Managing Linkages between (Communal) Rangelands and (Private) Cropland in the Highlands of Eastern Africa

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Abstract

Throughout eastern Africa the economic base of tribal societies has gone through rapid change, with concomitant declines in common pool resources and emergence of new tenure systems (public and private, informal and state regulated). The rapid pace of cultural, political-economic and environmental change have put significant strains on traditional management systems and coping strategies – mechanisms that once provided for basic needs of residents while to a large degree maintaining ecosystem function. Compounding the challenge is a rapid erosion of self-reliance among local communities with the influx of external knowledge and economic systems, and of modern institutional reforms (administrative, religious, educational).

These historical dynamics have created a number of problems for rangeland resource management, including decreased productivity, degradation of water resources, and increased conflict and competition. However, addressing rangeland resource issues requires a holistic understanding of livelihood systems, including trade-offs and interactions between communal rangelands on the one hand, and private property and cropland on the other. Communal rangelands in eastern Africa are interspersed with individual cropland both spatially and temporally, creating strong functional linkages that define both the problems affecting rangelands and the potential solutions. Viewing rangeland resource problems in relation to other resources demonstrates the need for integrative solutions, including an explicit recognition of the linkages between common and private property, user groups (in terms of social trade-offs) and disciplines (technological, social, policy).

This paper presents data from two benchmark sites of the African Highlands Initiative (AHI)[1] in the highlands of central Ethiopia and northeast Tanzania, respectively. Results of individual interviews and ethnohistorical research with elders, conducted as part of a preliminary watershed exploration exercise in these sites, are presented. They paint a picture of current land use systems, how these systems evolved over time and key "forcing functions" behind these changes. Both watershed-level diagnostic activities and historical trends analyses point to disturbing trends in natural resource degradation over time, how such trends have impacted upon rangeland resources and livelihoods, and the nature of interventions required to ameliorate both trends and outcomes.

I. Introduction

Throughout the highlands of East Africa, farming communities face critical challenges in providing for an ever-growing population while maintaining the productivity of basic resources. Most agricultural research and extension programs have approached this problem by focusing on the alleviation of farm-level productivity constraints, largely through technological solutions. There is a strong push within national and international arenas to move toward broader units of analysis and intervention, with the aim of enhancing the sustainability of rural livelihoods as well as environmental services emanating from highland areas. While watershed management has been proposed as a means of doing so, conceptual understandings of watershed management and related approaches vary considerably. This paper presents experiences of the African Highlands Initiative, an ecoregional research and development program operating in highland regions of eastern Africa, in operationalizing a locally-driven process for improved natural resource management (NRM) at watershed scale.

[1] AHI is an ecoregional program of the CGIAR (Consultative Group for International Agriculture Research) and ASRECA (the Association for Strengthening Agricultural Research in East and Central Africa).

The paper focuses on two of AHI's 5 benchmark sites: Ginchi (Galessa Watershed), located in the highlands of Western Shoa Zone, Ethiopia and Lushoto (Baga Watershed), located in the West Usambara Mountains of Tanzania. Following an historical overview of land use and landscape change in two AHI benchmark sites, attention is given to rangeland resources and livestock production systems. Functional linkages between livestock systems and other resources are drawn for each case. The paper concludes with a discussion of approaches under consideration for addressing identified watershed problems in an integrated way, and ensuring that social and environmental trade-offs between diverse user groups and system components are explicitly acknowledged.

II. Background

African Highlands Initiative

The African Highlands Initiative is a research and development (R&D) program working to address interrelated problems in the highlands of eastern Africa: declining agricultural productivity, natural resource degradation and poverty. AHI is an eco-regional programme under Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) and the Consultative Group for International Agricultural Research (CGIAR), and is convened by the World Agroforestry Centre (ICRAF). The program operates in 5 benchmark sites of the highlands of eastern Africa that share similar characteristics, including a high population density, marginal agricultural lands, declining agricultural productivity and limited economic opportunities. Since 1995, AHI has worked in partnership with national agricultural research systems (NARS) of Ethiopia, Kenya, Madagascar, Tanzania and Uganda to develop and test new approaches for improving rural livelihoods through better farm and landscape-level natural resource management (NRM) and benefits derived from the same.

In 2003, the African Highlands Initiative shifted its focus from farm-level natural resource management interventions (Phases 1 and 2) to watershed-level NRM (Phase 3) in response to recommendations made through an external program review. While farm-level interventions integrated social science perspectives to strengthen the quality of on-farm participatory research, partnerships (among researchers, extension and farmers) and farmer research groups, issues addressed in Phase 3 work are *inherently social and political* in nature. This requires a stronger grounding in property rights and collective action theory to support the design and testing of socially-optimal approaches to participatory watershed management.

Participatory, Integrated Watershed Management

Watershed management has received much attention in recent years due to global concern over declining water resources and increased evidence that farm-level technological innovation is insufficient for catalyzing widespread and equitable improvements in land-based livelihoods. In recognition of the strong two-way linkage between environmental improvement and poverty reduction and the functional relationship between water and other natural resources (CGIAR, 2003), the government of India has allocated significant funds to reverse degradation through watershed sustainable development (Shah, 1998; Turton and Farrington, 1998). Several East African governments are considering similar approaches. This "watershed movement" is emerging at multiple levels – in response to water deficits in urban and lower catchment areas on the one hand (Constantz, 2000; van Horen, 2001) and as a means to enhance livelihoods through more efficient and sustainable water and other natural resources use in rainfed areas and upper catchments on the other (De and Singh, 1999; Shah, 1998; Turton and Farrington, 1998). While ultimate origins and aims differ, resulting approaches are each denotated as “participatory”, “grassroots” or “community-based.” The large range of projects and approaches that falls under the participatory watershed management (PWM) umbrella has led to confusion as to its ultimate goals, lack of consistency in approaches, and limited success in putting it into practice (Bellamy et al, 1998; Rhoades, 2000; Shah, 1998). Approaches for operationalizing watershed management in ways responsive to *local* NRM concerns and attentive to trade-offs within the system (among different users or system components) are sorely lacking.

