LAND USE CHANGE AND SOIL DEGRADATION IN THE SOUTHWESTERN HIGHLANDS OF UGANDA

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A Contribution to the Strategic Criteria for Rural Investments in Productivity (SCRIP) Program of the USAID Uganda Mission

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Strategic Criteria for Rural Investments in Productivity (SCRIP) is a USAID-funded program in Uganda implemented by the International Food Policy Research Institute (IFPRI) in collaboration with Makerere University Faculty of Agriculture and Institute for Environment and Natural Resources. The key objective is to provide spatially-explicit strategic assessments of sustainable rural livelihood and land use options for Uganda, taking account of geographical and household factors such as asset endowments, human capacity, institutions, infrastructure, technology, markets & trade, and natural resources (ecosystem goods and services). It is the hope that this information will help improve the quality of policies and investment programs for the sustainable development of rural areas in Uganda. SCRIP builds in part on the IFPRI project *Policies for Improved Land Management in Uganda (1999-2002)*. SCRIP started in March 2001 and is scheduled to run until 2006.

The origin of SCRIP lies in a challenge that the USAID Uganda Mission set itself in designing a new strategic objective (SO) targeted at increasing rural incomes. The *Expanded Sustainable Economic Opportunities for Rural Sector Growth* strategic objective will be implemented over the period 2002-2007. This new SO is a combination of previously separate strategies and country programs on enhancing agricultural productivity, market and trade development, and improved environmental management.

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Executive Summary

The objectives of this review paper are to examine land use and land degradation in the southwestern "Kigezi" highlands of Uganda (Kisoro and Kabale districts) based on recent research findings that challenge conventional views on these phenomena in the region, and to discuss what these and other findings imply for policies and investment programs. The paper is based on published and "gray" literature and will be followed up with fieldwork in the region.

Accounts from the early 20th century provide evidence for a high level of agricultural intensification and widespread use of soil and water conservation (SWC) practices in the Kigezi highlands, including mixed cropping and crop rotations using legumes, a good vegetation cover on plots, minimum tillage, avoidance of steep-sloping areas, trash lines along the contour, and use of forward-sloping terraces. These practices led to a dynamic mosaic of terraces in the hilly landscape. Colonial administrators and visitors to Kigezi in the 1930s and 40s appear to have agreed that there were mild degrees of soil erosion and soil fertility depletion in the area, which caused yields to fall. They believed the proximate causes to be a shortage of land for rotational fallowing, livestock grazing on hill slopes and growing livestock numbers, and the cultivation of steep hillsides without adequate terracing. Rapid population growth in the context of "overpopulation" was seen as the major underlying cause of degradation. Nevertheless, most observers at the time also did not find that soil degradation in Kigezi was a "serious problem" or that a catastrophe was imminent to Kigezi agriculture from this cause.

There is no doubt that human activities have profoundly changed land cover in the Kigezi area during the last one or two centuries. Remotely sensed land cover data from the early 1990s show that small scale farmland covers 57% and 68% of the land area in Kabale and Kisoro districts respectively, while natural forests (excluding woodlots and plantations) cover only 2.0% of Kabale and 16.3% of Kisoro. People in the region have clearly expanded and intensified agricultural land use in response to increasing population densities and market opportunities, but it is much less certain how, where, and when intensification and expansion of land use have occurred, and what the consequences have been for soil quality and biodiversity. It is also important to note that changes in soil quality cannot be directly inferred from changes in land use and land cover; yet no study known to this author has

measured long-term changes in soil quality in the area. Even less known are the social and economic effects of land use system changes.

Despite the widespread belief that soils and vegetation are degrading in the Kigezi highlands, only a few studies have actually attempted to measure the longer-term changes in land use and land cover in the area. Only two among those apply "objective" measurement methods: one aerial photography and ground truthing, the other a resurvey in 1996 of transects done in 1945. These studies reveal interesting changes in the pattern of land use in Kabale District since the 1950s. The total size of farmland (fallow and cultivated) only increased significantly in one of the three surveyed areas, while in the other two the expansion of upland farmland had stopped already by the 1950s due to the lack of available land. The most apparent change in land use is the conversion of papyrus swamps into fields and pastures, especially in areas where all upland areas had already been converted into farmland in the 1950s. Where grassland, bushland and woodlands were covering important areas in the 1950s, these land cover types were converted into small-scale farmland and planted woodlots. This suggests that farmers tend to expand production first into upland areas and thereafter into wetlands, possibly because of the significant work involved in draining swamps. Another clear trend in the surveyed areas was the increase in woodlots, which were planted mainly on the steepest hillsides. There was also a significant increase in fallow land around Kabale Town, and in the average length of fallowing. The increase in fallow was more pronounced on the steepest slopes, where it tended to replace land hitherto grazed by local breeds of cattle. Interestingly, in spite of these changes, farmers in the area were convinced that fallowing in the area had decreased and not increased. The major land use and land cover changes in Kabale District between the 1950s and 1990s can thus be summarized as:

Bushland, woodland, and grassland on hillsides	→	Farmland and woodlots
Papyrus swamps in valley bottoms	→	Dairy pastures and cropland
Grazing land on steep slopes	→	Fallow and woodlots
Short (seasonal) fallows on hillsides	→	Longer fallows on hillsides

Amid these changes, the precolonial system of down-sloping terraces and drag-down hoeing, which sometimes entails "harvesting" the soil accumulated on the upper-side bunds, continues to this day. It causes a significant soil fertility gradient between the upper and lower part of the terrace, and a slow movement of particles and nutrients down the hill slope – that is, a relocation of soil resources within the landscape rather than their transport out of the area. High rainfall infiltration rates, well-structured soils, SWC techniques, and fallowing on the steepest slopes all contribute to reducing soil erosion. Several studies in the area have thus found relatively low rates of physical soil erosion; yet recent research suggest that especially the upper parts of terraces suffer from very low soil nutrient status and very low yields.

The rhetoric on soil degradation in the Kigezi highlands almost invariably paints an image of imminent disaster, and has done so since the first colonial agricultural officers arrived in the 1940s, despite much scientific uncertainty on this issue. Indeed, many of the changes in land cover and land management since the 1950s described here cannot be said to promote or constitute instances of soil erosion or soil nutrient depletion. Some even suggest a positive change in land management. This is not to say that the conditions or productivity of natural resources has improved, or that low soil productivity is not a problem in the area. However, there is little if any hard evidence to support the widely held view that population growth during the last 50 years has caused farmers to degrade soils through the effects of diminishing fallow and inappropriate farm practices.

Instead, one could argue that farmers have changed their land management practices in response to increased land scarcity in several positive ways, and/or intensified the use of existing practices. There has been an increase in intercropping and in market-oriented tree cultivation on fragile lands. Population pressure has also induced the reclamation of papyrus swamps for year-round production of dairy and vegetables for the market, and sweet potatoes, which is important for food-security, thus increasing private economic benefits from wetlands (although at the cost of biodiversity). Livestock rearing has declined due to diminishing upland grazing land. This change is positive in environmental terms, but may have had negative effects on local livelihoods. There was a pronounced increase in fallowing, but the reasons for it are debated. Some believe that more fallow is a consequence of soil degradation that renders some lands unsuitable for cultivation. Others see the phenomenon as a positive adaptation to increased population pressure, whereby farmers reallocate crop cultivation to less erosion prone lands while increasing yields on cultivated land through intercropping. It is also unclear whether "more fallow" is found also outside the Kabale Town area, or whether it is a localized phenomenon related to, as some think, favorable off-farm employment opportunities in Kabale Town combined with land abundance among a few wealthier farmers, a higher rate of government and absentee land ownership, or other factors. Such knowledge gaps show a need to study land use dynamics at a smaller scale and in a regional socio-economic context.

