ESAPP Q 501 – The impact of SWC on water use in the Gergera catchment, Tigray, Ethiopia

Trends and challenges in the Gergera watershed

Results from a socio-economic survey and focus group discussions at the Kushet, Tabia, and Woreda level

The Gergera watershed from the upper catchment

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Introduction

The ESAPP project 'The impact of SWC on water use in the Gergera catchment, Ethiopia' aims at assessing the impacts of SWC measures in the Gergera watershed, Ethiopia, and ways to up-scale the successful approach. Focus group discussions were used to complete and complement the information gathered by a socio-economic survey. The objective was to get a more in-depth understanding of socioeconomic aspects and stakeholder perspectives regarding SWC and its impacts in the watershed.

The Gergera watershed is fully rehabilitated and is one among the successful *Tabia*s and recognized as a model watershed in the regional state. This watershed consists of three villages named Gergera, Geter-Haikimeshal and Damino. The ESAPP project Q501 mainly focuses on the village Gergera. However, when the upper catchment of the watershed is conserved the benefits of these conservation activities are not only to this village but also to the villages down-stream. According to the head of the *Tabia*, during the past 10 years the labor force needed for implementing the SWC activities was mobilized from the three villages. For these reasons we decided to have a look at all three villages. In the socioeconomic part of the project a survey was carried out covering the three villages that belong to the watershed. The survey was made both by interviewing randomly selected households using a standardized questionnaire and focus group discussions with different stakeholders at different levels of decision-making.

The **socio-economic survey** was conducted in August 2008. It covered a total of 162 households in the Gergera watershed. The number of respondents selected for an interview was equal for the two villages Gergera and Geter-Haikimeshal, and a bit smaller for Damino because this village is located at the end of the watershed and partly belongs to other watersheds. The questionnaire contains detailed questions covering demography, access to infrastructure, sources of income, plot level yields and perceptions regarding agricultural productivity and SWC activities. Though households patiently respond to all questions, they were a bit reluctant to be honest to inform on plot level yields. For this reason, this report doesn't include plot level yields and comparison between plots with and without SWC.

The **focus group discussions** were held in October 2008. Five discussions were conducted at different levels of decision-making:

- **Kushet** (village) **level**: 3 discussions were held with farmers from 3 villages (*Gergera* in the upper catchment, *Geter-Haikimeshal* in the middle part of the catchment, and *Damino* in the lower catchment). From each village the discussion partners consisted of: model farmers, women farmers, young farmers, older farmers, landless farmers, *baito* (village council) representatives). The three discussions were held on Saturday, October 25th, 2008, at *Geter-Haikimeshal.* For the discussion guidelines please see Annex 2.

- **Tabia level**: 1 discussion was held with experts at the Tabia level which are local development agents; chair person Tabia; health extensionist; home agent; representatives of: elders, youth, farmer cooperatives, women association, water user association.

- **Woreda level**: 1 discussion held at the Atsbi Woreda Agricultural and Rural Development Bureau (ARDB) with experts from the Woreda level who are: head rural development; head women association; head natural resources; health; education; water; livestock.

All discussions were held in a relaxed atmosphere, and participants were interested and most of them participated actively in the discussion. The duration of the discussions was 2 to 3 hours each. Before starting the discussions, the facilitator briefly explained the project context and the

objectives and purpose of the discussions, and everybody introduced him or herself. All discussions were facilitated by Tsega G/Kristos of MU. Asmelash Berhane (MU) took notes, and Ahsenafi G/Micheal (MU) acted as a translator for Felicitas Bachmann (CDE, University of Bern, Switzerland), except for the Woreda level discussion, where no translation was available.

1. Trends and changes observed in the Gergera watershed

According to what land users said in focus group discussions, first SWC activities in the Gergera watershed started in 1992 /93 (1985 EC), and then in 1996 (1988 EC) in a more organized way. The upper-catchments of the watershed are well rehabilitated and protected. The water in the river, which starts from the bottom of the hill, is flowing throughout the year increasing its volume as it gets down and the size of hectares being irrigated is increased from year to year. Consequently the livelihood of the community is getting improved. The following is an overview on changes and trends observed in the Gergera watershed.

All respondents to the questionnaire survey witnessed that productivity of crop and livestock have improved, compared to five years ago (see Table 1). This was also confirmed by all focus group discussions. In the case of fruit and vegetable production not all respondents experienced an improvement.

Table 1: Agricultural productivity trends as of the last 5 years

Village	Productivity	Product type			
		Crop	Livestock	Vegetable/fruit	Honey
Gergera	Improved	100%	100%	55%	37%
	Not Improved			18%	27%
Geter-Haikimeshal	Improved	100%	100%	61%	25%
	Not Improved			17%	36%
Damino	Improved	100%	100%	77%	33%
	Not Improved			5%	23%

Note: the figures represent percentage of respondents from the sample.

What catches the attention is, that the percentage of respondents confirming an improvement is lowest in Gergera, the up-stream village and highest in Damino, the down-stream village. We don't know the reasons for this but assume, that it could reflect the fact that irrigation down-stream is technically more easy than up-stream (see below).