Increasing recognition of time-space interactions between plots and common pool resources, lateral flows of materials (water, nutrients, pests) and the interdependence between users in terms of resource access require strategies and assessment of options that go beyond the farm level (Knox et al, 2001; Johnson et al, 2001; Ravnborg and Ashby, 1996). This requires effective mechanisms to ensure *participation* of diverse interest groups and stakeholders, as well as *integrated* decision-making that acknowledges system linkages (among water, soils, crops, trees and livestock) and multiple spin-offs from any given intervention.

Participatory watershed management is defined as a process whereby users define problems and priorities, set criteria for sustainable management, evaluate possible solutions, implement programs, and monitor and evaluate impacts (Johnson et al., 2001). This means that broad-based livelihood concerns will guide the PWM agenda, where water is likely to be a key element. This is supported by literature (Bellamy et al, 1998; Datta and Virgo, 1998; Turton and Farrington, 1998), which suggests that watershed development works best when there is a perceived deficiency in a vital resource, when integrated with other means of enhancing livelihoods and when benefits of NRM are localized. Therefore, PWM should begin from the standpoint of locally-identified NRM problems at diverse levels, grounding the process in *local* motivations for corrective change.

The most logical way to engage people in collective analysis and decision-making is the community forum, but there are limitations to community-level diagnosis and planning. Methodological difficulties include finding participants willing to engage in protracted inquiry, the tendency of groups to lapse into convergent thinking, the difficulty of building mutually-inclusive communication frames, and power relations that result in unequal participation (Stevenson, 2002). These deficiencies can be exacerbated in community fora where politically-charged topics such as resource ownership and access are debated. Epistemologically debated are the erroneous notions of “local” and “community” that assume communities to be static, spatially-defined units with homogeneous social structure and shared norms (Agrawal and Gibson, 1999; Brosius et al, 1998). Experiences from India indicate that considerable skill is needed in building consensus among groups and in designing and implementing joint action, particularly for weaker sectors (women, the poor), due to competing interests and different levels of participation in political processes (Turton and Farrington, 1998). Outside mediation and vigilance through social monitoring is also needed to ensure even moderate degrees of equity and to put a check on who gains and who loses from watershed rehabilitation (Turton and Farrington, 1998). Lessons are needed on how to enable “socially optimal resource management” involving decision-making and conflict resolution among all watershed stakeholders (Knox et al., 2001).

Achieving *integration* in watershed management is equally challenging, in particular given the tendency for most formal research in support of agricultural development to diagnose and address problems through a single disciplinary lens. It is well known that farmers are by nature integrated in their thinking, given the need to optimally allocate finite resources (labor, capital, nutrients) among diverse farm enterprises and goals. However, when moving out beyond farm level, *motives* for effective integration break down due to the diffuse nature of benefits resulting from social or biophysical optimization. When the impacts of improved farm management on water resources as well as the benefits accruing to the individual investing in such outcomes are diffuse, for example, incentives break down for optimizing multiple biophysical outcomes (i.e. crop productivity *and* water recharge) at the watershed level. Equally difficult is to consider how to ensure socially-optimal outcomes, so that maximizing returns at farm level does not compromise the ability of neighboring farmers to do the same (for example, cultivation of fast-growing tree species on farm boundaries where benefits accrue to only one farmer yet the trade-offs to many). The difficulties of operationalizing integration therefore stem not only from conceptual challenges in managing multiple variables simultaneously, but in social dimensions such as the diffuse nature of returns to individual investments.

This paper presents preliminary experiences in operationalizing Participatory Integrated Watershed Management (PIWM), focusing in particular on problems associated with rangeland resources and on how they must be addressed in relationship to the broader land use system.

Collective Action and Property Rights

In recognition that enabling factors and bottlenecks are not only biophysical, but manifested in social, market, institutional and policy domains (German, 2003; Knox et al., 2001), watershed management requires a multi-level approach. Collective action, for example, is influenced by the size and social structure of management units; market forces can both weaken cohesiveness and provide incentives for cooperation; property rights and local by-law mechanisms influence people's willingness to invest in the natural resource base or cooperate; and regional policies may need to be re-negotiated to enable collective decision-making (Ashby et al, 1999; Ravnborg and Ashby, 1996).

To solve natural resource management problems in a way that is not detrimental to particular system components (water, soil fertility, crop/livestock/tree productivity, etc.) or groups (gender-, wealth-based or other), collective action via equitably negotiated decisions and outcomes is required. Recent research into collective action and property rights has yielded a better understanding of the conditions required to enable collective action in natural resource management, among these the presence of clearly defined rules for resource management and access; levels of user involvement in decision-making; the size and finiteness of the resource; the size of the user group (Pandey and Yadama, 1990; Wittapayak and Dearden, 1999); and initial imbalances in resource endowments (Burns et al., 1985), to name a few. Each of these factors plays an important role in influencing levels of mutual trust as well as expectations of what may be gained through cooperation (Blau, 1964; Burns et al., 1985).

