

Landcare Bylaws Increase Adoption of Soil Erosion Control Technologies: Evidence from Mt. Elgon Highlands in Eastern Uganda

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Abstract

Uganda faces severe environmental problems such as soil erosion, yet adoption of technologies that can sustainably reduce or stop soil erosion remains low. This is partly due to lack of locally enacted landcare bylaws and limited involvement of local communities in bylaws formulation. Using a case study of Kween district we assessed the effect of landcare bylaws and local community involvement in bylaws formulation on adoption of soil erosion control technologies. The study used primary data collected from a survey of 120 randomly selected farmers and secondary information synthesized from Kapchorwa District Landcare Chapter reports, consultative workshops attendance lists, lists of members on the Bylaw Implementation Committee, and the printed poster of the “Benet landcare bylaws”. The data was analysed through generation of descriptive statistics. Findings indicate that there was minimal involvement of local communities in bylaws formulation. Although penalties for breaking the enacted landcare bylaws exist, they were yet to be enforced. Further, we note a sharp increase in adoption levels of all technologies stipulated in the bylaws during the year (2009) when the bylaws were passed and popularized. Adoption of soil erosion control technologies is highest among people who participated in the formulation of the bylaws. Thus, we conclude that other factors remaining constant, both the landcare bylaws, and involvement of local communities in bylaws formulation are associated with increase in technology adoption.

Keywords: Landcare bylaws; Community involvement; Uganda

1. Introduction

Uganda faces severe environmental problems such as soil erosion, declining soil fertility and deforestation, among others (National Environmental Management Authority [NEMA], 2010). At least 87 percent of the country’s land suffers some degradation induced by humans (Bannada, 2010). Ranked in their order of priority, soil erosion is the major type of land degradation in the country (Ministry of Water and Environment [MWE], 2006). In 2002, Moyini and others estimated the cost of land degradation at US\$ 129.3 million per year. Olson et al. (2004), later noted that this loss was particularly emanating from stagnated or declining crop yields. Soil erosion leads to loss of nutrients that plants require for proper growth. Majorly because of soil erosion, on-farm crop yields are said to be three time less than the attainable potential yields. For example, it is noted in the country’s agricultural development strategy and investment plan that because of soil erosion, maize output declines by 190kg per hectare per year (Ministry of Agriculture, Animal Industry and Fisheries [MAAIF], 2010). Overall, environmental degradation was estimated to cause losses ranging from 4 to 12 percent of Gross Net Product. Soil erosion and nutrient loss accounts for 85% of the losses due to environmental degradation (Olson and Berry, 2003).

The National Environmental Management Authority (2010) identified the following areas as key hotspots where soil erosion is rampant: south western highlands, Lake Victoria Crescent, Northwest and Eastern highlands, and the cattle corridor. In these areas, 60 -90% of the land is affected by soil erosion; and the World Bank (2010) estimated soil erosion at more than 5 tons per hectare per year. In Uganda’s highlands, cultivation of steep slopes, deforestation and non-use of soil conservation technologies are the prime cause of soil erosion and landslides (NEMA, 2010).

In response to the devastating impacts of soil erosion, the Government of Uganda (GoU) formulated a number of natural resource management policies and passed several statutes at national level. Some districts and even lower administrative levels designed strategies and enacted bylaws to address land degradation (Nkonya *et al.*, 2005a). In addition, the National Agricultural Research System generated technologies that can sustainably reduce land degradation, but most farmers have not adopted them (MAAIF, 2011). Thus, land degradation due to soil erosion still persists and presents a big challenge to attainment of food security and substantially high incomes, especially among households that solely depend on agriculture.

