



HIMCAT
Newsletter No. 2

Spring 2008

“Erosion control measures and activities”



Picture: Compartmentalized and open trenches in Afghanistan (Andrew Billingsley)

Contents

- Announcements
- Interview with HIMCAT member
- Contributions from members
 1. Erosion control activities in selected catchments of the Tibet Autonomous Region, People's Republic of China – Work in progress (J. Merz)
 2. Dhotra Rehabilitation: a case study (M. Dhakal)
 3. Broom grass: A multipurpose plant with erosion control potential (S.K. Bhuchar)
 4. Soil and Water Conservation Demonstration Site Development with Community Participation: A Case Study of Godamchaur Demonstration Site, Lalitpur, Nepal (J. Joshi)
 5. Snow Management and harvesting in Mountainous regions; A Case Study from the Central Highlands of Afghanistan (A. Billingsley)

Coordinator's note

The HIMCAT extranet network is pleased to distribute the second HIMCAT newsletter on *“Erosion control measures and activities”*.

Soil erosion is a naturally occurring process on all land. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss each year. Soil erosion is a major concern all over the world. It may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing serious loss of topsoil. A number of HIMCAT members from different climatic eco-regions stretching from Afghanistan, India, Nepal to Tibet (China) shared their experience on activities and technologies preventing, mitigating and/or curing soil erosion addressing a combination of vegetative, structural and agronomic measures. Furthermore, find an interview with a HIMCAT member from the Chittagong Hill Tracts in Bangladesh on soil erosion.

Enjoy the reading.

Thank you to the members who contributed to this newsletter.

I. Providoli – HIMCAT coordinator

WOCAT / HIMCAT

The World Overview of Conservation Approaches and Technologies (WOCAT), is a network of soil and water conservation (SWC) specialists from all over the world. The WOCAT network facilitates the sharing of valuable knowledge in soil and water management and the efficient use of existing know-how www.wocat.net. The Himalayan Conservation Approaches and Technologies (HIMCAT) is an offspring of this global initiative. The HIMCAT is primarily a network of soil and water conservation and watershed management practitioners working for sustainable development of the Himalaya. The HIMCAT network welcomes discussion and experience sharing on issues related to soil and water management activities in Asia.

ICIMOD

The International Centre for Integrated Mountain Development (ICIMOD) is an international, independent mountain learning and knowledge centre committed to improving the sustainable livelihoods of mountain peoples in the extended Himalayan region. ICIMOD serves eight regional member countries of the Hindu Kush Himalaya area: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan as well as the global mountain community. Founded in 1983, ICIMOD is based in Kathmandu, Nepal, and brings together a partnership of its regional member countries, over 300 partner institutions, and committed donors. www.icimod.org.

ICIMOD is the focal point of WOCAT in the Himalayan region and is hosting the HIMCAT extranet site. <http://extranet.icimod.org.np/himcat/>.

Announcements

Proceedings of the 12th Annual WOCAT Workshop and Steering Meeting 12 -17 November 2007, Manila and Bohol, Philippines

The proceedings of the latest annual WOCAT workshop and steering meeting (WWSM) held in the Philippines can be download as pdf version from the WOCAT website on <http://www.wocat.org/wsproc.asp>.

Announcement of 13th Annual WOCAT Workshop and Steering Meeting 20– 25 October 2008; Switzerland

Since 1996, WOCAT has organized International Annual Workshops and Steering Committee Meetings (known as WWSM) with the goal (a) to bring together the main collaborating and funding institutions and the core collaborators, (b) to assess the progress and exchange experiences, (c) to further develop the programme and (d) to plan for the future including budgetary consequences.

The 13th WWSM will be organised by the WOCAT headquarter in Switzerland in October 2008.

Please check the WOCAT website www.wocat.org or contact the WOCAT secretariat wocat@giub.unbe.ch for further information.

Updated basic WOCAT questionnaires available

We are happy to announce that the updated basic questionnaires on SLM Technologies (QT) and SLM Approaches (QA) and the updated map questionnaire (QM) are all available now. Please download them from the WOCAT website www.wocat.net/quest.asp.

The revision of the basic version of the QT and QA questionnaires is related to several types of changes. Some questions, definitions, and comments needed reformulation to become clearer, some questions were newly added to respond to users need related to global issues and ecosystem services, and some questions were omitted altogether.

WOCAT overview book “Where the land is greener”

ICIMOD as the focal WOCAT point in the Himalayan Region is still trying to promote the WOCAT overview book in the region.



Handing over of the WOCAT overview book to Ahmad Shah Siddiqi from CRS, Afghanistan.

The WOCAT overview book “Where the land is greener” can still be purchased under the following link

<http://earthprint.com/go.htm?to=wocat001>

Free copies for ACP (Africa, Caribbean, Pacific) countries ->

www.cta.int

Training Workshop on ‘Degradation of Upland Watersheds of Bangladesh, 22-24 January, 2008

The Institute of Forestry and Environmental Sciences, Chittagong University (IFESCU) organized a “Training Workshop on Degradation of Upland Watershed of Bangladesh” from 22 to 24 January, 2008. The workshop was the outcome of a collaborative research program between IFESCU and USDA. The workshop brought together 25 academicians and researchers as well as managers and planners from government and non-government sectors in the country. 11 papers were presented including two invited papers from two resource persons on “Assessment of Watershed Management Technologies and Approaches by Using WOCAT Tools” and “About Jhum in the Chittagong Hill Tracts: Contesting Views, Myths and Facts” followed by discussions, synthesis, conclusions, and recommendations.

For details, please contact: Prof Dr. Sirajul Haque, IFESCU, Bangladesh. E-mail: sms_haque@yahoo.com

Training on “Low Cost Soil and Water Conservation Techniques and Watershed Management Activities”

31 March -22 April 2008

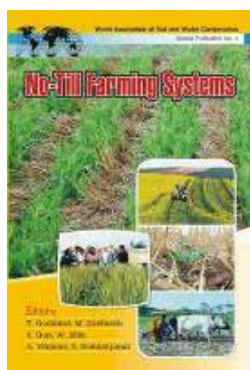
Keshar Man Sthapit, ICIMOD, Nepal, wsmtraining@icimod.org

ICIMOD is currently holding the second international training on “Low Cost Soil and Water Conservation Techniques and Watershed Management Activities” in Kathmandu, Nepal. The overall objective of the training is to enhance theoretical and practical knowledge and skills of participants in low-cost soil and water conservation techniques and watershed management activities.