What then are the implications of the above discussion for policies and investment programs aimed at promoting sustainable development in the southwestern highlands of Uganda? First, if soil degradation is less of a problem than first thought, and if farmers to a large extent are able to deal with that problem without expensive outside support, then it should be considered to allocate more of the scarce public funds to activities that more directly improve agricultural productivity and incomes. This in turn would provide farmers with both the means and incentives to invest in soil conservation. Second, when designing land management programs and policies, it is essential to understand that the amount of labor and capital farmers are willing to invest in their land depends on their access to alternative economic opportunities, particularly off-farm employment.

Thirdly, it is increasingly recognized that economic incentives are of key importance to the sustainable management of land resources. In the absence of tangible, private benefits, regulation, persuasion, and training are unlikely to produce significant results. In the Kigezi highlands the prospects for improving incentives based on market production and agroprocessing seem promising as the area enjoys relatively good access to markets and (mainly male) labor resources. While most attempts to introduce nonfood cash crops such as coffee, tobacco, pyrethrum, and flax into the area have largely failed, Kigezi farmers have successfully produced and marketed food crops such as beans and maize in the region for at least a century. These traditions and skills should be made use of when promoting market-led agricultural development.

Fourthly, Kigezi farmers seemingly good track-record of adapting to pressures on land resources supports the increasingly accepted idea that land management research and development programs are more likely to succeed if they integrate the knowledge, experience and innovative capacity of farmers into their activities. The improved technologies and practices developed during such an approach would also need to be sufficiently flexible to accommodate the great diversity of farmers' preferences, skills and access to land, labor and capital resources. There is also a remarkable spatial variability in land use and land degradation within the Kigezi highlands, which must be taken into account by programs and policies.

Land Use Change And Soil Degradation in the Southwestern Highlands of Uganda

Introduction

The objectives of this review paper are to examine land use and soil degradation in the southwestern "Kigezi" highlands of Uganda (Kisoro and Kabale districts); to present some recent research findings that appear to challenge conventional views on land degradation and land management in that region; and to discuss what these (and other) findings imply for policies and investment programmes that seek to improve land management and reduce poverty in that region. The review is to strengthen the empirical and methodological basis of IFPRI's Framework for the Assessment of Strategic Land Use Options for Uganda with respect to land management and livelihood interventions in southwestern Uganda - defined here as encompassing the districts of Kabale, Kisoro, Kanungu, Rukungiri, Bushenyi, Kasese, and Ntungamo.[1] This framework is being developed with support from USAID/Uganda in the context of the Mission's new Strategic Objective 7 "Expanded Sustainable Economic Opportunities for Rural Sector Growth". The paper is based on secondary published and "gray" literature and data; survey data from the "Policies for Improved Land Management in Uganda" project; and fieldwork in the region using key informant and group interviews.

Land Management in Precolonial Kigezi

One set of studies (cited in Carswell, 2000:2; Farley, 1996:79, 179-8) documents settlement and environmental change in precolonial times (i.e., before 1913) using methods such as pollen records and linguistic and archaeological evidence. The original[2] natural ecosystems in the area were characterized by a forest-savannah mosaic in most of the medium altitude areas, moist lower montane forests at the higher elevations, and papyrus swamps and mixed grasslands in the wetland ecosystems of the valley bottoms (Farley, 1996:79). Clearing of forests for crop cultivation and livestock grazing started as early as 2,200 to 4,800 years ago,

[1] Other studies done within the IFPRI land use options framework that focus on southwestern Uganda include: Nkonya (2001), Raussen et al (2002), Pomeroy et al (2002), and Baldascini (2002).
[2] Original does not necessarily imply a static condition. Also ecosystems undisturbed by man may well change and due to disturbance arising from natural factors such as climate.

and permanent settlements, normally associated with rotational fallow-type agriculture (as opposed to shifting cultivation by mobile groups) appear to have been established already around 2000 years ago (Carswell, 2000:2; Farley 1996:1997). Human impact on the environment thus has a very long history in the SW highlands, although we do not know the details of the spatial and temporal patterns in land use and land cover before the early 20th century when European explorers' and colonial administrators' written records become available. Precolonial patterns of land cover did not necessarily followed a linear trend towards more farms/grasslands and less natural vegetation but may well have fluctuated significantly in response to variable demographic, climatic and land management (e.g. the use of fire) factors.

Land Cover and Land Use in the Early 20th Century

Written accounts and photographs (examined in Carswell, 1997) from early in the 20th century suggest that there was a very small forest cover in most of Kigezi District already at that time, although some forests did remain. Accounts from the early 20th century provide evidence for a high level of agricultural intensification and widespread use of soil and water conservation (SWC) practices, including: mixed cropping and crop rotations using legumes, which (whether this was intended or not) help to preserve soil fertility; a near-continuous vegetation cover on plots; fallowing; minimum tillage and broadcast planting; avoidance of steep-sloping areas; thrash lines along the contour, and most significantly perhaps, the use of forward-sloping terraces laid out on the hill slopes in an continuously changing mosaic (Critchley 2000: 158; Carswell, 2000:6; Farley 1996:129). Observations made in the 1930s by the District Agricultural Officers suggest that the cultivation frequency was high: plots were cropped twice a year for 4-5 years on average before being laid fallow, while fallows were intensively grazed by livestock (Carswell, 2000:7). In some areas fallows were almost absent, there was little land left for expansion, and the grazing areas were diminishing. The average household cultivated around 6 acres of land.

Among the indigenous SWC practices mentioned above, the forward-sloping terraces have received most attention from outsiders. This terrace-type, which is a common tradition in Africa and Asia, is less elaborate and less labour intensive than for example bench terraces, and it is less permanent. The forward-sloping terraces used in southwestern Uganda, and further developed in the 1940s under colonial policies, were formed by laying out discontinues lines of elephant grass, fallow strips, trash lines, and earth ridges along the contour which, in combination with "drag-down hoeing" (Critchley 2000:157-9; Carswell, 2000:6-7; Farley, 1995:128-9), lead to the formation of low earth bunds along the contour and the build-up of rich soil at the bottom of each plot, and thus a pronounced fertility gradient from top to bottom (Critchley 2000:157-9). To spread the built-up fertility behind/on the bunds, and to avoid the collapse of bunds not planted with grass, farmers periodically broke up these bunds and formed new bunds in between the previous ones.[3] In aggregate these practices led to a dynamic mosaic of terraces on the hill slopes and the slow movement of soil particles and soil nutrients down slope (Ibid.). Soil fertility and physical stabilization is not the only advantage of down sloping terraces; high levels of soil water immediately above the bund, due to concentration of run-off, reduce the risk of total crop failure in years of low rainfall (Critchley 2000:159). Soil moisture conservation thus seems to be a key function of down-sloping terraces in Kigezi, but is one which is rarely mentioned (but see Ellis-Jones and Tengberg, 2000:20).

