledge or sell, give away or bequeath by will the land or part of it. The Land Act of 1998 prohibits landholders to evict *bona fide* occupants from land. If the *bona fide* occupant has developed the land, the landowner is allowed to continue owning the land but not the development on the land. The rent and tribute that tenants pay to land owners entitle them to cultivate crops, plant trees, and reside on the *mailo* land. However, there are some restrictions such as not allowing the tenants to plant more than 0.4 ha of coffee or grow cotton on *mailo* land. The tenants also are not allowed to cut and sell trees for profit. This provision includes even the trees that the tenants might have planted on the parcel (NEMA, 2001).

Other statutes that shape enactment of community level bylaws are those related to soil and water management. The notable statutes are the Hilly Mountainous Areas

[8] The Land Act of 1998 recognizes three types of occupants on registered land, namely: the lawful occupants, the *bona fide* occupants, and the non *bona fide* (unlawful) occupants. The lawful occupant is a person who entered the land with consent of the registered landholder or a person who occupies land by virtue of the repealed *busuulu* and *envujjo* law of 1928; or the Tooro or Ankole landlord and tenant law of 1937. A *bona fide* occupant is a person who, before entering into force of the 1995 Constitution, had occupied or utilized or developed any land unchallenged by the registered owner or agent of the registered owner for twelve years or more. A *bona fide* occupant may also be a person settled on land by the government or an agent of the government, which may include a local authority. The unlawful occupant is the one who does not qualify as a lawful or *bona fide* occupant but holds land under unlawful means.

Management Regulations of 2000 and the Minimum Standards for Management of Soil Quality of 2001.

The Hilly and Mountainous Areas Management Regulations of 2000 was passed with the aim of ensuring sustainable natural resource use and management in hilly and mountainous areas. Among other things, the regulations provide guidelines and measures for farming in hilly areas. For example, farmers are not allowed to grow crops or graze animals on steep slopes that exceed a slope of 15 percent. The districts are required to enforce this statute by ensuring that landholders and users comply with this statute (Bazaara, 2003). The Minimum Standards for Management of Soil Quality of 2001 categorizes land into different groups based on slope and land use. Each category has different sets of regulations. In general, the regulations give specific directives on tillage and planting methods and on management of soil erosion and drainage using physical structures and agroforestry. The regulations also give a blanket directive that requires farmers to follow soil fertility management practices recommended in their area.

The major weaknesses of the statutory law and regulations are the lack of financial resources and the heavy reliance on punitive measures to enforce them, both of which lead to weak compliance (Banana and Gombya-Sembajjwe, 2000; Mukasa 1995). When the government lacks financial resources, it cannot hire enough personnel or provide adequate equipment and other logistics for enforcing its NRM laws. The few hired government law enforcement employees are poorly paid and hence tend to be corrupt and/or do not have strong incentive to enforce government regulations. The central government also relies on the local government councilors to enforce the statutory law (Mukasa 1995). Since local councilors are elected officials, they may not effectively enforce statutory law that involves a considerable degree of coercion for fear of angering

the electorate. Additionally, the local governments also face serious budgetary and human resource constraints. Weak law enforcement renders most natural resources under the central government law *de facto* open access resources and hence open to depletion if economic conditions so dictate (Banana and Gombya-Sembajjwe, 2000).

Heavy reliance on punitive measures and the top-down approach in enforcing state law leads to poor compliance with statutory law and limited local community participation in monitoring and enforcing natural resource conservation regulations (Banana and Gombya-Sembajjwe, 2000). For example, Lawry (1990) noted that sustainable local resource conservation institutions are unlikely to grow where forests have little economic value to local community because of restrictive access rules. Alternative incentives for conservation by local people—such as increasing their access to natural resources and/or collection of royalties payable by out of community resource users—could increase the local community's compliance with statutory law and its participation in monitoring and enforcing natural resource conservation law (Ibid).

LOCAL GOVERNMENT INSTITUTIONS

Bylaws are subsidiary laws that are enacted by the local governments. In the case of Uganda, the local legislative bodies that enact bylaws are local council 1 (LC1) and local council 3 (sub-county). Laws enacted by district councils are called ordinances. Since there are 56 districts in Uganda and thousands of sub-counties and local government councils (LC1), it is not possible to list and discuss all bylaws and ordinances. The Ministry of Local Government also has not published a comprehensive list of ordinances and bylaws enacted at sub-county or community level. There is also scanty literature on bylaws in Uganda. The common bylaws in Uganda are related to tree planting and protection, and soil and water conservation in general (Sanginga 2002).[9]

Soil and water conservation (SWC) bylaws. Any person who clears land for cultivation on a slope shall construct bunds or barriers across the slope parallel to the contour; plant appropriate grasses or agroforestry trees on the bunds; construct barriers as determined by technical agricultural extension officer; and not plant annual crops on a steep slope (above 15 percent). Planting of tree crops shall be done along the contour.

Tree bylaws: Any person who cuts a live tree shall:

- Plant two trees;
- Ensure the planted ones are protected and well looked after;
- All persons who own private woodlots on hills and want to clear their woodlots must first seek approval and advice from the Forest Department, local council, and local chiefs on how best to harvest the woodlot without triggering soil erosion or other environmental degradation and biodiversity loss;
- Appropriate tree species shall be planted not less than 3m on both sides of feeder roads;

[9] Some of these "by-laws" may be ordinances or statutes since the author did not report the legislatures that enacted them.

- Only agroforestry trees shall be planted on the boundary or terraces of neighboring households' plots;
- The local committees with help of chiefs will make sure all road reserves[10] are planted with rows of trees on both sides.

The bush burning bylaws. No one is allowed to burn bush inside or outside their own farm.

These bylaws and ordinances reflect the broad statutes that require local governments to conserve the environment. For example, the no bush burning regulation reflects the prohibition of burning grass decree of 1974, which vested power to enforce it in the sub-county chiefs (Mukasa 1995). The requirement to plant and protect trees and the SWC bylaws also reflect the hilly and mountainous areas management regulation of 2000 and the minimum standard for management of soil quality of 2001.

The weaknesses of the local government ordinances and bylaws include:

1. The potential conflict of interest of the elected local government councilors. The councilors are required to enforce the ordinances and bylaws. If such regulations require a certain degree of coercion to enforce, the councilors are likely not to effectively enforce them for fear of not being re-elected.
2. The ordinances and bylaws are required to be consistent with the statutory law. Since statutory instruments are enacted with limited participation of local communities, they may not reflect the local conditions and sentiments.
3. Local councils have limited financial and human resources to enforce regulations.

[10] The Ministry of Public Works, Housing and Communications establishes a "road reserve," which is a minimum distance from a road, within which no one is allowed to establish any permanent structure that may interfere with traffic or future road development.

Customary institutions

There are 56 different ethnic groups in Uganda (Parliament of Uganda 1995), each with distinct dialect and fairly distinguishable traditions, customs, and norms (Wanyeki, 2003). Before colonization, these ethnic groups were organized in clans and kingdoms. The non-Bantu in the north and northwest (Lango, Acholi, Lugbara, and Alur), east and the northeast (Karimojong, Itesot, Kumam, Sebei, Sabiny, Japadhola, etc.) were organized in small clans that were headed by chiefs and clan elders.[11] The Bantu speaking ethnic groups were organized in much larger kingdoms with fairly centralized governments under kings (Fleming 1966). The major kingdoms were the Bunyoro-Kitara kingdom in the central and western region of the current Uganda and the Buganda kingdom along the Lake Victoria crescent region. Other smaller kingdoms were the Ankole and Tooro in the west and Soga in the east (Ibid). The central government recognizes the existence of cultural institutions though it does not give them political, legislative, or executive powers or any explicit role in the local government structure.[12]

Under the ethnic groups holding land under customary tenure, land belonged to the entire clan. The clan chiefs and elders allocated land to household heads to hold, rather than own, in trust and on behalf of the entire family. In most cases among the non-Bantu people, land was allocated on behalf of the entire clan. Likewise, for the Bakiga in western Uganda, land rights are embedded in concrete local practices, social relations,

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[11] The Bantu, which literally means "people," belong to the great family of Negroid tribes (Niger-Congo) living in central, east-central, and southern Africa. The over 400 languages spoken by the Bantu are related. The Bantu tribe names begin with Aba-, Ama-, Ba-, Ma-, Wa- (Webster, 1913). The non-Bantu people in Uganda include the Nilo-Saharan and Nilotic (people along the Nile River) groups, namely Langi, Acholi, Alur, Kakwa, Lugbara, Karamajong, Iteso, Sebei, Sabiny, and others (Ehret, 1971).

[12] In 1967, the government of Uganda abolished the traditional kingdoms but the Museveni regime restored some of them in 1993. The kingdoms that have been restored are: the Buganda, Bunyoro-Kitara, Tooro, Busoga, and Ankole.

obligations, and responsibilities (Tripp, 2004; Khadiagala, 2002a). Household heads entrusted with holding the land are required and to bequeath the land to their children, rather than sell it when they retire. Selling of land requires the approval of the clan members and the family household members (Khadiagala, 2002a). For example, in Kabale, as is the case in other communities holding land under customary tenure, all family and clan members who have potential interest in land and neighbors must be present during land transfer in form of inheritance or selling. Neighbors are invited to witness the transfer since they must agree with the boundaries (Ibid). Hence due to this inter-generational continuity of land holding, the household head and members are likely to have a special attachment to their land that may not necessarily develop under the titled land tenure systems. Obviously this may affect NRM in a way that would be interesting to explore in this study. We explore this by comparing the enactment, awareness of and compliance with NRM regulations in communities with predominantly customary tenure with communities with predominantly non-customary land tenure systems

Land ownership and transactions under the Bantu kingdom system differed from non-Bantu groups since land allocation and management involved both the king and the clan chiefs. Kingdoms were divided into smaller areas which were administered by chiefs appointed by the king. For example the Buganda kingdom had ten provinces (*saza*), which in turn were sub-divided into sub-provinces called *gombolola*. The *gombolola* was further divided into clan areas (*butaka*). There were over 40 clans in the entire Buganda kingdom (Mukasa 1995). Land ownership rights in the Buganda kingdom were divided according to these administrative layers, i.e.,: (i) right of the king (*kabaka*), (ii) *saza* chiefs, (iii) *gombolola* chiefs, and (iv) clan chiefs. The *Kabaka* was an absolute monarch,

whose word was law and the land in his whole kingdom belonged to him. He allocated ownership of land to his provincial chiefs (*saza* chiefs) who in turn allocated land to the clan chiefs on behalf of the *Kabaka*. The clan chiefs in turn allocated land to clan members on behalf of the *saza* chiefs (Ibid). Notwithstanding the additional layer of bureaucracy of the *Kabaka* and *Saza* chief, the clan members (*bataka*) had similar land rights as was the case among non-Bantu clan members. That is, they could not sell or transfer land without the consent of the clan chiefs (Ibid).

