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Drivers of Deforestation in the Lake Victoria Crescent, Uganda

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We examined key drivers of deforestation in the Lake Victoria Crescent, Uganda from 1989 to 2009 through a case study approach with a multiple-case design. Nineteen focus groups with local community members and forest officials, archival analysis, and field observation revealed both proximate causes and underlying drivers of deforestation. Proximate causes of deforestation included agricultural expansion into forests, unsustainable extraction of wood forest products, and clearing of forests for nonagricultural uses. Underlying drivers of these proximate causes included policy and institutional factors, economic factors, population growth, technological changes, and changes in culture—each resulting in alienation of local people from forest resources. Alienation of local people, defined as a psychological dispossession of responsibility for forest resources, is posited as the most important underlying driver of deforestation. We discuss the importance of the involvement of local people in the management and maintenance of forests in the Lake Victoria Crescent.

KEYWORDS alienation, conservation, deforestation, empowerment, Uganda

INTRODUCTION

Many countries' economies, including that of Uganda, are largely dependent upon forest resources (Food and Agriculture Organization of the United

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Nations [FAO], 1997). Despite this importance, a general trend of deforestation has been witnessed, especially in the tropics (Nagendra, 2007). Deforestation continues to affect the humid tropical forests of Latin America, Africa, and Asia (Tangley, 1986; Bawa & Dayanandan, 1997; Nagendra, 2007). Consequences include soil erosion, drought, flooding, water quality degradation, declining agricultural productivity, species extinction, and ultimately greater poverty for rural inhabitants of tropical nations (Tangley, 1986). Deforestation also contributes to loss of globally important carbon sinks that currently sequester carbon dioxide from the atmosphere (Stephens et al., 2007). Deforestation impacts the lives and livelihoods of millions of forest-dependent inhabitants around the world (Tangley, 1986; Nagendra, 2007).

Recognizing the fast disappearance of forests in the tropics, many interventions aimed at either conserving or sustainably managing forest resources, ranging from government-owned protected areas to private conservation through parks and community reserves, have been implemented over time (Nagendra, 2007). While studies conducted at regional, national, continental, or global scales tend to focus on coarse-grained drivers of forest cover change (e.g., Geist & Lambin, 2002; Nagendra, 2007; Vogt et al., 2006), other studies focus on the intricacies of a single site (e.g., Mwavu & Witkowski, 2008). Our approach addresses an intermediate scale, comparing multiple study sites of varying sizes within a single region referred to in this study as the Lake Victoria Crescent of Uganda, an area of roughly 15,228 km^2. Our intentions of working at this scale were manifold. We hoped to uncover consistent drivers of deforestation across multiple sites with cultural and ecological similarities. The intermediate comparative approach helps to differentiate trends from site-specific idiosyncrasies (Collier, 1993). With this knowledge, we hoped our results could support the potential design of region-specific interventions to combat deforestation.

Uganda covers an area of about 24 million ha (United Nations Environment Program [UNEP], 2008), of which approximately 4.9 million (20%) are under forest cover (Ministry of Water, Lands and Environment [MWLE], 2003). Uganda's forest resources employ millions of people and contribute 6% of the gross domestic product (Kayanja & Byarugaba, 2001; MWLE, 2001). Most of Uganda's population (85.1%) lives in rural areas (Uganda Bureau of Statistics [UBOS], 2008) and is generally poor. The population is thus heavily dependent on natural resources like forests for meeting basic needs (Mwavu & Witkowski, 2008). These include medicine, crafts and furniture, food and flavoring, firewood and charcoal, building materials and timber (UNEP, 2008; MWLE, 2001; Kayanja & Byarugaba, 2001). Forests also act as a catchment for water bodies including Lake Victoria, the second largest freshwater lake in the world. Other environmental services provided by Ugandan forests include maintenance of high biodiversity (Kayanja & Byarugaba, 2001; UNEP, 2008) and protection of globally important carbon

sinks that sequester carbon dioxide from the atmosphere (Stephens et al., 2007).