According to IFPRI (2007) adoption levels of soil and water conservation technologies ranged from as low as 2% to 17%. It should be noted that adoption of soil erosion control technologies prevents further land degradation and restores the fertility of degraded lands. Therefore, low incidence of adoption of

improved agricultural technologies implies that the benefits of such technologies are not yet fully exploited. The low adoption of soil erosion control technologies has been attributed to knowledge gaps in terms of associated costs and benefits of using these technologies, but is partly aggravated by policy bottlenecks (Sanginga *et al.*, 2007; Mmbaga *et al.*, 2007). Three major policy related problems reported by Nkonya *et al.* (2005b) are lack of locally enacted supportive policies (bylaws) to stimulate adoption of SEC technologies, limited involvement of local communities in the formulation of the bylaws and lack of or weak enforcement of penalties.

While proximate impacts of national policies and policy reforms on land management in Uganda are well documented by Nkonya *et al.* (2004), there is scanty literature on landcare bylaws at lower administrative levels in the country. For example, Sanginga (2000) stopped at highlighting the bylaws enacted at sub-county or community levels without specifying the associated means of enforcing them. Another study by Nkonya *et al.* (2005b) analysed the determinants of enactment, awareness of and compliance with Natural Resource Management regulations enacted at the community level.

The current study differs from the previous studies since it documents the bylaws together with the penalties for their enforcement, measures the level of local community involvement (disaggregated by sex) in bylaws formulation and implementation, and determines the effect of the bylaws and local community involvement in bylaws formulation on adoption of technologies stipulated in the bylaws. This paper is divided into different sections including: a review of the landcare bylaws in the study district, a conceptual framework relating landcare bylaws and adoption of soil erosion control technologies, methodology, results and discussions, conclusions and recommendations.

2. Landcare bylaws in Kween (Benet landcare bylaws)

The creation of the Landcare bylaws in Kween district serves to emphasize the fact that reversal of land degradation demands that governments devise a range of policy instruments that can influence behaviour and practice in a decentralized manner. The genesis of the bylaws in Kween district was the realization by people of the *Benet* community that they were facing severe problems of: (1) excessive run off, soil erosion and landslides; (2) few sited contour bunds to stop soil erosion and run-off; (3) destruction of crops, agroforestry trees, and soil and water conservation structures by roaming animals (especially after crop harvest during the dry season); (4) low tree cover, fuel wood and fodder scarcity; and (5) river bank erosion. Together, these problems had culminated into remarkable soil fertility decline, manifested in low crop yields and livestock production. The latter are the main sources of livelihood for people in Kween district and so their food security status was getting compromised and their incomes too were continuously reducing (Kapchorwa District Landcare Chapter [KADLACC] Report, 2009).

The landcare bylaws for Kween district were named after *Benet*, the community that initiated their formation and so they are referred to as the “*Benet Landcare bylaws*”. These bylaws came into being as a community initiative to formulate simple community bylaws that would help them effectively control the above problems. Previously, the presence of landcare policies, instruments, regulations, guidelines and implementing institutions, were hardly known by the communities and their practical implementation and adoption was therefore almost of no consequence. Furthermore, there had been no documented community landcare bylaws in use in the district, hence the need to have formerly endorsed and documented bylaws.

In June 2006, KADLACC with support of African Highlands Initiative (AHI) supported the initiation of Benet landcare bylaws formulation processes. In 2008, the International Union of Conservation of Nature (IUCN) leveraged on AHI earlier interventions on bylaws formulation and integrated Natural Resource Management (NRM) by supporting KADLACC and Kapchorwa Community Development Association (KACODA) in finalizing the bylaws. In May 2009 the *Benet* sub county council passed the “*Benet landcare bylaws*”. The formulation of these bylaws is in line with the GoU’s efforts in integrated NRM stipulated in the legislative and policy frame work, environmental statutes and regulations on landscape management. Indeed, article 237(7) and 242 of the constitution of Uganda and sections 38 and 39 of the local government statute allow for NRM policy and bylaws formulation (GoU, 1995). For each bylaw that is broken there are cash and non-cash penalties. The cash penalties are meant to pay for hired labour to do what the defaulter fails to do. They are also meant to deter people from disobeying the bylaws. Details about the Benet landcare bylaws are provided in the next paragraphs.