The colonization of Uganda by the British changed significantly the local institutions in the Buganda kingdom, which was then the most powerful kingdom (Fleming 1966). To secure cooperation from the Buganda royal family and other nobles, the British colonial government gave special favors to the royal family and nobles (Fleming 1966; Ribot, 2001). In 1900 the British rulers took the uncultivated land and other areas that were regarded as wastelands. The uncultivated and waste lands accounted for about 50 percent of land in the Buganda kingdom. The other 50 percent of the land was given to the *Kabaka*, senior chiefs and 1,000 junior chiefs, and an elite class of wealthy individuals. No land was allocated to the clan chiefs or clan members (Mukasa 1995; NEMA, 2001). Therefore, the clan chiefs and their subjects were turned landless. They became squatters or tenants on land they previously owned. The land tracts owned by the royal family, nobles, and the landed elites were so large that they were measured in square miles, and later came to be known as *mailo* (mile) land.[13] The new land ownership rights imposed by the colonial government in the Buganda kingdom changed drastically the property rights in the Buganda kingdom since it enlarged and consolidated

[13] See previous section (regulatory instruments) for more details of mailo land.

the land rights of the royal family and elites and denied land rights to the common peasants. The *mailo* land owners received land titles and therefore enjoyed secure land tenure under the legal British Protectorate. As discussed earlier, the Land Act of 1998 upheld the colonial land tenure statute but made an amendment that protects lawful tenants from eviction and loss of investment they made on mailo land. For other areas outside the Buganda kingdom, land belonging to the clans and unoccupied land was made the property of the colonial government and called "Crown Lands." However, this did not change a great deal the traditional institutions since the colonial government did not interfere in the ownership or management of land operated by the non-Buganda clans and kingdoms, which were regarded as weak and of no credible threat to the British colony (Fleming 1966; Ribot, 2001). Hence land ownership outside the Buganda kingdom largely remained under the customary tenure system, which was formally recognized in the Land Act of 1998.

Under the customary law of most ethnic groups outside the Buganda kingdom, ownership of land is always vested in the male household head and women spouses have secondary land ownership rights. If the male household head dies, the land generally goes to the sons (Tripp, 2004). However, land ownership under customary tenure does not carry the meaning that pertains in privately titled land ownership. For example, Gray and Kevane (1999) observed that privatization and titling of land strengthen men's position of land ownership and deny women the secondary land ownership rights that are ensured in the unwritten customary systems.

Taboos and superstition in rural communities also influence NRM. Mukasa (1995) and Ntambirweki (1998) observed that taboos and superstition among the Baganda prohibit people to pollute or drain wetlands and rivers since it was believed that

such acts could provoke the gods to punish the polluters. For example, some of the Baganda and other ethnic groups in Uganda believe that each wetland, forest, and bushy area belong to a spirit (*musambwa*) (Mukasa 1995). Hence, harvesting wetlands, forest, and other thick areas required the permission of the *musambwa*. This permission was issued by the community elders after the person intending to harvest the resource explained and convinced the elders and the community in general that the harvesting will not anger the *musambwa* (Ibid.).

Contemporary Ugandan communities have been heavily influenced by Christianity, Islam, and foreign cultures to an extent that observance of the traditional taboos and superstitions has weakened (Ntambirweki 1998), but not died. Customary institutions still play a vital role, not only in the social life in general, but in enactment, interpretation, and compliance with statutory and local government law and regulations (Bikaako and Ssenkumba, 2003; Khadiagala, 2004b). For example, Khadiagala (2004b) observed that the influence of customary norms among lawmakers has contributed to the failure to pass the Domestic Relations Bill that seeks to grant joint marital property rights to wives over any assets acquired during the course of marriage. Lack of resources to enforce statutory and local government law enhances the influence of customary institutions on rural communities (Gibson, et al., 2000) and in cases where there is weak government infrastructure—such as the *Karamoja* area in northeast Uganda—customary institutions are the *de facto* institutions for governance and other social functions.

3. THEORY AND CONCEPTUAL FRAMEWORK OF COMMUNITY NATURAL RESOURCE MANAGEMENT

At the community level, the need for addressing natural resource management collectively is critical. Efforts by one farmer to adopt improved land management may be undermined if other farmers do not adopt such technologies since actions of one farmer may have spillover effects beyond that farmers' boundaries. For instance if one farmer occupying a small share of the watershed area plants trees to control erosion, such action may not be effective if other farmers do not control soil erosion on their farms, since the resulting runoff would flow through the watershed, and possibly through the farm with trees (Garrity, 2000). In the highlands of southwestern Uganda, some farmers seeking fertile soil intentionally undermine terraces that have accumulated soil and nutrients over many years (Olson 1995). This leads to increased erosion not only in fields of the farmer destroying the Soil and Water Conservation (SWC) structures but also in fields of other farmers in the catchment. Hence economic incentives such as education, credit, and agricultural extension for individual farmers may not be adequate to address land degradation problems in a community.

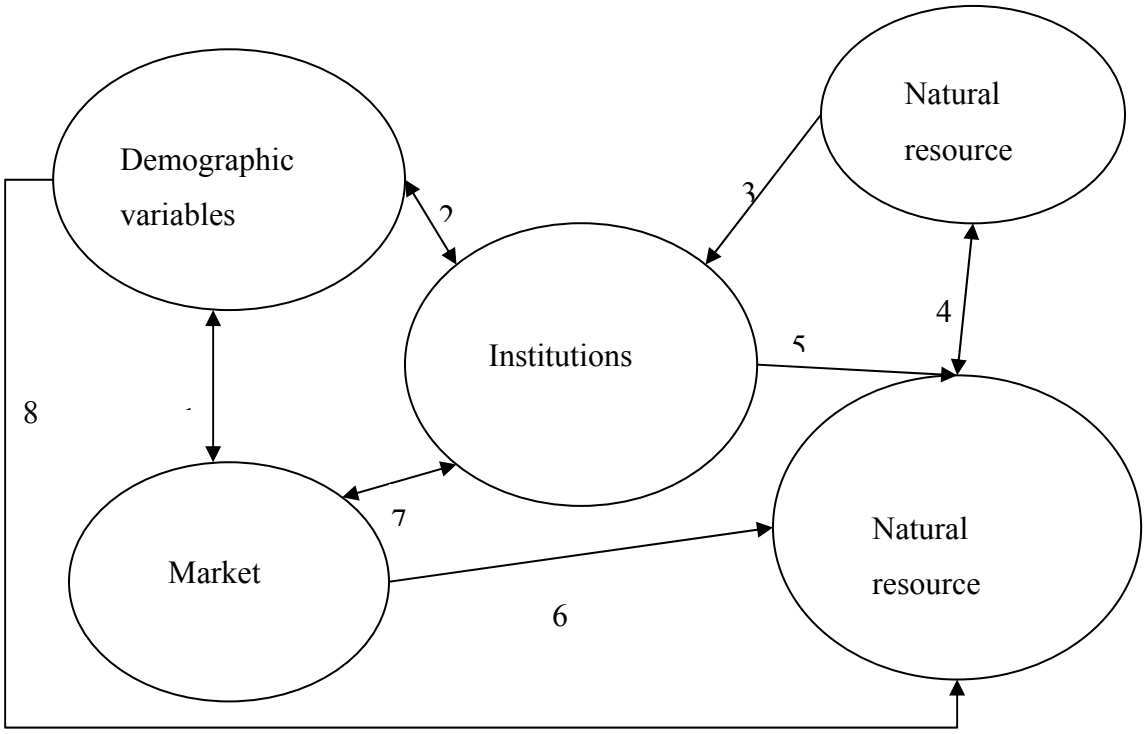
Community NRM depends on many factors that are not easy to discuss exhaustively (Agrawal, 2000; Poteete and Ostrom, 2003). These variables are grouped into four conceptual categories: (i) institutions (central and local government policies and institutions, and customary institutions); (ii) market access (size of the market; access to roads, information, and resource management and harvesting technology, etc); and (iii) demographic variables (population density, heterogeneity in terms of endowment of physical and natural capital, income, education, livelihoods, political, ethnicity, and other cultural attributes); and (iv) natural resource condition (Agrawal and Yadama 1997;

Poteete and Ostrom, 2004; Ostrom 1999). The institutions have direct impact on NRM and also mediate the impacts of the market access, demographic variables, and resource conditions (Agrawal and Yadama 1997; Ostrom 1999). The following diagram illustrates the conceptual framework used in this study.

Institutions:

As North (1990) noted, institutions shape human behavior and thus greatly influence the impact of other variables on NRM. In this research, we will test the effectiveness of institutions used by communities to manage natural resources (relationship 5 on figure 1). The effectiveness of the institutions will be tested by analyzing the compliance with the regulations related to NRM. We will examine three dependent variables: whether an NRM bylaw was enacted at the LC1 level; the level of awareness of the existence of local bylaws; and the level of compliance with local bylaws. We expect that bylaws passed by communities to manage natural resources would lead to less degradation of natural resources if the community complies with such bylaws (relationship 5 in figure 1). At the same time, changes in resource condition could lead to passing regulations—e.g. passing a bylaw to stem soil erosion on steep slopes (relationship 3).

Figure 1--Conceptual framework of determinants of natural resource management



Some of the institutional variables are independent (exogenous)—that is they influence enactment, awareness of and compliance with local bylaws and institutions. The exogenous institutional variables are discussed below:

PRESENCE OF PROGRAMS AND ORGANIZATIONS

One of the conditions for successful community resource management is the presence of community members or organizations that have substantial leadership or other assets (Ostrom 1990).[14] The presence of programs and organizations dealing with agriculture and the environment in communities is likely to influence positively

[14] Other conditions include credible commitment of resource users and mutual monitoring. In turn, these conditions depend on the number of decision makers, the number of participants necessary to achieve collective benefits, discount rates, and similarities of interest (Ostrom, 1990).

community resource management.[15] In Uganda, programs and organizations that have a stake in natural resource management are given representation in the local environmental and natural resource committees. In turn the organizations are required to sensitize and assist local people to use sustainable and improved resource management strategies and to observe environmental bylaws and other regulations (Lind and Cappon, 2001). This has given the organizations an important role in influencing land management at the local level. For example, Sserunkuuma, et al. (2004) observed that participation in agricultural extension and training in eastern Uganda increased farmers' adoption of soil and water conservation practices. We thus expect communities with programs and organizations that focus on agriculture and environment to be more likely to enact bylaws and become more aware of the existence of and compliance with such bylaws since such programs and organizations tend to advocate for NRM bylaws, sensitize farmers about such bylaws, and educate them on the benefits of complying with the bylaws (Lind and Cappon, 2001).

Presence of programs and organizations with a focus on financial services are likely to improve access to these services, which in turn could improve community members' ability to invest in soil and water conservation that requires large financial outlay. By relaxing credit constraints, financial services also can reduce people's discount rate, thus helping to facilitate collective action for NRM (Pender 1996). For example, Sserunkuuma, et al. (2004) noted that access to credit increases compliance with bylaws

[15] Organizations include Non-Government Organizations (NGOs) and Community-Based Organizations (CBOs). NGOs include both international and indigenous organizations established to provide services to communities or districts. They are autonomous and are required to conform to the government's regulatory requirements regarding registration and reporting. CBOs are those that evolve and are administered, financed, and managed at the local level. CBOs are not registered with the government. Programs include government and international projects and other development activities present in a community.

governing use of irrigation water in eastern Uganda. However, in an imperfect labor market as is the case in Uganda, access to credit may have a negative effect on NRM as communities with access to credit may invest in non-farm activities, which compete for labor with NRM (Scherr and Hazell 1994). Due to this, some households in the communities with access to credit may not fully depend on agriculture for their livelihoods, hence would have lower incentive to conserve the natural resource base. We therefore expect access to credit to have an ambiguous effect on natural resource management.