Uganda's annual deforestation rate between 2000 and 2005 was 2%, higher than neighboring countries like Kenya at 0.34% and Tanzania at 1.10% (FAO, 2005). The Lake Victoria Crescent, one of the most forested areas in Uganda (National Environment Management Authority [NEMA], 2004–2005), has continued to experience considerable deforestation. Clearly, interventions aimed at curbing deforestation have not been effective, suggesting that presumptions regarding primary drivers of deforestation upon which interventions have been based may be inaccurate or incomplete. Most of these assumptions are derived from singular small-scale studies that can potentially hinder the ability for comparison and generalization. This research article investigates the drivers of deforestation in multiple locations within the Lake Victoria Crescent, Uganda from 1989 to 2009, with the aim of developing a more complete theoretical understanding of the drivers of deforestation to better inform useful interventions to combat deforestation there.

METHODS

Study Area

The study area, referred to in this study as the Lake Victoria Crescent, is located between 0° 8′ S and 0° 42′ N and between 32° 5′ and 33° 32′ E. The area, roughly 162 km by 94 km, wholly or partially encompasses the districts of Mayuge, Iganga, Jinja, and Kamuli in eastern Uganda and Kayunga, Mukono, Luwero, Kampala, Wakiso, Mpigi, Mityana, Nakaseke, and Kiboga in central Uganda (Figure 1). This part of Uganda contains many forests (UNEP, 2008) including government-owned forests (Central and Local Forest Reserves) and privately owned forests. The area is also densely populated, with population densities of 226 persons per km^2 in eastern Uganda and 176 persons per km^2 in central Uganda (UBOS, 2012). Both the urban and rural populations are known to be heavily dependent on forest resources for human livelihood needs (Mwavu & Witkowski, 2008).

We selected this study area because of its decline in overall forest cover between 1989 and 2009, based on Landsat imagery classification, with classification accuracy ranging from 97.1 to 98.1% (Waiswa, 2011). Each study site consisted of a settlement and an adjacent forest.[1] The variable interfaces between forests and humans in the area provided the opportunity to explore and compare multiple potential explanatory variables associated with deforestation.

Study Implementation

A case study approach with a multiple-case design (Eisenhardt, 1989; Yin, 2009) was employed, as it enables both testing and generation of theory