From visual inspection the upper catchment is rehabilitated, fields have percolation ponds and the large gully is getting narrower. The reasons for productivity improvement are many-fold; besides the increased water potential (river, spring, well) due to soil and water conservation activities (see Table 3), the introduction of different types of inputs as shown in Table 2 has a positive effect.

Table 2: Agricultural inputs during the last five years

Village	Inputs	Product type			
		Crop	Livestock	Vegetable / fruit	Honey
Gergera	Available	2,5	2, 5 & 1,3	2 &7,5,6	1,2,3,4
	Lack			4 &3,5	3 &2
Geter-Haikimeshal	Available	2,5	2, 5 & 3,1	2,7	1,2,3,4
	Lack			4	2,3
Damino	Available	2,5	2, 5 & 1,3	2,7	2,4 & 1,3,5
	Lack			4	3 & 4

Note: figures represent types of inputs and sequence indicates level of importance.

Key:

Crop
2= improved variety
5= credit for inputs like fertilizer

Livestock
1=improved/new breed
2=improved access to forage and water
3=improved market access
5=improved vet service

Vegetable / fruit
2=improved variety
3= availability of pesticide/ herbicides
4= water/water pump
5= availability of credit for inputs like fertilizer
6= improvement of technical skills
7=access to market

Honey
1=water and forage
2=credit for input
3=technical know how
4=access to market
5= others

Crop production and productivity: Participants in the focus group discussions generally agreed that crop production and productivity have steadily increased over the time, from the beginning of SWC activities up to today. The household survey shows that access to improved crop varieties and credits for agricultural inputs are important reasons for crop production increase. In the discussion in Gergera it was mentioned, that productivity increased by far as today there are 2-3 harvests annually from rain-fed and irrigated cropland. Besides improved water availability the use of improved seeds, fertilizers and compost are reasons. In Damino, productivity increase was also related to increased soil moisture and relatively good management and irrigation practices. However, a landless farmer in Gergera mentioned that productivity decreases due to lack of fallowing practice and fertilizer costs that are too high. This might indicate that there is a problem of decreasing soil fertility in the case of resource poor households. However, this interpretation needs verification.

Livestock number and productivity: In village level discussions we were told that before the watershed was rehabilitated there were a lot of mules in the watershed used for transporting salt from the neighboring Afar region as people were engaged in very marginal salt trading. These days all the mules are gone since the people have started to harvest twice from their farm plots irrigated with water a result of successful rehabilitation activities. Participants in the focus group discussions generally agreed that both, the number of livestock as well as livestock productivity have increased over the past 15 years. Enhanced availability of water and forage resources as well as improved veterinary services are among the main reasons for livestock productivity improvement. The introduction of improved breeds (Begait) also led to productivity increase and to a stronger focus on livestock quality instead of quantity.

Formerly, few farmers owned large numbers of livestock and free grazing was the practice. Today, the number of livestock per household is small but almost every farmer owns at least two cattle, which lead to an increase in the total number of livestock held in the watershed. Technical packages, credit facilities and the improved availability of animal feed encouraged this development.

Most livestock owners adopted the cut and carry system as the major source of forage. This is partly because of availability of improved sources of forage in different forms since the closed areas serve as source of forage and forage trees are also planted in the gullies and on the sides of farmlands. On the other hand, this is strongly related to the decrease of the size of communal grazing land occurring over the past 15 years. This decrease in communal grazing land is the effect of the increase of the surface area used for area enclosures, forest land, cultivated and irrigated land, settlement area, and due to proportioning mountain areas to young landless families for production of fruits and honey. At the same time, the productivity of communal grazing land has improved due to grazing land enrichment by grass sowing, planting of fodder trees and cactus.

Food security: Data from the household survey indicated decreasing food security in the Gergera watershed. As we were surprised by this result we addressed the issue in the discussion at Tabia level. It was mentioned, that SWC and irrigation led to a production increase with 2-3 harvests annually and cash crop production (fruits, vegetables, honey, spices). So, production levels and food security were reported to have increased over the years. During 2007, however, heavy rains resulted in water logging and damages to fields caused by heavy run-off which covered fields with sand or washed them away, forming of new gullies, etc. The survey result most probably reflects the difficulties encountered. Finally, discussion participants agreed that food security has increased, although Gergera watershed is still not fully self-sufficient regarding food production. Regarding animal feed, the watershed is currently self-sufficient.

Forest land: Due to reforestation and area enclosure (mainly on slopes) the forested land has increased over the past 15 years.

Irrigation: The surface area of irrigated crop land has increased over the past 15 years. In Damino irrigation with traditional river diversion was practices before SWC activities started, while in Gergera irrigation only started after 2000/01 (1993 EC). Water availability increased due to treatment of the upper catchment with integrated SWC activities. As a result ground and surface water increased according to participants in the focus group discussions. Motor pumps, water lifting technologies, improved river diversion, digging wells are technologies applied to use surface and groundwater for irrigation purposes. Farmers seek to increase their irrigated area.