LAND TENURE

Conventional economic theory posits that resource allocation by economic agents requires both tradable natural capital and development of markets. When land or other natural resources are perceived as commodities then natural resource owners/users would allocate the resource most efficiently through the market. Since many SWC practices entail long-term investments, community members are not likely to invest in long-term SWC practices if they have insecure land tenure systems. Hence privatization of natural resources, titling, and registration has been believed to increase land investment and efficiency of their use. It follows that farmers with the most secure and longest-term land tenure are likely to invest in improving their land than those with less secure or short-term tenure. However, it is generally agreed that the impact of titling depends on other factors such as marketability of land, which may increase the willingness to make irreversible investments in land since such sunk costs can be recovered (Pender and Kerr 1999). Marketability of land may also increase the collateral value of land and hence access to credit (Feder, et al. 1988). The impact of titling and tenure in general also

depends on access, preexisting production systems and production potential, adjudication criteria and procedure, and the design of support institutions for the tenure systems (Lawry 1990). Insecure or unstable natural resource tenure is expected to influence NRM negatively as farmers with insecure tenure have no attachment to their farms. This creates little incentive for them to enact and comply with natural resource management by-laws.

What has been unclear in literature is whether or not customary tenure is secure even though landholders under this system do not have formal land titles. Criteria for land tenure security are also debatable. Having a title may not mean security, especially in the case where enforcement of such tenure rights is weak. Some works have shown that customary tenure is likely to entail more rights, responsibilities, and restrictions that do not pertain to the freehold and leasehold tenure systems. As alluded to earlier, under customary laws in most Ugandan ethnic groups, parents are expected to bequeath their land to their children. This creates a special attachment to land held under customary laws and puts on parents a responsibility of ensuring that the land is still productive when they bequeath it to children. Thus the expected impacts of the land tenure system on NRM are ambiguous.

CUSTOMARY INSTITUTIONS

Following the definition of institutions discussed earlier, customary institutions include customary law, cultural traditions, norms, taboos, superstitions, land tenure[16] and other regulations that exist in a community. In Uganda, as elsewhere in Africa, these institutions differ significantly across ethnic groups (Bikaako and Ssenkumba, 2003) but

[16] The customary land tenure system has already been discussed but is mentioned here to remind readers that it is one of the customary institutions.

tend to be uniform in one given ethnic group. Hence, we will represent the customary institutions with the ethnic group variables. Since there are about 56 ethnic groups in Uganda, we will group them into fewer major ethnic groups in order to reduce the number of variables. We categorize the Bantu people into three groups following their history discussed earlier:

1. The Baganda who belong to the Buganda kingdom. The Baganda include the Bantu people in the Lake Victoria crescent region.
2. The Banyakitara people of the Bunyoro Kitara, Ankole and Tooro kingdoms. The Banyakitara include the Bakiga, Banyoro, Banyankole, Bafumbira, Batooro, and other Bantu people in western Uganda.
3. The eastern Bantu people include the Basoga, Bagishu, Bagwere, Banyole, and other Bantu people in the eastern Lake Victoria shores, i.e. Busia, Bugiri, Jinja, Iganga, Mbale, Pallisa, Sironko, and part of Tororo.

We group the non-Bantu people into three major categories: the eastern, northern, and west Nile non-Bantu people.[17]

1. The non-Bantu eastern people are the Iteso, Kumam, Sebei, Sabiny, Japadhola, and others.
2. The northern non-Bantu people include the Langi and Acholi.
3. The west Nile people include the Alur, Kakwa, and Lugbara.

We expect the customary institutions to have ambiguous impact on enactment and compliance with NRM bylaws. Since the customary institutions are not explicitly recognized by the central and local governments, it is possible that community members may attempt to legitimize their customary institutions by enacting bylaws with outcomes on NRM similar to those of their customary institutions. However, customary institutions such as taboos, norms, and superstitions are likely to lead to natural resource

[17] For details of the grouping of the Nilotic ethnic groups, visit: http://countrystudies.us/uganda/21.htm

conservation outcomes, thereby obviating the need to enact formal bylaws, but increasing compliance with existing bylaws that are consistent with such customary institutions. For bylaws that are not consistent with customary regulations, community members are likely to comply with their customary regulations. Additionally, community members are likely to ignore bylaws that do not have an equivalent customary regulation (Gibson, 2000).

As observed by Ntambirweki, contemporary Ugandan communities have been heavily influenced by Christianity, Islam, and foreign cultures (Ntambirweki 1998). The influence of foreign culture on local cultural values tend to be greater in communities where Christianity or Islam came first or was well-received and in areas closer to major urban centers. Areas closer to urban centers attract immigrants who increase the socio-cultural heterogeneity, which in turn can impede collective action (Poteete and Ostrom, 2004). The Lake Victoria crescent region, where the Baganda live, is the most urbanized region, with 25 percent of the population of 6.7 million people living in urban areas (UBOS, 2003b).[18] Hence, we expect the weakest observance of customary institutions among the Baganda. Thus we will use the Baganda ethnic group as the control group to which the other ethnic groups will be compared.

DEMOGRAPHIC FACTORS

The demographic factors considered in this study are: poverty, human population density, human capital, and village wage rate. As depicted in figure 1 and as will be discussed below, the impacts of demographic factors on NRM are both direct

[18] The share of urban population of the other regions (with predominant ethnic groups in parentheses) is: Eastern = 7 percent (eastern Bantu and non-Bantu); Northern and Northwest = 9 percent (Langi, Acholi, Lugbara, Kakwa, and Alur); Western = 7 percent (Banyakitara).

(relationship 8) and indirect (relationship 2 and 5). An example of the direct impact of demographic factors on NRM is the low probability of poor farmers to use purchased inputs required for soil fertility management. Institutions such as the microfinance organizations could indirectly influence the impact of poverty on soil fertility management, for example, by giving loan to farmers to buy inputs. Most of demographic factors also affect market access (relationship 1). For example, population density affects market access since the size of a market is determined by human population (Staal, et al., 2002; Wood, et al. 1999).

(i) Poverty

Does poverty force people to have a short-term perspective, whereby they tend to deal with the immediate livelihood needs without considering the long-term effects of their activities on natural resource base and environment? A school of thought supporting this view argues that natural resource degradation contributes to declining agricultural productivity and reduced livelihood options, thus worsening poverty and food insecurity, while poverty and food insecurity in turn contribute to worsening resource degradation by desperate households lacking alternatives to degrading their natural capital stock (Durning 1989; Leonard 1989; Cleaver and Schreiber 1994; Pinstrup-Andersen and Pandya-Lorch 1994). Poverty may reduce incentives to invest in resource conservation and make collective action more difficult to attain by increasing individual discount rates (Pender 1996).

Another school of thought asserts that there is no necessary linkage between poverty and resource degradation. If markets are perfect, land and other resources will be allocated to their most profitable uses and all investments yielding a positive net present value will be made (Singh, et al. 1986). However, in an imperfect markets setting, the

nature of poverty is important in determining the impacts on natural resource management and degradation. The communities that are not poor by welfare criteria such as minimum levels of consumption may face "investment poverty" that prevents them from making profitable investments in resource conservation and improvement (Reardon and Vosti 1995).

A third view on impact of poverty on NRM is that poverty may promote greater affinity to conserve natural resources since the poor depend more on natural resources than the well-off. Furthermore, poorer households have lower opportunity costs of their labor, which can promote labor intensive NRM investments (Pender and Kerr 1998; Clay, et al. 1998) and facilitate collective action in NRM (Gebremedhin, et al., 2003). Based on these three schools of thought, we expect poverty to have an ambiguous impact on enactment, awareness, and compliance with NRM bylaws.

(ii) Human population density

Several empirical works have shown that human population has an ambiguous impact on NRM (for example Allen and Barnes 1985; Agrawal and Yadama 1997). One view is that as population increases, scarcity of natural resources increases. Consequently, the value of land and other resources relative to labor increases, which may prompt farmers to conserve their natural resources (Boserup 1965; Tiffen, et al. 1994). This may induce greater collective action to protect natural resources as well as intensification of agriculture on private land (Pender, 2001). As population continues to grow, however, the ability to attain effective collective action may decline (Poteete and Ostrom, 2004). At very high population density, diseconomies of scale and moral hazard behavior may set in (Ibid). For example, Gebremedhin, et al., (2003) observed that high population density may lead to attempts by community members to "free-ride" on efforts

of others. High population density may also lead to severe scarcity and consequent breakdown of collective action. Thus there may be an inverted U-shaped relationship between population pressure and collective action in NRM (Pender, 2001).

(iii) Human capital

Human capital includes knowledge and skills embodied in people, such as education, health, experience, and knowledge. A higher level of education and knowledge may increase people's awareness on future benefits of complying with NRM by-laws, thus leading to better natural resource management. However, education may increase the value of labor, which in turn reduces the probability to use labor-intensive soil and water conservation technologies. Education may also increase non-farm opportunities, which would then compete for labor with farm activities (Scherr and Hazell 1994) and give people more "exit options," thus a tendency to undermine collective action (Bardhan 1993). Human health is expected to influence NRM positively since agricultural practices are typically manual hence require a healthy person to perform them effectively (Bloom, et al., 2004).

(iv) Village wage rate

Compliance with NRM legal instruments may entail a substantial labor investment. For example a number of SWC practices such as construction and maintenance of terraces, bunds, and other SWC structures are labor-intensive. Restrictions on bush burning also require farmers to use other more labor-intensive methods of land clearing. Hence, a higher village wage rate is likely to have a negative impact on compliance with NRM bylaws. It is also likely that local community councilors may be reluctant to enact a bylaw that they know would be costly for the

community members to comply with. We therefore expect that the wage rate would have a negative impact on the likelihood to enact NRM bylaws.

NATURAL RESOURCE CONDITION

The natural resource condition may influence natural resource management directly (relationship 4) and indirectly (relationships 3 and 5). We consider in this study the agricultural potential to represent the natural resource condition. The agricultural potential is expected to have an ambiguous influence on enactment and compliance with bylaws. High agricultural potential increases the value of land. Thus degradation of land leads to more costly losses and hence the need to comply with soil conservation by-laws. But higher agricultural potential also increases the benefit of using land in a degrading way since the short-term benefits may be high. Communities in low agricultural potential areas may have to practice extensive agricultural production in order to meet their subsistence needs. This could lead to cultivation or grazing on fragile lands that may trigger severe land degradation. Fuelwood needs and other forest product needs in marginal areas may also exceed the biomass reproduction, which in turn could lead to deforestation. All this could make it difficult to enact and comply with NRM bylaws.

Abundance of resources in high potential areas or places that have not been severely degraded also creates little incentive for the community members to practice natural resource conservation (Ostrom 1999). High agricultural potential is also likely to create more productive activities that may increase the opportunity cost of labor for land conservation (Ostrom 1999). This in turn would have a negative impact on the likelihood to enact and comply with bylaws that require substantial labor input.

MARKET ACCESS

Access of the village to markets, infrastructure and services affects the value of agricultural products by affecting local prices or access to information (e.g., access to roads, transportation, harvesting technology, and extension services). As market access increases the value of natural resources increase. Hence the incentive to comply with by-laws for soil conservation also increases. Market access also gives greater exit options to farmers who fail to cooperate with collective community agreements (Bardhan 1993; Pender and Scherr, 2002; Poteete and Ostrom, 2003). If institutions regulating natural resources are weak or absent (relationship 6, 8, and 10), access to roads and communication infrastructure decreases the transactions costs of resource harvesting. For example, holding all else constant, the cost of harvesting forests closer to roads is likely to be lower than the case of harvesting forests that are farther away from the road. This suggests that access to roads and other forms of infrastructure could accelerate natural resource degradation (Chomitz 1995; Young 1994; Agrawal and Yadama 1997; Poteete and Ostrom, 2003). However, law enforcement agents also use the same means of transportation and communication to enforce natural resource regulations. Hence it is likely enforcement of regulations in remote areas may be weak. For example, Banana, et al. (2001) observed that exploitation of forest resources in Uganda was less around the capital city Kampala than farther away because the forest department did not have enough resources to travel to remote areas to enforce forest harvesting regulations. Hence, market access is expected to have an ambiguous effect on enactment, awareness of and compliance with by-laws, for similar reasons that agricultural potential has ambiguous impacts.