The training package consists of four distinct modules:

- **Module 1** covers introduction to watershed management, low cost techniques, strategy for promotion of techniques and world conservation approach and technology (WOCAT).
- **Module 2** covers 30 different conservation techniques.
- **Module 3** covers 9 different major watershed management activities
- **Module 4** consists of experience-sharing by the participants on conservation techniques in their work situation.

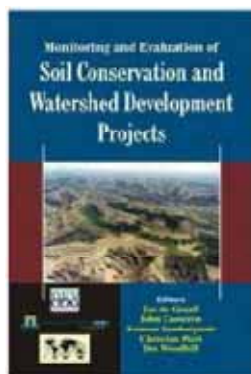
Book release



No-till farming systems

A global collection of information presented by farmers, extension specialists, discipline professionals and research scientists. The book aims to celebrate from where the no-till farming has come, and to advance the concept by sharing the latest information and knowledge from around the world.

World Association of Soil and Water Conservation, Special Publication No. 3, Editors: T. Goddard, M. Ziebis, Y. Gan, W. Ellis, A. Watson, S. Sombatpanit, 2008. ISBN: 978-974-8391-60-1.



Monitoring and Evaluation of Soil Conservation and Watershed Development Projects

This book provides diverse information and critical know-how to implement appropriate methodology and cost-efficient monitoring and evaluation systems better suited to assess the impacts of soil conservation and watershed multi-sectoral development activities. It draws on a worldwide experience of specialists and a large array of ground-truthing projects and programmes.

Science Publisher, Editors: J. de Graaff, J. Cameron, S. Sombatpanit, C. Pieri, J. Woodhill, 2007. ISBN 978-1-57808-349-7.

Interview with HIMCAT member

Interview with Mr. Sudibya Kanti Khisa,
 Natural Resource Management specialist, Chittagong Hill Tracts
 (CHT), Bangladesh (email: skhisha@yahoo.com)



Q. Do you consider soil erosion a problem in the Chittagong Hill Tracts (CHT)? How?

A. Yes, it is. Soil erosion is the lead cause of nutrient loss and productivity decline in the upland farming practices in CHT.

Q. What do you think are the key factors leading to soil erosion in the CHT?

A. I think, the key factors are the inappropriate farming practices like cultivation of hill slopes for root crop cultivation (e.g., aroids, turmeric, zinger etc) and the practice of short rotation shifting cultivation.

Q. Is soil erosion affecting the ecosystems and people's livelihoods in your working area? How?

A. Yes, there are many clearly visible distressing effects on the upland ecosystem and thereby affecting the livelihoods of the communities. Streams and rivers are gradually being silted up. Many perennial streams, waterfalls and seepage water sources are now dried up. Silting up of river beds and Kaptai lake are causing navigation problems. Productivity of farms declined and the costly chemical fertilizers are now more used for enhancement of farm productivity. Now, the communities face difficulties in sustaining their livelihoods with their landholdings and are looking for off-farm livelihood alternatives. This has prompted to the increased cases of land grabbing or infringement of others' lands causing social conflicts among the CHT communities.

Q. What can be done to prevent soil erosion in the CHT?

A. There are many indigenous technologies for reducing soil erosion. These are agronomic, cultural and mechanical, or combination of both, and they are already used by some farming communities like use of bio-fertilizing and cover cropping with indigenous leguminous cover crops like *Mucuna spp*, *Cajanus cajan*, *Tephrosia candida* etc, heavy mulching in root crop cultivation, diversified cropping, crop rotations, relay cropping, various agroforestry farming practices, contour cropping, terracing, diversion canals etc. All these indigenous technologies have been documented and need to be scaled-up through awareness building, motivation, and demonstration in the areas where soil erosion preventive measures are not undertaken by some communities due to socio-political reasons.

Q. What do you do to support sustainable management of land and water resources (nationally, regionally or globally)?

A. At the local level, involved in the promotion of different sustainable land management practices in CHT through on-farm training and implementation of different agroforestry farming practices by the CHT communities, carried out documentation of best farming practices in the CHT while working as FAO National Consultant (Forestry), implemented a regionally collaborative "action research and demonstration program" on "Appropriate Technologies for Soil Conserving Farming

Systems” with the financial support from ICIMOD-ADB. Moreover, as Principal Investigator, I carried out the Case studies of Farmers’ Innovations in Shifting Cultivation Practices in CHT with the financial support of ICIMOD-IFAD and studies on “Ethno-botanical Knowledge of the Chakma Communities in Forest Resource Management in CHT” supported by ICIMOD during January to March, 1998.

At the national level, as the National Coordinator of BANCAT (Bangladesh Conservation Approaches and Technologies) , I organized and supported training programs on sustainable upland farming practices for the field staff of NGOs and government agriculture and forest departments, documentation of sustainable natural resource management technologies and approaches in CHT and recently have undertaken a program of professional capacity building of the university graduate and post-graduate students in the assessment and documentation of best practices of watershed management technologies from different agro-ecological zones of Bangladesh and in connection with this program, I submitted a proposal to ICIMOD for financial support . Very recently, as the designated Chief Investigator with the support from two members of BANCAT Working Group as Co-investigators, I am studying the “Underlying Causes of Deforestation and Forest Degradation” in the Chittagong Hill Tracts with the financial support from Institute of Cultural Affairs-Bangladesh of the Department of Sociology, University of Dhaka.

At the global level, since 1995, I have been participating in different international symposiums and workshops of World Association of Soil and Water Conservation (WASWC) and International Erosion Control Association (IECA), USA and presenting the case studies of sustainable land management and upland farming practices.

Q. For how long have you been associated with WOCAT-HIMCAT-BANCAT? Pls. state some key benefits of associating with these networks?