In order to control excessive run-off, soil erosion and landslides, it was agreed that it is community collective responsibility to manage the landscape to tackle the problem involving both up slope and down slope households. Any person who shall not voluntarily participate in the management of the landscape shall be arrested and detained for 2 days at the Sub- County cells and shall pay a cash fine of two US dollars,

The bylaw on making contours states that every household must site, establish and maintain contours on its farmland. Additionally, each household must plant Napier grass and agroforestry trees to stabilize the contour bunds. The head of a household that fails to site contour bunds on its farmland shall be arrested and

made to pay a fine of two US dollars. He/she shall also pay a fine of eight US dollars to 13 USD for community support in establishing contour bunds with Napier grass and Agroforestry trees on that household's farmland.

The bylaw on free grazing livestock that destroy crops, trees and contours states that all livestock must be managed in confined places either on zero grazing or fenced paddocks to prevent them from destroying crops, trees and the sited contours. For every tree or seedling damaged or uprooted by loitering animals the owner shall pay a fine of four US dollars. Failure to replace the destroyed crops, trees or contours or pay the fine the livestock owner shall be arrested and then taken to the sub county cells until he/she complies.

The bylaw on low tree cover states that every community member must plant trees on steep hilly slopes and fragile landscapes. Any person who disobeys this law shall pay a fine of four USD and will be compelled to plant 200 tree seedlings. Additionally, all the absentee landlords must establish contours and plant trees on their farmlands. Any absentee land lord who does not comply shall pay eight USD and relevant means will be devised to compel him/her to abide by the provisions of the bylaw.

All residents and absentee land lords must not cultivate 10 to 30 metres along river banks from the highest water mark. All river banks must be left under natural growth at 10 to 30 metres for big rivers and 5 metres for smaller streams. Any person found ploughing or growing crops along the streams/ riverbanks, he/she shall pay a fine ranging from 2 to 17USD and warned seriously; or He/she shall be arrested and jailed for two days, forced to uproot the crops on the river banks, and pay a fine of four US dollars.

The penalties for the different bylaws are stated in ranges to account for the social economic status of the defaulter and the magnitude of the offence. However, by the time of the study the penalties for breaking the bylaws were not being enforced mainly because the local leaders, some of whom are supposed to be lead implementers were not supportive. Nkonya et al. (2005b) reported that the fear of losing votes if the local leaders seek to be elected back into office makes them reluctant in enforcing the penalties. Thus, successful implementation of the bylaws requires that local leaders embrace the bylaws and support implementation by the communities. The fact that penalties were not enforced meant that it was not possible to determine whether the stated penalties are appropriate to deter people from breaking the bylaws.

3. METHODOLOGY

3.1 Theory of negative environmental externalities

The theory of negative externalities is the foundation of environmental economics. According to this theory, externalities arise when certain actions of producers or consumers have unintended external (indirect) effects on other producers or consumers. Externalities may be positive or negative but the focus of this study is on negative environmental externalities. Negative environmental externalities arise when actions by an individual or group of individuals produce harmful effects on others. Usually, policy options are required to internalise the negative environmental externalities (Merlo and Croitoru, 2005).

In the context of this study, community landcare bylaws are needed to ensure collective action in soil erosion control at landscape level. It is a requirement stated in the bylaws that all farmers along landscapes on Mt. Elgon should adopt soil erosion control technologies. This is because efforts by one or a few farmers to adopt soil erosion control technologies may be a waste if other farmers do not adopt such technologies. The actions of non-adopters of soil erosion control technologies may have spill-over effects – beyond the farmer's boundaries. For example, failure of households whose farms are located uphill to use soil erosion control technologies leads to excessive water run-off and persistent soil erosion both on the uphill and the downhill farms.