4. METHODOLOGY

DATA COLLECTION

Part of the sample used in this research is a sub-sample of the communities included in the Uganda Bureau of Statistics (UBOS) National Household Survey (UNHS) conducted in 2002/03. A stratified two-stage sample was drawn for the UNHS. Using the 56 districts as strata, 972 enumeration areas (565 rural and 407 urban) were randomly selected at the first stage sampling, from which a total of 9,711 households were randomly selected at second stage sampling.[19] The sampling was weighted using the population of each district. Data used in this report are derived from a smaller survey including 123 of the enumeration areas (hereafter referred to as the IFPRI-UBOS survey). This smaller survey drew a sample using the rural enumeration areas from eight districts as the sampling frame. The districts picked for the small survey were: Arua, Iganga, Kabale, Kapchorwa, Lira, Masaka, Mbarara, and Soroti. Since the aim of the IFPRI-UBOS survey was to study poverty-NRM linkages, the criteria used to select the districts were level of poverty and endowment of natural resources at district level (i.e., districts were selected to represent these dimensions). Table 1 summarizes the number of communities selected for the IFPRI-UBOS survey from each district and the poverty status and endowment of natural resources of the district.

[19] Only 55 of the 56 districts were covered in the survey. One district (Pader) was not covered due to insecurity during the time of the survey. Some enumeration areas in Gulu and Kitgum were also not covered for the same reason. An enumeration area covers one or more local council 1 (LC1), which are the lowest administrative units in Uganda. Enumeration areas are the smallest unit areas used for census purposes.

Table 1--Selected Districts and Communities

District	# of communities	Poverty headcount (%)[1]	Poverty Status[2]	Natural resource endowment[3]	Region
Arua	16	66.6	Medium	Low potential (unimodal medium)	West Nile
Iganga	16	52.5	Low	High potential (bimodal high rainfall)	Lake crescent
Kabale	16	71.8	High	High potential (highlands)	West
Kapchorwa	8	43.4	Low	High potential (highlands)	East
Lira	17	64.8	Medium	Low potential (Unimodal medium)	North
Masaka	20	50.8	Low	High potential (bimodal high rainfall)	Lake crescent
Mbarara	20	52.4	Low	Medium potential (bimodal low rainfall)	West
Soroti	10	79.0	High	Low potential (Unimodal medium)	Northeast
Total	123	60.4			

1. Poverty count is a broad indicator of poverty that measures the percentage of people living in households with real consumption per adult equivalent below the poverty line of the region. This indicator does not measure the depth of poverty, i.e. how far below the poverty line are the poor (UBOS, 2003a).
2. Using the National level, poverty status of a district was ranked as follows:
Below 55: Low; Between 55 to 70 Medium; Above 70: High
3. Agricultural potential is an abstraction of many factors—including rainfall level and distribution, altitude, soil type and depth, topography, presence of pests and diseases, presence of irrigation, and others—that influence the absolute (as opposed to comparative) advantage of producing agricultural commodities in a particular place.

To increase the sample size for analyzing determinants of enactment, awareness and compliance with NRM bylaws, we also used data from two prior community level surveys conducted by IFPRI in Uganda. The two surveys collected the same data (as the IFPRI-UBOS survey) on bylaws, level of compliance, awareness, and their determinants. The other two IFPRI surveys (IFPRI survey I and IFPRI survey II) did not use the

poverty criterion in sampling communities.[20] Using the composite data also increased the spatial coverage of the data since it covered the entire country except the northeast region of Karamoja (Moroto, Nakapiripit, and Kotido districts) and the island district of Kalangala (see Figure 2).

In all three sets of surveys used in this study, we used the smallest administrative unit, the Local Council 1 (LC1), to collect data. In cases where an enumeration area included more than one LC1, we randomly selected one LC1 within the enumeration area.

In all surveys used in this study, about 10–15 key informants were purposively selected to provide information on institutions, natural resource governance and management, and labor issues on behalf of the entire community. Typically the key informants selected included the village chairperson or secretary, the village secretary for environment, the village secretary for agriculture, some women and youth, and other key informants. Inclusion of leaders ensured that authoritative respondents discuss issues pertinent to management of natural resources. Presence of women and youth ensured that the vulnerable groups they represent were involved in the discussion. A semi-structured instrument was used to collect the information from the community representatives.

DATA ANALYSIS

Statistical and econometric methods are used to analyze the determinants of enactment, awareness, and compliance with bylaws that affect natural resource management.

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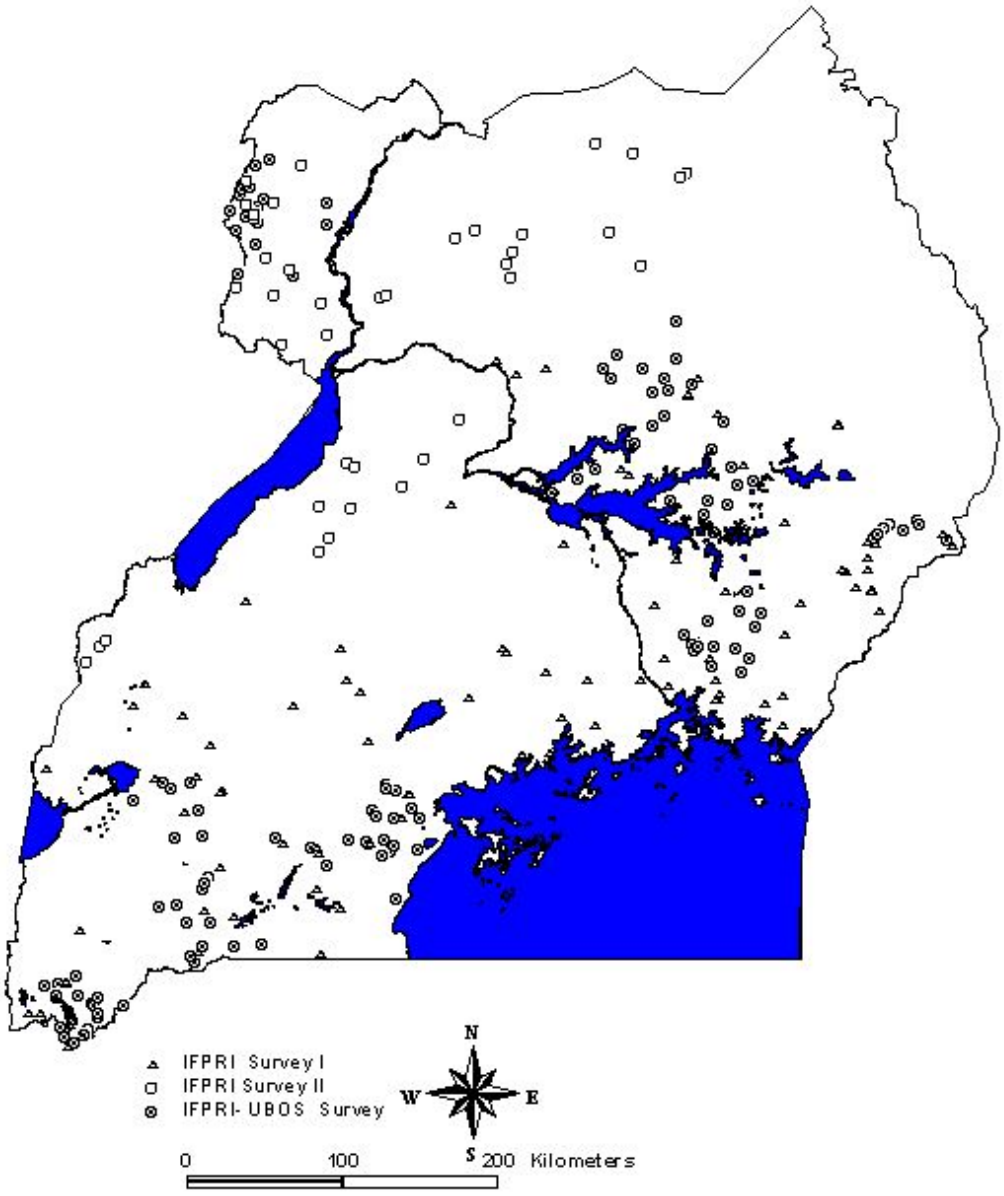
[20] For details of the two IFPRI community surveys, see Pender, et al., 2001 and Pender, et al., 2004.

Figure 2: Spatial distribution of communities sampled for IFPRI and IFPRI-UBOS surveys



To set the stage for the econometric analysis, we first use bivariate data analysis to explore two-way association of important variables. We then use a probit model to analyze the determinants of the probability to enact bylaws since the dependent variable of this model is dichotomous (have enacted or not enacted bylaws). To ensure that the dependent variable is endogenous to the community, we set it equal to one only when the

bylaw was enacted by the LC1 in the past 10 or less years. We set the age of the bylaw at ten years to correspond with the beginning of the decentralization policy implementation by the current Museveni regime in 1992 (Onyach-Olaa, 2003). We assume that the incumbent councilors are likely to have played a vital role in enactment of bylaws that are 10 or fewer years old.[21] Any bylaw enacted by the LC1 in 1991 or earlier or by a legislature outside the community, was regarded as exogenously enacted.

To analyze awareness and compliance, we use four ordinal categories to represent their levels. For the case of awareness of legal instruments, 1 = "no one is aware" that the legal instrument exists; 2 = "some are aware" when less than 50 percent of the community members are aware that the legal instrument exists; 3 = "majority are aware" when 50 to 90 percent are aware that the legal instrument exists; and 4 = "all are aware" when more than 90 percent are aware that the legal instrument exists. In the case of compliance with the legal instrument, 1 = "no one complies" when no one in the community complies with the legal instrument; 2 = "some comply" when less than 50 percent of the community members comply; 3 = "majority comply" when 50 to 90 percent comply; and 4 = "all comply" when more than 90 percent comply. Since these categories are ordered, we use an ordered logit model.

We collected the level of awareness and compliance for the year that we conducted the survey; thus these dependent variables are endogenous, regardless of the legal instrument and the legal body that enacted it. However, we analyzed the awareness and compliance with only two legal instruments in the econometric analysis, no bush

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[21] Additionally, under the current Ugandan constitution, the term limit for the president is 10 years. However, this term limit does not apply to elected local councilors, who are elected once in every five years. However, the period sets a logical basis for assuming that the incumbent councilors have a significant impact on enacting bylaws that are 10 or fewer years old.

burning and the requirement to plant and protect trees. We did not analyze awareness and compliance with other legal instruments because only few communities reported to have such instruments. Not all four levels of awareness of these bylaws were reported. For example, no community reported to have no one aware of the existence of the bush burning or tree planting and protection bylaws. Only two communities out of the 94 that enacted the no bush burning bylaw in the past ten years reported that a minority of community members are aware of this regulation. Likewise, only seven out of the 64 communities that enacted the tree planting and protection regulations reported that a minority of the community members were aware of this regulation. Hence we will use probit model (rather than ordered probit or logit) to estimate the determinants of awareness of these bylaws since there are too few observations of more than two levels of the response to produce reliable results considering more categories.