In AHI benchmark sites, four fundamental "structural constraints" to collective action have been identified: a) ineffective, top-down and poorly implemented by-laws governing the use of natural resources; b) the tendency of local knowledge to be questioned in the face of more dominant knowledge systems, undermining consensus on "best practice" and eroding traditional forms of collective action; c) limited resources, incentives (property rights, ability to invest) and short-term benefits to local stakeholders; and d) historical and political factors that have influenced contemporary land uses, collective action in natural resource management and inclusiveness of development processes (AHI-Ginchi, 2003; AHI-Kabale Policy Task Force, 2003; AHI-Lushoto, 2004). This paper describes the last of these, in particular in reference to rangeland resource problems in Ethiopian and Tanzanian benchmark sites. Implications of findings for approach development to ensure more broad-based participation in and benefits from collective action are also addressed.

III. Trends in Land Use, Collective Action and Rangeland Resources in the Eastern African Highlands: Case Studies from Tanzania and Ethiopia

To characterize current land use systems and how these evolved over time, individual interviews were conducted to identify key NRM problems at watershed level and focus group discussions with elders were used to identify and trace key trends in NRM over time. Once the most salient trends were identified, elders were asked to track the rate of change in key variables associated with these trends on a scale of 1 to 10 (with the number 10 equivalent to the maximum expression of the variable) through four periods spanning approximately 75 years. Where illiteracy rates were high, time periods were matched to critical events that provide a clear reference point for comparisons. Results of this work are presented, together with a discussion of problems and trends particular to rangeland resources and livestock management systems.

Case #1: Galessa Watershed - Western Shewa Zone, Ethiopia

System Characteristics

In the Galessa Watershed, while the government has ultimate ownership of all land, three productive units can be distinguished that roughly correspond to distinctive tenure systems. The first are individually owned infields, which are generally fenced and located near homesteads. Animals are ‘parked’ in homesteads at night, depositing a large amount of dung near these infields. The high fertility and fencing of these areas enables farmers to focus on cash crop production in these areas. The second productive unit is the outfield. While individual families have *de facto* ownership of these outfields through exclusive use rights during the cropping season, outfields are seasonally converted into communal grazing areas. Communal grazing initiates once the majority of crop residues are collected by individual landholders or grazed by their cattle. Once this period begins, dung deposited on the outfields becomes an open access resource. Since trees in the system are few and indigenous forests distant, dung is collected and used as fuel. Families generally hold land on both sides of a catchment, enabling them to have crops in the field on one side of the catchment while the opposite side is grazed (Figure 1). The third productive unit includes year-round communal rangelands. While neighboring villages have the right to exclude others from these areas, they are generally treated as open access resources.

Figure 1. Areas of seasonal grazing (foreground) and cropland (background) are switched during alternate growing seasons in Galessa. Photo by Laura German.

A participatory watershed exploration conducted with watershed villages led to the identification of priority problems in the system. These include: declining soil fertility; poor productivity of crops and livestock; water resource degradation (both quantity and quality); excess run-off from farmland leading to the loss of seed, fertilizer and soil; the loss of indigenous tree species; and feed and fuel shortage.

System Evolution

The most salient changes in landscapes, land use and livelihoods over time include population growth and dramatic declines in indigenous tree species (from both within farmland and contiguous tracts of forest), crop productivity, average household livestock holdings, grazing land and water resources. These trends were tracked through 4 periods corresponding to critical junctures in people's memory: from the Italian Invasion until 1955 (Period I), the latter part of Haile Selassie's reign (Period II), the Socialist regime of 1971-1991 (Period III), and post-Derg era from 1991 to the present (Period IV). With the exception of water resources, numerical data gathered through trends analyses with village elders (Figure 2) fail to illustrate the severity of the problem. While these data show a 50% decline in land allocated to forest, loss of indigenous tree species on farmland is masked by figures which fail to track the prevalence of trees on farm. While these data do show a significant decline in land allocated to permanent grazing areas, the most significant grazing pressure resulted instead from a dramatic shortening of the "fallow" period as population pressure intensified. This is said to have occurred due to successful malaria and smallpox eradication programs in the 1950s and 1960s (Robinson and Yamazaki, 1986). The loss of indigenous trees was accompanied by a decrease in fuel wood availability. This has caused families to shift to the use of dung as a fuel source. Used in earlier periods solely for baking bread, dung is now used for all cooking needs.

