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RESEARCH ARTICLE

EXPERIENCES AND CHALLENGES OF INTEGRATED WATERSHED MANAGEMENT IN CENTRAL ZONES OF SOUTHERN ETHIOPIA

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ABSTRACT

Integrated watershed management (IWM) is one of the best strategy to halt soil degradation. It mainly comprises protecting and rehabilitating watershed areas aimed to mitigate problems of runoff and floods, rehabilitate degraded lands, enrich ground water, increase production and vegetation cover. A holistic approach has been followed participating all stakeholders and it has operational since 2011 trough mobilizing community, constructing soil and water conservation structures, planting biological stabilizers, enclosing communal land and maintaining the structures. Apart from the massive IWM, South Agricultural Research Institute has implemented a pilot project at two mini watershed areas namely Qotto Asano and Ojojie. To attain the objectives, SARI has implemented technology introduction, watershed management, training and technology scaling up simultaneously. The lessons from technology innovation revealed that the watershed residents have been actively participated in problem identification, planning, technology choice, designing, bylaws setting, implementing, evaluations and maintenance. Lastly, in implementing IWM, there are an immense social, economical, institutional and environmental challenges that need emphasis of policy makers and development practitioners. Benefit, impacts of incentives, absence of linking community bylaws to formal laws, financial limitation, failure to consider land use, soil type and slope during designing are challenges that need policy considerations and remedy actions for sustainable use of natural resources.

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INTRODUCTION

The Southern Nations, Nationalities and Peoples' Region (SNNPR) is one of the nine regional states of Ethiopia located in the south and south-western part of the country with a total area of 110931.9 km^2 (about 9.82% of the country). SNNPR has a diverse agro-ecology with typical ethnical cultural diversity (more than 56 distinct nations and nationalities) all having their own culture, farming system and natural resource management knowledge. Though the region has an immense natural resource basis like forest, land, water, species bio-diversity, the rapidly increasing of population and the dependency of community on agriculture for its livelihood has contributed to the fast and vast deterioration and destruction of the natural resource. Coupled with variability of climate, unwise management and use of natural resources resulted in wide deterioration of the productive land.

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The potential of the land has deteriorated from time to time due to run off, intensive cultivation, farming on steep lands, removal of crop residues, overgrazing and deforestation. To address the challenges and threats of food production and deterioration of land productivity the government of Ethiopia has devised and launched massive integrated watershed management as a 'Green Economy Strategy' to halt soil erosion, maintain soil fertility, rehabilitate degraded and gully areas, increase ground water availability, regenerate vegetation cover, maintain bio-diversity and to gain other socio-economic and environmental benefits. In SNNPRS, to reverse and mitigate such a widespread natural resource degradation, various efforts have been made by government and non-government organization. For example: over the last three decades different soil and water conservation (SWC) measures have been implemented; currently more than 79 districts of the region have been covered by Productive Safety Net Program (PSNP) implementing different SWC activities, integrated watershed management launching in 2011 are the main interventions.

Moreover, the South Agricultural Research Institute (SARI) had initiated model integrated watershed management project and has implemented in to two severely degraded mini watershed areas since 2011.

Watershed management is a landscape-based strategy that aims to implement natural resource management systems for improving livelihoods and promoting beneficial conservation, sustainable use, and management of natural resources (Chisholm and Tassew, 2012). Integrated watershed management involves protecting and rehabilitating watersheds in a way that increases production, generating both short-term and long-term benefits for people living in the watershed area. It also ensures the protection of the downstream communities not being affected by erosion and flooding.

The overall effort of the integrated watershed management is thus, a holistic approach aimed at optimizing the use of land, water and vegetation in an area while improving water availability, increase fuel, fodder and alleviating the problems of soil erosion and floods. In commencement of watershed management an integrated and holistic approach should be followed to participate all stakeholders in planning, interventions and evaluations. In implementing community-driven integrated watershed, community has to identify problems, set priority, identify and map intervention areas, set action plan, set community bylaws, pull resources, implement interventions, monitor and evaluate activities, protect and maintain the interventions, manage and share economic and environmental benefits among the watershed residents.