Therefore, for soil erosion to be completely stopped there is need for all farmers on the landscape to adopt appropriate technologies. Similarly, Garry (2000) asserts that on steep or hilly slopes the use of soil erosion control technologies by one or a few farmer(s) may not be effective in controlling soil erosion, since the resulting run-off from non-adopters would flow through the entire landscape at a high speed. That's why landcare bylaws come in handy to ensure that all farming households on the entire landscape use soil erosion control technologies. In the highlands of Mt. Elgon (Eastern Uganda), farmers experience severe run-off and soil erosion because of few contours along the landscapes, destruction of existing contours by roaming animals, and low tree cover caused by deforestation.

Adoption of soil erosion control technologies depends on many factors but the scope of this paper is limited to the effects of landcare bylaws and the involvement of local communities in bylaws formulation. As noted by North (1990), institutions shape human behaviour and thus greatly influence the decisions regarding natural resource management. In the context of this study, landcare bylaws are institutions meant to combat land degradation by promoting adoption of soil erosion control technologies. Logically, compliance with the bylaws means adopting the technologies stipulated therein, which then translates into reduced soil erosion, increased soil fertility and hence higher crop yields.

3.2 *The study area*

The study was conducted in eastern Uganda, in Mt. Elgon highlands, which is characterized by high and well distributed rainfall (>1,200mm/year), high altitude (700 to 2,800 masl), cooler temperatures, and relatively fertile volcanic soils (Nkonya *et al.*, 2008). The study was specifically undertaken in Kween district, where farmers experience severe land degradation caused by the steep rugged nature of the terrain and heavy rains (MFPED, 2000). The choice of the study district was based on the fact that among the other districts in the Mt. Elgon highlands, only Kween has officially enacted bylaws locally to address the problem of land degradation.

3.3 *Data sources, tools and methods of collection*

The study used data and information drawn from both primary and secondary sources. The sources for primary data included a survey of farmers and key informant interviews. A survey of 120 randomly selected farmers was conducted. The selected farmers were interviewed face-to-face using a semi-structured questionnaire. The interviews were conducted during the months of March and April in 2011. The main advantages of using a semi-structured questionnaire are: it allows the interviewer to prompt and probe deeper into a given situation, and to explain or rephrase the questions if the respondent is unclear about the questions. Thus, according to Fowler (1998), use of a semi-structured questionnaire can effectively minimize bias and random error. A checklist was used to guide the discussions with key informants.

Additional secondary information was synthesized from Kapchorwa District Landcare Chapter (KADLACC) reports, consultative workshops attendance lists, lists of members on the Bylaw Implementation Committee (BLIC), and the printed poster of the “Benet landcare bylaws”. These sources of secondary information were obtained from the Coordinator of KADLACC, local council leaders, and some people who participated in bylaws formulation and implementation processes.

The data collected included; description of the landcare bylaws for Kween district, local community involvement in bylaws formulation processes, farmer use of landcare technologies stipulated in the bylaws, and impacts attributed to the landcare bylaws, as perceived by the communities. The data was analysed through generation of descriptive statistics namely: frequencies, percentages, line chart, two-sample proportion tests and 1- sided Fishers’ exact test.

4. Results and Discussions

4.1 *Involvement of local communities in bylaws formulation*

Findings from the survey revealed that there was minimal involvement of local communities in the formulation of the “Benet” landcare bylaws. The level of local community involvement was as low as 9% and was dominated by men (about 90% of participants). Indeed, results of the two-sample proportion test confirmed that there was statistically significant difference ($z = -12.575$, $p = 0.00$) in the proportion of participants and non- participants. Focusing on participants only, results further revealed that the proportion of male participants was significantly higher than that of females ($z = 16.781$, $p = 0.00$) (Table 1). The most commonly cited reason for not participating was *lack of information on the time when and venue where the bylaws formulations processes were being held* (about 60%). Other reasons for non-involvement were; *was never invited* (26%), *was away for a visit* (about 11%) and *lacked confidence because of being illiterate* (3%).