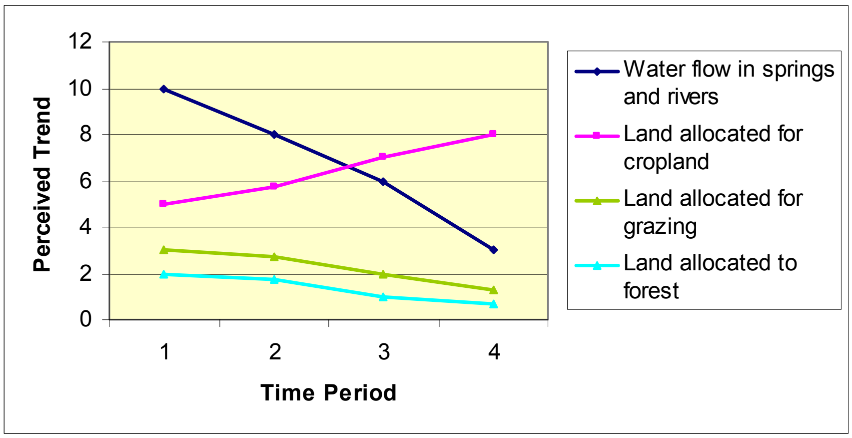

Figure 2. Perceived Trends in Land Use and Water Resources, Galessa Watershed

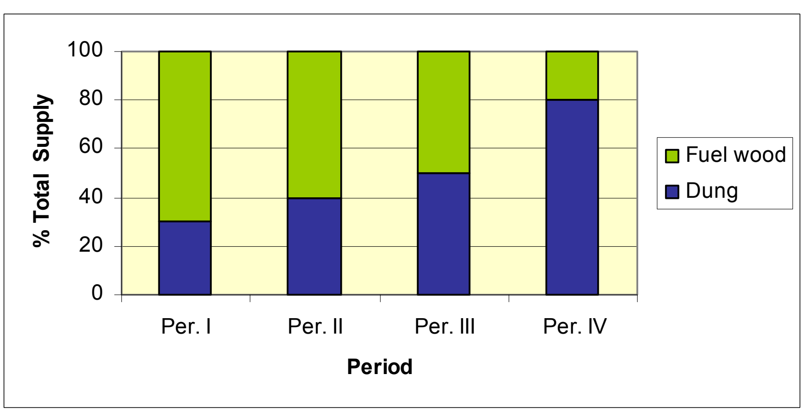

Figure 3. Perceived Trends in Fuel Consumption in Galessa

According to key informants, the nationalization and redistribution of land under the Socialist Derg regime (Lanz, 1996) had the most significant effect on the above trends in NRM. The first two periods were characterized by a feudal system in which resources were concentrated in the hands of a few wealthy landlords who monitored the use of land and forest resources under their dominion. Beginning with the socialist period (1974-1991), land ownership was placed in the hands the governing Derg regime and use rights were redistributed by family size. This shift in land tenure and access led to indiscriminate felling of trees as a highly regulated system of forest management broke down and forests "became nobody's property". Population growth and land redistribution also reduced average landholdings, decreasing the fallow period and sharply reducing the availability of livestock feed.

Rangeland Resources: System Evolution and Current Challenges

From the perspective of rangeland resources, watershed-level NRM problems can be lumped into two main areas: water resource degradation and system nutrient decline. Water resource degradation has occurred as a result of both land tenure (individual use rights to land around springs) and the lack of collective action in spring management, which have in turn given rise to a host of problems: poor land management near springs (including insufficient vegetation cover and poor soil stabilization in the outfields), the sharing of unprotected watering points between livestock and humans (Figure 4), and conflict over water resource access among neighboring villages in the dry season. The second problem, system nutrient decline, is a significant contributor to the pressure currently felt on grazing land in Galessa and other parts of Ethiopia (Kebede, 2002). It is exacerbated by open access to dung and crop residues on the outfields, leaving limited incentives to invest in soil fertility improvement through alternative energy sources (i.e. agroforestry) or the incorporation of dung and crop residues. It is also complicated by the seasonal rotation of individual use rights to cropland and common use of these same areas during grazing periods, which limits the range of technological options for soil fertility improvement as technological innovations must be compatible with the grazing system (access to fields by cattle, timing of crop-rangeland transitions, etc). While the tendency to utilize increasing amounts of dung for fuel continues (Figure 5), farmers have begun to apply a small percentage of the collected dung back to the outfields in an attempt to improve crop yields in these areas.

Figure 4. Cattle drinking from shared watering point at Galessa. Photo by Laura German.

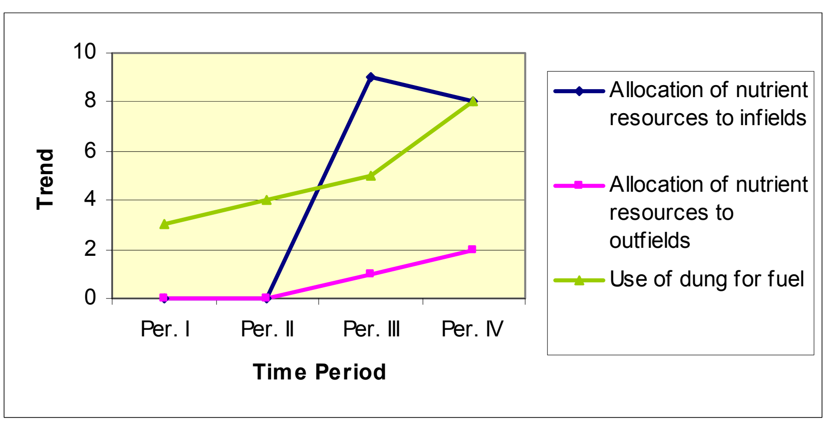

Figure 5. Perceived Trends in Nutrient Allocations in Galessa

The challenge becomes how to modify land management practices for water resource rehabilitation and soil fertility improvements given the seasonal overlap in private cropland and communal grazing land, the diffuse nature of user groups on year-round grazing land and for watering points, and unequal benefits from communal grazing periods (as those with more cattle scavenge more nutrients from the outfields). The sharp fertility differential between infields which receive significant nutrient inputs in the form of dung, and outfields which receive only nutrients deposited in the form of dung, is in itself a symptom of the problem. It demonstrates an unwillingness to invest in areas for which benefits are more diffuse. Clearly, the decline in system nutrients and water resources cannot be ameliorated through the conventional research approach that emphasizes individualized solutions. Rather, negotiated action plans including technological, institutional and policy dimensions are needed.