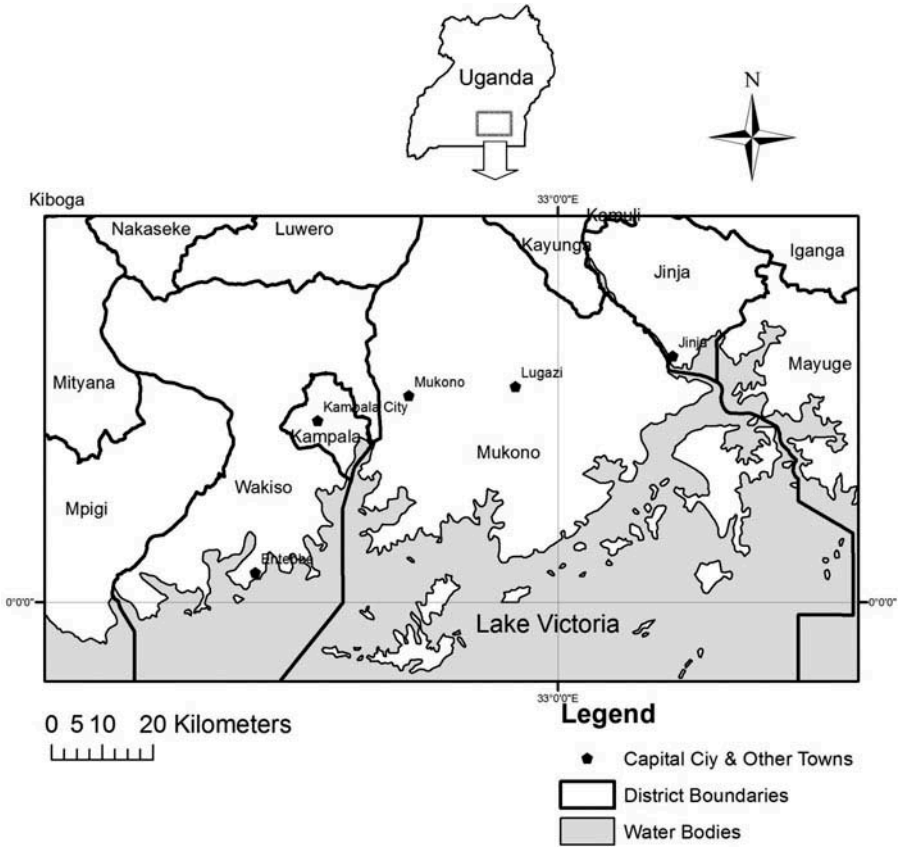

FIGURE 1 Map of the study area, Uganda's Lake Victoria Crescent, showing district boundaries, Uganda's capital city (Kampala), and other major towns.

(Eisenhardt, 1989). The first step involved selecting cases through theoretical sampling. The cases in this study were defined as locations that included a natural forest in the immediate vicinity of a local community where forest cover loss had occurred between 1989 and 2009. This selection was facilitated by a reconnaissance survey coupled with Landsat imagery classification maps from previous studies and personal knowledge of the study area. Out of the 36 cases that fit the selection criteria, 13 cases (36%) were randomly selected for inclusion in the study under the assumption that they could reasonably represent the study area. The use of multiple cases aimed to enhance the generalizability of the findings to the region of interest.

Data collection took place from August to November 2010. Data sources included archival sources, focus group discussions, and direct observation of forest cover and utilization of forest resources. Archival sources included mass media articles and publications related to forestry in Uganda, the

Uganda Forestry Resources and Institutions Center (UFRIC) database, which is based on International Forestry Resources and Institutions (IFRI) protocol (Nagendra, 2007), and past study reports on long-term community-level forestry monitoring studies under the IFRI program at Makerere University. Information sought from archival sources included trends of forest cover and drivers of deforestation.

One focus group discussion with a group of key informants was conducted in each of the selected 13 cases. This involved contacting local community leaders of the areas where the selected cases were located through visits or telephone and introducing the study to them as a way of building rapport. The local community leaders then aided in the selection of people who they thought to be most knowledgeable about forest cover change in their respective areas (key informants) through purposive and snowball sampling (Babbie, 2007). These key informants mostly included: (a) local community leaders, (b) community elders, (c) local community members, and (d) private forest owners. Additionally, six focus group discussions were conducted with groups of managers at different levels in the government forestry sector (National Forestry Authority and District Forestry Service). The selected managers were responsible for overseeing the forest reserves in the selected 13 cases. There were only six focus group discussions because some of the managers were responsible for overseeing more than one of the 13 selected cases. The purpose of the 19 focus group discussions was to gather local understanding and accounts of the drivers of forest cover loss in the selected cases from 1989 to 2009.

The focus group discussions were aided by Landsat imagery-based land-use and land-cover dynamics maps of the study area printed on poster size paper. Each map had a base layer showing the 1989 land-cover classification of the study area—including open water, nonforest, and forest cover classes. The base layer was overlaid with interconversions from forest to nonforest and vice-versa for each of four time periods: 1989 to 1995, 1995 to 2002, 2002 to 2006, and 2006 to 2009. During each focus group discussion, immediately after introducing the study and gaining consent from the key informants, a poster containing the four maps was displayed, and the local area depicted on the maps was explained. The layers were then introduced and discussed chronologically. For each layer, the key informants were shown areas where change (afforestation or deforestation) or no change took place in their respective locality. A discussion was held with the leading question being: "What prevailing factors accounted for the observed change or no change in forest cover status?" This open-ended question was followed by probing questions to ensure that there was clarity in responses and to explore multiple potential explanations. The probing questions focused on forest activities, forest management, policy and institutions, population dynamics, culture, and technology changes as they related to forest cover

status. The discussions were held in any of the three languages—Luganda, Lusoga, and English—as deemed appropriate. While notes were taken during all focus group discussions, only four were digitally recorded, as some of the key informants did not consent to being recorded. Focus group discussions averaged about 50 minutes. All recorded discussions were transcribed.