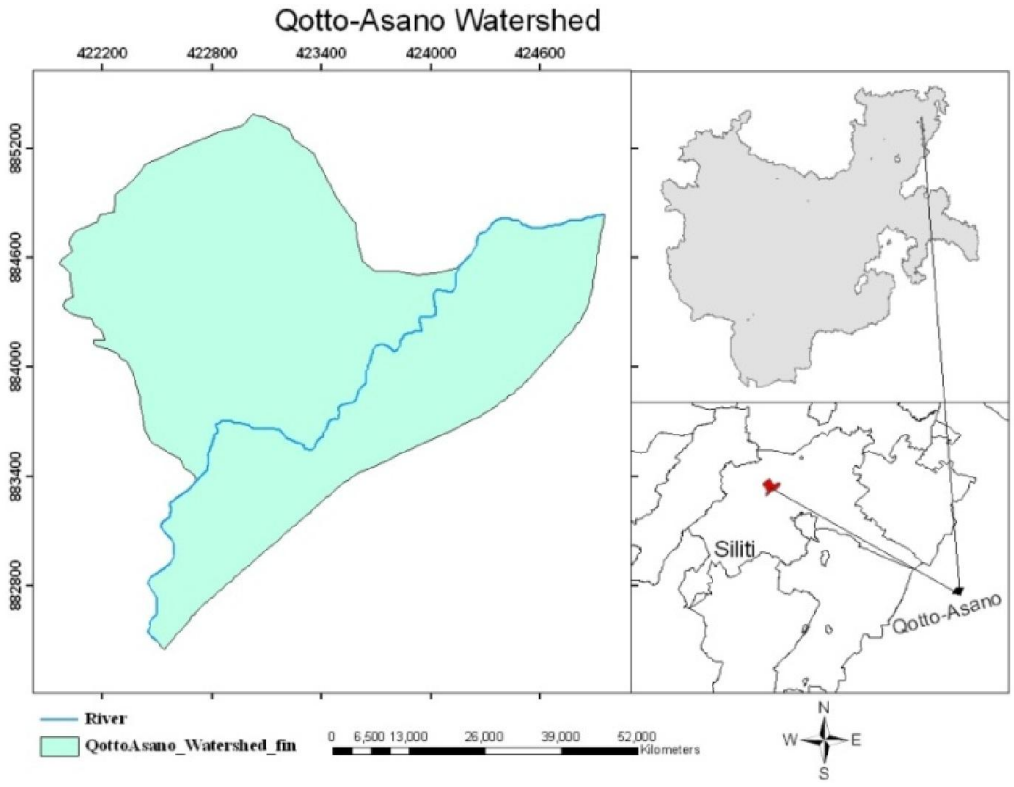
While launching integrated watershed management as a strategy in 2011, the regional government has formed a watershed consortium called 'watershed committee' at each administrative level starting from the region to the lower *kebele* [1] level then to mini watershed at village level. Moreover, for the full participation and ownership sense of the rural farming communities, an intensive training and moblization were carried out in all intervention areas of the region starting from the inception period to implementation. The training and moblization were instrumental to particiapte and initiate the rural communities in integarted watershed management.

MATERIALS AND METHODS

Situation analysis

A situation analysis of the southern region was carried out participating all relevant stakeholders. It had pin pointed out that land degradation in the form of soil erosion, fertility loss and deforestation were a top prioritized problems. To solve such severe land degradation problem of the region an action oriented research project were initiated and implemented by SARI in to two mini watershed areas at the central, cereal dominated and densely populated zones.

The general objective of the project was to contribute to food security, through improving livelihoods of the rural communities and sustainable management and use of natural resource.