During the formulation of the bylaws three activities that had the highest levels of local community involvement were consultation workshops on: capacity building and technical backstopping (about 31% attendance); review of draft bylaws (18% attendance); and unveiling parish level natural resource management issues of concern to the communities (about 15% attendance). Attendance of these three major consultation workshops on bylaws was used to further explore the differences in involvement disaggregated by sex. Findings presented in Table 1 shows that local community involvement in all the three workshops was dominated by men and the z statistics confirm that the differences in the levels of participation by sex were statistically significant. On this ground, we affirm that the number of male participants in bylaws formulation was indeed significantly higher than that of female participants.

Table 1: Attendance of bylaws formulation consultation workshops by sex

Workshop participants	Percentages of participants by workshop		
	Capacity building & technical backstopping	Consultation on draft bylaws	Parish level consultation on NRM
All (n = 220)	30.45	18.18	14.55
Men (n = 198)	30.81	19.70	15.66
Women (n = 22)	27.27	4.55	4.55
<i>z</i>	5.52	6.30	5.51
<i>p</i>	0.00	0.00	0.00

Source: Own calculations from consultative workshop attendance lists

The low involvement of women in bylaw formulation consultation workshops is explained by the fact that they were unwilling to attend meetings and freely contribute ideas whenever they were called upon (discussion with key organizers of the workshops). The organizers of the workshops attempted to increase the involvement of women partly by using women local leaders to mobilize fellow women to attend the workshops. It is important to ensure full participation of women in issues pertaining to landcare so that their voices are heard too. This is because the agricultural sector employs a higher proportion of women (83%) than men and so issues pertaining to landcare are likely to affect women more than men. Moreover, Sanginga et al. (2005) noted that sometimes men's interests differ from those of women and for that reason equal representation of both sexes in bylaw formulation processes is indeed vital.

When asked whether non-involvement in bylaws formulation had impacted on them, majority (83%) of the non-participants (n = 92) said "No" and explained that they still got to know about the bylaws when they were being popularised on local radio stations and in trading centres. Nonetheless, there are a few respondents who said that because they did not participate, they were *insufficiently informed about the bylaws* (7%) and that their *ideas were not incorporated in the bylaws* (2%). On the other hand, those who were involved in bylaws formulation processes felt proud to have had the opportunity to participate and get first-hand information about the bylaws, feel they own the bylaws and would want to see them fully functioning through the proposed tools of enforcement.

4.2 Status of implementation of the landcare bylaws

The landcare bylaws are supposed to be implemented through the collective responsibility of local leaders, farmers, and the Bylaws Implementation Committee (BLIC). The BLIC is supposed to take the central role in ensuring effective implementation and it is composed of Parish chiefs, Local Council I, Secretary for environment and production, opinion leaders, and a few farmers. Specifically, members of the BLIC are supposed to perform the following roles: 1) Ensuring that the bylaws are implemented correctly as per the guidelines; 2) Holding negotiations between different stakeholders concerning destruction of crops, livestock, and water diversions, conflicts, and compensations; 3) Mobilizing and sensitizing community members on integrated Natural resources management; 4) Participating in monitoring of bylaws implementation by farmers; 5) Evaluating the bylaws implementation progress through periodic meetings; and 6) Assisting the local councils, chiefs, courts of law and police in maintenance of law and order and improving transparency.

As the case was with involvement in bylaws formulation processes, majority (>64%, N = 70) of the members on the BLIC are men. However, discussions with members of the BLIC revealed that by the time of the study none of them was undertaking his/her roles. This is because although the roles of the BLIC are well spelt out, individual members of the BLIC have not yet been assigned specific roles and neither have they been trained and empowered to perform their roles. This implies there is a capacity gap, which if not urgently addressed, means that bylaws implementation cannot be fully effected.

4.3 Adoption of soil erosion control technologies stipulated in the bylaws

Three soil erosion control technologies namely: contours, Napier grass and Agroforestry trees, are mentioned in the "Benet landcare bylaws". By early 2011, a high percentage (83%) of farmers in Kween district had adopted contours. More than half (54.6%) of the farmers were using at least two of the technologies stipulated in the bylaws. Despite the presence of enacted landcare bylaws, there were a few farmers (9%) who had not adopted any of the technologies mentioned in the bylaws (Table 2). This suggests the need to continue popularising the bylaws among the local communities.