Direct observation of phenomena of interest during field visits also informed discussions during interviews and helped to verify previously collected data, such as agricultural encroachment in forest reserves that could easily be observed.

Data Analysis

Data analysis was executed in five steps which included within-case analysis, cross-case synthesis, shaping hypotheses, enfolding literature, and reaching closure (Eisenhardt, 1989). Within-case analysis involved developing detailed case-study reports consisting of narrative descriptions of data for each of the 13 case studies. This was accomplished through reading written notes and transcripts associated with each case repeatedly while taking notes associated with drivers of deforestation. Note-taking was guided by themes already present in the literature with an explicit effort to also allow other themes to emerge inductively from the data. This involved a constant comparison of data to drivers uncovered in previous literature. The notes constituted the narrative description.

Within-case analysis produced useful and thorough summaries of field data and facilitated familiarization with each case, a vital requirement for cross-case comparison (Yin, 2009). It also enabled identification of unique patterns that could explain forest cover loss between 1989 and 2009 in each case before attempting to generalize across cases (Eisenhardt, 1989). Cross-case synthesis involved comparing narrative descriptions to search for patterns (similarities and differences) amongst groups of cases (Eisenhardt, 1989; Yin, 2009). General patterns based on observed similarities and differences formed hypotheses about drivers of deforestation. The hypothesized drivers that occurred across cases were refined through iterative and constant comparison of hypotheses with evidence (data) for each case to determine fit. Cross-case synthesis thus provided an opportunity to refine theories about the hypothesized drivers of deforestation (Eisenhardt, 1989). The emergent hypotheses were compared with existing literature, seeking both confirmatory and contradictory cases. This provided an opportunity for deeper insight and sharpening of emerging constructs and theories about drivers of deforestation. Closure was reached when no new phenomena were observed in the analysis of cases and when no improvements in theory were gained through additional comparisons between the data, theory, and the literature (Eisenhardt, 1989).

RESULTS

Model of Drivers of Deforestation in the Lake Victoria Crescent

Our analyses reveal that deforestation in the Lake Victoria Crescent, Uganda from 1989 to 2009 was a consequence of proximate (direct) causes which were triggered by a number of underlying (indirect) drivers (Figure 2). We describe each below.

Proximate (Direct) Causes of Deforestation

Proximate causes encompassed *direct* human uses of local forests. The uses could either be legal or illegal, while the purpose of use could be subsistence, commercial, or both. Agricultural expansion occurred through legal allocation of forestland by government agencies to private investors to establish large-scale crop plantations. There was also illegal establishment of small-scale (subsistence) crop gardens, especially seasonal crops such as maize, beans, and green vegetables in the forest reserves. The small-scale crop farming was mainly carried out by people living in the immediate vicinity of forests. Extraction of wood forest products included commercial harvesting of timber, firewood, wood billets, and charcoal. Clearance of forests for nonagricultural uses included human settlement, sand mining, and brick-making. The extraction of wood products for commercial purposes and the clearing of forests for nonagricultural uses were generally illegal activities, as most of the forests in the study area are government-owned forests in which such activities are prohibited.