To implement integrated watershed management, development practitioners, researchers, academicians and policy makers have to debate and work together in aspiring for change in natural resource management and use.

[1] *Kebele* is the lower administrative level of the country, in derg regime it was named as peasant association (PA).

Moreover the project has specific objectives of identifying and prioritize watershed problems, collect base line information, enhance evaluation and transfer of proven agricultural technologies and enhancing implementation of integrated soil and water management. The sub-watershed chosen were Qotto-Asano and Ojoje watersheds. This paper is focusing in one of the mini-watershed namely Qotto-Asano mini-watershed.

Qotto-Asano min watershed is located in Silitie zone, Siliti district at 183 km north east of Hawassa, capital of SNNPR and 150 km south west of Addis ababa. It covers 350 ha of land, of which about 60 ha is communal enclosed area while the rest is private farm land. Astronomically it is situated at the coordinates of 07^0 59' North and 38^0 18' East with altitude ranging from 1900 to 2207 meter above sea level with woina dega (mid-land) type of agro ecology. The Mean daily temperature ranges between 18-25^0C with annual average rainfall of 850 to 1000mm. Two kebeles were included at the watershed namely Asano and Qotto transacted by Garorie river. Garorie river is the only river that transects the mini watershed and flows to Tinshu Lake Abaya. The farming system of the watershed is mixed farming of which cash crop known as chat is the dominant, followed by cereals like maize, teff and wheat. There are few cattle, small ruminants and poultry owned by few residents of the mini watershed.

Exploration of the watershed

A quick survey using PRA technique was conducted to identify and prioritize constraints affecting natural resource and agricultural production in the mini watershed. During the exploration, watershed communities were actively participate for the identification and prioritization of constraints. The watershed problems identified have social, economical, technical and technological dimensions that all need an interventions. A validation workshop for the prioritized constraints were conducted at district level. During the workshop, theme of action research, prioritized constraints and theme of action was proposed by stakeholders.

Planning of the watershed interventions

Selection of the intervention site, delineation and mapping of the mini watershed, stakeholder analysis, resource exploration, planning and reviewing integrated action research agenda were the major activities undertaken during the planning phase. Apart from the prioritized problems, much emphasis was given to the degraded areas of the watershed in planning action research.

Interventions

The interventions in Qotto-Asano mini watershed comprises four integrated components: namely mobilization of communities, technology introduction and evaluations, soil and water conservation and afforestation activities and technology demonstration and technology scaling out.
All the components of the watershed interventions have been supported by capacity building including training of beneficiary farmers, development workers and experts. Moreover, improved seed, multipurpose tree seed and seedlings, cuttings of forage and farm implements were given to the watershed community as incentives in implementing the watershed activities.

Mobilization of community for collective action (CA)

It is necessary to initiate and motivate watershed communities to create awareness and ownership sense among the farming community. In CA all the process of soil and water conservation starting from planning to all chosen intervention then to evaluation is leaded by local institutions selected by farmers and farmers living in the watershed area. CA helps to guarantee proper implementation of development works and proper communal resource management and use (Waga *et al.*, 2007). During the mobilization the following major steps were undertaken.

Discussion with farming communities*:* This was done in the presence of local leaders at different level. This discussion aims at clearing farmers' dependency to food aid and initiate self motivated development effort. Involving local leaders in organizing collective action is essential for the sustainability of interventions.

Organizing communities in to working groups*:* At the mini watershed level, one watershed team 'watershed consortium' was established to coordinate the planning and implementation of watershed management agendas. The watershed team was established having 15 committee with full gender and social strata disaggregation. The watershed committee includes *kebele* leaders, managers, elder farmers, women farmers, innovative model famers, school representative, social institute namely *ider* leaders and development agents.

Formulation of community bylaws: To ensure proper implementation of agreed watershed management community bylaws is instrumental. The bylaws may be different based on the type of issue. The bylaws was developed by involving the community, experts from Siliti district Agricultural Office and researchers from Hawassa Agricultural Research Center. The byelaws with respect to the implementation and protection of the established physical and biological structures is effected through the traditional institutions in the mini watershed area.