Table 2: Adoption of technologies spelt out in the bylaws

Technology	Frequency	
	(n = 120)	Percent
Contours	99	83.19
Napier grass	60	50.42
Agroforestry trees	40	33.61
Contours + Napier grass	54	45.38
Contours + Agroforestry trees	33	27.73
Napier grass + Agroforestry trees	30	25.21
Contours + Napier grass + Agroforestry trees	26	21.85
None of the technologies	11	9.24

Source: Own calculations from survey data

Generally, adoption of soil erosion control technologies is highest among people who participated in the formulation of the bylaws. Except for contours, at 5% level of significance there is sufficient statistical evidence indicating that involvement in formulation of bylaws increases adoption of technologies stipulated therein. Specifically, involvement in bylaws formulation increases the likelihood of adoption by 34.6% and 32.8% for Napier grass and agroforestry, respectively (Table 3). The findings thus, confirm the concern that low community involvement in bylaws formulation is indeed a hindrance to wide-scale adoption of soil erosion control technologies as reported by (Nkonya *et al.*, 2005b).

Table 3: Technology adoption by participation in bylaws formulation

	Percentage (%) of adopters of SEC technologies		
	Contours	Napier grass	Agroforestry
Participants (n = 12)	81.82	81.82	63.64
Non-participants (n = 108)	83.33	47.22	30.84
Overall (n = 120)	83.19	50.42	33.61
1-sided Fishers' exact	0.585	0.029	0.035

Source: Own calculations from survey data

For each technology adopted, farmers were asked to state the year when they first used the technology. Using this information, we computed the total number of adopters for the study sample for the period 2001 to 2010. This was done in order to enable examination of the distribution of adopters across the ten years. Findings revealed that the shares of 2009 (in terms of adopters) were remarkably higher than those of other years. Specifically for the period 2001 – 2010, 32% of Napier grass adopters, 27.6% of contour adopter and 17% of agroforestry trees adopters, were first time users of these technologies in 2009. The rest of the adopters are thinly distributed among the remaining 9 years (Figures 1 and 2). It should be noted that in 2009, the “Benet landcare bylaws” were passed and popularised through radio messages, meetings at village, parish and sub-county levels, and display of posters in some trading centres. Thus, it is not far-fetched to attribute the remarkable increase in the percentage of farmers adopting soil erosion control technologies in 2009 to the formulation of and compliance with the bylaws.