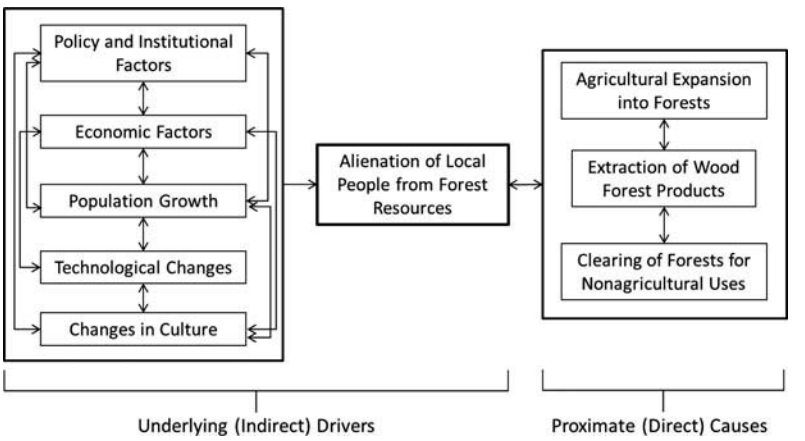

FIGURE 2 Theoretical model of drivers of deforestation in Uganda's Lake Victoria Crescent, showing hypothesized interactions between underlying drivers and proximate causes of deforestation based on empirical data. Arrows (single or double-ended) indicate interactions between model components.

Underlying (Indirect) Drivers of Deforestation

Underlying (indirect) drivers of forest cover loss included social and institutional processes that triggered proximate causes impacting forest cover at a local scale. Policy and institutional factors included the relationships between and actions of formal government institutions with influence over the forestry sector. A government policy initiative that attempted to address escalating unemployment in Uganda allocated forestland to foreign investors to enhance industrialization. This ultimately contributed to deforestation, as allocated forestland was cleared. Government leases of forestland to both local and foreign investors for tree plantation establishment also led to clearance of natural forests which were not consistently replaced with forest, as the intended plantation establishment was not always fully implemented.

Existing policies and laws, such as the Uganda Forestry Policy (MWLE, 2001) and the National Forestry and Tree Planting Act (Republic of Uganda, 2003), aimed at promoting sustainable forest management seemed not to be achieving their goal. Many key informants were unaware of the policies and laws. Some people perceived the policies and laws as not being in the best interests of local people, explaining that they reduced access to forest products. Enforcement of forest rules and regulations has been hampered by inadequate resources, especially human and financial, within forestry management agencies. Interview excerpts included: "We are two staff here in charge of 21 central forest reserves"; "Three supervision motorcycles broke down; only one is running"; and "We manage 70% of the forests but have no budget allocation from central government."

There were also alleged loopholes attributed to lack of clarity in the existing forestry policy and law. For example, because the District Forestry Service (DFS) was not legally required to verify the origin of forest products it was mandated to license for transportation, it was reported that DFS would regularly allow the passage of products that were illegally harvested from central forest reserves under the jurisdiction of the National Forest Authority (NFA). Therefore, NFA conflicted with DFS for supporting illegal activities, as this hindered NFA's role of sustainably managing central forest reserves.

Political interference in the management of forestry resources also contributed to deforestation. One interviewee expressed, "Politics in this area is mainly about the forest." Many politicians were reported to have sacrificed forests for votes. Other reports of corruption and general mismanagement within the forestry sector, and a lack of political will to address these issues, were also common amongst respondents.

Economic factors such as poverty were also major drivers of deforestation. Increasing levels of poverty were commonly attributed to crop failures due to disease, pest infestations, and droughts. Coffee, the longtime main cash crop, was attacked by the coffee wilt disease which nearly wiped out coffee plants. Agroprocessing industries relying on coffee and

other impacted crops also collapsed during the study period. Crop failures were also attributed to declining soil fertility as a result of both continuous cultivation and increasing scarcity of agricultural land. Increasing poverty was also attributed to reduced returns from alternative economic activities such as fishing. Government initiatives had also failed to adequately catalyze alternative livelihoods for residents, often due to inadequate coordination amongst government sectors. For example, while one government agency encouraged farmers to grow crops such as *Vanilla planifolia* and *Moringa oleifera* or raise silkworms, there weren't sufficient mechanisms in place to market such products. As a coping strategy, local people resorted to multiple forms of forest resource extraction, resulting in deforestation.

Study participants also reported increasing demand and associated markets for forest products in Uganda's Lake Victoria Crescent from 1989 to 2009. Respondents commonly attributed this to increasing economic development and population growth. Urbanization also led to higher demand for energy and wood for the construction industry, among other uses. Key informants reported economic activities such as fish smoking, brick baking, and local gin distillation as leading to deforestation, as they are heavily dependent on firewood. The increasing demand for products such as charcoal, firewood, agricultural crops (especially food crops), and timber from forests resulted in higher and quicker financial returns compared to traditional nonforest income generating activities such as agriculture and fishing. These greater returns worked to increase both legal and illegal forms of deforestation.