The levels of compliance with the tree planting and protection bylaw had similar problems of small number of observations for the "no one complies" and "minority comply" levels. Thus we will also estimate the determinants of compliance with tree planting and protection bylaw using a probit model.

The general empirical model to be estimated for the determinants of enactment, awareness of and compliance with bylaws is as follows:

$$Prob(LAW = 1) = f(INST, P, HR_i, MKT, ETHN, POP, WAGE, APO, TENURE, e_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$Prob(LAW = 0) = 1 - f(INST_i, P, HR_i, MKT, ETHN, POP, WAGE, APO, TENURE, e_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$Prob(AWARE = 1) = g(INST_i, P, HR_i, MKT,, ETHN, POP, WAGE, APO, TENURE, e_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Prob(AWARE = 0) = 1-gf(INST, P, HR $_i$, MKT, ETHN, POP, WAGE, APO,TENURE, e_i) ……. (4)

Prob(COMPTREE = 1) = h(INST, P, HR $_i$, MKT, ETHN, POP, WAGE, APO, TENURE, e_i) ……..... (5)

Prob(COMPTREE = 0) = 1- h(INST, P, HR $_i$, MKT, ETHN, POP, WAGE, APO,TENURE, e_i) .....… ...(6)

Where: LAW = is a dummy variable representing whether any NRM bylaws had been enacted by a community in the past ten years;

AWARE = a vector of level of awareness of bylaws (AWARE = 1 if all are aware and AWARE = 0 otherwise);

COMPTREE = Compliance with tree planting and protection bylaw (COMPTREE = 1 if all comply and COMPTREE = 0 if otherwise);

INST = a vector of formal exogenous institutional variables, i.e. programs and organizations present in community with focus on agriculture, environment, or rural finance services;

P = a measure of poverty. We will test the impacts of two measures of poverty on NRM: (a) poverty gap (or depth) (P_1), which is the difference between the poverty line (z) and the real private consumption per adult equivalent (y_i), i.e. (z - y_i) and (b) severity of poverty (P_2), which is the average value of the square of depth of poverty for each individual. The poorest people contribute relatively more to the index since it is computed using poverty gap as weight (more weight

to very poor than to less poor). P_2 is also called Foster Greer Thorbeke (P_2)[22] (UBOS 2003a).

$$P_2 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{(z - yi)}{z}\right)^2$$

HR = vector of human resource variables in the community, namely proportion of literate adults, health status of community (the proxy used for the health status is the share of households in a community that do not have adequate food throughout the year),

MKT = a vector of market access variables measured as the potential market integration (estimated travel time to the nearest five markets, weighted by their population (Wood, et al. 1999)) and distance to an all-weather road.

POP = population density in the community

ETHN = a vector of dummy variables representing ethnic groups (relative to Baganda (central region Bantu people)), including Banyakitara (western region Bantu people), northern non-Bantu people, west Nile people, eastern Bantu people, and eastern non-Bantu people).

APO = vector of agricultural potential, i.e. agro-ecological characteristics affecting agricultural productivity (e.g., annual rainfall or length of growing period). We follow the classification by Ruecker, et al. (2003), who classified Uganda APO as high unimodal rainfall, medium unimodal rainfall, low unimodal

[22] While this measure has clear advantages for some purposes, such as comparing policies that are directed toward the country's poorest, it is not easy to interpret. It is the ability of the measure to order distributions in a better way than the alternatives that makes it useful, not the precise numbers obtained.

rainfall, low bimodal rainfall, medium bimodal rainfall, and high bimodal rainfall. The APO dummies were strongly correlated with the ethnic groups. To address this concern, we grouped the APO zones into two categories: high agricultural potential (bimodal high, bimodal medium, and unimodal high rainfall) and low agricultural potential (bimodal low, unimodal medium, and unimodal low rainfall);

TENURE = Land tenure system vector, reflecting the dominant tenure system in the village, whether customary, leasehold, freehold, or mailo. There were only a few communities that reported to have freehold and leasehold as the dominant land tenure system. Additionally, the mailo land tenure was highly correlated with the Baganda ethnic group. To address both problems, we grouped land tenure into only two groups: customary and non-customary tenure;

WAGE = average rural (female and male) wage rate in the community in Uganda Shillings (Ush) per day; and

e_i = a vector of errors for the equations estimated, assuming $e_i \sim N(0,1)$

For the specification of the ordered logistic regression model for compliance with no bush burning bylaw, we considered a latent variable COMPLY* as the level of compliance for legal instrument.[23]

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[23] The ordered regression assumes that only the intercept, and not the coefficients of the independent variables, changes as the level of the dependent variable change; this is called the parallel regression assumption (Long, 1997). We used the Brant (1990) test to determine whether or not this assumption holds for equation (7). We failed to reject the null (Prob>χ^2 = 0.491) that the coefficients of the independent variables are constant as level of compliance with no bush burning law changes. Hence we used the ordered logit to estimate equation (7).

$COMPLY^* = f(Inst_i, P, HR_i, Mkt, ETHN, Pop, WAGE, APO, TENURE, e_i)$ …….(7)

Where: e_i = a vector of error for the equations estimated, e_i ~logistic.

Other variables are as defined in equation (1)

$COMPLY = 1 \text{ if } COMPLY^* \leq b_1$

$COMPLY = 2 \text{ if } b_1 \leq COMPLY^* \leq b_2$

$COMPLY = 3 \text{ if } b_2 \leq COMPLY^* \leq b_3$

$COMPLY = 4 \text{ if } COMPLY^* > b_3$

Where e_i is assumed to be distributed according to a logistic distribution and b_i is a threshold parameter for each level of compliance, which is estimated along with the coefficients of the explanatory variables.

As noted earlier, compliance with bylaws depends on level of awareness about the existence of bylaws. This implies the error terms of the three models are not independently distributed. It would therefore be ideal to estimate these models using a system of equations to improve the efficiency of the estimates. However although maximum likelihood is potentially feasible with two or three dependent variables, it is cumbersome for models with more than two variables. We therefore estimate single equations of each of the three models. The next section discusses the results of the analysis, starting with descriptive analysis and then econometric results.

We performed a Wald test to determine the variables that we could drop to improve the statistical power of the model. The coefficients of the wage rate and human health were jointly not significantly different from zero at p=0.10 in all models, hence these variables were dropped from the models.

5. RESULTS AND DISCUSSION

DESCRIPTIVE STATISTICS

Bylaws, ordinances, and statutes affecting NRM

This section reports the perceptions of community leaders about the legal instruments that are in force in the community.[24] It is possible that national statutes and district ordinances may have been enacted but the community leaders are not aware of them. Over 70 percent of the communities sampled have enacted at least one NRM regulation (Table 2).

Table 2--Relationship between type of legal instruments and administrative region

	Bylaw or other legal instrument				
Region	Tree laws	No bush burn	Practice SWC	Don't pollute or encroach water bodies or wetlands	Any NRM regulation
	% of communities reporting				
Central (n = 52)	30.8	25.0	7.7	7.7	70.6
East (n = 80)	38.8	20.0	8.8	8.8	75.0
North (n = 70)	42.9	21.4	5.7	5.7	68.3
West (n = 69)	24.6	72.5	20.3	20.3	72.6
All regions (n = 271)	34.7	34.0	10.7	10.7	71.7
F-test	0.466	0.000	0.037	0.053	0.937

With the exception of bylaws related to trees, the types of bylaws enacted differ significantly across the region. The western region reported a significantly higher percentage of communities that have legal instruments related to bush burning, SWC practices, and prohibitions against encroaching or polluting water bodies and wetlands. These results are not surprising given that the hilly terrain in the western region calls for

[24] Note that in the descriptive statistics section, we discuss both external and local legal instruments. Only the econometric results discussion on the probability to enact a bylaw at community level exclusively discusses local bylaws.

effective SWC to stem the potential erosion. The region also has vast grazing lands in Mbarara and Ntungamo districts that are prone to bush burning—hence the need to have legal instruments prohibiting bush burning.

Table 3 shows a weak association between land tenure and type of legal instruments.

Table 3--Relationship between legal instruments and land tenure

	Bylaw or other legal instrument				
Tenure	Tree laws	No bush burn	Practice SWC	Don't pollute or encroach water bodies or Wetlands	Any NRM regulation
	% of communities reporting				
Customary	37.23	40.96	12.23	10.11	70.91
Freehold	25.00	37.50	12.50	6.25	50.00
Leasehold	50.00	16.67	0.00	0.00	66.67
Mailo	37.84	24.32	8.11	2.70	78.26
Any land tenure	36.84	37.65	11.34	8.50	70.85
F-test	0.924	0.037	0.319	0.103	0.615

Only the share of communities that have enacted a legal instrument prohibiting bush burning was statistically different at $p = 0.05$ across land tenure systems. The percent of communities enacting legal instruments prohibiting bush burning is lowest in communities that have predominantly leasehold system. This is perhaps due to the likely short-term perspective for farmers who hold land under leasehold.[25] Communities holding land under mailo tenure are also less likely to enact a legal instrument prohibiting bush burning. This may be due to the fact that the bush burning practice is not common among the Baganda in the central region, where the mailo tenure system is most prevalent.

The relationship between type of legal instrument and the legislature that enacted it is weak for all legal instruments discussed in this paper. Only legal instruments related

[25] The five or more years that farmers with leasehold tenure hold land is relatively shorter than the perpetual land holding under freehold, mailo, and customary tenure.

to trees and water bodies and wetlands appear to have an association with the legislature that is significant at 10 percent (Table 4).[26]

Table 4--Relationship between legal instrument and legislature enacting it

Legislature	Tree laws	No bush burning	SWC	Don't pollute or encroach water bodies or Wetlands
Sample size	97	91	29	26
	% of communities reporting			
LC1	25	24	24	19
Sub-county	3	9	14	4
District	16	9	24	77
Central government	35	44	34	00
Colonial government	21	11	3	00

The weak association between type of legal instruments enacted and level of government is probably by construction since the Local Government Act and a number of other statutes give local government powers and responsibilities to enact and enforce ordinances and bylaws but such legal instruments should not be in conflict with the corresponding statute. Thus the local governments and the central governments will tend to enact the same type of legal instruments.

As discussed earlier, the level of awareness about legal instruments is key to compliance with that particular legal instrument. Hence it would be interesting to analyze how awareness is related to a number of attributes that affect compliance. There is no significant association between level of awareness and the administrative level of government that enacted the legal instrument (Table 5), implying that awareness creation

[26] The central government appears to be more likely to enact legal instruments related to trees than other levels of government while the districts are more likely to enact legal instruments prohibiting pollution or encroachment into areas gazetted as water bodies or wetlands.

methods used do not differ on the basis of who enacted the legal instrument. Hence community leaders, programs, and organizations that create awareness of bylaws, statutes, and ordinances give relatively equal weights to legal instruments enacted by different levels of government.

Table 5--Relationship between level of awareness of legal instruments and legislature that enacted the instrument

Legislature	Tree bylaws (n = 94)	No bush burning (n = 92)	Practice SWC (n = 28)	Don't encroach or pollute water bodies or wetlands (n = 26)
LC1	3.4	3.6	3.7	3.7
Sub-county	3.3	3.4	3.3	
District	3.0	3.4	3.4	3.0
Central government	3.1	3.7	3.3	3.4
Others	3.1	3.3	3.0	-
Total	3.2	3.6	3.5	3.4
F-test	0.250	0.164	0.666	0.429

There is a weak association between level of compliance with legal instruments and region. Only legal instruments prohibiting bush burning, pollution or encroachment of water bodies and wetlands differ significantly ($p = 0.10$) across administrative regions (Table 6).