Case #2: Baga Watershed – Lushoto District, Tanzania

System Characteristics

The second case study is of the Baga Watershed in Lushoto, a District located in the East Usambara Mountains of Tanzania. This system is significantly different from the Ethiopian case, as most land is individually owned through *de jure* or *de facto* systems of land tenure. The system is therefore better characterized by distinctive types of landholdings than by land tenure per se. Hillslope cultivation is the most traditional form of land use, where staple crops are grown as well as tea and coffee as cash crops. Valley bottoms, while previously unutilized, were opened up between during the 1970s as market-oriented vegetable production took hold. Livestock holdings are small and managed primarily through a system of zero grazing. Intra-household variation in resource endowments result in large part from the size and quality of family land and livestock holdings, with access to valley bottoms and irrigation water strong determinants of income potential. There is anecdotal evidence to suggest that those plots and households dedicated to cash crop production are receiving greater proportions of the available organic nutrient resources, leading to significant inter- and intra-household nutrient flows.

There is a great deal of overlap in the problems identified in the participatory exploration of the Baga watershed with those identified in Galessa. They include: degradation of water resources (quantity of drinking and irrigation water, drying of valley bottoms), negative spin-offs from the cultivation of exotic tree species (drying of watering points, allelopathic and shade effects on crops, reduced infiltration), excess run-off from unconserved farmland, and limited access to productive resources (land, fodder, credit, inputs) – in particular for women, youth and the very poor.

System Evolution

Changes in landscapes, land use and livelihoods over time are ones frequently cited for resource-poor communities in highland areas: gradual loss of forest cover, climatic change leading to unpredictable and extreme weather, soil fertility decline from erosion and the shortening of fallow periods, and a decline in water resources. Causal processes behind such changes include political change, technological innovation and cultural change. Key political events include the end of the colonial era, during which time colonial policies on proper land use were systematically rejected by the incoming government as an expression of newfound freedom from outside occupation. As stated by one elder from Kwekitui village:

> Before independence [in 1961], government laws were very much respected. This was in most cases not by choice, but forced upon villagers because of very strong law enforcement that existed during the colonial time. After independence this gradually started to change, mainly due to 'promises' made during the struggle for independence [that people should abandon most of the colonial rules as they will be free].

While most key informants acknowledge in retrospect that the land management practices enforced during colonial times were beneficial to local residents due to their role in maintaining the natural resource base upon which livelihood depends, at the time few people understood their importance. A second important political event occurred during the Socialist regime's villagization program *Ujamaa*, initiated in the 1970s. During this time, then president Nyerere implemented a policy requiring that people relocate to *Ujamaa* villages. According to key informants, this relocation had three purposes: a) school education to combat ignorance, b) health services to combat disease, and c) programs to confront poverty (including the planting of trees). Significant changes resulting from this period include a rapid population growth resulting from decreased infant mortality, a dramatic increase in land pressure, and multiple cultural and ecological spin-offs from this (decline in forest cover and livestock ownership). The government furthermore implemented land reform policies, allocating tracts of forests to individual families. This is said to have increased run-off from hillslopes, altered rainfall patterns, decreased access to timber and encouraged increased cultivation of exotic tree species.

Technological interventions were also identified as causal factors in land use change. Government and NGO-sponsored afforestation programs during this period provided a ready supply of exotic seedlings for cultivation on private farmland in the absence of native forests. Therefore, in contrast to the Ginchi case, tree cover is extensive in large portions of the District – with identified problems stemming from tree abundance rather than absence. Perceived ecological spin-offs of the integration of these trees into local landscapes include the impact of allelopathic and shade effects on crops (primarily from *Eucalyptus* and *Gravellia* spp.), decreased infiltration leading to increased erosion (primarily Black Wattle), and water resource degradation (primarily from *Eucalyptus* and *Agrocarpus* spp.) – which local residents believe reached an alarming rate in the 1980s due to an increase in exotic tree cultivation. Another important trend was the introduction of exotic crops. The first impacts were seen with tea and tomato, introduced at large scale during the 1980s. Environmental and social impacts include a decline in soil nutrient reserves (due in part to government loans and subsidies for the purchase of chemical fertilizers, higher erosivity of chemical over organic fertilizers, and decreased use of the latter), increased demand for pesticides due to the higher susceptibility of exotic crops to pests and disease, and the clearing of previously forested valley bottoms to vegetable cultivation. Finally, the introduction of animals from external livestock markets is perceived as being linked to the increase incidence of livestock disease in recent years. Market influences work hand in hand with new technologies to bring about change, most notably through increased demand for exotic vegetable crops and tree species (primarily *Eucalyptus* spp. and *Acacia mearnsii*).

Cultural changes during this period were also significant. Most prominent in the minds of local residents has been the presence of exogenous institutions (schools, religious institutions, development programs), which led to a dramatic increase in exposure to outside influences during the 1980s due to their expanded influence over the same period. This exposure to outside ideas led to a significant decline in traditional beliefs and norms governing the use of natural resources and other aspects of civic life (Figure 6), undermining the ability to reach consensus on appropriate NRM. Traditional practices and beliefs were treated as superstitious, leading to the destruction of sacred trees and forests and a decline in collective action practices for pest management. The latter is seen as the main cause of increased pest and disease over the same period. Favoritism in the enforcement of by-laws, local perceptions that policy formulation is undemocratic, and by-laws that are poorly targeted to address the problem each work to undermine collective action in NRM. An example of the last of these is an emphasis on highly localized measures for spring protection (a 15m forest border) that fails to tap the potential for spring recharge through an integrated catchment management approach.