Population growth, according to the respondents, was another factor that was responsible for the observed deforestation. Uganda's annual population growth rate was 3.2% (UBOS, 2012). A 20-yr-old study participant explained, "We are now many. We used to be in our father's house, but now I have my own house with a wife and five children." Previously available agricultural land has not only become scarce, but also unproductive due to continuous cultivation by increasing populations that have ultimately become poorer and more food insecure. In the search for alternative means of survival, the people have not only resorted to forests for increased extraction of commercial forest products such as timber and firewood, but have also cleared forests for agricultural land that is believed to be more fertile for crop production. Each has ultimately increased deforestation.

Changes in technology were yet another major driver of deforestation. Enhanced transportation and transition from hand to power tools, such as chainsaws, accelerated deforestation. These changes were driven primarily by immigration of individuals with enhanced technologies. Changes in technology were exacerbated by leasing of forestlands to external enterprises and increased demand for forest products, which in turn catalyzed more production and transportation of forest products. As local people adopted new technologies, they moved away from their more traditional role as forest stewards.

Changes in culture also appeared to drive deforestation. Relevant cultural factors include beliefs, myths, and perceptions that people hold toward forests (Machlis, Force, & Burch, 1997). Traditional beliefs described by respondents were expressed in discussions of the sacred values of forests and the traditional role of local people as forest stewards. Examples of such sacred beliefs and practices that helped conserve forests included designation of certain forests as worship sites, limitations on quantities of forest products that could be taken out of the forest, and beliefs that certain tree species could not be harvested from some forests. Multiple factors interacted to erode these perceptions. With increasing economic desperation, a perceived expropriation of the resource, new ideas and competition introduced through immigration, increased demand for products, and new means to produce them, respondents described how the region witnessed a cultural shift toward more utilitarian values associated with local forests, further contributing to deforestation.

Each of these underlying drivers have brought about feelings of alienation of local people from forest resources, a scenario where individuals or groups of people feel disenfranchised of their rights to utilize or access resources. We use the term alienation to refer to the transfer (real or perceived) of one's property to another (Schlager & Ostrom, 1992) and its resultant psychological state of expropriation (Olwig, 2005). Olwig (2005) describes alienation as a state in which people feel emotionally or operationally disconnected from something in which they formerly felt meaningful connection, in this case the forest resource.

Interviews revealed alienation as deeply rooted in perceived historical injustices regarding tenure disputes over government forest reserves, with individuals or groups claiming ownership over gazetted forests. Such claims of ownership fomented a number of conflicts that undermined sustainable forest management and led to deforestation. Leasing or selling concessions within government forest reserves to people from outside local communities for private business ventures, such as the establishment of tree plantations or timber harvesting, also drew local ire and was seen as a dispossession of sorts amongst the local people. One respondent claimed, "Our forests are being given to nonnatives." Another stated, "People brought in from outside by government are the ones harvesting the forests. The forests are no longer ours." Even when local people needed to engage in legal forestry activities, they indicated that required permits were often too expensive.

Local feelings of alienation from forest resources were worsened by poor communication and inadequate collaboration between forestry sector managers and forest-dependent local communities. Some local people complained that forest managers were guarding the forests with guns. One study participant explained, "We cannot even enter our forests these days to harvest anything as we fear being shot." However, the local people revealed that such forest management agencies' attempts to restrict use through more

restrictive policies and increased enforcement of rules and regulations were usually short-lived.

Because local people perceived a loss of ownership over forest resources, their interest in maintaining them diminished. They thus reportedly intensified their illegal use of forest resources resulting in increased deforestation. Perceptions of rampant corruption and political interference in the affairs of the formal forestry sector also exacerbated the situation.