Table 6--Relationship between level of compliance with legal instruments and administrative region

Region	Tree laws (n = 94)	No bush burning (n = 94)	Practice SWC (n = 28)	Protect water bodies and wetlands (n = 25)
			Level of compliance reported*	
Central	2.6	3.0	2.5	2.8
East	2.6	2.8	3.0	
North	2.4	2.8	2.5	3.0
West	2.4	3.2	2.2	3.2
All regions	2.5	3.1	2.5	2.9
F-test	0.577	0.095	0.527	0.064

* Note: 1 = No one complies, 2 = some comply, 3 = majority comply, 4 = all comply

The association between compliance and land tenure is also weak (Table 7).

Table 7--Relationship between compliance and land tenure

Land tenure	Tree laws (n = 94)	Don't burn bush (n = 94)	SWC (n = 28)	Protect wetland & water sources (n = 25)
		Level of compliance reported*		
Customary	2.5	3.1	2.5	3.0
Freehold	2.3	3.3	3.0	3.0
Leasehold	2.3	2.0	-	-
Mailo	2.5	3.0	3.0	2.0
All tenure categories	2.5	3.1	2.6	3.0
F-test	0.897	0.348	0.595	0.383

* Note: 1 = No one complies, 2 = some comply, 3 = majority comply, 4 = all comply

This suggests that there may be little difference in security across land tenure systems—consistent with other studies in Uganda (e.g. Nkonya, et al. 2004). Analysis of this association will be revisited in the econometric analysis where other determinants of compliance will be considered simultaneously.

Compliance with legal instruments is expected to be affected by their legitimacy and by the participation of the communities in enacting and enforcing them (Okubal and Makumbi, 2000).[27] Results presented in Table 8 do not provide strong evidence to support this proposition as only legal instruments related to trees have weakly statistically significant association with the level of government that enacted them.

Table 8--Relationship between compliance and legislature

Land tenure	Tree laws (n = 92)	Don't burn bush (n = 93)	SWC (n = 27)	Protect wetland & water sources (n = 24)
		Level of compliance reported*		
LC1	2.7	3.2	3.1	3.2
Sub-county	2.3	2.7	2.3	-
District	2.3	3.2	2.3	2.0
Central government	2.4	3.1	2.1	2.9
Other legislature	3.0	3.1	2.0	-
All legislatures	2.5	3.1	2.6	2.9
F-test	0.066	0.416	0.302	0.300

* Note: 1 = No one complies, 2 = some comply, 3 = majority comply, 4 = all comply

In this case, more communities comply with LC1-enacted bylaws than legal instruments enacted by higher levels of the government. Table 9 reports a strong association between awareness of legal instruments and compliance with such instruments. This justifies NEMA's policy that emphasizes the importance of environmental education.

[27] Legitimacy is measured in this study by level of participation in enacting bylaws. Hence the two are represented by one variable: a dummy variable = bylaw enacted by community council=1 or outside the community=0.

Table 9--Relationship between level of awareness and compliance with legal instruments

Compliance	Some are aware	Majority are aware	All are aware
Nobody complies	45.00	3.02	4.41
Some comply	40.00	34.85	32.35
Majority comply	10.00	54.55	38.24
Everybody complies	5.00	7.58	25.00
Average compliance	13.00	42.90	44.20

Note: No community reported compliance with a regulation that they are unaware of.
This is expected since it is illogical to comply with a regulation that one is not aware of.

ECONOMETRIC RESULTS

For each model discussed in the methodology section, we ran two sets of regressions each time using one of the two measures of income poverty, namely severity of poverty and depth of poverty (poverty gap).

FACTORS AFFECTING ENACTMENT OF BYLAWS

The important factors that determine enactment of NRM bylaws at community level are customary institutions, population density, land tenure, and presence of programs and organizations with focus on agriculture and natural resources (Table 10).

Table 10--Determinants of enactment of NRM bylaws by community[1] (Probit regression)

Variable	Coefficients
Ln(distance to all-weather road in km)	0.076
Potential market integration (pmi)[2]	-0.000
High agricultural potential	-0.092
Ethnic groups (cf Baganda)	
Northern non-Bantu people (Langi and Acholi)	1.051++
Banyakitara (Western Bantu people)	0.829*+
Bantu eastern people (Basoga, Bagishu, Bagwere, Banyole, etc)	0.822+
Non-Bantu eastern people (Iteso, Kumam, Sebei, Sabiny, Japadhola, etc)	1.073*++
West non-Bantu Nile people (Lugbara, Alur and Kakwa)	1.067*++
Ln[Population density (people/km^2)]	-0.001*-
Square [Ln(Population density (people/km^2))]	0.000**++
Poverty gap in community	0.992
Share of adults in community who are able to read and write	-0.012
Customary land tenure	-0.611*-
Number of programs and organizations with focus on:	
Agriculture and environment	0.213***+++
Rural financial services	0.084
Constant	-1.741**--
Number of observations	234
% of communities that had enacted any NRM bylaw in the past 10 years	11
Prob > χ^2	0.001

Legend: * p<.1; ** p<.05; *** p<.01 When one of the independent variable is poverty depth
+ p<.1; ++ p<.05; +++ p<.01 When one of the independent variable is poverty severity and associated coefficient has positive sign
- p<.1; -- p<.05; --- p<.01 When one of the independent variable is poverty severity and associated coefficient has negative sign

1. Bylaws enacted by the community local council (LC1) ten or less years ago.
2. Estimated travel time to the nearest five markets, weighted by their population (Wood, et al. 1999).

Controlling for land tenure, presence of programs, and organizations that facilitate institutional development, poverty status, and other factors, the non-Baganda ethnic groups are more likely to enact NRM bylaws than the Baganda. This is perhaps due to the socio-cultural homogeneity of these groups, which are farther away from urban centers than in the case of the Baganda. Urban centers and their surroundings tend to attract immigrants who increase socio-cultural heterogeneity, which in turn reduces the propensity to collective action (Agrawal and Gibson 1999; Poteete and Ostrom, 2004).

We observe a U-shaped relationship between the probability to enact NRM bylaws and population density, which reaches a minimum at around 1000 people per km^2. Since a population density higher than that is not observed in many rural areas, the upward sloping portion of the relationship is not relevant for most rural areas.[28] This indicates that for most rural areas there is a non-linear negative relationship between population density and the probability to enact NRM bylaws. That is, at low population density, communities are more likely to enact NRM bylaws than at higher population density. These results are consistent with Gebremedhin et al. (2003) who observed that densely populated communities in Ethiopia are less likely to participate in collective action to manage community woodlots due to high propensity to free-riding in such areas. Similar observations are reported by Ostrom (1999), who observed that group size is likely to increase transaction costs of collective action.

Land tenure has a significant impact on the probability to enact NRM bylaws. Communities that have predominantly customary land tenure are less likely to enact NRM bylaws than those holding land under other tenure systems. This is likely due to the presence of customary laws on NRM that serve the same purpose as the LC1 NRM bylaws, such that there is no need of passing additional bylaws. For example, parents are required by customary laws to conserve their land in such a way that it would be productive when they bequeath it to their children. As discussed earlier, customary institutions also prohibit community members to pollute or degrade wetlands and forests.

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[28] There were only 18 out of 270 communities that had population density above 1,000 people per km^2. These communities were refugee camps in northern Uganda and in Bundibugyo and a couple of rural townships.

The Buganda king also requires his subjects to have a *matooke* (plantain banana) plot to ensure they have enough food for their families and to have trenches on steep slopes.

Presence of programs and organizations focusing on agriculture and NRM increases the probability to enact NRM bylaws, as expected. This suggests that advocacy for enacting NRM bylaws done by programs and organizations operating in communities is effective. The results also support Ostrom (1990), who noted that social capital embodied in programs and organizations enhances effective community resource management.

DETERMINANTS OF AWARENESS OF AND COMPLIANCE WITH NRM BYLAWS

The major determinants of awareness of legal instruments are distance to an all-weather road, ethnic group, and the presence of programs and organizations that focus on agriculture, environment, and rural financing (Table 11).

Table 11--Determinants of awareness of NRM legal instruments (Probit model)[1]

Variable	Awareness of … bylaw	
	No bush burning	Plant & protect trees
Ln(distance to all-weather road in km)	-0.716***---	-0.741*-
Potential market integration (PMI)[2]	-0.003	-0.003
High agricultural potential	0.262	-0.394
Ethnic groups (cf Baganda)[3]		
Northern non-Bantu people (Langi and Acholi)	1.726	-0.240
Banyakitara (Western people)	0.101	-0.129
Eastern Bantu people (Basoga, Bagishu, Bagwere, etc)	-0.586	-1.598
West Nile people (Lugbara, Alur and Kakwa)	-1.016	-3.474*---
Ln[Population density (people/km^2)]	0.001	-0.003
Square [ln(Population density (people/km^2))]	0.000	0.000
Poverty gap in community	-4.959	-3.201
Share of adults in community who are able to read and write	-0.837	-0.136
Customary land tenure	-0.402	1.479
Number of programs and organizations with focus on:		
Agriculture and environment	-0.021	0.672**++
Rural financial services	0.361**++	0.005
Bylaws enacted by Community council? (yes=0, no=0)	0.407	-0.175
Constant	2.480**	1.571
Number of observations	74	50
Prob > χ^2	0.008	0.187

Legend: * p<.1; ** p<.05; *** p<.01 When one of the independent variables is poverty depth
+ p<.1; ++ p<.05; +++ p<.01 When one of the independent variables is poverty severity and associated coefficient has positive sign
- p<.1; -- p<.05; --- p<.01 When one of the independent variables is poverty severity and associated coefficient has negative sign
1. Awareness about legal instruments was rated as follows: 1 = no one is aware, 2 = some are aware; 3 = majority are aware; 4 = all are aware
2. Estimated travel time to the nearest five markets, weighted by their population (Wood, et al. 1999).
3. The dummy variable non-Bantu eastern people was dropped as it failed by 100 percent to predict awareness of bylaws.

Distance to all-weather roads has a negative association with the level of awareness of no bush-burning and tree planting and protection regulations, suggesting that communities farther away from all-weather roads have less access to information about such these regulations. This could be explained by the facilitative role that roads play in movement of people and information. The Lugbara and Alur communities in west Nile are less aware of the tree planting and protection requirement than the Baganda. This

is despite the tobacco production in the area that requires growers to plant trees to replace those cut for tobacco curing.

As expected, the number of programs and organizations that focus on agriculture and the environment is positively associated with more awareness of regulations to plant and protect trees. This shows that these programs and organizations participate in both facilitating enactment and awareness creation of the NRM bylaws. The number of rural financing institutions also is associated with higher awareness of no bush burning legal instrument but this impact is not strong.

The eastern Bantu communities are less likely to comply with the no bush burning bylaw than the Baganda (Table 12). This could be explained by the predominantly perennial cropping systems of the Baganda that is not compatible with the bush-burning practice.