Population Growth in 20th Century Kigezi

Colonial population estimates (based on small-sample surveys) support to some extent the view that intensive agriculture was practised already in the early 20th Century. In 1921 the population of Kigezi District was 206,090 (39 persons/km^2) and in 1931 226,080 (43 persons/km^2). Population densities are likely to have been significantly higher in the southern highlands (Kabale and Kisoro districts) and lower in northern Kigezi (Rukungiri and Kanungu districts), which is also the situation today.[4] Table 1 shows the steady increase in population density up through the 20th century, for Kigezi District and the Kigezi highlands respectively. In the latter area, there were around 140 people per square kilometer already by 1950, and fifty years later almost three times as many. This compares with an average population density of 114 persons/km^2 for Uganda as a whole in 2002. The high population densities in the Kigezi highlands are related to a long history of immigration,

[3] It is not clear if the breaking up of bunds took place before the colonial interventions, or, as suggested by Critchley (2000:157), whether the too-high vertical interval between the bunds prescribed by the colonial bye-laws was the cause of the extreme fertility gradient and pressure on bunds, which induced farmers to break the bunds. The latter seems unlikely, though.

[4] According to a report in 1945 by the DAO, John Purseglove, the population density of Kigezi District as a whole was 60 persons/km2, reaching 81 persons/km2 in Ndorwa, one of the southern *sazas* (Carswell, 2000:11).

mainly by the agricultural Bakiga from Rwanda, presumably as a result of favorable conditions for agriculture in the area (Carswell, 2000:2; Critchley, 2000:156). Immigration in recent decades has been negligible, however: in 1991, only 12,000 people residing in Kabale/Kisoro were born outside the area (Ministry of Finance and Economic Planning, 1995). Instead, many people have moved from Kigezi to less densely populated areas. In 1991, 320,000 people born in Kabale/Kisoro districts thus resided in other, less populated districts, mainly in western Uganda (Kabarole, Mbarara, Hoima, Rukungiri, Bushenyi, and Mubende, in order of importance) (Ibid.). (This is more than half of the 1991 population of 603,899 people in Kabale/Kisoro districts. Recent population growth in Kigezi is therefore associated with high Total Fertility Rates (7.99-8.35 in 1993; Farley, 1996:95) combined with improved health conditions.

Table 1. Changes in Population Density in Kigezi, 1921 - 2002

Year	**Population Density in Kigezi District**[1] *Persons/km²*	**Population Density in Kigezi Highlands**[2] *Persons/km²*	**Population Density in Uganda** *Persons/km² land*[7]
1921	39[3]	NA	
1931	43[3]	NA	
1948	76[3]	139[4]	
1959	94[3]	NA	
1969	122[5]	164[5]	48[5]
1980	141[5]	185[5]	64[5]
1991	187[5]	246[5]	85[5]
2002	295[6]	392[6]	114[6]
2010	386[6]	518[6]	138[6]

Notes: [1]Kigezi District is comprised of present-day Kabale, Kisoro, Rukungiri and Kanungu districts. Population densities are computed based on the total area of these districts. [2]Kabale and Kisoro districts (Southern Kigezi District). [3]Own calculations based on absolute population numbers for Kigezi District reported in Carswell (2000:2). [4]In 1943, according to Purseglove (1946), cited in Farley (1996:168). [5]Census data, Ministry of Finance and Economic Planning (1995). [6]Based on projections made by Ministry of Finance and Economic Planning (1995). Average annual population growth rate in 1980-91 was 2.51% in Rukungiri District, 2.17% in Kabale District, and 3.53% in Kisoro District (Ministry of Finance and Economic Planning, 1995:199). The growth rates increased compared with the 1969-80 period. [7]Total Uganda land area is 204,638.3 km^2 (excluding 'open water').

Establishment of the Myth of Population-Induced Soil Degradation

Colonial administrators and visitors to Kigezi in the 1930s and 1940s held divergent views to the extent and seriousness of soil degradation in the area. Most observers, it appears, agreed that the area *did* suffer from some degree of soil erosion and soil fertility depletion, and, as a result, falling yields (Carswell, 2000:5-11; Critchley 2000:157-9). The immediate causes were seen to be continuous cultivation / lack of land for rotational fallowing, livestock grazing on hill slopes and the growth in livestock numbers, and the cultivation of steep hillsides. Rapid population growth in the context of "overpopulation" was seen as the major underlying cause. But most observers also did *not* see soil degradation in Kigezi as a "serious problem" or thought that a "catastrophe was imminent to Kigezi agriculture from this cause" (Carswell, 2000:7,11). Many even recognized the effectiveness of indigenous practices in controlling soil erosion (Carswell, 2000:6, 9). The first study of soil quality in the area was done in 1945 and lent little support to the view that soil erosion or soil nutrient depletions were problems in the area. It examined 24 soil samples from heavily cultivated hillsides in Kigezi District (Martin 1945, cited in Farley 1996:168-9). The study revealed "a mean pH of 6.7, indicating that the soils were well supplied with bases (i.e., macronutrients) … and that the soils were well-aggregated with good, stable structures – although the soils in the plots that had been cultivated for a number of years did exhibit signs of some deterioration… Finally the study reported that in the Kabale area the soils are very permeable to water and the rainfall intensity is low so that very steep slopes can be cultivated without much danger" (Ibid.).

The First Anti-erosion Programme in Kigezi

Interestingly, then, the first anti-erosion programme in Kigezi in the late 1940s does not seem to have been put in place because of a belief (and certainly not because of hard evidence) that the area *currently* suffered from serious soil erosion, but rather the *expectation* that rapid population growth would surely cause soil degradation unless something was done. This conviction (or narrative) was nourished by the general focus (by colonial staff) on soil degradation in Eastern and Southern Africa, starting in the 1930s (Carswell, 2002a:4). It was based on the assumption that Kigezi farmers would be unable to adapt their practices to increased population pressure, an assumption which in somewhat contradicted by some of the same administrators' statements that these farmers had actually developed relatively efficient soil conservation practices as a response to population growth. Curiously, the belief, unsubstantiated by hard evidence and contradicted by the history of the land use system in place, that population growth would surely result in soil erosion in Kigezi led to the launch of a widely implemented and highly praised soil conservation programme in 1946, led by John Purseglove who was the DAO in Kigezi in 1944-53. Grace Carswell (1997; 2000) has written extensively about this programme, which was dubbed the "The New Plan" or *plani ensya* in Ruchiga.