A. Since 2004, being the national coordinator of BANCAT- a national focal point of WOCAT-HIMCAT, I have been associated with these professional networks including WASWC and IECA, and involved in knowledge sharing with the presentation of the BANCAT activities of sustainable land management in the international WOCAT Workshop and Steering Meetings known as WWSM.

The benefits of associating with WOCAT, HIMCAT, WASWC and IECA, are many; such as, I am now in touch internationally with many professional friends and colleagues of these professional networks, and in a position to sharing and exchanging our knowledge and learn more about SLM . I am now more and more encouraged having these feelings generated in my mind that I am not alone in carrying out this daunting task of achieving SLM. I would like to remember and mention here that the most remarkable benefits I received from WOCAT, HIMCAT-ICIMOD colleagues are the free of costs support-services like proof reading and editing of case studies of our BANCAT overview book including other technical and moral supports in organizing national training programs, assessment and documentation of conservation approaches and technologies.

Q. What is the most challenging about your job?

A. The most challenging part is how to translate our knowledge most efficiently into the ground and make the policy makers understand the magnitude of the challenges of soil erosion and watershed degradation associated with unsustainable livelihood of the vast majority of our farming communities.

Profile HIMCAT member: Mr. S.K. Khisa

Present designation(s)/organisations: Consultant with the Bangladesh Integrated Social Advancement Program (BISAP); Coordinator - BANCAT.

Past working experience:

- Headmaster at Babuchara High School (January, 1976 to February, 1978). Received President's medal for voluntary service to the community;
- Research Officer(Silviculture and Forest Pathology) at Bangladesh Forest Research Institute, Chittagong. (March, 1978 to February, 1985);
- Manager(Rubber) and then the Project Manager of Upland Settlement Project Chittagong Hill Tracts Development Board, Khagrachari (February, 1985 to November, 2006);
- FAO Representation in Bangladesh (October, 2003 to March, 2004) as National Consultant(Forestry);
- Program Support Consultant with UNDP-CHTDF, IDB Bhaban, Agargaon, Dhaka (April, 2005 to March, 2006);

Publications: Total 36 publications. Key publications:

- Khisa, S.K. 2003. Sloping Agricultural Land Technology for Hillside Farms in the Chittagong Hill Tracts. In: Ya, Tang and P.M.Tulachan (ed): Mountain Agriculture in the HKH region, Proceedings of an International Symposium held May 21 to 24, 2001, ICIMOD, Kathmandu, Nepal;
- Khisa, S.K. and A.T.M.Farid.1996. Promoting a Farming Systems Approach to Soil Conservation Extension in Chittagong Hill Tracts. In: Samran Sombatpanit *et al* (ed): Soil Conservation Extension: From Concept to Adoption. WASWC, Bangkok, Thailand;
- Khisa,S.K., M.K.Alam and N.A.Siddiqui.2004. Broom Grass(*Thysanolaena maxima*) Hedges: A Bio-engineering Device for Erosion Control and Slope Stabilization in CHT. In: Bake,D.H et al(ed): Ground and Water Bio-engineering for Erosion Control and Slope Stabilization, IECA, Science publishers Inc.

Books:

- Khisa, S.K., JU.Shoaib and N.A.Khan (ed). 2006. Selected Natural Resource Conservation Approaches and Technologies in the Chittagong Hill Tracts, Bangladesh.
- Khan, N.A., M.K.Alam, and S.K.Khisa(ed).2002. Farming Practices and Sustainable Development in the Chittagong Hill Tracts, Bangladesh. 272 pp.
- Khisa,S.K..1994. Rubber Cultivation and Processing in Chittagong Hill Tracts (in Bengali), 336 pp.

Address: Orchid House, Khobongpuria, Khagrachari, Bangladesh; House #29, Block # B, Road #2, Niketon, Gulshan-1, Dhaka-1212, Bangladesh.

Contributions from members

1 Erosion control activities in selected catchments of the Tibet Autonomous Region, People's Republic of China – Work in progress

For the programme:

Dr. Juerg Merz, Component Advisor, INTEGRATION environment & energy,
jmerz@integration.org

The Sino-German programme on 'Renewable Energy, Rural Development and Qualification Tibet Autonomous Region' (LIBII) is part of German technical cooperation financed by the German Federal Ministry for Economic Cooperation and Development (BMZ). The implementing partner on the German side is the Deutsche Gesellschaft fuer Technische Zusammenarbeit GTZ) GmbH. GTZ collaborates with the Erosion Control Bureau of Tibet Autonomous Region and other partners implementing erosion control activities in two catchments of Eastern Tibet. As shown in Figure 1 there are a number of causes and effects to land degradation in the selected catchments. It is also evident that this problem is not only associated with bio-physical problems, but also directly linked to people's aspirations and requirements for sustainable livelihoods. In order to address the problem comprehensively, several root causes need to be addressed simultaneously and the proposed actions need to be planned as part of a comprehensive development strategy at the catchment level.