Irrigation is practiced in the entire watershed but with different scales and different irrigation methods. All farmers practice furrow irrigation but the way they get water to irrigate their fields differs from village to village. The overall view on how the three villages practice irrigation is narrated in the following paragraphs.

- In Gergera village, located at the bottom of the hills of the upper catchment, some farmers have private hand dug wells on their plots that serve as sources of water to irrigate their fields. These farmers incur additional costs in terms of labor, fuel and water pump equipments to lift the water from the wells to the canals in their fields (sometimes up to 10 meters). Not all farmers have hand dug wells though, and even if they do have, the relatively shallow ones dry shortly after the rainy season.

- In Geter-Haikimeshal farmers use the river, private hand dug wells or communal hand dug wells to irrigate their fields. Here, groundwater recharge is better compared to Gergera. Few farmers reclaimed some land from the riverbed and transformed it into fruit orchards. Farmers that have plots along the river use gravity or water pumps to irrigate their fruit orchards and plots. In general, the mechanisms adopted to irrigate the fields

are either using gravity or water lifting technologies. Since the quantity of water is relatively high, a large number of farmers practices irrigation.

- Damino is the village that is located at the outlet of the watershed. Many farmers in this village have irrigable plots. The source of water for irrigation is the river that starts from Gergera; they irrigate their fields using gravity. There is a river diversion structure already in place.

Land rehabilitation and gully formation: The former riverbed was changed partly to fruit orchards in the village Haikimesehal. The former big gully in Gergera is rehabilitated and currently a communal grazing land and partly farmland. At the same time, slopes, especially in the upper catchment, are covered with much more bushes and trees than 15 years ago, when they were almost bare.

The focus group discussions revealed that between 1996-2007 (1988-99 EC) gully formation strongly decreased due to SWC intervention. It was said, that where SWC measures are in place, gully formation decreases. However, in 2007/08 (2000 EC) there were heavy rainfalls and rapid gully formation was observed in some areas of the watershed; especially the size of untreated gullies increased considerably. Also, stronger floods were reported coming from areas above the Gergera catchment, where much less SWC was implemented.

Conflicts over natural resources: Based on focus group discussions it can be said that in the past, only very few conflicts over natural resources occurred. A reason for this is that each village established by-laws regulating a fair distribution of resources such as water and grass. However, from Gergera and Geter-Haikimeshal a tendency towards more conflicts was reported, and people from Gergera related it to the increase in irrigation from communal wells, and to conflicts over the distribution of grass.

Demography: During the past 15 years, the population in the Gergera watershed has steadily increased. As a combination of factors such as population growth, small plot sizes and limited land available, the number of landless households is increasing. The discussion with people from Gergera revealed that most young people and young families today are landless, and it was reported that sometimes conflicts with offspring arise due to the limitation of available land.

Table 3: General trends in the Gergera watershed

Indictors	Before 1988 (EC)	After conservation EC		
		1988-93	1993-1998	1998-2000
Population	*	**	***	****
Landless	*	**	***	****
Number of livestock	*	**	***	****
Livestock productivity	*	**	***	****
Area of forest land size	*	**	***	****
Communal grazing land: size	****	***	***	*
Communal grazing land: productivity	*	**	***	****
Area of irrigated land	*	*	**	****
Water availability	*	*	**	****
Crop production / productivity	*	**	***	****
Gully formation	****	***	**	***
Conflicts over use of natural resources	--	*	**	**

Table 3 illustrates the general trends observed in the watershed (please note, that the table indicates trends but is not quantified).

Conclusions

1. The household survey as well as group discussions indicates an overall improvement of the livelihoods of the community and diversified income for the farm households. The productivity as well as the diversity of crop and livestock production has increased during the past 15 years, and food security improved. Two main reasons can be identified:

   A) the positive impacts of SWC activities in the watershed, which led to an increase of water availability (in quantity and time) and allowed to steadily extend the irrigated area, and

   B) the availability of agricultural inputs such as improved seeds, new breeds, fertilizer, credits, veterinary services, improved bee hives, etc.

2. All villages in the Gergera watershed strongly benefit from positive impacts of SWC activities. Not all villages do have an equal benefit though, i.e. depending on their geographical location within the watershed, farmers have to face higher or lower costs for irrigating their fields. In Gergera, farmers incur additional costs associated to digging wells and lifting water from the wells. They also face water shortage in the dry season. In Damino, farmers do not face such type of problems and they are enjoying the benefit of irrigation without incurring these additional costs. This indicates that water is relatively scarce and expensive in the village Gergera. The introduction of water saving irrigation technologies such as deficit irrigation or drip irrigation could mitigate the problem.

3. Because of their location in the watershed, not all villages benefit equally. Although these inequitable benefits currently do not seem to be a major source of conflict, it has to be considered, that this might change in future. Therefore it is advisable to develop mechanisms that ensure fair distribution of benefits among the villages as well as within each village. Probably the bylaws each village has developed already might serve as a basis for developing a bylaw that regulates benefits between villages.

SWC structures in the former gully

Irrigated vegetable production

2. Villager's perception of positive and negative effects of SWC activities

In the household survey as well as during focus group discussions people were asked what they consider to be positive and negative effects of SWC activities in the Gergera watershed.