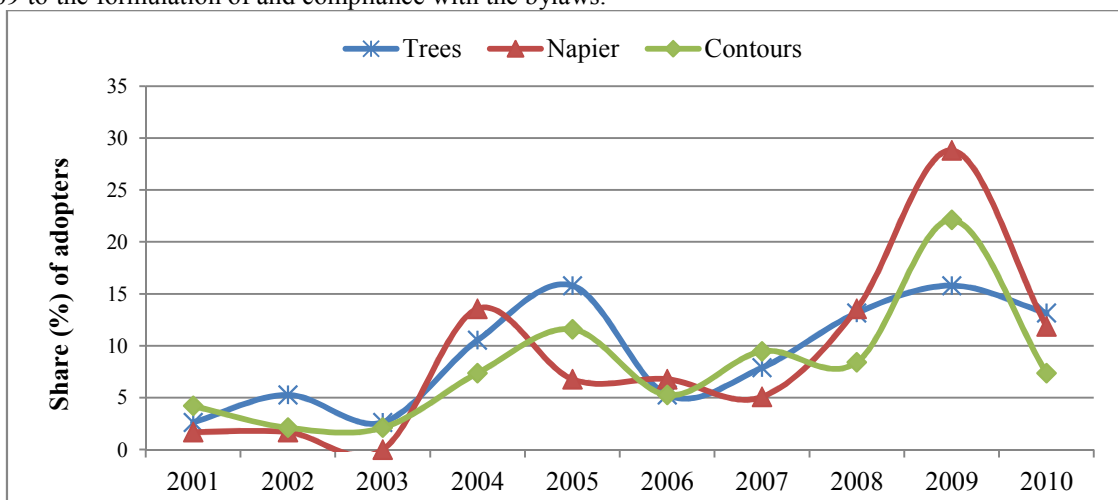
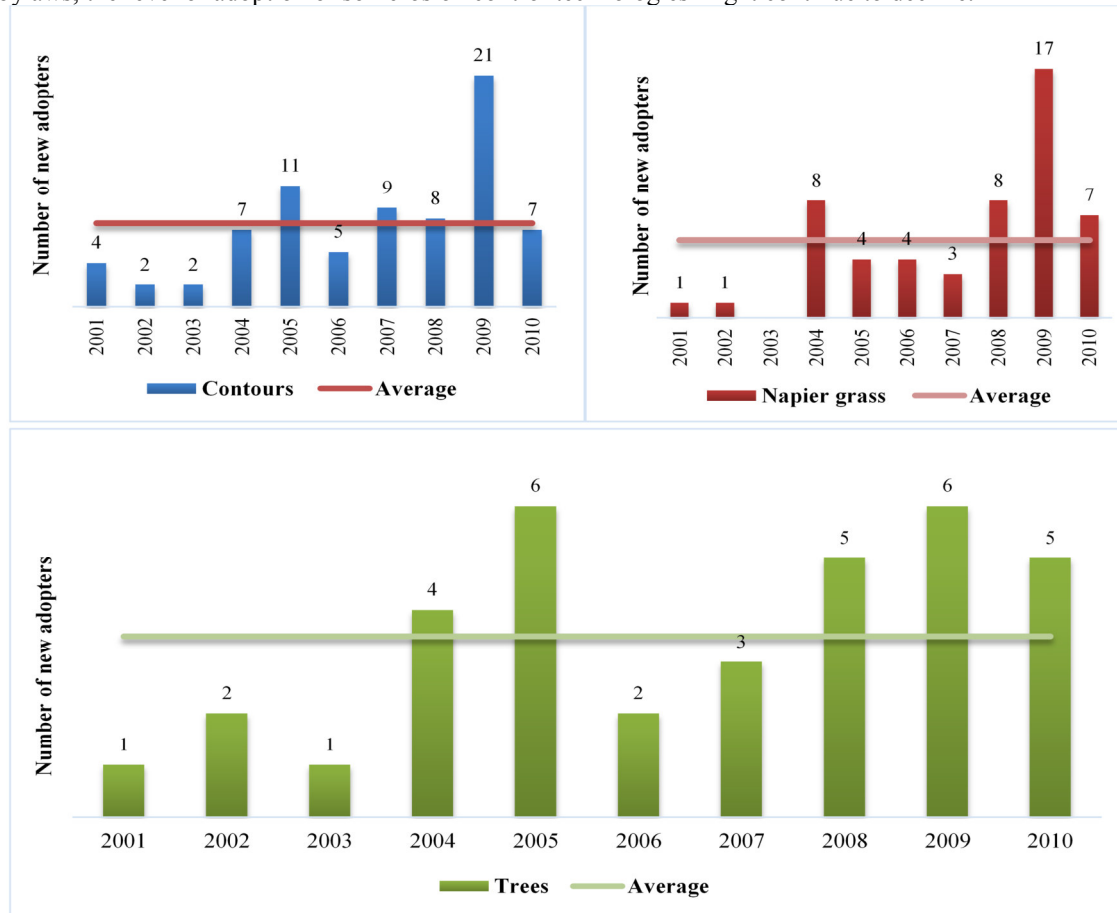


Figure 1: Distribution of technology adopters over the period 2001 -2010

Source: Own calculations from survey data

The result support the finding by IFPRI (2007) that farmers adopt soil and water management

technologies primarily because they are required by their local bylaws to do so. The drop in the proportion of farmers adopting soil erosion control technologies in the year 2010 could be an indication of bylaws disobedience emanating from the fact that people have come to realize that the penalties are not being enforced after all. This points out that unless the BLIC begins to enforce the penalties associated with breaking of the bylaws, the level of adoption of soil erosion control technologies might continue to decline.