The key element of the programme was the introduction of mandatory system of alternate strip cropping, bunding, and more "organized" fallowing. The scheme was "legally" based on a set of 15 Agricultural Rules (which much later were revised and endorsed as the 1961 Kigezi Bye-Law) that specified SWC measures such as the dimensions and spacing of bunds and strips, fallow lengths, and the use of trash lines, as well as rules to control for cattle grazing, grass burning, tree planting, and swamp reclamation (Carswell, 2000:13; Critchley 2000:157; Farley, 1996:124-8). These rules were enforced by the local courts as well as the local chiefs (Carswell, 2000:13). The SWC scheme was implemented through a mixture of well-attended and well thought-out educational campaigns, innovative "soil conservation" competitions, and a considerable measure of coercion (fines and imprisonment) made possible by a hierarchical system of powerful chiefs (Carswell, 2000). The programme was a political success for the local colonial administration, in the sense that farmers implemented its key elements without much resistance, contrary to most other such programmes in Eastern and Southern Africa. It also resulted in a more "orderly-looking" landscape, which pleased the eye of European planners (i.e., it resembled a European agrarian landscape): the traditional, dynamic, and (for Europeans) chaotic *mosaic* of fields and discontinuous bunds on the hillsides was transformed into a more permanent "*geometric pattern* of terraces and vegetation-bordered plots" (Farley 1996:127; Carswell, 2000).

One of the key causes of the success of Purseglove's programmes, according to Carswell (2000), was the fact that the introduced SWC measures and practices were only slight modifications or adaptations of existing practices. Moreover, the programme was flexible enough to abandon programme elements that did meet local resistance because they implied major changes in land use or land tenure. The high rate of implementation of the program's SWC technologies can be attributed to Purseglove's great wisdom and appreciation of local conditions and practices, but also to the fact that the system had already reached a high level of intensification, which is the same as saying that farmers were already accustomed to labour intensive methods using relatively elaborate SWC techniques (Farley 1996:129; Carswell 2000). Indeed, it appears from Carswell's analysis that Purseglove's programme had transformed the landscape into European orderliness in the course of only three years (1946-49)! One explanation for this remarkable (if not unbelievable) achievement is that farmers had already begun to adopt the "improved" practices well before the start of the programme (Carswell, 2000).

If it is true that the key to the program's success was that it to a large extent replicated existing practices (Farley 1996:129), then one could also suspect that it made a very little difference in technical and agronomic terms. The programme clearly streamlined and coordinated the construction of down-sloping terraces, but it is unclear if this spatially more orderly terrace pattern controlled soil erosion more effectively than the indigenous mosaic-pattern terraces. The implementation of Purseglove's New Plan may thus resemble the fairy tale "The Emperors New Clothes" by H.C. Andersen. The programme also appears to have intensified and slightly modified existing patterns of labour use in terracing and other SWC measures. This shift in resource allocation might well have had a negative impact on the economy of many households, in so far as the same rules for farm-level labour investments applied to all farmers irrespective of their individual resource endowments, skills, preferences, and access to nonfarm employment. A more positive view of the programme is that it was a case of "collective action", which coordinated (and possibly improved) individual SWC practices and so increased the aggregate impact of these practices at the landscape level. This and other possible socio-economic costs (such as increased economic and gender-based inequality) and benefits of soil conservation interventions and policies in the area are poorly understood (Carswell, 2000:23).

Land Use and Land Cover Patterns in the 1940s and 1950s

The first systematic survey of land use and land cover in Kigezi was carried out by J.W. Purseglove in 1945 within a 20 km radius of Kabale town (Lindblade et al, 1998:566): "Purseglove systematically selected 14 transects (totaling approximately 52 km) within the populated area. Along each transect he measured the length of all plots traversed and recorded the primary and secondary uses of the field along with the slope; he estimated the length of time that fallow plots had been left to rest from the types of weeds growing in that field". The transects generally covered the entire slope of a hillside, from the valley bottom to the summit. Purseglove's survey gave the following distribution of land use on the transects, confirming that land use in the area was dominated by intensive agriculture (Ibid.:567): cultivated 51%, fallow 19.4%, grazing 15.4%, trees 4.1%, swamp 7.4%, bush 1.1%, and non-cultivable 1.8%. In terms of the length of fallowing, 49.6% of fallow plots had rested 6 months or less, 28.3% between 6 and 12 months, 13.2% between 1 and 2.5 years, and 4.8% more than 2.5 years (4.1% were not estimated). In 1996 Purseglove's transects were resurveyed by Lindblade, Carswell, and Tumuhairwe. We shall return to the results of that study in the next section.

Aerial photographs taken in July 1954 constitute the earliest accurate remotely sensed imagery of southwestern Uganda. The scale of the photos is approximately 1:30,000. Dust/haze and shadows on west facing slopes limit somewhat their quality and reduces the contrast between land cover classes (Breyer et al, 1997). Based on analysis of these photographs, Breyer et al (1997) mapped the land use cover for Katuna and Mpalo watersheds in Kabale District, situated immediately south and north east of Kabale town respectively. The analyzed areas in the two watersheds cover 12.8 % of Kabale District or 9.4% of southern Kigezi (Katuna is 128.8 km2 and Mpalo 104.3 km2). Their results, presented in Table 2, corroborate those reported by Lindblade et *al* (1998) – although the latter are based on observations made a decade earlier – and show that in Katuna "in the 1950s almost all suitable farmland was converted into *Small Scale Farmland (As)* [75.4% of the area] while *Grassland (G), Plantation & Woodlot (Tp)* and *Woodland* and *Bushland (Tw)* remained in the marginal and remote areas" (Breyer et al, 1997: 24; italicized words refer to the land use cover classes defined by the study [p.17-19]). *Permanently Flooded, Herbaceous Wetland (Sph)* was the second most important type of land use cover in Katuna, covering 12.6% of the watershed. The same pattern is to some extent repeated in the Mpalo watershed, with the significant difference that here *Small Scale Farmland* covered a smaller area (45.5%) while *Woodland* and *Bushland (Tw)* is the second most important land use cover type (27.2%). This difference in the relative importance of farmland and wood/bushland corresponds to differences in population densities and cultivation intensities and histories between the two areas. This is important to bear in mind when analyzing patterns of land use cover changes in different areas *within* the southwestern highlands.

Table 2: Land Use Cover Distribution in Katuna and Mpalo Watersheds, Kabale District, 1954

Land Use Cover Class	**Katuna** *% of area*	**Mpalo** *% of area*
Small Scale Farmland (in dryland areas)	75.4	45.5
Permanently Flooded, Herbaceus Wetland	12.6	6.1
Grassland	6.7	19.1
Plantation & Woodlot	2.6	2.1
Woodland and *Bushland*	1.7	27.2
Large Scale Farmland (in dryland areas)	0.7	0.0
Other	0.2	0.0

Source: Breyer et *al* (1997:21,24)

Changes in Land Use and Land Cover 1950-2000

There is no doubt that human activities in southwestern Uganda have profoundly changed land cover in southwestern Uganda over the course of the last one or two centuries, and even earlier than that. Remotely sensed land use cover data from the early 1990s, acquired and analyzed by the National Biomass Study (1996), shows that (mainly small scale) farmland covers 57% and 68% of the land area (i.e., excluding lakes) in Kabale and Kisoro Districts respectively, while natural forests (excluding woodlots and plantations) cover only 2.0% of land in Kabale District and 16.3% of Kisoro District (Raussen et al, 2002). It is also beyond doubt that people in the region have expanded and intensified their agricultural and pastoral land use systems as a response to increasing population densities and market opportunities (Carswell, 2002b). What is much less certain is how and where, and in which periods intensification and expansion of land use have occurred, and what the consequences have been for soil quality and biodiversity. Even less known are the social and economic consequences of the restructuring of land use systems. Also, in the following discussions, it is important to note that changes in soil quality cannot be directly inferred from changes in land use and land cover. No study known to this author has attempted to measure long-term changes in soil quality in southwestern Uganda.[5]