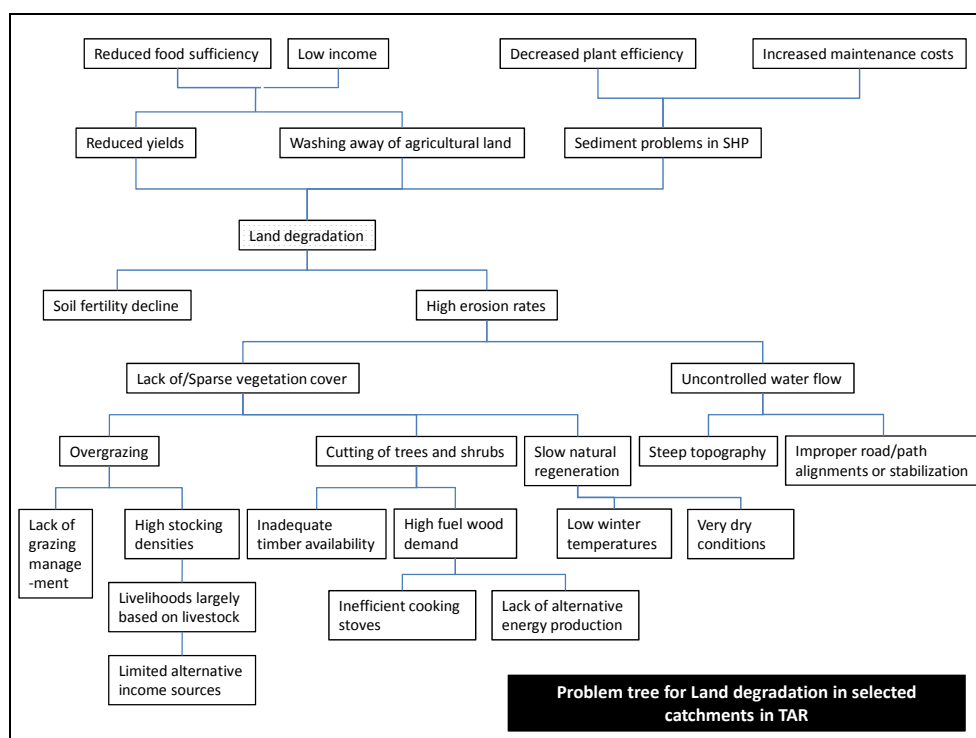


Figure 1: Causes and effects of land degradation in the selected catchments

It is envisaged that LIB II will be able to provide first experiences, insights and possible measures on the stabilization of degraded slopes in selected areas through structural, vegetative and managerial measures. The approach aims

- To develop successful demonstration areas and cases in the selected catchments;
- To provide an enabling environment for reduced resource mining;
- And to make different stakeholders aware of their role and the impact of land degradation.

The holistic perspective of catchment management planning will herewith be retained, but the actual treatments will focus on some critical areas in the catchment. In a long run, these areas could be upscaled with the help of the upcoming government projects to the remainder of the catchment area and to other areas with similar conditions. At the same time measures addressing issues related to erosion control in the wider catchment areas such as grazing management, alternative income sources and alternative energy sources will be implemented where possible. At large, the measures implemented will focus on the two main problems mentioned below (see also Figure 1):

- *Lack of or sparse vegetation cover*

Vegetation resources are required for different local needs including grazing, fuelwood, timber and non-timber forest products. These resource needs are closely linked with each other (Figure 2) and several hot spots have been identified by Lempelius (2007). These hot spots need to be addressed in an integrated manner. In order to reduce fuelwood demand and the demand for manure as fuel, two strategies may be applied: implementation of **improved cooking stoves** to improve fuel use efficiency and **solar cookers** for boiling of food and water. The reduced fuelwood demand has itself a positive impact on the forest and shrub conservation. In addition to that, **active re- or afforestation** needs to be considered. Reforestation however needs to be viewed from a more holistic perspective. While in the past afforestation programmes generally planted tree species only, the planting of shrub species in combination with tree species needs to be considered. Double vegetation stories provide better erosion control and provide additional fodder for livestock. Afforestation should further follow a diversity principle with economically interesting species amongst ecologically important and valuable species. Mieke (2007) proposes different species for the given conditions and suitable for cultivation in village nurseries. Vegetation cover is additionally challenged by heavy grazing. In order to reduce the pressure on the grasslands, **improved grazing management** models need to be studied and tested. Reduced herd sizes would considerably ease the pressure on the resources, but is very difficult to achieve unless there are **alternative income sources**. Income from livestock is the main source of income in both areas (Lempelius, 2007). Some alternatives were identified in both catchments, but would need further follow-up. In addition **improved winter feed** for better livestock health and reduced browsing around the villages during the winter season needs to be identified and tested.

The increase in vegetation cover provides improved watershed services, especially sediment control. Lower sediment concentration in the river water extends the life of hydro-mechanical equipment of small hydropower plants. In recent years the **private operator model** was introduced to some small hydropower plants in the Tibet Autonomous Region and is further promoted as part of component 4 of the programme. This model foresees better and more sustainable management of the power plants. In addition, the **productive use of energy** is promoted by the programme in order to increase the income of rural households from processed

agro-products rather than the sale of primary agricultural products. Surplus energy may be used for **pumping irrigation water** for the agricultural areas as well as village nurseries.

- *Uncontrolled water flow*

In places of severe erosion and land degradation, vegetative measures as well as management changes will not succeed in full recovery of the land resources. In these cases only **structural measures** will promise some success. Sthapit and Bhuchar (2007) identified a number of erosion processes in the two catchments and proposed possible remedies. As part of the capacity building efforts in erosion control the programme supports staff from the Erosion Control Bureau to attend a training course on low cost erosion control measures organized by the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu. This is followed by training for technicians to be organized in Tibet Autonomous Region. The detailed planning and implementation of structural measures shall be guided by the participants of the training as a training follow-up supported by a regional short term expert with experience in low cost erosion control measures.

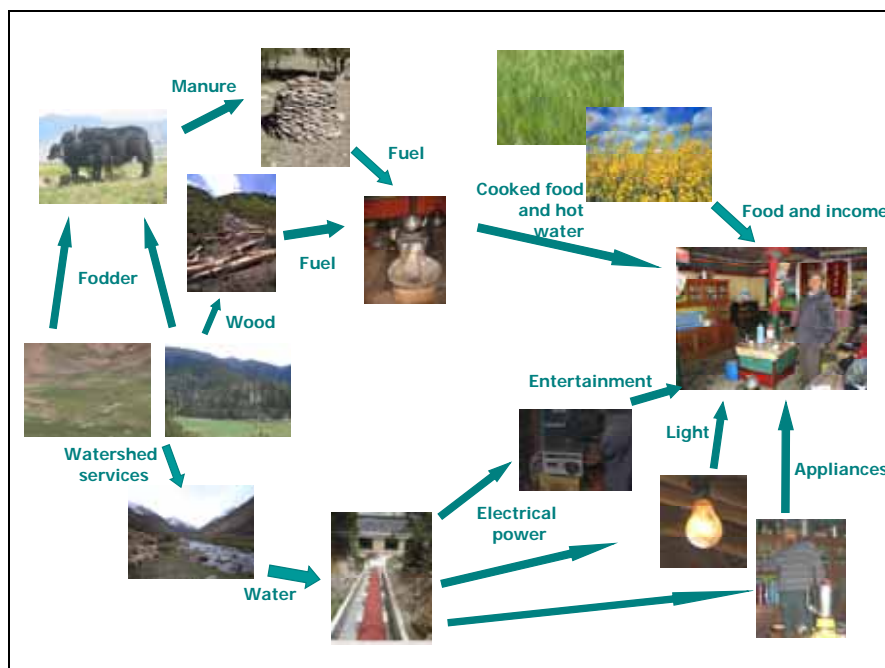


Figure 2: Current resources flows in a Tibetan village

The fact that the local population is largely dependant on locally available natural resources, their awareness of their role in the process and their contributions to reduce the pressure on the resources is key to the success of these activities. Simple tools of environmental education will be applied. It is foreseen that the programme will develop a well-illustrated booklet addressing the local illiterate population with some texts in very simple Tibetan language.