Table 4: Positive effects of SWC activities in Gergera Watershed (survey)

	Proportion of households agreed:		
	Gergera	**Geter-Haikimeshal**	**Damino**
Reduction of soil erosion and gully formation	100%	100%	100%
Improved crop production	73%	70%	55%
Increase forage for livestock	80%	78%	75%
Increased forage for bee	76%	44%	57%
Increased honey production	68%	42%	6%
Emerging new water spring	6%	3%	2%
Improved water potential river, spring, well	58%	47%	48%
Improved downstream irrigation	13%	7%	11%
Increased vegetation cover	70%	54%	64%
Increased cultivated land	28%	22%	18%
Adopt cut and carry forage system	97%	97%	98%
Additional income from involvement in food/cash for work	97%	98%	98%

Table 4 supports the positive changes and trends regarding production increase, water availability and reduction of erosion observed and reported from farmers in the watershed. Currently we don't know exactly how to interpret the differences between villages. The considerable difference between Gergera and Damino regarding honey production might be an expression of either, a late starting of honey production in Gergera, a much higher economic importance of honey production in Gergera, or specific problems related to bee keeping in Damino (use of pesticides?). Interestingly, benefits mentioned during focus group discussions are all directly or indirectly related to an increase in crop and/or livestock production (see Table 6). The income gained from involvement in SWC work was not mentioned at all.

Table 5: Negative effects of SWC activities in the Gergera watershed (survey)

	Proportion of households agreed:		
	Gergera	**Geter-Haikimeshal**	**Damino**
Water logging	12%	2%	0%
Space competition due to SWC structures	70%	78%	59%
Crop destruction due to rodents harbored in SWC structures	100%	93%	95%
Limited grazing land	18%	3%	5%
Emerging of malaria	22%	32%	23%
Emerging of Bilharzias	0%	3%	0%
Emerging of Swampy areas	8%	0%	2%
Compete time for off-farm activities	48%	53%	36%

Comparing the most important disadvantages of SWC mentioned during focus group discussions (Table 6) and negative effects of SWC reported in the household survey (Table 5), we find damages to crops (and livestock) caused by rodents living in SWC structures and the increasing number of wild animals related to reforestation and increased vegetation cover to be the most important disadvantage of SWC. Although a majority of respondents to the survey agreed that competition for space between SWC structures and crops was a negative effect of

SWC, this was not mentioned as a mayor problem during focus group discussions; the same applies to the competition for time between SWC construction and maintenance and off-farm activities. However, a serious problem is the emergence of malaria, and to a much lesser extent the emergence of bilharzia!

Table 6: Benefits and disadvantages of SWC as mentioned by villagers (focus group discussions)

Village	Most important benefits of SWC	Most important disadvantages of SWC
Gergera	• Increased availability of bee forage • Increased availability of animal feed • Increased availability of irrigation water	• Wild animals (monkeys, hyena) increase in number and attack livestock • Rodents (mice, rats)
Geter-Haikimeshal	• Run-off from upper catchment reduced → limited negative impact on cultivated land and livestock • Increased availability of animal feed • Regeneration of different plant species • Increase of soil moisture (especially during dry periods) • Increased yields • Reduced gully formation due to reforestation	• Wild animals (monkeys, hyena) increase in number and attack livestock and crops • Malaria
Damino	• Increased availability of irrigation water • Expansion of irrigated area • Increased availability of bee forage • Increased availability of animal feed • Enhanced soil fertility	• The lack of simultaneous treatment of the upper catchment, which belongs to another Tabia has negative effects downstream • Rodents

A serious issue was also addressed in Damino, where someone raised the problem of the lack of appropriate SWC in the upper catchment which belongs to another Tabia, causing damages and negative effects in the lower catchment; a problem which can only be tackled in collaboration with neighboring Tabias.

3. Factors of Success

In order to draw replicable lessons, and for further up-scaling it is very important to identify the factors that contributed to the success observed in Gergera in rehabilitating an extremely degraded area in a relatively short time. The question was addressed in all focus group discussions, i.e. from the grass root community at the village, to the *Tabia* level and up to the *Woreda* officials. No significant differences were found between what was pointed out to be factors of success by the 5 groups.

The factors of success can be categorized as follows:

- **Integration of different levels of decision-making**: the region, the Woreda, the Tabia, the local community as well as the NGO IrishAid were directly involved into the Gergera SWC programme.

- **Commitment of administrative bodies and good collaboration between different administrative levels:** the strong commitment of the Tabia administration and the very committed and dedicated head of *Tabia,* having well-coordinated communication with the *Woreda* people up to the regional administration in place were always stressed as a key factor for success. They underline this fact by saying that the *Tabia* administrator is here for the last 10 years and so he is very good in all his endeavors This also includes

good communication and collaboration between the different administrative bodies. Strong leadership and good management also added to the success. The harmony between the *Tabia* administrator and the community is an important factor that played a crucial role in implementing the successful SWC activities.