Despite the widespread beliefs that soils and vegetation are degrading in the southwestern highlands, only very few studies have actually attempted to measure the longer-term changes in land use and land cover in the area. These studies have focused on what used to be the southern part of Kigezi District (Kisoro and Kabale districts), and within this area, on the area around Kabale Town. (Until 1974 Kigezi District encompassed the area now covered by Kisoro, Kabale, Rukungiri and Kanungu districts.) Only two of these studies rely on "objective" methods to measure land use change. The study by Breyer et *al* (1997) used aerial photography and ground truthing to detect land use cover changes between the 1950s and 1990s in two watersheds in Kabale District. The applied land use cover classification, which follows the National Biomass Study (1996), placed cultivated land and fallow land in one class (*Farmland*) and hence did not allow for an assessment of changes in fallowing. It is also worth mentioning that the study did not relate land cover to relief or altitude and hence did not examine changes in land use for some important dimensions of the landscape, notably the distribution of land use by slope gradient.[6] The other study detected land use cover change in a 20 km radius around Kabale Town by resurveying in 1996 the transects done in 1945 by John Purseglove (Lindblade *et al*, 1998). Neither study covered any of the tropical high forests in the region and so does not measure changes in natural forest cover.[7] The few other studies on long-term land use and land cover changes rely on oral records, e.g. Farley (1995: 213).

Table 3 and 4 show changes in the distribution of land use in Kabale District, as assessed by Breyer et *al* (1997) and Lindblade *et al* (1998). In the **Katuna** watershed in the southern part of Kabale District, Breyer et *al* (1997) found a significant conversion of *Wetland* into *Small Scale Farmland*, while there was no change in the *Farmland* cover in dryland (upland) areas (Table 3). The share of *Plantation & Woodlot* had increased slightly

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[5] Ssali (2001) reports on a resurvey in 2000 of the soils of 149 fields first surveyed in the 1960s in seven districts in Central and Eastern Uganda. Unfortunately this study does not cover southwestern Uganda.

[6] Yet, since wetland vegetation is always found in valley bottoms it is possible to distinguish between the latter and uplands. Since detailed topographical electronic maps exist for southwestern Uganda, one could fairly easily analyze land use cover change by slope using the data generated by Breyer et al (1997).

[7] The Center for the Study of Institutions, Populations, and Environmental Change (CIPEC) of Indiana University and Uganda Forestry Resources and Institutions Center of Makerere University are at the time of writing doing a time series analysis of land/forest cover change at the local and meso scales in central and western Uganda, using MSS and TM satellite imagery from the early 1970's, 1986, 1995, and 2001. These images will be geo-rectified to the 1:50,000 scale GIS coverages created by the NBS. The University of Maryland and the Wildlife Conservation Society monitoring land cover in the Albertine Rift.

by 2.8%. In the **Mpalo** watershed north of Kabale Town, there was a significant decrease in the share of *Bushland and Woodland* (13.2%) and *Grassland* (8.9%). These classes had been replaced by *Small Scale Farmland*, whose share increased by 13.0%, and by *Plantation & Woodlot*, which increased by 8.2%. In contrast to the situation in Katuna, there was only a small decrease in the share of *Wetland* (1.6%), which now occupies 4.5% of the area.

Table 3: Changes in Land Use Cover Distribution in Katuna and Mpalo Watersheds, Kabale District, 1954 to early 1990s

Land Use Cover Class	**Katuna** *LUC area % change*	**Mpalo** *LUC area % change*
Small Scale Farmland (in dryland areas)	0.0	13.0
Small Scale Farmland (in wetland areas)	10.3	1.6
Permanently Flooded, Herbaceous Wetland	-12.4	-1.6
Grassland	-2.1	-8.9
Plantation & Woodlot	2.8	8.2
Woodland and *Bushland*	-1.4	-13.2
Large Scale Farmland (in dryland areas)	-0.1	0.3
Large Scale Farmland (in wetland areas)	1.8	—
Other	1.2	0.4

Source: Breyer et *al* (1997: 23,27)

Lindblade *et al.* (1998) found that the share of tree cover had increased by 5.1% (doubled) between 1945 and 1996 and that the grazing area had decreased by 6.1% (Table 4). They also found a total conversion of swamps into cropland and pasture. The area covered with cultivated and fallow land, corresponding to Breyer et *al* (1997)'s *Farmland* class, increased with only 4.5% (from 70.4% to 74.9%). However, Lindblade *et al* also found a significant increase in the share of land under fallow (12.2%), and an increase in the average time fields were fallowed from 9.4 months to 14.2 months (for example, the share of the fallow land rested between 6 and 12 months increased from 28.3% to 68%, whilst the share of seasonal fallows – i.e. land rested 6 months or less – declined from 49.6% to 5.1%). They define fallow as "land which had been cultivated at some point although was not currently used for crops or trees and was not being systematically grazed" (Ibid.:568).

Table 4: Distribution of Land Use on 14 (51 Km) Transects in a 20 Km Radius of Kabale Town, Kabale District, in 1945 and 1996.

Land Use Class	**1945** *Percent of total transects*	**1996** *Percent of total transects*	**Change in % LU Distribution 1945-96**
Cultivated	51.0	43.3	- 7.4
Fallow	19.4	31.6	12.2
Grazing	15.4	9.1	- 6.3
Trees	4.1	9.2	5.1
Swamp	7.4	0.0	- 7.4
Bush	1.1	0.3	- 0.8
Non-cultivable	1.8	6.5	4.7

Source: Lindblade et *al* (1998:567)

The survey by Lindblade et *al.* (1998) also examines the distribution of different land uses by location on the hillsides (including the valley bottoms), thus revealing spatial reallocations of land use that might influence land degradation (Table 5). Their analysis shows that trees and fallow have largely replaced grazing on the steep, back slopes of the hillsides. In 1996 woodlots occupied 27.4% of the steepest slopes (over 20°) as compared to only 7.1% in 1945, while the share of fallow land in the same location increased from 14.6% to 38.0%. Grazing areas on the steepest slopes (over 20°) decreased from 47.3% to 6.5%. The latter corresponds to a general decrease in the numbers of local cattle breeds, and a relocation of pastures to the now-drained swamps in the valley bottoms. The ownership of these lowland pastures is concentrated on a few farmers, many of which use them to graze exotic species of dairy cattle. The increase in fallowing and fallow length occurred unevenly in the different locations on the hillside. The largest increase in the share of fallow thus occurred on the steepest slopes (23.4%: from 14.6% to 38.0%), while the share of fallow increased with 11% on the 0-15° slopes and 5.9% on the 16-20° slopes. In 1996, Lindblade et *al.* (1998) also found an increasing length of fallow as slope increases.