Conducting base line survey: The information obtained will be used to compare and study changes and impacts brought during the completion or after the exit of the project. Both quantitative and qualitative data were collected from primary and secondary data sources. General diagnostic survey was carried out in the selected mini watershed area before any interventions. During the survey, focus group discussion (FGD) and household survey were carried out to collect available data from the residents.

RESULTS AND DISCUSSION

Process of watershed management

At Qotto-Asano watershed, community were actively participated in identification, planning, implementation and finally in evaluation of the intervention.

The community has participated and contributes its labor/time, skill, farm implements, construction materials, seeds and seedlings and etc as inputs in the process. Without these inputs the mini watershed development is hardly possible. The participation level of the community at the beginning of the process was very weak. however, from frequent training and introduction of improved agricultural technologies in the mini watershed shift the interest and participation level of farmers overtime. The possible reasons for an active involvement of the farmers are many folds. Apart the main ones, mobilization of the community, some local institutional arrangements, sense of ownership, productivity increment in main crops, rehabilitated mini watershed and early impacts observed in rehabilitated mini watershed are few cases.

Introducing and evaluation of agricultural technologies and practices

On the basis of the identified and prioritized constraints of the watershed, introduction and participatory evaluation of haricot bean, *teff*, wheat, sorghum, finger millet, *enset* bacterial wilt disease management, integrated soil fertility management, on farm soil and water conservation, agroforestry practices and forage technologies were introduced and evaluated on participatory basis on selected farmers' land and Farmers' Training Center (FTC) of the watershed. All crop varieties and practices introduced to the watershed were evaluated by criterion formulated by farmers themselves and thereby the variety and practices selected were demonstrated to the farming community of the watershed. All the selected technologies were scaled up for wider dissemination to increase farm income of watershed residents there by improve the livelihoods of the communities. While evaluating introduced technologies women have been actively involved in screening up and selection process of improved varieties and farming practices.

Introducing soil and water conservation practices

There are different socio-economic and institutional causes for the depletion of the natural asset. Among these, agricultural mismanagement of soil and water resources, clearing of forests, removal of crop residues, open and overgrazing, use of marginal land for cultivation, poor soil management, weak adoption and/or inadequate soil and water conservation practices are the major environmental constraints and threats for the sustainability of land and water resources. Population increase, land shortage, insecure land tenure, poverty and economic pressure are the major causes of mismanagement of the natural resources (FAO, 2001).

Introduced soil and water conservation techniques have been implemented by the watershed community to rehabilitate the degraded communal and private land. Soil bund with forage trees and grasses, ditches and agro forestry practices along farm boarder and live fences are the commonly on- farm soil and water conservation measures practiced by farmers. The objectives of on-farm soil and water conservation measures are to conserve soil andwater, to maintain vegetation cover, to create ground water recharging capacity, to rehabilitate and reclaim marginal lands, and stabilize crop yields by adopting suitable soil and integrated nutrient management.

The introduced physical soil and water conservation that has been implemented in the mini watershed were soil and stone bund, trench bund, micro basin, ibro- basin, fanya- juu, check dams constructed using gabions and stone. Implementing physical SWC measures without biological stabilizers could not be appropriate measure to reduce soil erosion. Unless productivity is increased by increasing biological stabilizers on bunds, physical structure like *fanya-juu* alone could not be characterized as ''a win-win'' measures to reduce soil erosion (Kassie *et al*., 2008). Thus, all the physical structures constructed in Qotto-Asano mini watershed are fully supported by biological stabilizers such as multipurpose trees, fodder grasses and legumes. The biological stabilizers were applied both by direct sowing and planting seedlings. Apart from the exotic soil and water conservation techniques, indigenous soil and water conservation activities have been implemented by individual farmers for the aim of mitigating soil erosion, conserving soil moisture and increasing soil fertility at a household farm level. The commonly used indigenous SWC practices includes planting bushes and shrubs in between farm boarder, preparing ditches, practicing cut off drain, counter ploughing, digging holes around perennial crops, crop rotation and some few traditional fallowing.