Table 12--Determinants of compliance with NRM legal instruments[1]

Variable	Compliance with …. bylaw	
	No bush burning bylaw (ordered Logit)	Plant and protect trees
Ln(distance to all-weather road in km)	0.105	0.015
Potential market integration (pmi)[2]	-0.001	-0.002
High agricultural potential	-0.161	1.050**++
Ethnic groups (cf Baganda)		
Northern non-Bantu people (Langi and Acholi)	0.302	0.282
Banyakitara (Western Bantu people)	0.906	-2.980*-
Bantu eastern people (Basoga, Bagishu, Bagwere, Banyole, etc)	-2.628**--	-1.747
Non-Bantu eastern people (Iteso, Kumam, Sebei, Sabiny, Japadhola, etc)	-0.018	-0.006
West Nile people (Lugbara, Alur and Kakwa)	-0.767	-0.711
Ln[Population density (people/km^2)]	-0.001	-0.000
Square [ln(Population density (people/km^2))]	0.000	0.000
Poverty gap in community	-10.177	-17.825**-
% of adults in community able to read and write	0.954	3.325***+++
Customary land tenure	0.217	1.546
# of programs & organizations with focus on:		
Agriculture and environment	0.018	0.072
Rural financial services	-0.310	0.520*+
Bylaw enacted by community council? (yes=1, no=0)	1.139**+	1.719***+++
Brant test of parallel regression assumption (Prob > χ^2)	0.582	-
Number of observations	87	63
Prob > χ^2	0.015	0.017

Legend: * p<.1; ** p<.05; *** p<.01 When one of the independent variables is poverty depth
+ p<.1; ++ p<.05; +++ p<.01 When one of the independent variables is poverty severity and associated coefficient has positive sign
- p<.1; -- p<.05; --- p<.01 When one of the independent variables is poverty severity and associated coefficient has negative sign

1 Compliance with legal instruments was rated as follows:1 = no one complies; 2 = some comply; 3 = majority comply; 4 = all comply

2. Estimated travel time to the nearest five markets, weighted by their population (Wood, et al. 1999).

Both the depth and severity of poverty are associated with lower level of compliance with tree planting and protection regulations. The results support the view that there is a poverty-natural resource degradation trap, which raises concerns about severe resource degradation in poor areas.

Literacy significantly increases the level of compliance with legal instruments regarding trees. This suggests that well educated communities are likely to understand

better the benefits of conserving trees. Since lack of education is also a poverty indicator, the results give more evidence that poor communities are likely to degrade resources more than well-off communities.

The number of programs and organizations with a focus on rural financial services has a positive impact on level of compliance with tree related legal instruments. This may be due to the potential of such programs and organizations to ease financial constraints and allow households to take a longer term perspective; this finding is also consistent with the hypothesis of a nexus between poverty and land degradation.

The level of compliance with regulations is affected by the level of government that enacts the regulation. The level of compliance with tree planting and protection and no bush burning regulations is higher when the regulations are enacted by the LC1 than if enacted by legislative bodies outside the community. The results are consistent with Ostrom (1990) and Okubal and Makumbi (2000) who observed that local legitimacy and ownership of legal instruments increases compliance.

6. CONCLUSIONS AND POLICY IMPLICATIONS

Since legal instruments are commonly used to manage natural resources at community level, their enactment and enforcement is crucial for sustainable natural resource management (NRM). Our research shows that programs and organizations with a focus on agriculture and the environment increase the probability to enact NRM bylaws and increase awareness of such instruments at community level. Both the Uganda's environmental policy and statutes explicitly recognize the role of these programs and organizations in NRM, but workable strategies are needed to make them more effective

and sustainable. The current NAADS program provides an ideal platform for ensuring that the operations of NGO's are institutionalized and mainstreamed in the government's agricultural and NRM programs. It is also important to create incentives for NGOs to operate in remote areas, where they are less present (Jagger and Pender, 2003).

Low human capacity is always cited as a major challenge to decentralization and devolution of power (e.g. Banana, et al., 2001; Lind and Cappon, 2001; Onyach-Olaa, 2003). Hence, involving programs and organizations with focus on agriculture and the environment to offer environmental education and sensitize communities to enact bylaws could help address the low local human capacity and lack of environmental education.

We observe a higher level of compliance with bush burning, tree planting, and protection regulations if these instruments are enacted by the community council than when they are enacted by external legislative bodies (any regulation not enacted by community councilors). These results imply the importance of empowering communities to enact bylaws as stipulated in the Local Government Act of 1997. However, the powers of the community to enact bylaws are limited, since statutes and ordinances require local councils to enact bylaws that are consistent with the district ordinances and national statutes. This has restricted councilors in some communities to only enforce the central government statutes and district or sub-county ordinances. For example, about a third of the communities surveyed have never enacted any NRM bylaw of their own. Since environmental problems differ significantly across communities, the need to enact bylaws locally to address local environmental problems is paramount. Additionally, the enforcement of bylaws is done by local councilors who are elected officials. Hence the local councilors may be unwilling to enforce bylaws that they do not support and/or may offend the electorate as this could lead to losing votes if they seek re-election. The same

problem affects statutory regulations, which are also enforced by local councilors. To address this problem, policy makers need to consider moving the enforcement role from elected local political officials to non-elected technical personnel.

Our results show that compliance with NRM bylaws increases as the level of awareness of existence of such bylaws increases. These results suggest that one of the major causes of low level of compliance with some of the bylaws is lack of awareness and education on NRM legal instruments, rather than defiance of such instruments. These results therefore support the strong emphasis that NEMA puts on environmental law education. Awareness of bush burning and tree planting and protection regulations is also greater in areas closer to all-weather roads, perhaps due to better access to information in such areas. This underscores the importance of developing roads and markets to increase access to information.

Empirical evidence from this research suggests promoting literacy also can increase compliance with NRM bylaws. This indicates that continued investment in education through Universal Primary Education (UPE) and adult education can yield benefits for the environment as well as contributing directly to reducing poverty. The Ugandan UPE program has been one of the most successful in Africa but adult education has stalled and Uganda's literacy level remains relatively low. UNDP (2004) estimates that adult (15 years and above) literacy in Uganda is 69 percent. This rate is higher than the Sub-Saharan Africa rate of around 54 percent but lower than the average in the east African region (84 percent for Kenya and 77 percent for Tanzania). Adult education campaigns should not only focus on literacy and numeracy but also on agriculture and environmental education, health, and other practical skills that would be appealing to

adults. It is also important to integrate environmental curricula into primary, secondary, and post-secondary institutions.

Initial increase in population density reduces the likelihood of enacting bylaws. This trend bottoms out at a 1000 people/km^2 threshold beyond which communities appear to be more likely to enact bylaws and other legal instruments regarding NRM. Ways to ensure that communities prevent natural resource degradation as the rural population continues to increase need to be considered. For example, natural resource degradation in densely populated areas may be reduced by promoting alternative and cheap sources of cooking energy. This is especially urgent in internally displaced people and refugee camps and in rural areas that are sources of charcoal and other forest products for large urban centers. Currently, the Uganda electrification rate is only 6 percent and fuelwood accounts for 93 percent of the energy consumption.

Customary land tenure decreases the likelihood of enacting NRM bylaws as compared to other tenure systems. This may be explained by the existence of customary laws that also promote sustainable NRM. As noted earlier, the existence of NRM customary laws in communities with predominantly customary land tenure makes the LC1 NRM bylaws less necessary to enact. Our study did not collect enough customary institution data since its major focus was on local government bylaws. This implies the need to study more comprehensively the customary institutions that affect NRM to better understand how they could be used to strengthen the enactment, enforcement, and compliance with legal instruments of local and central government. There is also need to examine the implications of the 1998 Land Act and other legal instruments on customary institutions. For example, even though the 1998 Land Act recognizes the customary land tenure system, it does not explicitly recognize the customary laws, probably because they

are not documented systematically and comprehensively. The Constitution also requires that for any law to be legal and effective, it must be written. This would invalidate many customary laws since most of them are not written but are orally passed from one generation to another.

Our results suggest that income poverty decreases compliance with tree planting and protection regulations. Other measures of poverty, namely lack of education and access to financial services, also decrease compliance with tree planting and protection regulations. Our results therefore give credence to the natural resource degradation-poverty trap and imply that efforts to reduce poverty could also lead to improved natural resource management.

REFERENCES

Agrawal, A., G. Yadama. 1997. How do social institutions mediate market and population pressures on resources? Forest Panchayats in Kumaon India. *Development and change* 28:435-465.

Allen, J.C. and D.F. Barnes. 1985. The causes of deforestation in developing countries. *Annals of the Association of American Geographers* 75:163-84.

Appleton, S. 2001. *Poverty reduction during growth: the case of Uganda*.Center for African Studies, Oxford University, U.K. Mimeo.

Bakema, R.J. and L. Iyango. 2001 *Engaging local users in the management of wetland resources. The case of the national wetlands program, Uganda.* Kampala Uganda: Uganda Wetland Program (NWP).

Banana, A., W. Gombya-Sembajjwe, and J. Bahatí. 2001. *Explaining deforestation: The role of forest institutions in Uganda forests*. A Policy Brief. Kampala: UFRIC, Makerere University.

Banana, A., and W. Gombya-Sembajjwa. 2000. Successful forest management: The importance of security of tenure and rule enforcement in Ugandan forests. In *Forests, trees and people program, food and agriculture organization forest, trees and people program*, ed. Gibson, C., A. McKean, E. Ostrom. Forest Department Working Paper No. 3: 73-82. Rome: Food and Agriculture Organization of the United Nations.

Bardhan, P., 1993. Analytics of the institutions of informal cooperation in rural development. *World Development* 21(4): 633-639.

Bazaara, N. 2003. *Decentralization, politics and environment in Uganda*. Environmental Governance in Africa. Working paper 7. Washington D.C.: World Resource Institute.

Bikaako, W. and J. Ssenkumba. 2003. Gender, land and rights: Contemporary contestation in law and policy and practice in Uganda. In Women and land in Africa – culture, religion and realizing women's rights, ed. Wanyeki, L.M. London, UK: Zed Books.

Bloom, D., D. Canning, and J. Sevilla. 2004. The effect of health on economic growth: A production function approach. *World Development* 32(1):1-13.

Boserup, E. 1965. *The conditions of agricultural growth*. New York: Aldine.

Brant, R. 1990. Assessing proportionality in the proportional odds model for ordinal logistic regression. *Biometrics* 46:1171-1178.

Byamukama, D.K. 2001. Women's access to social justice in decentralised arrangements: the case of Uganda. Paper presented at the seminar on Strengthening the Economic condition and Role of Women in Agricultural and Rural Development by Revisiting the legal Environment. Kampala, Uganda, February 19–23, 2001

Chomitz, K. 1995. Roads, land, markets and deforestation: A spatial model of land use in Belize. Paper presented at the first open meeting of the human dimensions of global environmental change community. Durham, North Carolina: Duke University.

Clay, D.C., T. Reardon, and J. Kangasniemi. 1998. Sustainable intensification in the highland tropics: Rwandan farmers' investments in land conservation and soil fertility. *Economic Development and Cultural Change* 46 (2): 351-378.

Cleaver, K.M. and G.A. Schreiber. 1994. *Reversing the spiral: The population, agriculture and environment nexus in Sub-Saharan Africa.* The World Bank, Washington, D.C.

Durning, A. 1989. *Poverty and the environment: Reversing the downward spiral*. Worldwatch Paper 92. Washington, DC: Worldwatch Institute.

Ehret, C. 1971. *Southern Nilotic history: Linguistic approaches to the study of the past*. Evanston, IL : Northwestern University Press.

Forest Department. 2002. Forest nature conservation master plan. Volume 1. Kampala, Uganda

Feder, G., T. Onchan, Y. Chalamwong, and C. Hongladaron. 1988. *Land policies and farm productivity in Thailand.* Baltimore: The Johns Hopkins University Press.