As part of the wider dissemination efforts, the programme foresees the assessment of the applied technologies and approaches in light of applicability to other areas and the development of multimedia material based on the lessons learnt. All technologies and approaches will be documented using the approach promoted by the World Overview of Conservation Approaches and Technologies (WOCAT). These activities will be

closely linked to the activities related to capacity building of the Erosion Control Bureau.

References

- Sthapit, K.M.; Bhuchar, S.K. (2007) Mission Report: Assessment of Erosion Types and Measures and Draft Training Curriculum. Lhasa: LIB II.
- Miehe, S. (2007) Mission Report: Vegetation Survey of Selected Catchments and Recommendations for Plantation Measures. Lhasa: LIB II.
- Lempelius, C. (2007) Mission Report: Socio-Economic Situation and Land Use Pattern in two Catchments of Chamdo Prefecture. Lhasa: LIB II.

2 Dhotra Rehabilitation: a case study

HIMCAT team; ICIMOD (main contact – Madhav Dhakal, mdhakal@icimod.org)

Introduction

Rehabilitation of degraded lands is important for sustainable watershed management and improved livelihoods. It was an important theme in ICIMOD-coordinated People and Resource Dynamics Project (PARDYP; October 1996-June 2006). In PARDYP, the land users together with the PARDYP research team, rehabilitated degraded sites in the project sites of Nepal, India, China and Pakistan (Bhuchar *et al.* 2005). One of the successful case studies from Nepal was the rehabilitation of Dhotra site in the Jhikhu Khola watershed and it is described hereafter.

Site description

Dhotra rehabilitation site is located in the Kavre Palanchowk district of Nepal and has an area of about 2.5 hectares. The site is located at an elevation of about 875 m amsl. The site is community land of the 40 households (240 people) of Dhotra village, who are dependent on this area for grazing. The rehabilitation site is surrounded by irrigated cropland downstream, grazing land, and degraded sal-(*Shorea robusta*) dominated forest. Rainfed forward-sloping terraces immediately adjoin the site.

The area has a distinct dry season from November to May and a wet monsoon period from June to October. Annual rainfall is around 1200 mm. The site has red soils that are highly weathered and, if not properly managed, are very susceptible to erosion.

Rehabilitation works at Dhotra

In Dhotra VDC (Kavre Palanchok district) a local youth club (Ekantabasti Youth Club) tried rehabilitating the Dhotra site in 2004. The club approached PARDYP for technical assistance. The area had been degraded by overgrazing with two big gullies formed and small landslips along the gullies affecting a trail and the adjoining agriculture land. An unsuccessful attempt had been made to plant up the area eight years previously. It had failed due to the difficulty of retaining soil moisture in the area's compacted red soils.

Meetings were organized to plan future activities, to ensure community participation, and to share responsibilities among local users and PARDYP. The community was committed to rehabilitating the area and took the responsibility for planting, protecting and the overall management of the planted species. PARDYP provided planting materials and technical help.

A needs assessment with the local people identified the most useful tree species. They entrusted the selection of the grass and hedgerow species to the project's expertise. Project staff arranged planting materials and other logistic support, and showed villagers how to make eyebrow pits, plant hedgerows and plug gullies. About 450 villagers participated in the rehabilitation activities with women contributing more than a half of the labour. Women's priorities were considered while selecting the plant species; species preferred by women were *Michelia champaca*, *Melia azedarach*, *Schima wallichii*, *Choerospondias axillaris*, *Azadirachta indica* and *Embllica officinalis*.

A five-women strong user committee was formed to manage and protect the planted species and a five-strong male task force was set up to maintain regular links and coordination between the user committee, the youth club and villagers. The coordination committee, with guidance from the youth club, was responsible for facilitating and coordinating all the second season rehabilitation work in 2005.

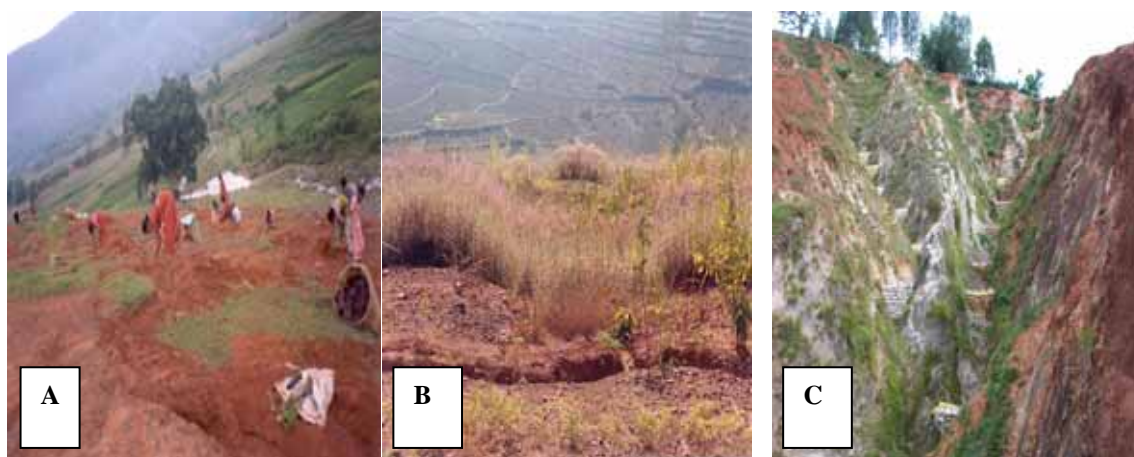
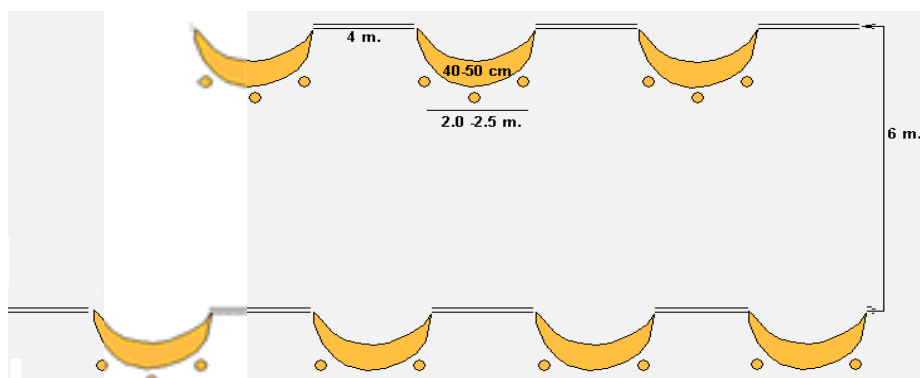