Aforestation of the mini watershed

Apart from plantation of biological stabilizers to support the physical structures, more than 50 thousand multi-purpose seedlings were planted on enclosed communal land of the mini watershed. Acasia albida, Acasia salgina, Greaveli robosta, Casuarina equistifolia, and Croton macrostachyus are the main trees planted since 2011. In enclosed area, some indigenous trees have rejuvenated from soil bank and it also contributed for rehabilitating the mini watershed.

Technology demonstration and scaling up

During the situation analysis, it was pointed out that there were different crop and livestock technologies introduced and used by farmers in the mini watershed before, but the rate of dissemination was too slow due to lack of quality improved seed and animal breed. Moreover, technologies introduced and selected by farmers during the inception period have to be disseminated at wider scale. On the basis of this argument hybrid maize, haricot bean, egg laying white leghorn chicken, bread wheat, *teff*, Irish potato, and forage trees and legumes have been scaled up in and surrounding the mini watershed. The process of technology dissemination comprises beneficiaries selection, training, site selection and land preparation, clustering, agricultural input delivery, supervision and finally farmers' field day and documentation. Wealth status of farmers, willingness of farmers to apply the technology as per the recommendation, gender aspect and interest of farmers to apply on farm SWC were main criterion to involve watershed community in technology scaling up.

Lessons of integrated watershed Management

The Ethiopian government advocated collective action on physical soil and water conservation works that, all regions are implementing IWM by motivating and creating awareness to farmers about 'Green Development Strategy.'

In SNNPR, the first round public massive SWC work was launched on January 2011 for consecutive 30 days, the second in February 2012 and the third round on March 2013 for 30 consecutive working days and still it remains in the ground. In this campaign work, farmers make a chain of development group whose farm area is adjacent at village level by developing good team sprit for the effectiveness of the activity. Each *kebele* is divided to mini watershed in which farmers make a working group called *'limatawi budin'* and construct physical SWC in an agreed program and work norm with full responsibility both at farm and communal land.

Annually the campaign is started in February, where most parts of the region is off season for agricultural activity thus farmers have less work load which enable them willing to participate. Prior to the construction, training is executed for the aim of awareness creation in each mini watershed. They discussed about the detail activity plan of watershed and its importance which contributed for its sustainability. Most of the extension agents have trained on the design and types of structures, how and where to apply depending on soil type, slope and nature of the land. Apart from the training, all the intervened mini watershed areas are identified and geo referenced using GPS and all interventions are executed as per the watershed development map.

As opposed to the past watershed development works, community is actively participating in problem identification, planning, technology and treatments choice, designing, community byelaws setting, implementation, monitoring, evaluations and maintaining of the interventions. All the integrated watershed activities are leaded by watershed consortium called 'watershed committee' composed of 7 to 10 members drawn from respective line government organizations for each administrative level starting from the region to *kebele*. Progress report from all intervention areas (village) to higher level (the region and then to the Federal state) is communicated using telephone and fax daily. In general, the massive public program is not only conserving soil and water but also it has empowered and created awareness among farmers on resource utilization as well as the benefit and concept of integrated watershed management which this might reverse the problem of sustainability and constraints of previous efforts.

Among the major interventions, structures like terracing, stone and soil bunds, trench bunds, check dams, cut of drain, micro and ibro basin, *fanya juu* and small water harvesting ponds are constructed in dry season. Moreover, area enclosure of communal land, afforestaion, nursery establishment, seedling raising, maintenance of SWC structures are part and parcel of the massive public watershed development interventions in the region. In severely degraded and gully areas of farm and communal land check dams using stone and gabions are constructed. In the rainy season, physical structures are supported with biological bund stabilizers and farmers are provided with seedlings and seed for sustaining structures. The biological stabilizers such as multipurpose trees, fodder grasses and species are prepared in community nursery sites. In some cases, districts who have no nursery sites purchase biological stabilizers from private farmers.