Fleming, W.G. 1966. Authority, efficiency and role stress: Problems in the development of east African bureaucracies. *Administrative Science Quarterly* 11(3):386-404

Garrity, D. 2000. The farmer driven landcore movement: In Institutional innovation with implications for extension and research. In *Scaling up the Impact of Agro Forestry Research,* ed. Cooper P. J. M and G.L Denning. Nairobi, Kenya: ICRAF.

Gebremedhin, B., J. Pender, and G. Tesfaye. 2003. Community resource management: The case of woodlots in northern Ethiopia. *Environment and Development Economics* 8: 129-148.

Gibson, C., A. McKean, E. Ostrom. 2000. *Explaining deforestation: The role of local institutions.* In *Forests, trees and people program*, ed. Gibson, C., A. McKean, E. Ostrom. Food and Agriculture Organization Forest, trees and people program – Forest department Working Paper No. 3. Rome.

Griffiths, J. 1986. What is legal pluralism? *Journal of legal pluralism* 24:1-50.

Gray, L and M. Kevane. 1999. Diminished access, diverted exclusion: Woman and land tenure in Sub-Saharan Africa. *African Studies Review* 42(2):15-39.

Guillet, D. 1998. Rethinking legal pluralism: Local law and state law in the evolution of water property rights in northwestern Spain. *Comparative Studies in Society and History* 2:97-117.

Jagger, P., J. Pender. 2003. *Impacts of programs and organizations on the adoption of sustainable land management technologies in Uganda.* Environment and Production Technology Division EPTD), Discussion Paper 101. Washington D.C.: International Food Policy Research Institute.

Keizire, B. 2003. Implementation of policy response packages to Promote Sustainable Management of Fisheries in Uganda. Kampala, Uganda: Ministry of Agriculture, Animal Industry, and Fisheries.

Khadiagala, L.S. 2002a. Justice and power in the adjudication of women's property rights in Uganda. *Africa Today* 49(2):101-121.

Khadiagala, L. S. 2002b. Negotiating law and custom: Judicial doctrine and women's property rights in Uganda. *Journal of African Law* 46:1-13.

Knox and Meinzen-Dick. 2001. *Collective action, property rights, and devolution of natural resource management: Exchange of knowledge and implications for policy.* Collective Action and Property Rights (CAPRi) Working Paper 11. Washington D.C.: International Food Policy Research Institute.

Lamprey, R. 2000. Wildlife protected area system plan for Uganda. Vol. 1. The Proposals. UWA.

Lawry, S. W. 1990. Tenure policy towards common property natural resources in Sub-Saharan Africa. *Natural Resources Journal* 30:403-404

Leonard, H.J. 1989. *Environment and the Poor: Development Strategies for a Common Agenda*. New Brunswick, NJ: Transaction Books.

Lind, J. and J. Cappon. 2001. Realities or rhetoric? Revisiting the decentralization of natural resource management in Uganda and Zambia. Nairobi, Kenya: Acts Press.

Long, S. 1997. Regression models for categorical and limited dependent variables. *Advanced quantitative techniques in the social sciences.* Thousand Oaks, CA: Sage Publications (7):114-147.

MFPED. 2003. *Background to the budget financial year 2003/04*. Kampala Uganda

Meinzen-Dick, R. and R. Pradhan. 2002. *Legal pluralism and dynamic property rights*. Collective Action and Property Rights (CAPRi) Working paper No. 22. Washington D.C.: International Food Policy Research Institute.

Muhereza, F. 2002. *Commerce, kings and local government in Uganda: Decentralizing natural resources to consolidate the central state.* Environmental governance in Africa working papers: Working Paper 8. Washington, DC: World Resources Institute.

Mukasa, F. 1995. *The legal conservation of swamps in Uganda.* Masters Thesis Submitted to the Faculty of Law, Makerere University.

NEMA (National Environment Management Authority). 2001. *State of the Environment Report for Uganda 2000*. Kampala, Uganda

___2004. *State of the Environment Report for Uganda 2004*. Draft report, Kampala, Uganda

Nkonya, E., J. Pender, P. Jagger, D. Sserunkuuma, C. Kaizzi and H. Ssali. 2004. Strategies for sustainable land management and poverty reduction in Uganda. Research Report No. 133. Washington, D.C.: International Food Policy Research Institute.

North. D. 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University press.

Ntambirweki, J. 1998. The evolution of policy and legislation on wetlands in Uganda. Faculty of Law, Makerere University. Mimeo.

Onyach-Olaa, M. 2003. The challenges of implementing decentralization: recent experiences in Uganda. *Public Administration and Development* 23:105-113.

Okubal, P. and M. Makumbi. 2000. Rethinking natural resource degradation in semi-arid Africa – implications for policy. Toroma Uganda Case study. Overseas Development Institute (ODI) Mimeo.

Olson, J.M. 1995. *Natural resource management by farmers in Kabale District*, Uganda. Nairobi. International Center for Research in Agroforestry.

Ostrom, E. 1990. *Governing the Commons: The evolution of institutions for collection action. Political economy of institutions and decisions.* New York: Cambridge University Press.

Parliament of Uganda 1995. *Uganda Constitution*. At http://www.parliament.go.ug/chapt11.htm. Accessed on May 11, 2004.

Pender, J. 2001. Rural population growth, agricultural change and natural resource management in developing countries: A review of hypotheses and some evidence from Honduras. In *Population matters: Demographic change, poverty and economic growth in developing countries*, ed. N. Birdsall, S. Sinding, and A. Kelley. Oxford, UK: Oxford University Press.

Pender, J. 1996. Discount rates and credit markets: Theory and evidence from rural India. *Journal of Development Economics* 50, 257-296.

Pender, J. P. Jagger, E. Nkonya, and D. Sserunkuuma. 2001. *Development pathways and land management in Uganda: Causes and implications.* EPTD Discussion Paper No. 85. Washington, D.C.: International Food Policy Research Institute.

Pender, J., P. Jagger, E. Nkonya and E. Kato. 2004. *Livelihood and land use options in northwestern Uganda.* Washington D.C.: International Food Policy Research Institute. Mimeo.

Pender, J. and Kerr, J., 1998. Determinants of farmers' indigenous soil and water conservation investments in India's semi-arid tropics. *Agricultural Economics* 19, 113-125.

Pender, J. and J. Kerr. 1999. The effects of land sales restrictions: Evidence from south India. *Agricultural Economics* 21: 279-294.

Pender, J., and S. J. Scherr. 2002. Organizational development and natural resource management: Evidence from Central Honduras. In *Property rights, collective action and technologies for natural resource management,* ed. Meinzen-Dick, R., A. Knox, F. Place, and B. Swallow Baltimore, MD: Johns Hopkins University Press.

Pinstrup-Andersen, P. and R. Pandya-Lorch. 1994. *alleviating poverty, intensifying agriculture, and effectively managing natural resources.* Food, Agriculture, and the Environment Discussion Paper 1. Washington, D.C.: International Food Policy Research Institute.

Poteete, A., E. Ostrom. 2003. *In pursuit of comparable concepts and data about collective action.* Collective Action and Property Rights (CAPRi) Working Paper 29. Washington D.C.: International Food Policy Research Institute.

Poteete A., E. Ostrom. 2004. Heterogeneity, group size and collective action: The role of institutions in forest management. *Development and Change* 35(3):435-461.

Reardon, T. and S. Vosti. 1995. Links between rural poverty and the environment in developing countries: Asset categories and investment poverty. *World Development* 23(9): 1495-1506.

Republic of Uganda: *The Land Act* 1998. Government Printer, Kampala Uganda

Ribot, J. 2001. Decentralized natural resource management: Nature and democratic decentralization in Sub-Saharan Africa. Paper presented at the UNCDF symposium, Cape Town, South Africa. March 26, 2000.

Ruecker, G., S.J. Park, H. Ssali and J. Pender. 2003. *Strategic targeting of development policies to a complex region: A GIS-based stratification applied to Uganda*. ZEF Discussion Papers on Development Policy, Discussion Paper No. 69. , University of Bonn: Center for Development Research,

Sanginga, P. 2002. Strategies for Managing conflicts in natural resources management and use in East and Central Africa. Kampala Uganda: CIAT. Mimeo.

Scherr, S. and P. Hazell. 1994. *Sustainable agricultural development strategies in fragile lands*. Environment and Production Technology Division Discussion Paper No. 1. Washington, DC: International Food Policy Research Institute.

Singh, I., L. Squire, and J. Strauss. 1986. *Agricultural Household Models: Extensions, Applications and Policy*. Baltimore, MD: Johns Hopkins University Press.

Sserunkuuma, D. N. Ochom and H. Ainembabazi. 2004. Collective Action in Canal Irrigation Systems Management: The Case of Doho Rice Scheme in Uganda**.** At http://www.ifpri.org/2020/nw/nwpapers/dohabr200306.pdf. Accessed on April 21, 2004.

Staal, S.J., I. Batenweck, M.M. Waithaka, T. deWolffe and L. Njoroge. 2002. Location and uptake: Integrated household and GIS analysis of technology adoption and land use with application to smallholder dairy farms in Kenya. *Agricultural Economics* 27:295-315.

Tiffen, M., M. Mortimore, and F. Gichuki. 1994. *More people – less erosion: Environmental recovery in Kenya.* London, UK: Wiley and Sons.

Tripp, A.M. 2004. Women's movements, customary law, and land rights in Africa: The case of Uganda. *African Studies Quarterly* 7(4) (Online) URL: http://web.africa.ufl.edu/asq/v7/v7i4a1.htm

Uganda Bureau of Statistics (UBOS). 2003a. Uganda National Household Survey 2002/2003. Report on the Socio-economic Survey., Entebbe Uganda: UBOS

_____2003b. Statistical abstracts, 2003. Entebbe, Uganda: UBOS.

UNDP (United Nations Development Program). 2004. *Human development report, 2004. Cultural liberty in today's diverse world.* New York: UNDP.

UPPAP. 2002. Uganda Participatory Poverty Assessment Process National Final Report. Kampala Uganda: Ministry of Finance, Economic Development and Planning (MFPED). Draft.

Wanyeki, L.M. 2003. Women and land in Africa – culture, religion and realizing women's rights. London, UK: Zed Books.

Woelcke, J., T. Berger, and S. Park. 2002. Land improvement and technology diffusion in Uganda: A bioeconomic multi-agent approach. Paper presented at the Conference on Policies for Sustainable Land Management in the East African Highlands, UNECA, Addis Ababa, April 24-26, 2002. Mimeo.

Webster. 1913. Webster's Revised Unabridged Dictionary at http://www.dictionary.net/Bantu accessed on March 31, 2005.

Western, D. and R.M. Wright.1994. *Natural connections: Perspectives in community-based conservation.* Washington D.C.: Island Press.

Wood, S., K. Sebastian, F. Nachtergaele, D. Nielsen, and A. Dai. 1999. *Spatial aspects of the design and targeting of agricultural development strategies.* Environment and Production Technology Division Discussion Paper 44. Washington, DC: International Food Policy Research Institute.

Young, K. 1994. Roads and the environmental degradation of tropical montane forests. *Conservation Biology* 8(4):972-6.

Zake, J. Y., M.K. Magunda and C. Nkwiine. 1997. Integrated soil management for sustainable agriculture and food security. The Ugandan case. Paper presented at the FAO workshop on Integrated soil management for sustainable agriculture and food security in Southern and Eastern Africa, Harare, Zimbabwe Dec. 8-12, 1997.

Zantell, B.A., B.A. Knuth. 2004. Participation rhetoric or community based management reality? Influences on willingness to participate in a Venezuelan freshwater fishery. *World Development* 32(5):793-807.

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