Figure 1. Planting activities at degraded Dhotra community site (A); after one of rehabilitation measures (B); gully plugging (C). In the gullies, 25 check dams were constructed using soil-filled cement bags. Bamboo was planted on the upper and lower side of each check dam.

Structural measures

Based on earlier experiences, the project recommended construction of eyebrow pits and trenches along the contours to harvest surface runoff. Small curved trenches in the shape of an eyebrow facing inward to the slope were dug at intervals to catch water and slowly return it to the soil. Altogether 130 eyebrow pits were dug together with catch drainage trenches. The row-to-row distance between the eyebrows was 6m; the average length, depth, and width were 2m, 40cm, and 50 cm, respectively. The average length of the drainage trenches was 4m and the depth was 20 cm. The eyebrow pitting design is as shown in figure below: -

Eye-Brow Pitting Design



Vegetative measures

Fast growing and nitrogen fixing species were planted along the trenches and at the lower margins of the pits. Between the eyebrow pits species preferred by the villagers (Box 1; Figure 2) were inter-planted. Simultaneously, work on gully plugging, by using simple vegetative and structural measures (soil filled cement bags; Figure 1C), was also taken up.

Box 1. Plant species planted at Dhotra

Tree species

Schima wallichii, *Michelia champaca*, *Melia azedarach*, *Choeropondias axillaries*, *Bamboo*, *Phyllanthus emblica*, *Prunus cerasoides*

Hedgerow species

Crotalaria juncea, *Tephrosia candida*, *Flemingia microphylla*, *Tithonia diversifolia*

Grasses

Stylosanthes guianensis, *Panicum maximum*, *Pennisetum purpureum*, *Melinis minutiflora*, *Brachiaria decumbens*, *Aeschynomene americana*, *Vetiveria lawsoni*

Post-PARDYP results

About 40 households actively participated during the rehabilitation activities and accepted the technology. The drivers for adoption were participation of land users; technical backstopping in the initial stages; extension of need-based technology. Seeds, seedlings, and technical advice were provided by the project as incentives. Most of the grazing land users were also members of the local community forest user group. Thus user group is considering using a similar technology in the degraded parts of their forest.

Due to the technology carrying capacity of land and farm income increased. About \$17 was collected from grass seeds and grass selling in first 2 years. Also, there has been an increase in the soil cover from about 5% in 2004 to about 80% now thus increasing soil moisture, reducing soil erosion and increasing biodiversity (WOCAT database 2007).

References

ICIMOD (2007) *Good Practices in Watershed Management, Lessons Learned in the Mid Hills of Nepal*. Kathmandu: ICIMOD

WOCAT database: *QA NEP 13 and QT NEP 13*. www.wocat.net

Bhuchar, S.K., Shah, P. B., White, R. 2005. Potential Strategies for Rehabilitating Degraded Lands in the Middle Mountains of the Hindu Kush-Himalayas. In R. White and S.K. Bhuchar (eds)

“Resource Constraints and Management Options in Mountain Watersheds of the Himalayas: Proceedings of a Regional Workshop held 8-9 December, 2003 in Kathmandu, Nepal”. ICIMOD



publication, pp.: 187-203

Figure 2. Vegetative measures to rehabilitate degraded dry land in Dhotra.

a. Champ (*Michelia champaca*); b. *Tephrosia candida*; c. Paiyun (*Prunus cerasoides*); d. Vetiver, e. Bakaino (*Melia azedarach*); f. Sunhemp (*Crotalaria juncea*); g. Molasses (*Melinis minutiflora*)

3 Broom grass: A multipurpose plant with erosion control potential

ICIMOD, S.K. Bhuchar, sbhuchar@icimod.org

Introduction

Broom grass or *Thysanolaena maxima* (Roxb.) Kuntze is a tall, tufted, reed-like perennial grass with leaves bearing resemblance to those of bamboo (Figure 1). It belongs to the family Poaceae and is commonly known as amliso in Nepalese, tiger grass/bouquet grass/broom grass in English, ons/kuchi in Uttarakhand (India). The species grows well in temperate and sub-tropical parts of India, Bangladesh, Bhutan, Burma, China, Nepal, New Guinea and Malaysia, up-to 2000 meters above mean sea level (Palni *et al.* 1994). The species is adapted to grow in wide ranging habitats (Table 1) and can be successfully cultivated in different land-use types –margins of rainfed and irrigated agriculture fields, degraded and wastelands, forests and along roads and footpaths.