Interactions between Proximate Causes and Underlying Drivers of Deforestation

As depicted in the model, both proximate causes and underlying drivers were responsible for causing the deforestation situation in the Lake Victoria Crescent from 1989 to 2009. The proximate causes and underlying drivers worked singly or in combination. Each of the underlying drivers could influence the proximate causes directly or indirectly to trigger deforestation. The indirect influence reflects a cumulative effect of multiple underlying factors upon the alienation of local people from the forest resource.

DISCUSSION

Deforestation in Uganda's Lake Victoria Crescent from 1989 to 2009 was driven by both underlying drivers and proximate causes. These findings about drivers of deforestation generally concur with empirical findings from prior studies. Other studies cite similar drivers of deforestation—including the unplanned spread of agriculture or increasing cropland area (Geist & Lambin, 2002; Mwavu & Witkowski, 2008); firewood and timber harvesting (Geist & Lambin, 2002); increasing population density (Struhsaker, 1987; Bawa & Dayanandan, 1997; Place & Otsuka, 2000; Mwavu & Witkowski, 2008; Lung & Schaab, 2010); market access (Place & Otsuka, 2000); unclear land tenure and or property rights (Place & Otsuka, 2000; Vogt et al., 2006; Nagendra, 2007; Mwavu & Witkowski, 2008); lack of forest monitoring and noninvolvement of users in forest maintenance (Nagendra, 2007); and conflicts of interest, political interference, negative perceptions about forests, and unfavorable or prodeforestation policies (Mwavu & Witkowski, 2008).

The drivers of deforestation are also reflected to some extent in multiple more general theoretical models of human impacts on the landscape. The human ecosystem model, as well its predecessors the IPAT (Vaillancourt, 1995) and POET (Ehrlich & Holdren, 1972) models, highlights the interaction between socioeconomic resources, cultural resources, social institutions, social cycles, and social order in socioecological systems (Machlis et al., 1997). Our model of drivers of deforestation makes explicit the complexities and potentially cyclical and exponential effects of interactions of the human

ecosystems model, as multiple factors converge to build upon feelings of alienation from the resource, which in turn appear to influence each of the drivers of deforestation. Deforestation will probably continue to occur in the Lake Victoria Crescent, as demonstrated by not only the many drivers of deforestation, but also the interactions between them. However, making the drivers explicit and highlighting the significance of alienation of local people from forest resources may pose some possibilities for future interventions to curb deforestation in this region.

Although both proximate and underlying drivers of deforestation were identified, the underlying drivers form the more fundamental and ultimate reasons for observed deforestation as compared to proximate factors. It is therefore important that attempts at addressing deforestation focus on interventions that combat these underlying drivers. The model reveals a complex system, as manifested by the interactions amongst underlying drivers alone. Each, however, drives alienation of local people from forest resources, which ultimately influences the proximate causes. In turn, local peoples' alienation from forest resources reinforces each of the other underlying drivers. As such, addressing feelings of alienation may represent an important focus of interventions addressing deforestation in the region.

Alienation creates a sense of lack of ownership and responsibility denial toward forest resources amongst local communities. Study participants who viewed forest reserves as government-owned resources reported their own opposition to forestry rules and regulations and mistrust of forestry officials. Obua, Banana, and Turyahabwe (1998) found similar findings elsewhere in Uganda, where restricted access to forest resources amongst local communities around Budongo Forest Reserve resulted in mistrust, antagonism, and conflicts with the Forest Department. In the Lake Victoria Crescent, local people's feelings of alienation led to their use of forests for purely economic gains without any reported sense of care for future conditions. Similar reports of deforestation following government designations of protected areas exist elsewhere as well (Stevens, 1993).