Source: Own calculations from survey data

Figure 2: Trends in number of new technology adopters; 2001 – 2010

4.4 Farmers' perceptions about the outcomes of the landcare bylaws

Despite the zero enforcement of the penalties, bylaws have had many positive outcomes in the communities. According to the results presented in Table 4, the most commonly mentioned positive impacts were: reduced soil erosion (68%), less destruction of crop and contours (56%), and increased crop output and sales (33%). The presence of the bylaws has made many households to site contours on their farms, which has led to reduced soil erosion and therefore maintenance of soil fertility. Also, because people fear being penalized in case their animals roam and destroy crops and contours, there is less destruction, which has encouraged people to grow more crops and even get marketable surplus. Moreover, the Napier grass and the trees planted to stabilize the contours also serve as an additional source of income through the sale of cuttings and tree products. Additionally, fuel wood and fodder, which used to be scarce before the formulation of the bylaws, are now readily available and relatively cheap.

Table 4: Desirable outcomes attributed to landcare bylaws

Outcome	Frequency (N = 103)	Valid Percent
Reduced soil erosion	70	67.96
Less destruction of crops and contours	58	56.31
Increased crop output and sales	34	33.01
Augmented income from Napier and trees	18	17.48
Availability of cheap tree products	18	17.48
Clean water	9	8.74
Fresher air	5	4.85
None	2	1.94

Source: Own calculations from survey data

Nonetheless, to a small extent, bylaws have resulted into some undesirable effects as explained herein. Although majority (74%) of the people who knew the bylaws said that no negative impact had resulted from the bylaws, a substantial percentage (25%) of them reported that bylaws have created enmity and conflicts between the plaintiffs/complainants (e.g. a person whose crops or contours have been destroyed by roaming livestock) and defendants (e.g. the owner of livestock that has caused the destruction). For example, when the plaintiff takes the defendant's livestock to the sub county for detention, the defendant starts to hate or socially exclude the plaintiff, even though he gets back his livestock without being penalised. Similarly, Sanginga et al. (2005) reported that NRM bylaws always cause some negative impacts such as enmity between people who hate the bylaws and those who are supposed to be implementing the bylaws.

5. Conclusions and Recommendations

There was minimal involvement of local communities in the formulation of the Benet landcare bylaws. The study finds sufficient statistical evidence that participation in bylaws formulation was dominated by men. Similarly, on the implementation side, the bylaws implementation committee (BLIC) has a remarkably higher proportion of men than women. By the time of the study, none of the BLIC members were performing their duties due to inadequate capacity and powers to enforce the penalties. Thus, although penalties for breaking the enacted landcare bylaws exist, they are yet to be enforced.

The study recommends that the capacity needs of the Bylaws Implementation Committee should be addressed through training and empowerment to enforce penalties. Government of Uganda together with NGOs such as the African Highlands Initiative and International Union of Conservation of Nature should provide technical support to all BLIC members to enable them execute their specific roles. Since there is no strong basis upon which this study could measure the effectiveness of bylaws penalties in stimulating technology adoption, later when the penalties have been enforced for a reasonable time, a follow up study can then be done to test the effectiveness of the penalties in increasing technology adoption.

Both local community involvement in bylaws formulation and the bylaws enhance adoption of soil erosion control technologies. This is shown by the sharp increase in adoption levels of all technologies stipulated in the bylaws during the year (2009) when the bylaws were passed and popularized. In terms of proportions, adoption of technologies stipulated in the bylaws is highest among farmers who were involved in the formulation of the bylaws. Therefore, other districts experiencing the challenge of land degradation should enact bylaws that are specific and relevant to their socio-economic situation. However, when formulating the bylaws, gender equity in local community involvement should be taken into consideration.

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