Figure 1. A broom grass clump at ICIMOD's demonstration and training Centre in Godavari (Nepal; photo M. Dhakal)

Multiple uses of broom grass

Broom grass is a multipurpose plant. Its panicles are used for tying brooms; leaves and tender culms are used for fodder; woody culms for fuel, paper pulp, reed-pens, mulch material and support stakes for trailing crops. The species is also used in traditional health-care as decoction of its root is used as a mouthwash during fever, and paste of dried or fresh roots applied on the skin to check boils (Rai & Sharma 1994). The forage from broom grass is available in sufficient quantities from the month of June to December (in frost free areas) and the leaves contain a balanced proportion of nutrients (Table 2).

Table 2: Nutritional value of *T. maxima* leaves

Parameter (%)	Palni <i>et al.</i> (1994)	Singh <i>et al.</i> (1995)	Bhuchar (2002)
Digestibility	57.9	-	54.3-57.9
Total Ash	11.8	5.65	10.7-11.8
Ether extract	6.67	1.94	4.2-6.7
N-free extract	33.1	51.6	39.3-44.6
Crude protein	18.1	10.2	15.1-18.2
Crude fibre	30.4	30.5	29.5-31.0
Cellulose	30.2	-	30.3-37.8
Hemicellulose	29.6	-	29.6-34.4
Lignin	9.1	-	4.6-9.2

Cultivation of broom grass on agriculture terrace margins improves forage production and soil conservation without affecting the productivity of the crops. In mid-hills of Uttarakhand, 1 kg of fresh rhizome planted at a distance of 1x1 m yielded about 16 t ha⁻¹ of above ground biomass in the 3rd year of plantation.

Soil and water conservation aspect

Broom grass is a good soil and water conservation species. It has a fibrous root-mat which helps protect topsoil and nutrients from erosion on sloping terrain, landslide-affected areas, and agricultural fields. Sharma *et al.* (2001; Table 3a), and Mathema & Singh (2003; Table 3b) found that water runoff and soil loss from plots treated with broom grass were reduced by up to 88%, as compared to bare land. Wherever possible, broom grass is used in bioengineering as an effective and low cost measure - Agrawal & Rikhari (1998) estimated that monetary expenses incurred during such plantations were approximately US\$ 17.00 per 1000 plant slips.

Table 3a. Water and soil runoff quantities and conservation values of different land use types in Khanikhola watershed (Sikkim, India; Sharma *et al.* 2001)

Plot type	Water runoff (litre)	Soil loss (kg)	CV water (%)	CV soil (%)
Maize	25±4	1.51±0.18	69	56
Finger-millet	18±3	1.32±0.14	78	62
Mixed cropping	12±3	0.95±0.12	85	73
Large cardamom	15±3	0.45±0.06	81	87
Broom grass	10±2	0.41±0.07	88	88
Bare land	80±11	3.46±0.35	-	-

CV: Conservation value.

Table 3b. Comparison of soil loss and runoff from different land use types in Jhikhu Khola watershed (Nepal; Mathema & Singh 2003).

Land use type	Soil loss (t/yr/ha)	Runoff (%)
Outward sloping terrace	10.4	2.8
Degraded land	21.3	40.1
Degraded land treated with broom grass	12.8	26.5

Economic importance

Thysanolaena brooms processed from broomsticks or inflorescence bearing panicles have a high demand in countries like India, Nepal, Bangladesh and in the Middle East. Shankar *et al.* (2001) estimated a return of 1.7 times of the total investment during a six year plantation cycle, which included the cost of labour (62% of the input) and rent for the land (about 33%). The returns could increase significantly if the cultivators are self employed and the land is available free of rent. The same study estimated that each ton of broomsticks after processing into finished brooms fetched about US\$ 1333.

A reliable estimate of the annual broomstick demand in different countries is not available. However, the annual Indian broom market was estimated to be something

like US\$ 60 million (Shankar *et al.* 2001). *Thysanolaena* broom is very effective for sweeping wooden, stone and mosaic floors, and carpets, and is superior to some of the other species, including *Cocos nucifera*, *Phragmites* spp. and *Saccharum* spp.

Propagation methods

T. maxima can be propagated through seeds, slips - containing 3-4 buds and 1-2 nodes - and rhizomes. Seed are very tiny and germinate best under light conditions at 25°C (Bhuchar 2002). Normally, broom grass is propagated through rhizome during monsoon and winter seasons. Bhuchar (2002) found that nursery can be raised during warm summer months. A reproducible micro-propagation protocol with the help of excised zygotic embryos for mass multiplication of *T. maxima* has also been developed by Bhuchar (2002).

References

- Agrawal, D.K. & H.C. Rikhari. 1998. Mountain risk engineering: low cost biological and physical measures for control of small hill slope instabilities. In *Research for Mountain Development: Some Initiatives and Accomplishments*. Gyanodaya Prakashan, Nainital, India, 1998, pp. 119-144.
- Bhuchar, S.K. 2002. *An eco-physiological evaluation of Thysanolaena maxima (Broom grass): A multipurpose, perennial grass of high fodder value*. Ph.D. thesis (unpublished), Kumaun University, Nainital, India.
- Palni, L.M.S., B.P. Kothiyari, H.C. Rikhari, S. Bhuchar, G.C.S. Negi, S. Sharma, S.S. Samant, S. Bisht, & D. Choudhury. 1994. *Thysanolaena maxima* (Roxb.) Kuntze: a multipurpose, perennial grass of high fodder value. *Hima-Parayavaran* **6(1)**: 9.
- Rai, L.C. & E. Sharma. 1994. Medicinal Plants of the Sikkim Himalaya-Status, Use and Potential. *HIMAVIKAS Occasional Publication*, G.B. Pant Institute of Himalayan Environment and Development, Almora, India.
- Sen, A. 2000. Sweep Stakes: Easy to grow, easy to sell – broom growers reap the benefits. *India Today* Feb, 14, 2000: 12.
- Singh, K.A., R.N. Rai, N. Balaraman, & L.N. Singh. 1995. Evaluation of forage grasses for the mid hills of Sikkim (eastern Himalayas). *Range Mgmt. and Agroforestry* **16(1)**: 39-45.
- Sharma, E., S.C. Rai & R. Sharma (2001). Soil, water and nutrient conservation in mountain farming systems: Case-study from Sikkim Himalaya. *Journal of Environmental Management* **61**: 123-135.
- Uma Shankar, S.D. Lama & K.S. Bawa. 2001. Ecology and economics of domestication of non-timber forest products: an illustration of broomgrass in Darjeeling Himalaya. *Journal of Tropical Forest Science* **13**: 171-191.
- Watson, R and H.J. Dallwitz. 1992. *The Grass Genera of the World*, pp. 952-53.