On communal land of mountainous and hilly areas having steep slopes, physical soil and water conservation like soil and stone bund are commonly constructed based on the availability of local resources. In some areas fruit trees and other multipurpose trees are planted at the boarder of the gully. In some watershed areas, where there is less or no access of construction materials agricultural offices of respective districts purchase and supply the local construction materials.

Constraints and challenges of integrated watershed management

For the last three decades starting from *Derg* [2] regime, different natural resource management practices have been implemented in the form of soil and water conservation (SWC), integrated watershed management (IWM), joint forest management (JFM), sustainable land management (SLM), public natural resource management through Productive Safety Net Program (PSNP), and participatory integrated watershed management (PIWSM). All the efforts done by government organization and non-government organizations before are not efficient and sustainable to solve the problem of environmental degradation rather it was expanding rapidly and become a serious environmental and socio-economic threats. The main reason for the limitation and sustainability issues of the interventions are that all the attempts made to alleviate the problem was not fully based on the agro-ecological, socio economic and topographic variability considerations of the region (Hurni, 1993).

Recently starting in 2011, the government of Ethiopia devised a new strategy called 'green development strategy' of participatory integrated watershed management. In participatory integrated watershed management, the approach has to be qualified through two aims: first, the process must be participatory in terms of the particular issues to be worked on and how related activities are carried out (German *et al*., 2006). Secondly, the process must be integrated, the integration of discipline (technical, social and institutional dimensions) or objectives (conservation, food security, income generation) (Ibid).

In implementing integrated watershed management in SNNPRS, there are some constraints and challenges faced in planning, participating multiple actors, designing, resource pulling and using, interventions, monitoring and evaluation, and maintenance of the constructed terracing of soil and stone bund, fanya juu terrace, check dam or any other structure and planting biological stabilizers. Some of the important challenges faced in conceptualizing and operationalzing integrated watershed management are presented as follows.

Farmers are inclined to short term benefits: since the main occupation and means of livelihood for rural community is agriculture, farmers have less interest to long term conservation investments rather they prefer interventions and watershed technologies that offer benefits in the short period of time.

[2] *Derg* regime is the past Ethiopian government lasted from 1974 to 1991.

Low management for tree planting: Tree planting through agroforestry and social forestry should be an integral part of rural development program to provide the community with food, fuel wood, income and environmental benefits (Badege, 2001). In integrated watershed management, there are efforts to raise seedlings, land preparation and planting trees and forages for the purposes of biological stabilizers, agro forestry and plantation on communal and private land. Millions of seedlings are planted in rainy season, but the management and re-planting of trees are very weak and it lacks frequent supervision, monitoring and evaluation.

Resource use and management is not appropriately customized: Farm implements, construction materials like gabions, stone, biological stabilizers (seedlings, cuttings, seeds) are supplied to support and implement integrated watershed management. while implementing IWM some districts have not utilized resources efficiently. In some cases there are gabions stored or openly placed in the office instead of delivering to *kebele*, forage/forest seedlings are stored in some district of Agricultural Offices for more than a week without planting.

Negative impacts of incentives: Direct economic incentives in money and kind payment for compensation of labour for soil and water conservation structure has been applied for longer period of time. Currently PSNP is applied for selective food insecure rural family to work on public work including massive physical soil conservation and biological stabilizers. The challenge is not giving incentives to food insecure groups, rather it appear and brought two challenges on integrated watershed management. Firstly**,** when the farmers get graduated, their willingness to participate and work in massive soil and water conservation become less and secondly those food secure neighboring farmers are unwilling to involve in massive work.