- **Awareness and commitment of the community at large:** the community at large has a high level of awareness regarding the importance of available natural resources and the positive effects of SWC, and was and is involved in rehabilitation and protection (youth association, women association, farmer association). in 1992, the community in Gergera was requested by the former *Tabia* administration to be relocated to other places because of the severe degradation they were suffering. As they tried to explain, it used to be very difficult to cross the gully as it got deeper and wider from year to year, a result of heavy runoff. As a result of the community being confronted with the severity of the problem, they became really committed to contribute their free labor whenever needed and to participate in SWC activities. The effort and full participation of the community throughout the process from problem identification to implementation and maintenance of SWC was often mentioned.

- **Open-mindedness of the community**: The community is open to accept advice and new technologies introduced by the Tabia experts (development agents).

- **Service provided by Tabia experts:** development agents are reported to be very committed and providing good awareness creation activities and training on agricultural practices, diversification, intensification, etc.

- **Limiting and protecting free grazing:** In slopy areas free grazing is completely prohibited and in the grasslands grazing is on rotational basis and for a limited number of cattle.

- **Integrated approach:** the SWC approach used integrates physical (e.g. gabion, retaining walls) and biological (e.g. grazing land enrichment, planting fodder trees, grass sowing, etc) SWC measures which is considered an important factor of success. Also the integration of different sectors and therefore multidisciplinary approach was considered important as well as contributions from research (ICRAF, ISD) and different NGOs throughout the process of SWC implementation.

- Additional factors mentioned are: The existence of **strong by-laws,** and **financial support by IrishAid.**

Based on the discussion at different levels, it seems that the commitment of the community and the *Tabia* administrator are the key players for the successful implementation of SWC activities. Implicitly it seems also commitment of the community depends up on the harmony between the *Tabia* administration and the community. In a way this indicates that having wise *Tabia* administrator that can work in harmony with the community is a key factor of success. The communities' openness to accept introduction of rural development technologies also depends on the trust and respect of the *Tabia* administration. The success factors mentioned at *Woreda* level were focused more on policy issues and scientific approaches of the SWC activities in particular and rural development in general. The factors raised by the community were more related to concrete activities, at the *Tabia* level it seems a combination of both activities and inputs.

4. Challenges

4.1 Challenges during implementation of SWC

Discussing with Tabia representatives, we addressed the question, which challenges had to be faced in the past, i.e. during implementation of the SWC programme. The following main challenges were mentioned for the past:

- **Mobilisation and sense of ownership**: in the beginning it was not easy to mobilize people, as they were skeptical about expected outcomes of SWC activities. The awareness on the benefits of the programme was lacking, and the attitude towards sharing benefits was problematic. Creating sense of ownership was an issue throughout the programme. Today there is sense of ownership but the head of Tabia considers it to be still too weak.

- **Coordination with adjacent Tabias**: there is low concertation with adjacent Tabia in regarding the treatment of the upper catchment. There have been meetings and discussions, but they were difficult

- **Cut and carry system**: a major challenge was limiting open grazing, as it was difficult to convince people of the benefits of restricted grazing and the cut and carry system.

- **Maintenance of SWC structures**: it is considered difficult to encourage people to maintain SWC structures in their own interest. The perception that SWC structures belong to and are in the responsibility of the government, is still widespread and therefore payment for maintenance work is expected.

The watershed is rehabilitated and during the process many variables were controlled by the *tabia* administration. Now the watershed is considered as a model because of its achievements. In order to maintain the existing benefits and to maximize them trends and developments in the watershed and beyond have to be considered, as they may have positive or negative impacts on the sustainability of the current land use system and resource management in the Gergera watershed. In all focus group discussions we let people discuss on challenges they think the watershed will have to face in future.

4.2 Future challenges for the watershed

At all levels of discussion similar challenges were mentioned, which can be categorized as follows:

4.2.1 Increasing pressure on natural resources

Deforestation: Possible deforestation was the main concern of the village community. They mentioned that vegetation coverage in the area closures is currently lower compared to previous years because the guards were not paid regularly their monthly allowance by the Bureau of Natural Resources. This may imply that the Bureau of Natural Resources and Agriculture is the owner of the area closure. Also Tabia representatives were very concerned about the danger of deforestation. It was argued that rising costs for fuel, the lack of alternative sources of energy (such as e.g. electricity), and the fact that the watershed is situated in proximity of rural centers may increase the pressure on forestland, as people might want to use

the forest as a source of fuel wood, which would accelerate the deforestation problem. This problem of limited availability of fuel wood and lack of alternatives and the resulting pressure on area enclosure was also stressed at the Woreda level. In order to mitigate the problem, the introduction of improved, i.e. more energy-efficient stoves was started.

Overuse of water resources: at the Tabia level the concern was mentioned, that the groundwater potential might decline due to over-extraction of water by excessive use of water pumps, and the low efficiency of water use. At the Woreda level it was suggested to assess the potential of wells to ensure equity in the use of water, and to start drip irrigation.

Increasing number of livestock in the watershed: Woreda people consider the increasing number of livestock together with limited grazing land available to be a challenge for the future of the watershed, and see a danger that free grazing and encroaching of closure areas will occur.