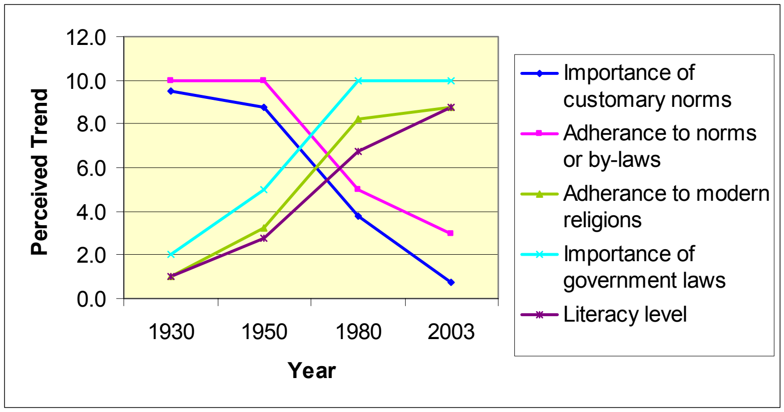

Figure 6. Perceived Trends in Modernization and NRM Cooperation

Rangeland Resources: System Evolution and Current Challenges

While communal rangelands were prevalent in the past and animal feed abundant, population growth and land pressure have led to the near eradication of rangeland resources. According to key informants (elders), fodder was abundant and livestock numbers high until the 1980s when grazing area dramatically decreased, livestock disease became more prevalent (in line with the introduction of crossbred dairy cattle) and district by-laws were put in place to enforce zero grazing. Livestock numbers seem to have decreased significantly during this same period. These trends are illustrated in Figure 7.

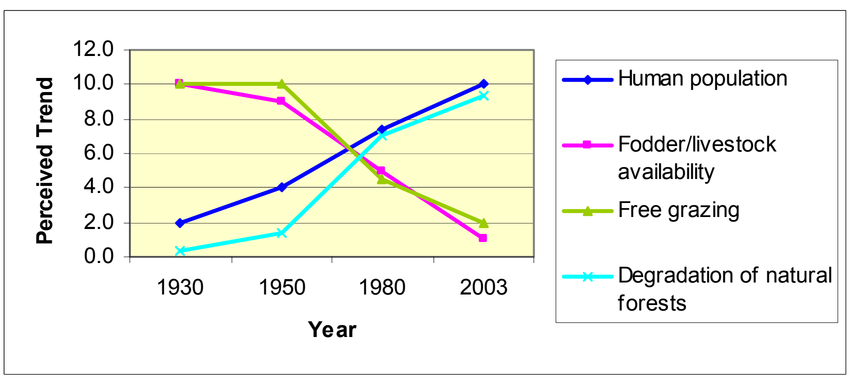

Figure 7. Perceived Livestock Trends, Baga Watershed

While the livestock component of the system appears to be in decline (Figure 8), it is nevertheless important to addressing broader NRM concerns. On the one hand, livestock trends accompany broader trends in system nutrient decline. While this is in part due to causal forces acting upon livestock and cropping systems alike (population growth, land pressure), it is also seen to result from functional linkages between crop and livestock systems. First, a decline in livestock numbers has led to a sharp decline in the availability of farmyard manure, once a significant fertility amendment for hillsides and valley bottoms alike. The tendency to substitute organic with inorganic amendments is believed to contribute to the increased erosivity and decreased fertility of soils. Second, farmers are increasingly feeding crop residues to livestock due to the decrease in feed availability, further undermining soil fertility. Finally, solutions must address crop, soil, tree and livestock components in an integrated manner to optimize the productivity of each component and minimize their collective impact on water resource decline.

This last issue is where the collective action dimension must enter into solutions, given that the costs and benefits of alternative management regimes will vary for different users. In addition to managing component linkages (interactions between soil fertility or crop growth; timber production and spring recharge; crop, tree and fodder production) to enhance biophysical synergies over trade-offs, social trade-offs (in terms of the distribution of costs and benefits to different users) must also be managed. While women and upslope farmers suffer most from water resource degradation, families with small landholdings suffer most from the cultivation of exotic tree species on neighboring farms. If productive resources (livestock, valley bottoms) are not managed in a more equitable manner, intra-household nutrient transfers will continue to favor wealthier farmers who are willing to pay for organic nutrient resources to feed their nutrient-demanding cash crops. Since goals related to all system components and households can not be maximized simultaneously, the aims of participatory watershed management and associated interventions must be negotiated among diverse user groups.

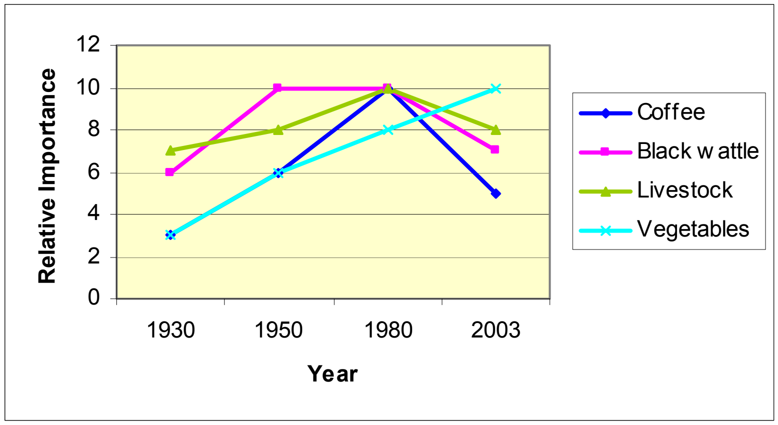

Figure 8. Perceived Enterprise Trends, Baga Watershed

IV. Implications for Operationalizing "Participation" and "Integration" in Watershed Management

Considering the complexities in these two land use systems and the diversity of problems affecting watershed communities, the challenge of developing approaches to enable improved NRM at landscape level are daunting. Recent diagnostic work, community interactions and conceptual advances have led us to explore several key strategies that are explored below.