A multifaceted approach may be required if alienation is to be addressed. This could involve, among other approaches, rebuilding a sense of ownership and responsibility for forestry resources amongst local communities. Arguments against such approaches have been noted in the literature, including a general lack of capacity in local communities to manage forests (Agea, Obua, & Fungo, 2009). Similarly, in cases where poverty is common, some note concerns of overexploitation with renewed user rights for local people (Brandon & Wells, 1992; Rabinowitz, 1999). Evidence suggests that enhanced relationships between local people and natural resource governance institutions, however, can help to offset economic pressures on forests, even in areas of high poverty (Stern, 2008a, 2008b; Baral & Stern, 2011). These relationships are typically predicated on trust and legitimacy (Stern, 2008a, 2008b), which may be a particular challenge amidst accusations of

corruption (Otieno & Buyinza, 2010). In prior studies, precursors to trust in similar situations have included meaningful and respectful communication between officials and local residents, officials' receptiveness to local input, consistent and honest performance, benefits to local people associated with protected area presence, and equitable treatment of different groups (Stern, 2008b). In other cases, local people have been employed or directly relied upon to defend their forest resources, capitalizing upon, or reinstituting a sense of ownership over the resource (Schwartzmann, Moreira, & Nepstad, 2000; Fearnside, 2003; Baral & Stern, 2011). In many of these cases, nongovernment organizations have served key roles in enhancing local capacity and enabling the reestablishment of trusting relationships between governance institutions (Borges-Mendez, 2008; Normile, 2010; Stern, 2010; Baral & Stern, 2011).

Without some form of user rights (see Mendelsohn, 1994; Geisler & Daneker, 2000), a sense of ownership, and a system for governing appropriate use, however, such strategies may not be able to withstand the various pressures brought to bear by the multiple underlying drivers described in this article. As such, solutions to deforestation in the region may need to reconsider overarching governance strategies to become more inclusive of local people.

Developing new forms of governance not only requires a willingness of the national government and other key stakeholders, but also considerable time to develop the capacities and relationships necessary to administer sustainable resource management systems (Baral, Stern, & Heinen, 2007; Baral & Stern, 2011). Nongovernmental organizations could serve as an effective bridge between government organizations and local communities to start along this path, especially those with staff in place within the communities (Stern, 2010). A consistent presence of these entities within communities, capacity building, projects that link incentives directly to maintaining high quality resources (such as ecotourism or sustainable harvest of valuable nontimber forest products), equitable distributions of benefits, and various forms of long-term local empowerment in decision making have been revealed as important to sustaining forest conservation (McShane & Wells, 2004; Baral & Stern, 2011). Empowered local people with a sense of ownership over the resources have been known to effectively self-govern under these conditions and defend resources against outside pressures (Schwartzmann et al., 2000; Fearnside, 2003). However, the policy environment must also shift to allow for new forms of resource governance. If local people no longer feel alienated from their resources, they may be more likely to be interested in working together to sustain their benefits into the future.

CONCLUSION

This study investigated the drivers of deforestation in Uganda's Lake Victoria Crescent between 1989 and 2009. The study revealed that deforestation was a consequence of proximate causes which were triggered by a number of underlying drivers acting singly and in combination. The proximate causes included agricultural expansion into forests, extraction of wood forest products, and clearing of forests for nonagricultural uses. The underlying drivers included policy and institutional factors, economic factors, population growth, technological changes, and changes in culture. Our comparative analysis revealed that these factors appeared to exacerbate feelings of alienation of local people from forest resources across each of our cases. These feelings of alienation of local people from forest resources further bolster each of the other drivers identified. Because of the complexity of the interactions amongst drivers of deforestation, we predict that deforestation will continue to occur in the area. While external market forces will inevitably continue to exert pressures on local people and resources, we recommend that interventions to curb deforestation focus on overcoming the feelings of alienation of local people from forest resources, as a stronger sense of local ownership in other parts of the world have correlated with greater protection of forest resources when coupled with strategies such as local capacity building in sustainable forest management, the development of alternative livelihoods which depend upon standing forests, and continued technical support (McShane & Wells, 2004; Stern, 2010). Such strategies would involve rebuilding a sense of ownership and responsibility for forestry resources amongst local communities and building trust between local communities and other forestry stakeholders, such as forestry officials and nongovernment organizations. The road is likely to be long, but without meaningful change, it is likely that the resource will continue to be depleted.

NOTE

1. Specific sites are not disclosed to honor confidentiality agreements with study participants.

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