Table 5: Distribution of Land Use By Slope and Year of Survey: A Comparison of the Transects Conducted in January 1945 and 1996, Kabale District, Uganda

Land use category	0 to 15 Degrees		Over 20 Degrees	
	1945 %	1996 %	1945 %	1996 %
Cultivated	57.9	48.0	25.9	26.8
Fallow	19.0	30.0	14.6	38.0
Grazing	5.9	9.7	47.3	6.5
Woodlots	3.6	2.9	7.1	27.4
Bush	0.4	0.0	4.5	1.3
Wetlands (intact)	11.1	0.0	0.0	0.0
Non-cultivatable	2.1	9.3	0.5	0.0
Length of slope category (m)	3449	3595	955	779

Source: Lindblade et *al.* (1998:568)

Summary

Which general pattern of land use change in Kabale District over the last 50 years can be detected from the above two studies? The total size of farmland (fallow and cultivated) only increased significantly in one area, while in the other two *the expansion of farmland in the upland areas had stopped already by the 1950s*, due to the lack of available land. The most unambiguous trend was the *conversion of papyrus swamps into fields and pastures*. This conversion was more pronounced in the areas where all upland areas had already been converted into farmland in the 1950s. In the areas where grassland, bushland and woodlands were covering important areas in the 1950s, these land use classes were converted into small-scale farmland and planted woodlots. These findings suggests that farmers tend to expand production first into upland areas and thereafter into the wetlands, possibly because of the significant work involved in draining swamps. Another clear trend in all areas was the *increase in woodlots*; and in the 20 km radius around Kabale Town for which such information exists, the steepest hillsides saw the largest increase in woodlots. Finally, also around Kabale Town, there was a *tremendous increase in the size of fallow land* as well as in the average length of fallowing. As in the case of woodlots, the increase in fallow areas was more pronounced on the steepest slopes, where they tended to replace land hitherto grazed by local breeds of cattle. Particular interesting in this regard is that all farmers interviewed by Lindblade et *al.* unanimously stated that fallowing in the area had decreased, and not increased as shown by the survey. The reasons for the increase in fallowing are debated. Some believe that more fallow is a consequence of soil degradation and the loss of arable land to farmers (Critchley, 2000:160). Others see the phenomenon as a positive adaptation to increased population pressure (Lindblade et *al.*, 1998). According to this interpretation, farmers reallocate crop cultivation to less erosion prone lands, and increase yields on cultivated land through intercropping practices thereby releasing space for soil fertility restoration through fallowing (Grisley and Mwesigwa, 1994). The latter argument, however, has been challenged by Siriri et al (2002) who found that grass fallows, the most common fallow practice, has no discernible effect on soil fertility. It is also unclear whether "more fallow" is found also outside the Kabale area, or whether it is a very localized phenomenon, e.g. related to favorable off-farm employment opportunities in Kabale Town and farm work for wealthier farmers (which would reduce time for cultivation), combined with land abundance among a few wealthier farmers who have sufficient land to use fallow as a soil fertility strategy. This indicates a need to study land use dynamics at a smaller scale and in a regional economic context.

Figure 1: Major Land Use / Cover Changes in Kabale District 1950s – 1990s

Bushland, woodland, and grassland on hillsides	→	Farmland and woodlots
Papyrus swamps in valley bottoms	→	Dairy pastures and cropland
Grazing land on steep slopes	→	Fallow and woodlots
Short (seasonal) fallows on hillsides	→	Longer fallows on hillsides

Soil Nutrient Depletion and Soil Erosion in Contemporary Kigezi

Soil Erosion

Site-specific, short-term measurements show relatively low rates of physical erosion in the Kigezi highlands. A laboratory study outside Kabale town found soils from the area "to be well aggregated with stable structure and high organic matter levels, and … particularly resistant to erosion" (Magunda, 1992, cited in Carswell, 2002:16). Martin (1944), cited in Farley (1996:168-9), came to similar conclusions 47 years earlier. Tukahirwa (1995) measured rill and interrill (sheet) forms of soil erosion on experimental plots cultivated with sorghum (using smallholder practices) on three adjacent hill slopes near Kabale town. In 1994 soil losses were 1.4, 38.3, and 19.4 tons/ha/year on the 10%, 25% and 45% slopes respectively, and run off was 6.3, 18.4 and 13.8 mm/ha/year. These are very low values in a tropical African context. Low erosion and run off were related to low rainfall erosivity (1049 MJ ha/hr/year) (gentle rainfall), very high infiltration rates (2021 mm/hr and 1637 mm/hr on the 10% and 25% slope respectively), and low soil erodibility due to a favorable soil mineralogy, a stable soil structure, and a high organic matter content (5-10%). Aside rainfall and slope, she also found that surface cover (density of sorghum plants) greatly influenced erosion rates. Field observations made by Farley (1996:170) in Kabale and Kisoro districts largely confirm these findings.

While reducing rill and interrill forms of soil erosion at the landscape level, the system of drag-down hoeing on forward sloping terraces appears to severely reduce the physical quality of soils on especially the upper parts of terraces, which constitute a sizeable part of the total cultivated area in Kigezi. Siriri et al (submitted) thus found important micro-spatial variations in soil physical properties on 30 bench terraces in Kabale District cultivated with sorghum by smallholders. The upper section of the terraces were characterized by high bulk density, high clay contents, and low water conductivity. The effect of these properties on crop growth is retarded root penetration that limits the ability of crops to explore the soil mass for nutrients and water. The authors thus found that on the upper 40% of the terrace bench, crop growth was mainly influenced by bulk density, clay fraction, and organic carbon. Limited soil depth due to soil movement down slope also characterized the upper slopes. Unfavorable soil physical properties, constraining especially water uptake, were thus the most important factor explaining the much lower sorghum yields on the upper part of the terrace bench: the upper 40% contributed with only 12% of the total yield, while the lower 40% contributed 72%. On the lower part of terraces, soil potassium and phosphorous were the most limiting soil factors to crop performance. There were no significant differences at the landscape level between the five transects studied.

Mass soil movements, whether or not caused by human activity, is a potentially important but little researched form of soil erosion in the Kigezi highlands. The same characteristics (highly permeable clay loams) that make soils in Kigezi resistant to rill and interrill erosion, unfortunately also appear to make the hillsides prone to land slides and mud flows during the rare intensive rainstorms in the area (Tukahirwa, 1995:161). Bagoora

(1988) measured the incidence of landslides in four areas in one sub-county in Kabale District and concluded that erosion was a serious problem in the area. This study, however, has been criticized for over-generalizing its results based on a small and purposively selected sample (Carswell, 2002:16).[8] The area is also prone to localized source-point erosion such as road cuttings, incised gullies and other exposed areas on the hillsides (Tukahirwa, 1995:161).

Land Use Change and Soil Degradation Revisited

Clearly, only some of the changes in land use over the last fifty years (as identified above) can be said to promote or constitute instances of land degradation (here confined to soil erosion and soil nutrient depletion), while other changes even suggest a positive change in land management (but not necessarily an improvement in the conditions or productivity of natural resources). This does not mean that low soil productivity is not a problem for many farmers in the area and affects livelihoods negatively. However, there is little if any *hard evidence* to support the assertion that population growth over the last 50 years in Kabale District has caused farmers to degrade soils through the effects of diminishing fallow (that depletes nutrients) and inadequate investments in soil conservation.