A. Entry Points

One of the first strategies employed to initiate action in the watershed was the identification of strategic "entry points". Rigorous diagnostic processes (from social and biophysical standpoints) take time, and it became clear early on that concrete actions for community benefit needed to be carried out so as to maintain community interest in the process. For Lushoto, successful farm-level technological interventions from Phase 2 were utilized as entry points, beginning with cross-site visits to successful cases and training events. In Ginchi, where altitude limits the range of alternative farm-level technologies, the top-ranked watershed issue (as determined by both average and socially-disaggregated ranks) was utilized as an entry point. Keen interest in water resource management was clear early on, so the site team began developing participatory action plans for spring development. Short-term solutions include engineered outcomes ("spring development") through broad-based contributions in the form of funds, labor and materials from neighboring villages, while long-term solutions include a more integrated catchment management approach. Lessons are as of yet few due to the early stage of this process; success is likely, however, given the high interest of neighboring villages in participating in AHI.

B. Operationalizing "Integration" and "Participation"

The concepts of "participation" and "integration" in PIWM have helped considerably in operationalizing this complex agenda. After identifying a list of discrete watershed issues in each site, we took stock of progress made by looking at the extent to which we were achieving effective participation and integration in the process. Two considerations emerged from this analysis: how to better integrate a list of discrete NRM concerns, and how to best enable local ownership of the process while ensuring certain program values (equity, sustainability) are fostered. An essential element of this thinking was how to identify interventions that are most likely to catalyze change ('turn keys') from both social and biophysical perspectives (German, Stroud and Amede, 2004). From this analysis, it was clear that both "participation" and "integration" would be key catalysts in terms of the selection of issues to be worked on. Participation would be key to catalyzing change in the sense of selecting issues of high priority to most groups, thereby maximizing opportunities for collective investment in work plans. Integration would be key in the sense of selecting a group of issues with strong functional linkages between them (biophysical 'clusters'), so that the impacts of interventions made within one component (tree growth, water discharge, crop growth, soil fertility) would be felt and managed within other components, creating an opportunity for positive synergies.

This strategy is currently being adapted to specific sites. While impacts and lessons on how to put these concepts into practice will only emerge through field-based learning in the coming months, several strategies for ensuring their operationalization have been discussed:

(i) Anticipate the Social and Biophysical Ramifications of Proposed Interventions

One way to ensure effective participation and integration in watershed management is to anticipate the expected social and biophysical ramifications of proposed interventions. For each technological alternative, for example, it is important to move beyond disciplinary biases to anticipate the potential impacts on diverse watershed components and particular social groups so as to maximize social and environmental gains and minimize the losses. For example, if specific trees are being considered to solve the fuel wood crisis in Galessa watershed, the potential of these trees to provide not only fuel but also fodder and shade for livestock and income, and to enhance soil moisture retention and water recharge, should be considered. From a social perspective, gendered dimensions of tree tenure and access should be understood and women involved in decision-making on what trees to plant, where and by whom. It is important to remember that any technological innovation can have multiple benefits and impacts, and that these must be managed explicitly and negotiated among diverse interest groups.

In addition to technological interventions, institutional and policy interventions may be needed to back up decisions when negotiated by diverse interest groups so as to ensure cooperation. For optimizing the returns from diverse system components (biophysical ramifications), by-laws could be enacted that sanction which trees can be planted in different landscape niches so as to minimize negative impacts on water resources, for example. To optimize the benefits to diverse social groups, on the other hand, by-laws may be needed to minimize the impacts of technological innovations on or to ensure the benefits reach more vulnerable groups. Examples include limitations on which species can be cultivated on farm boundaries given potential negative impacts on crops, and female participation in decision-making on tree species and tenure given the greater burden they tend to bear in transporting fuel wood and water to the homestead.

One way to optimize returns to diverse social groups is through *negotiated action plans*. While we are just now beginning to generate experiences in this field, several considerations have emerged through discussion and implementation. Farm-level interventions, while often carried out through group work, are generally negotiated up to the level of the household only and applied to private property. Watershed-level interventions have the potential of enabling technological interventions to work better from both technical and social standpoints, given the strong interactions between neighboring landscape units (farms, individual and private property, etc.). The question then becomes how to ensure equity in such negotiated outcomes, in terms of moving from potentially interest-based to more equitable decision-making. One important concern is *the level at which action plans should be developed*. Due to ease of implementation, there is a strong tendency among AHI site teams to favor "watershed"-level plans in which representatives of each village come together to plan for the entire area. However, there are important implications of this in terms of levels of participation and awareness of the process. Two strategies for getting around this constraint have been proposed. The first involves planning at the watershed level only after bringing villages together to elect representatives, and to develop a plan for community feedback once preliminary action plans have been developed. Another option, currently being explored in Lushoto, is to identify stakeholders specific to each issue and to bring these stakeholders together at village or watershed level for planning around that issue. The latter seems to be an approach that enables greater depth in watershed planning, for example by explicitly bringing local knowledge into the process and by focusing on a particular set of issues rather than trying to plan for all activities at once (Box 1).