Lack of appropriateness and uniformity of design: In designing and placing the design on ground, it should strictly follows the soil type, slope and orientation of the land. While implementing campaign integrated watershed management, there is a limitation in putting the standard design as per the slope, soil type and orientation of the treated watershed. Moreover, in selecting the construction material there are some defects. for example, instead of using stone bund or check dam, soil bund is constructed in severely degraded and highly flooded areas.

Less work on degraded steep lands: Degraded marginal steep lands need huge conservation investment in terms of labour and material. Most of the integrated watershed management has been implemented in less degraded communal and private land. If the highly severely gully and degraded areas are not terraced efficiently with appropriate conservation structures, it will create flood and severe soil erosion at the lower coarse of the watershed which has direct impacts on livelihoods of residents affecting their life, asset, farm and livestock.

Open livestock grazing: Free and open grazing on communal land is common. When cattle and shots are allowed for grazing on sloppy lands, it aggravates soil erosion. Communal land are mainly utilized for free and un controlled grazing exposing the top soils to be washed away easily. Farmers living in densely populated areas prefer to use communal land to graze their herds. In areas of high population density and low per capita land holding, farmers are reluctant to apply and/or implement SWC measures on communal land for the reason that they inclined towards their short term benefit like feed for their herds, timber and fuel wood source.

Limited financial support: The finance provided for implementing and monitoring integrated watershed management is limited and in some non-PSNP districts the operational budget allocated to the program is low. As result of finance limitation, the frequent technical supervision, monitoring and feedback activities are restricted which imposed its own negative impacts on quality of works and its sustainability.

Low attention to maintenance: The issue of sustainability in terms of monitoring and evaluation with maintenance of the constructed terracing, soil bund, fanya- juu terrace or any other structure on time is under question because the plan and construction activity mainly focused more on constructing new physical structures than integrating or maintaining the earlier.

Benefit sharing and management: IWM by its very nature is long term investment discouraging small scale resource poor farmers in obtaining short term benefits. While investing in IWM the resource poor farming communities have to be compensated with crop and livestock farming technology and practices. Agricultural technology like improved crop, forage, animals breeds and improved practices should be offered to farmers. Moreover, there are short term benefits that can be obtained within one or two years (for example grasses). This benefit should be allocated among the residents equally or it has to be collected and sold to others to earn additional money. The money obtained in this process should be utilized and managed for community social and economic capital development.

Conclusion and Recommendation

Integrated watershed management is promoted as a strategy in achieving food security objectives through increasing ground water availability, increasing vegetative biomass, reducing soil erosion and flooding. In operationalzing IWM in SNNPRS, various efforts has been customized starting from the regional state down to village level. The approach followed by IWM is more or less participatory that all stakeholders have been actively participated in all phases. In implementation, millions of physical structures and biological stabilizers are constructed and planted in different parts of the region. Besides, area enclosure of communal land for the purpose of regeneration and rehabilitation have been done since 2011.

SARI, has also actively involved in integrated watershed development linking the watershed management with technology introduction at two pilot sub-watersheds. SARI's intervention in IWM is more of action research, that all stakeholders of the watershed have been benefited from the introduced crop, animals and natural resource management technologies and practices to improve livelihood of people there by maintaining the natural resources basis of the areas. In implementing the integrated watershed management, the southern regional state has drawn important lessons in all phases of the program. All stakeholders have participated in identifying and prioritizing problems, mapping intervened areas and in customizing collective action for mobilization and involving watershed communities for labour intensive soil and water conservation, reforestation, area enclosure and maintenance of the existing structures. Though there have been much efforts in implementing massive IWM, there have been ample social, institutional, economical and environmental challenges. Issues of economic incentives, linking community bylaws to the formal rules and laws, resource management and use, financial support in facilitating IWM , land use, soil type and slope consideration in designing and planting stabilizers, benefit sharing of IWM are the major challenges that need policy considerations and remedy actions for sustainable management and use of the natural resources.

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