Changes in Land Management

Instead, one could argue that farmers have changed their land management practices in response to increased land scarcity in several positive ways, and/or intensified the use of existing practices. There has been an increase in intercropping (Lindblade et al, 1998), which has raised production per area (but not necessarily labour productivity), and which has allowed more land on the steep hillsides to be laid fallow for longer periods. Farmers have also increased the production of trees, and allocated this activity to the most fragile lands, or as some would argue, to land abandoned due to over cultivation. By this they have taken advantage of an expanding market for timber and fuelwood. Population pressure has also induced the reclamation of papyrus swamps for year-round production of dairy and

[8] It is nevertheless the most (and often only) cited study in the many reports claiming a high incidence of soil erosion in the southwestern highlands. Many other documents report soil erosion without providing any evidence, or they base their conclusions on extrapolations from macro-level soil surveys and geological maps and related soil-map projects, or on macro models of soil nutrient balances - such as those by Stoorvogel and Smaling (1990) (Farley 1996, 167).

vegetables for the market, and sweet potatoes which is an important staple crop. This investment (supported by the colonial administration) has increased the productivity of this land cover class, although only the wealthier households have access to this new resource. The decline in livestock rearing under the pressure of diminishing upland grazing land can be seen as a positive response in environmental terms, but one which has had a negative effects on livelihoods, except for the minority of households that now own dairy cattle.

Soil Erosion in the Down-sloping Terrace System?

As mentioned earlier, the system of down-sloping terraces and 'drag-down hoeing' – which sometimes includes "harvesting" the soil accumulated on the upper-side bunds – was practised well before colonial times and appears to continue to this day. The system results in a significant soil fertility gradient between the upper and lower part of the down-sloping terrace; possibly more as a result of differences in soil physical and hydrological properties than in soil nutrient status (Siriri et *al.*, unpublished). At the landscape scale, this system causes a slow and temporarily relocation of sediments down the hill slope, rather than a massive erosion of soils and the rapid transport of sediments out of the landscape (Critchley, 2000:159; Farley, 1996:168-174). Apart from terracing, high rainfall infiltration rates / low run-off, soils with a stable structure, thrash lines, intercropping and a good plant surface cover, and frequent use of fallowing on the steepest hill slopes are factors contributing to seemingly low rates of soil erosion.

Perceptions of Soil Degradation in Contemporary Kigezi

Notwithstanding the scientific uncertainty regarding soil erosion and soil fertility depletion in the area, the rhetoric on soil degradation in the southwestern highlands almost invariably paints an image of imminent disaster – and has done so in the last 50 years despite mounting counter-evidence and the non-coming of doomsday. The stark difference between farmers' and development workers' perceptions of long term negative changes in fallowing in Kabale, and Lindblade et al (1998)'s more positive conclusions based on the hard evidence, suggest that we should be cautious when drawing conclusions about land use and soil quality dynamics based on oral records combined with assumptions about the relationship between population growth and environmental degradation. First, farmers, environmental NGOs, and local administrators may well all have incentives for promoting the view held by many outsiders (often driven by the international environmental agenda) that soil degradation *is* a priority problem because it draws attention and resources to the area. In this regard, it should be remembered that most "integrated natural resource management" or integrated rural development" projects provide not only technical solutions to soil degradation problems, they also bring a host of other benefits to the area, such as employment, cheap credit, "per diems", etc. From the perspective of local officials, professionals, and communities, "sustainable development" in this context may ironically mean ensuring a sustained presence of NRM projects, irrespective of whether they contribute or not to improved land management. Secondly, as pointed out by Carswell (2002a:19), the narrative of population-induced land degradation, reiterated first by colonial officials and then development workers, has been adopted by the local population in so far as they participate in the reproduction of this story.

Program and Policy Implications

What are the implications of the above discussion for policy strategies and investment programmes aimed at promoting sustainable development in southwestern Uganda?

First, Kigezi farmers seemingly excellent track-record in terms adapting to pressures on land resources, supports the now commonly accepted idea that land management research and development programmes are more likely to succeed (in technical and economic terms) if they harness the knowledge, experience and innovative capacity of farmers (while recognizing that not all farmers possess the same capacities in these regards) (see e.g., Critchley, 2000: 60; Farley 1996; Raussen et al, 2002; Ellis-Jones et al, 2001). The technologies and practices developed during such an approach would also need to be sufficiently flexible to accommodate the fluctuations in, and diversity of, farmers' skills, preferences and access to land and labour resources.

Second, if soil degradation is less of a problem than first thought, even in the long term, and if farmers to a large extent are able to deal with that problem without expensive outside support (for example, planting of woodlots has been practiced throughout the century, and until recently without outside support), then there may be a need to reorient investments to activities that more directly improve land productivity and livelihoods. Such a refocusing seems to be underway in southwestern Uganda, although a serious assessment of the change in development approaches in the area is outside the scope of this paper. This reorientation conforms with the more general realization that "the limited effectiveness and low adoption of widely promoted ant erosion measures makes it necessary to reconsider the causes of productivity decline as well as to consider the social and economic constraints of improving SWC practices" (Ellis-Jones & Tengberg, 2000:18). For example, Ellis-Jones and Tengberg (2000:19) observe that farmers faced with declining productivity are able to select from a range technologies to reverse this decline. Among these options, investments in SWC typically yield benefits only after a longer time period, compared with crop improvement technologies (fertilizers, improved seeds, pesticides) that normally yield benefits in the short term. Furthermore, physical structures, such as terraces, on their own do not necessarily raise yields. They thus see SWC as the result of accumulative responses to a range of influences over time (Ibid.). One of the three premises of their "new approach" to land management is thus to "focus on moisture conservation and fertility enhancement for crop production, with conservation of soils being achieved simultaneously".

Farley (1996) likewise observes that reducing erosion was *not* one of the management priorities for many of the surveyed smallholders in Kisoro and Kabale Districts. This despite the fact that they had a very detailed (yet not perfect) knowledge of local soils, a very good understanding of the causes and different forms of soil degradation, and recognized the occurrence of some form of soil erosion within their plots – especially rill erosion – which some of them referred to as "soil transfer" rather "soil loss" (Ibid:172-3). This does not mean, however, that soil erosion and soil fertility were not perceived as important problems by these farmers (Ibid:190). He also found that biological SWC practices such as contour planting and grass bunds (and manure and composting) were more common than physical constructions (e.g. run-off channels and check dams), due to their multi-functionality and lower labour requirements.