BOX 1: Steps in Stakeholder-Based Planning

1. Issue-based stakeholder identification
2. Meet with individual stakeholder groups (validate issues; clarify 'stake'; elicit propose solutions and multi-stakeholder engagement strategy)
3. Document local knowledge on viable solutions (What actually needs to be done to rectify situation?)
4. Analysis of commonalities & divergences in 'stakes'
5. Stakeholder engagement meetings (presentations of diverse 'stakes'; identification of commonalities and differences; present local knowledge findings; develop plans for action and further dialogue)

Another proposed strategy for ensuring optimal decision-making for improved watershed management is to *anticipate where collective action and policy back-up will be required* to enable innovations in natural resource management. For this, it is important to consider the conditions under which by-laws or collective action would be needed to enable improved NRM, and under what conditions an individualized approach is sufficient. Two possibilities might be considered – again from the standpoint of ensuring effective integration and participation:

- Where the intervention is likely to have an overly negative impact on other system components (water, livestock, crop yield, soil fertility), or
- Where the intervention is likely to have an overly negative impact on certain groups, or cause conflict through increased demand over the resource.

An example from Ethiopia helps to illustrate this better. During the watershed exploration exercise, researchers identified conflict among neighboring villages due to limited water resources. Villages with more water were being visited by farmers and livestock from neighboring villages. Paths through the farms and villages were being blocked as a manifestation of resistance to water sharing. As we work to develop watering points in the watershed and water quantity and quality are positively affected, neighboring villages are likely to want access to these water resources. A solution may, therefore, be the source of a future problem (in this case, water resource conflicts), a problem that can be anticipated from what is known about the current situation. We are currently thinking through how to enable communities to consider such potentialities up front and to develop an approach for managing watering points once "developed". This might include negotiation with neighboring communities to develop structures and rules of governance for the resource given anticipated demands on the resource in the near and distant future, and strategies for periodic re-negotiation of these strategies under changing circumstances.

(ii) Monitor Social and Biophysical Ramifications of Interventions

In recognition that not all ramifications of current interventions will be anticipated, a second way to ensure effective participation and integration in watershed management is to implement an effective monitoring strategy to capture social and biophysical impacts as they emerge. The risk of not doing so is much to great, given the possibility that today's solutions will become tomorrow's problems unless well managed. While an optimal strategy for monitoring the impacts of interventions on diverse system components and social or stakeholder groups has yet to be tested in the field, it is clear that rigor and efficiency must be important considerations. The trade-offs of external and participatory monitoring should be weighed in terms of the ability of each to capture nuances and political dynamics within a community, and the need to minimize time investments of farmers and outside actors. While socially-disaggregated monitoring could be taxing for facilitators and other participants, it may prove to be the only means to ensure effective "participation" (i.e. capturing negative impacts on less outspoken or more vulnerable groups) in societies governed by hierarchical decision-making.

C. Addressing Structural Constraints and Broader "Forcing Functions"

A final strategy, with elements in various stages of design and implementation, includes more strategic interventions that may be considered longer term, but nevertheless necessary to overcome some of the factors currently hindering collective action in NRM. These are designed to address structural constraints or broader historical forces currently undermining collective action, as identified in the background. The first is to test a bottom-up policy formulation process developed in Kabale District, Uganda (AHI-Kabale Policy Task Force, 2003) to address ineffective and undemocratic policies and policy formulation mechanisms for natural resource governance. The second is to enable traditional knowledge capture and analysis with communities and school systems, so as to discern its role vis-à-vis scientific knowledge for addressing current watershed problems. A final strategy is to build upon rather than substitute existing organizations and social capital (mutual social/financial/labor support functions, conflict resolution mechanisms, leadership and institutions) in watershed communities, developing strategies to address identified weaknesses where necessary.

V. Conclusions

This paper discusses some of the difficulties of operationalizing a locally-driven watershed management agenda in the highlands of eastern Africa. Problems associated with livestock systems and rangeland resources in two highly distinctive systems help to illustrate the need for effective ***P***articipation and ***I***ntegration in this process (***PI***WM). Some useful lessons emerging from preliminary diagnostic exercises and conceptual development point to how this very complex agenda might be operationalized in practice, including an emphasis on strategic entry points and on targeting broader structural influences that undermine incentives for collective action.

The paper clearly illustrates how approaches to farm- and landscape-level natural resource management that fail to capture the functional linkages between individual and common property, and system diagnosis and intervention that fail to move between scales (plot, farm, landscape), will miss important opportunities and fall short in their solutions. The Ginchi case demonstrates most clearly the complexity of rural land use systems by illustrating the spatial and temporal linkages among diverse tenure arrangements (private and common, *de jure* and *de facto*). Both cases demonstrate the need to consider causal linkages among system components (livestock and cropping systems, fuel and water) so that gains to different components and resource users can be optimized. Each case also illustrates the need to look beyond the plot or farm level when diagnosing and designing interventions for NRM problems, as some problems are only manifest at this level and others can only be effectively addressed through negotiation and higher-level institutional arrangements. Such complex interactions between system components, resource users and tenure regimes will affect both the popularity and impacts (social and environmental) of alternative land uses, and must therefore be brought on board as solutions are negotiated.

Strategies for anticipating and monitoring social and biophysical impacts and trade-offs and for forging "win-win" scenarios that optimize gains for different resource users and objectives (i.e. income generation and improved NRM) are discussed. In addition to ensuring that multiple perspectives and goals are brought into project interventions and NRM strategies, such approaches make explicit the need to integrate ethical concerns into our approaches to community engagement. Yet further research is needed on the effectiveness of such approaches in practice. Such experiences can most effectively be gained through the use of action research methods through which the question, "what works and why" can be answered by superimposing clearly defined research questions and observation frames on well-managed community processes.

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