Discussion

As indicated by the time line analysis (Table 3) human as well as livestock population in the watershed is increasing. Although productivity has been increased over the past 15 years and still might increase to a certain extend in future, the carrying capacity of the watershed's natural resources is limited. People also reported that here and there conflicts over the use of natural resources, mainly grass and water, are starting. This is true especially for Gergera village. The combination of factors such as population growth, rising fuel costs and the wish and necessity to extend the irrigated area increasingly creates stress on the natural resources, which may result in deforestation, groundwater depletion or overuse of grazing land. In 1992, land was redistributed for the last time. Since then, the number of landless youth and young families has increased. In one way or the other, the life of these people depends on the resources that exist in the watershed. As group discussions revealed, the by-laws secure that the youth can benefit from the grass as long as s/he owns cattle. However, a big question is, for how long these people will be able to sustain their life this way?

Especially in Gergera, the number of hand-dug wells is increasing, while the predominant irrigation method is still furrow irrigation. This inefficient way of using irrigation water together with the ever extending irrigated area may lead to ground water depletion. However, the recharging and discharging rates of water bodies is not yet known. Another risk we perceive is, that if hand dug wells are located too near to each other, some wells may get dry earlier and this could arise conflicts between the users.

Another issue common to all villages is the increasing number of livestock kept in the watershed. Livestock is not only important to land owning farmers, but is also a major source of livelihood for landless people. Increasing livestock numbers together with the problem of the failure of guards due to payment problems may put more pressure on area closures, i.e. may lead to a tendency to encroach the area closures in search of animal feed.

Recommendations:

- A combination of factors leads to increasing pressure on natural resources in the watershed. There are no simple answers to this complex problem. However, an assessment of the carrying capacity of the watershed in terms of livestock numbers could help to fine tune interventions accordingly.

- The existing by-laws play an important role regarding equitable distribution of grass and water, and for the protection of natural resources and need to be maintained. The same

applies for the system of guards to control closure areas. However, an urgent solution to the problem of irregular payment has to be found to avoid that past achievements regarding reforestation are menaced.

- The capacity of water bodies, their discharge and recharge levels have to be assessed. According to the potential of water bodies, maximum levels of water use need to be defined and controlled in order to secure the long-term existence of sufficient water resources. In order to avoid groundwater depletion, water saving irrigation technologies must be introduced and applied.

4.2.2 Sense of Ownership

The **need to create a sense of ownership** was addressed in discussions at the Tabia and the Woreda level. There is a sense of ownership, but it is considered to be too weak or somehow unreliable. Unless otherwise the community feels ownership of all the SWC activities, what has already been achieved may no be sustainable. As we can understand from the discussions the communities don't seem to feel ownership over area closures and SWC structures as they are expecting the administration to pay something to protect it from any damages. However, the *Woreda* as well as the *Tabia* administrators believe that the community is the owner of SWC activities. The justification for this belief is that the community has fully participated in the construction works and contributed free labor, stone and sand whenever needed. So, in the process the community has developed ownership. But the reality is that every farmer has an obligation to contribute 20 days labor per year, which is the norm in Tigray region, whether she/he likes it or not. On the other side farmers really benefit from the closed and rehabilitated areas as these areas serve as source of forage. It can be supposed, that if the farmers realize the benefits they get from the SWC activities they will protect them.

Though justifications given by the administration body are logical, reality is different. At all levels of discussion one concern was the danger of deforestation in the future. One way or the other village representatives were raising the issue of incentives for maintaining physical structures and allowances for the guards of area closures. It seems that though the communities sense the benefits, they are waiting for some party to take the responsibility. It also seems that they presume that SWC structures and area closures belong to the government, and in this case they think the government should take care.

In village discussions the concern was raised that in future **less attention may be given to the maintenance of SWC structures**. This concern is somehow related with two other facts that were mentioned, 1) the fear of only getting limited support by NGOs or GOs, which may discourage people, and 2) that people will look for alternative job opportunities if there is no motivation or incentive for maintenance of SWC structures, which would result in a lack of manpower to maintain the structures. It seems that although being aware of the positive effects of SWC activities and the benefits they get from it, farmers perceive their engagement in construction and maintenance of SWC structures first of all as an income generating activity.

As mentioned above, every farmer has an obligation to contribute 20 days to work on SWC. One problem regarding this regulation is, that sometimes the catchments where people have to do the work is far away from where they live, which results on one hand in a lot of time wasted on the way to these places, and on the other hand, to a lack of motivation as the farmers do not benefit of the labor they invest. We presume that if they could fulfill their obligation of 20 working

days (or at least part of it) within their own catchment, the sense of ownership could be strengthened.

The attitudes of farmers towards the natural resources their living depends on, and the sense of ownership regarding the watershed management project implemented in the past is shaped by farmers' experience of past and current policy approaches. Therefore, the creation of a sense of ownership is a complex issue which needs recurrent efforts. Thus, to sustain and maximize the benefits from SWC activities the community has to believe and feel that they are the owners and are responsible to protect it to maximize their benefits. Awareness creation is a means to foster a sense of ownership and has to be implemented intensively by devising different mechanisms and involving the different influential actors in the community.