Third, when designing land management programs and policies, it is essential to understand that how many of their labour and capital resources farmers choose to invest in their land depends on their access to other economic opportunities, particularly off-farm employment. The patterns and dynamics of livelihood strategies in southwestern Uganda is outside the scope of this paper and will be dealt with in a subsequent review. Related to this, it is becoming increasingly recognized that economic incentives are *the* key to a sustainable and sound management of land resources. In the absence of tangible benefits, regulation, persuasion and training are unlikely to produce significant results in the long term. In the case of Kabale and Kisoro districts, the prospects for improved incentives based on market production and increased agroprocessing seem promising (Raussen et al., 2002), given that these districts enjoy relatively good access to markets and available (male) labour resources. As shown by Carswell (1997), while most attempts to introduce cash crops such as coffee, tobacco, pyrethrum, flax, into the area have failed (the reasons for which are not well known), Kigezi farmers have successfully produced and marketed food crops "as cash crops" (for example beans and maize) in the region for at least a century, most lately beer and cooking bananas. Such traditions and skills (and lessons from previous failures) should be made use of when investing in market-led agricultural development. The actual or potential contribution to improved land management and productivity from migrants' remittances seems less clear (Critchley, 2000:160) and needs further study.

Fourth, this review as well as other studies (e.g., Farley, 1996; Raussen et al, 2002) reveal a remarkable spatial variability in incidences of land degradation and land management within the relatively homogeneous area comprised by Kisoro and Kabale Districts which must be taken into account by programmes and policies. And as mentioned above, there is also a remarkable diversity of capacities and strategies among individual households, which could be practically dealt with through the development of a region-specific typology of households or livelihood strategies. Diversity of land use strategies would also be examined on the basis of age and gender categories.

References

African Highlands Initiative. 1997. Natural resource management constraints and prospects in Kabale District: A participatory rural appraisal.

Bagoora, F.D.K. 1988. Soil erosion and mass wasting risk in the highland area of Uganda. Mountain Research and Development, Vol. 8, 2/3, p. 173-82.

Baldascini, A. 2002. Income generating opportunities arising from natural ecosystems in Uganda: an overview. SCRIP phase II report submitted to the USAID Uganda Mission. International Food Policy Research Institute, Washington, D.C.

Bashaasha, B. 2001. The impact of soil infertility management practices on natural resources and household welfare in South Western Uganda. Unpublished manuscript.

Breyer, J., D. Larsen, and J. Acen. 1997. Land use cover change in South West Uganda. The case of Katuna & Mpalo watersheds in Kabale District. African Highlands Initiative and International Centre for Research in Agroforestry (ICRAF), Nairobi.

Carswell, G. 1997. African farmers in colonial Kigezi, Uganda, 1930-1962: opportunity, constraint and sustainability. PhD thesis, University of London.

Carswell, G. 2000. Soil conservation policies in colonial Kigezi, Uganda. Successful implementation and an absence of resistance. Manuscript submitted to: Beinart, W. and J. McGregor. In press. Social history and African environment. Heinemann and James Currey.

Carswell, G. 2002a. Continuities in environmental narratives: the case of Kabale, Uganda, 1930-2000. Unpublished manuscript.

Carswell, G. 2002b. Food crops as cash crops: the case of colonial Kigezi, Uganda. Unpublished manuscript.

Clausen, R. and M. Mcgahuey. 2001. SW Uganda landscape concept. Unpublished manuscript.

Critchley, W.R.S., D. Miiro, J. Ellis-Jones, S.R Briggs, and J. Tumuhairwe. 1999. Traditions and innovation in land husbandry. Building on local knowledge in Kabale, Uganda. RELMA Technical Report 20.

Critchley, W.R.S. 2000. Groundtruthing. New perspectives on soil erosion and conservation in the tropics. PhD Dissertation. Vrije Universiteit.

Ellis-Jones, J. and A. Tengberg. 2000. The impact of indigenous soil and water conservation practices on soil productivity: Examples from Kenya, Tanzania and Uganda. Land Degradation and Development, Vol. 11, p. 19-36.

Ellis-Jones, J., D. Miiro, A. Lwakuba, W. Critchley. 2001. Scaling up pilot research approaches and technologies. A case study from Kabale, Uganda. Natural Resources Systems Programme, Hillsides Systems. Silsoe research Institute, UK.

Farley, C. 1996. Smallholder knowledge, soil resource management and land use change in the highlands of southwest Uganda. PhD Dissertation, University of Florida.

Grisley, W. and D. Mwesigwa. 1994. Socio-economic determinants of seasonal cropland fallowing decisions: smallholders in south-western Uganda. Journal of Environmental Management, Vol. 42, p. 81-89.

Lindblade, K. and G. Carswell. 1998. Mitigating the relationship between population growth and land degradation. Land-use change and farm management in Southwestern Uganda. AMBIO 27.

Magunda, M.K. 1992. Influence of some physico-chemical properties on soil strength, stability of crusts and soil erosion. PhD thesis, Minnesota.

Martin, W. 1944. Soil structure. East African Agricultural Journal, Vol. IX, p. 189.

Ministry of Finance, Planning and Economic Development. 1994. The 1991 population and housing census (national summary).

National Biomass Study. 1996. 1:50,000 Land cover (use) data sheets for Uganda. Kampala, Forest Department, Ministry of Natural Resources. (Data File.)

Nkonya, E. 2001. Soil conservation practices and non-agricultural land use in the southwestern highlands of Uganda. SCRIP phase II report submitted to the USAID Uganda Mission. International Food Policy Research Institute, Washington, DC.

Pomeroy, D., Tushabe, H., and Mwima, P. 2002. Uganda ecosystem and protected area characterisation. SCRIP phase II report submitted to the USAID Uganda Mission. Makerere University Institute for Environment and Natural Resources (MUIENR) and International Food Policy Research Institute, Washington, D.C.

Purseglove, J. 1946. Land use in the overpopulated areas of Kabale, Kigezi District, Uganda. East African Agriculture and Forestry Journal, Vol. 12, p. 3-10.

Raussen, T., F. Place, F. Alacho, and W. Bamwerinde. 2002. Report on a survey to identify sustainable agricultural and natural resources-based technologies for intensification in southwestern Uganda. SCRIP phase II report submitted to the USAID Uganda Mission. International Centre for Research in Agroforestry, Nairobi, and International Food Policy Research Institute, Washington, D.C.

Siriri, D. and L. Mwebaze. 2000. The potential of organic and inorganic soil amendments for crop production in the Kigezi highlands. Unpublished manuscript.

Siriri, D. and T. Raussen. 2001. The development potential of agroforestry technologies in the Kigezi highlands. Unpublished manuscript.

Siriri, D., J.K. Zake, and T. Raussen. 2002. Crop and soil variability on terrace benches in the highlands of Uganda. Unpublished manuscript.

Siriri, D. and T. Raussen. 2002. The agronomic and economic potential of tree fallows on scoured terrace benches in the humid highlands of southwestern Uganda. Unpublished manuscript.

Ssali, H. 2001. Soil organic matter and its relationship to major farming systems in Uganda. In: Nkonya. E., D. Sserunkuuma, & J. Pender (Eds.). 2002. Policies For Improved Land Management In Uganda: Second National Workshop. EPTD Workshop Summary Paper No. 12. Washington, D.C.: International Food Policy Research Institute.

Tukahirwa, J.M. 1995. Measurement, prediction and social ecology of soil erosion in Kabale District, Southwest Uganda. PhD dissertation, Makerere University, Kampala, Uganda.

Tukahirwa, J.M. 1999. Diagnostic and characterisation studies conducted from 1945-1995 in southwest Uganda. African Highlands Initiative, Report No. 10.