To create awareness and strengthen the communities ownership of the natural resources in the watershed grass root communication that involves different influential actors in the communities has be in place.

Recommendations

- Continuous efforts are needed to create awareness and to sensitize farmers for their own responsibility in sustaining the positive results the watershed protection programme has had. Different types of civic associations (e.g. farmer cooperatives, community associations) could be used as an orientation and discussion forum. Also schools could be involved and students sensitized as was mentioned in the Tabia discussion.

- Another means that could help to create a sense of ownership is by devising alternative modes of sharing benefit and burdens among the lower and upper communities of the catchment. It seems that in the lower catchment benefits are higher and burdens lower compared to the upper catchment, a situation which calls for some kind of compensation for Gergera village by the other two villages. However, this impression must first be verified, and then the issue should be addressed very carefully to avoid rising conflicts between different villages. The by-laws already existing at the village level regulate sharing of grass from grasslands and area closures and water from communal ponds. Strengthening the bylaws or developing specific by-laws on sharing benefits between communities or protecting area closures could be used to address the problems of ownership.

4.2.3 Coordination with neighboring Tabias regarding SWC

To avert soil and environmental degradation different SWC activities have been undergoing since the last ten years in different Tabia of the Woreda. The activities were and are intensive to reverse the severe degradations. However, nature and strength of the structures as well as the land use patterns of the adjacent Woredas have got less attention. Therefore, in focus group discussions the concern was raised, that damages may occur to the SWC structures in the lower catchment and the fields of the three communities because of the lack of proper treatment in the upper catchment, which belongs to another Tabia. Village Dimano has already experienced this type of damage. In summer 2007, heavy rains and a broken dam in the upper catchment resulted in floods that caused destruction of many structures in the river and washed away many fields near the river. Tabia representatives reported that discussions with representatives from the Tabia in the upper catchment have been initiated, but that they were difficult.

Recommendations

- Efforts should be made to coordinate planning and implementation of SWC activities with the Tabia to which the upper catchment belongs to, as otherwise the efficiency of structures in the lower catchment to protect soils and fields is endangered and heavy damage and possible setbacks will have to be faced.

- Seemingly, discussions between affected Tabias are difficult. It might be necessary that representatives of the Woreda administration initiate and facilitate respective negotiations and support the coordination of SWC activities between the Tabias.

4.2.4 Other challenges

Other challenges mentioned in the discussions were:

- **Use of pesticides**: Parallel to the expansion of irrigation, increasing amounts of pesticides are applied. This negatively affects bee keeping and honey production, and resulted in a decrease of honey production this year.

- **Supply of material**: people are concerned that only a limited supply of material (gabion, pick axes, shovels etc.) for gully treatment and other SWC activities is provided.

- **Climate variability**: people are concerned that climate variability may cause drought or floods and negatively affect agricultural production.

5. Up-scaling

During the Tabia as well as the Woreda discussion the question was raised, which lessons learnt from the successful experience of the Gergera watershed could be relevant for replication and up-scaling. The following elements were mentioned:

- **Community centered participatory approach:** The involvement of the community from the very beginning and in all phases of the implementation process is considered to be important. At the same time it was stated, that community participation and active contribution leads to a sense of ownership.
- **Integrated watershed approach:** Many people stressed, that the integrated approach, used in Gergera was very successful. This implies the integration of different sectors (agriculture, livestock, forestry, health, education, etc.) and multidisciplinary collaboration. At the same time this was considered to be a main challenge for up-scaling.
- **Gergera as a model:** currently Gergera is a model (among others) serving for horizontal (i.e. within the watershed) and vertical (i.e. to other watersheds) up-scaling. Exchange visits are organized with other watersheds, and sharing of experience between the Woreda and region, and even with other African countries (e.g.Uganda).

- **Limited resources:** The Woreda administration faces limited availability of financial resources and material inputs such as gabion. Although each year the government allocates resources, available resources are insufficient compared with the extent of the problems to be addressed all over the Woreda.
- **Limitation of labor force:** The Woreda administration fears that it will be difficult to mobilize sufficient labor force. In the past, the Tabia community was involved in environmental rehabilitation in selected watersheds. However, after sensing the merit of the integrated watershed management each kushet became interested in replicating the approach in their site. As a result, the active labor force is divided.

Annex 1: List of participants of focus group discussions

1. Kushet level discussions

All three discussions were held on Oct. 25th, 2008, in Geter-hiqmesahel. As Saturday is market day in *Geter-hiqmesahel*, everybody was there anyway and it was convenient for the farmers to meet there.

A. Gergera sub watershed

S/N	Name	Sex	Responsibility
1.	H/Yielma G/Slassie	M	Kushet chairperson
2.	Kahsay Giramy	M	Model farmer and Kushet rural dev't head
3.	H/Berhu Kahsu	M	Young farmer
4.	Hagos Araya	M	Landless farmer
5.	G/Slassie Teka	M	Landless farmer
6.	Hishe Hadush	M	Elder farmer
7.	Seifu Girmay	M	Landless farmer and model farmer
8.	Akeza Abebe	F	Women head households
9.	Demeqch Berhe	F	Women head households
10.	Mulu Hagos	F	Women head households
11.	Aberha Assefa	M	Model farmer

B. Geter-hiqmesahel sub watershed

S/N	Name	Sex	Responsibility
1	Assefa Kahsay	M	Youth farmer
2	Solomon Taddess	M	Model farmer
3	Tsega Woldu	F	Women headed HH and youth farmer
4	Berhane Werede	F	Model farmer
5	Woldu Abera	M	Elder farmer
6	Alem Mehari	M	Land less farmer
7	G/Hiwot Hailu	M	Young farmer and land less farmer
8	H/Kahasy kidane	M	Model farmer
9	Alem Tadess	M	Land less
10	Azemera Girmay	F	Women headed HH

C. Endamino sub watershed

S/N	Name	Sex	Responsibility
1	Kidanue G/Yohannes	M	Model farmer
2	Giday G/Mariam	M	Model farmer
3	P/Heshi G/Yoahnnes	M	Model farmer
4	H.Nigusse G/Eyesus	M	Landless farmer
5	Nigusse Aregawi	M	Landless farmer
6	H/ Heshi G/Yoahnnes	M	Landless
7	Gebre Meles	M	Model farmer
8	P/Berihu Alemayoh	M	Model farmer
9	Berhe G/Hiwot	M	Young farmer
10	Gitet Girmay	M	Young farmer

Tabia level discussion
Discussion held on Oct. 26th, 2008, in Geter-hiqmesahel

S/N	Name	Sex	Responsibility
1	Tsadkan Abreha	F	Health extension worker
2	P/Kalaiu Etay	M	Tabia Cooperative head
3	Kahsay Gebru	M	Livestock Tabia DA
4	Beri G/Salssie	F	Tabia Women Affairs
5	Heluf G/MAriam	M	Water user association (Geter-hiqmesahel)
6	Yemane G/Her	M	Irrigation DA
7	Tesfu Gidana	M	Tabia Supervisor (BoANR)
8	Giramy Nigussie	M	Natural Resources DA
9	Haftu Hailu	M	Crop DA and tabia Rural dev't Head
10	Amare Mehari	M	Tabia Chairperson
11	Haftu G/Hiwot	M	Bee keeping DA
12	Gidena G/Tekle	M	Tabia vice chairman
13	Taddess Lemma	M	Tabia youth association
14	Shambel Eyasu Berhane	M	Elder farmer
15	Kahsu Atsebeha	F	Tabia women association head
16	Mahumide Tahir	M	Water user association
17	Kalaiu Berhe	M	Tabia water development Agent
18	G/Medhine Teare	M	Elder farmer

2. **Woreda level discussion**
Discussion held on Oct. 27th, 2008, at the Atsbi Woreda Agricultural and Rural Development Bureau (ARDB)

S/N	Name	Sex	Responsibility
1.	Teklay Gebru	M	Head of ARDB
2.	Gebrkiros G/Kirstos	M	Livestock Section
3.	Haftay Tesfay	M	Watershed management section
4.	Goitom G/Her	M	SWC expert
5.	Tewolde Abrha	M	Crop section
6.	Berhan Teka	F	Women Affair
7.	Hailay G/Her	M	Water Development
8.	Kahsay G/Medhine	M	Education
9.	Weldmaria G/Slassie	M	Natural Resources Section

Annex 2: Guidelines for focus group discussions

Kushet level

1. General question:
    - What is special about Gergera
    - What are the factors of success in Gergera watershed
2. Time line comparison : When did SWC start?

	Before 1988	**After conservation**			
		Between 1988-93 EC	**Between 1993 -1998 EC**	**Now 2000 EC**	**In the future (in 10 years)**
Population size					
Number of landless farmers					
Number of Livestock					
Livestock productivity					
Area of forest land					
Communal Grazing lands size					
Communal Grazing lands productivity					
Area of irrigated land					
Water availability					
Crop production / productivity					
Gully formation					
Conflicts over use of natural resource (water, grazing, fire wood, etc…)					

3. List the top three benefits of SWC.
4. List the top three disadvantages of SWC.
5. What are the different means to maintain the positive results?
6. What are the possible challenges you could possibly face in maintaining the observed benefits?

Tabia level

1. General question:
    - What is special about Gergera?
    - What are the factors of success in Gergera watershed?
2. What lesson you can draw from the Gergera to replicate it in other watershed in your tabia?
3. What are the challenges you face during implementation of SWC until now, and what new challenges do you expect to come in the future (e.g. questions regarding distribution of benefits, ownership)?
4. How do you address equitable distribution of water, grass or other resources in area closures, grazing land (between the villages and within village)?

Woreda level

1. general question:
    - What is special about Gergera
    - what are the factors of success in Gergera whatersherd
2. What are the lessons you draw to make the watershed as learning forum for other similar watersheds/ what lesson and opportunities you draw to upscale the experience you have.
3. What are the possible constraints for up-scaling the approach
4. What are the possible challenges ahead and how to address them in the watershed (e.g. maintenance of SWC measures, equity of resources such as water, and other benefits, sense of ownership)