Table 1 Site characteristics of *T. maxima* in the Kumaun and Garhwal regions of Uttarakhand (Indian central Himalaya; Bhuchar 2002).

Site Aspect	Altitude (m amsl) / slope (°)	Habitat	Moisture %	pH	Organic C (%)	Total N (%)	Total P (%)
NW	700 / 45	Along road and water channel, Sal-Pine mixed	36.2	7.1	2.6	0.31	0.08
NW	700 / 50	Sal-Pine mixed forest, along rivulet	26.7	7.2	2.3	0.18	0.06
SW	1600 / 60	Along footpath, on slope of forest edge	24.8	7.7	2.1	0.23	0.05
NE	1200 / 75	Along, road, landslip	14.2	9.3	1.6	0.14	0.04
NE	1800 / 80	Edge of Chir Pine forest, near seasonal rivulet, rocky slope	21.4	7.9	0.8	0.06	0.02
SE	1600 / 65	Along rivulet	30.3	8.7	1.3	0.15	0.04
SE	1500 / 72	Rocky and gravelly, along road, close to perennial rivulet.	20.0	5.6	0.8	0.05	0.01
NW	1900 / 65	Edge of Oak-Pine forest, along rivulet	37.6	8.1	2.7	0.3	0.09
SE	700 / 70	Landslide area, close to water channel	13.3	9.1	0.8	0.03	0.006
SW	1100 / 72	Landslide area, near water channel	11.6	5.3	0.4	0.007	0.007

4 Soil and Water Conservation Demonstration Site Development with Community Participation: A Case Study of Godamchaur Demonstration Site, Lalitpur, Nepal

Jagannath Joshi, jagannath_joshi@yahoo.com
Department of Soil Conservation and Watershed Management
Babar Mahal, Kathmandu Nepal

Introduction

Soil and water are the principle natural resources of Nepal and ultimate source of people's livelihood. However, sustainability of these resources is a major concern due to watershed degradation in general and soil erosion in particular. The soil erosion and landslides are considered as the most critical environmental problems of Nepal.

Natural soil erosion is the inherent characteristics of Nepal's geological, geomorphologic and climatic conditions, which has been accelerating due to anthropogenic causes. The increasing population of Nepal has been exerting tremendous pressure on the watershed ecosystem and resources, especially on land and water.

Recognizing the critical situation of watershed degradation, specifically soil erosion in the country, Government of Nepal has been implementing Soil Conservation and Watershed Management (SCWM) program and projects since 1974, through Department of Soil Conservation and Watershed Management (DSCWM). At present DSCWM is providing SCWM service to 60 out of the 75 districts of Nepal.

SCWM Initiatives

The physiographical, geological and climatic variation and diversity dictates a disparity in degradation problems and demand appropriate SCWM technologies and activities to combat the degradation in Nepal.

Various soil conservation technologies developed in different parts of the world have been used to implement SCWM programs in Nepal. There are successful examples as well as failure cases of SCWM projects/activities in different physiographic regions of the country. Though, various factors are responsible for success or failure of SCWM projects/activities, appropriate technology is the most important one.

Testing, improvement and development of appropriate technological packages to solve various erosion problems is one of the important steps in SCWM. Demonstration Plots or Sites are very effective means of technology testing, data collection, result demonstration, teaching, educating and creating awareness for conservation as per the principle "seeing is believing".

Based on experience of different SCWM projects, DSCWM has realised the need of appropriate SCWM technology development and dissemination. Consequently, technology testing/development and demonstration plots were established in Surkhet (Subbakuna), Makawanpur (Kulekhani, Burropit), Kabhre (Panchkhal) and Nuwakot (Pipaltar) districts during 1985 to 1990. Main objectives of the demonstration plots were: to test/improve and develop site specific SCWM technology, to demonstrate the technology (to ensure replication) and to raise local people's awareness. Local

communities had participated actively in the development and management of the plots. All the demonstration plots were developed and managed till 2002 and then handed over to local communities or institutions that were involved in their management.

DSCWM has again realized that those plots were not sufficient to test, improve or develop various SCWM technologies in different physiographic regions required for landslide treatment, gully treatment, water management and so on. So, DSCWM has again started to establish, develop and manage demonstration sites involving local community and District Soil Conservation Offices. In this connection, a demonstration site was established in Godamchaur village of Lalitpur district in 2006.

Godamchaur Soil Conservation Demonstration Site

Godamchaur Soil Conservation Demonstration Site is located in Godamchaur Village Development Committee-1, Lalitpur district (Photo 1 and Figure 1). The site is locally known as Ratmate Khaulo or Ratmate Pahi (Red soil landslide). The site is a landslide (0.3 ha), just above (upstream) of Simle village, which has about 3 hectares catchment area.

According to the local people, nearly one century ago the villagers have constructed a drainage channel to drain run-off water safely from upstream of their village to protect their agricultural land from erosion. Gradually the channel became deeper and wider forming a big gully which had initiated landslide later on. In 1980, a torrential rain triggered a bigger landslide above the drainage. Since then red soil is exposed by the landslide, which is used by the local people as red-soil mine for many years e.g. to paint the outside of their houses. This activity has accelerated the expansion of the landslide. About one decade ago, a person was killed on the spot due to collapse of unstable mass while digging out the red soil from the mine and some other people were injured. That accident made local people aware of the seriousness of the problem. In 2000, Godamchaur Community Forest User Group (GCFUG) was formed and the landslide area was included inside the community forest area. GCFUG has tried to protect the landslide area but could not control due to lack of appropriate technological knowledge and skills. In the mean time DSCWM had selected the landslide area to develop as a demonstration site after discussion with GCFUG members.



Photo 1. Satellite images of a hill slope in Godamchaur showing Ratmate landslide.

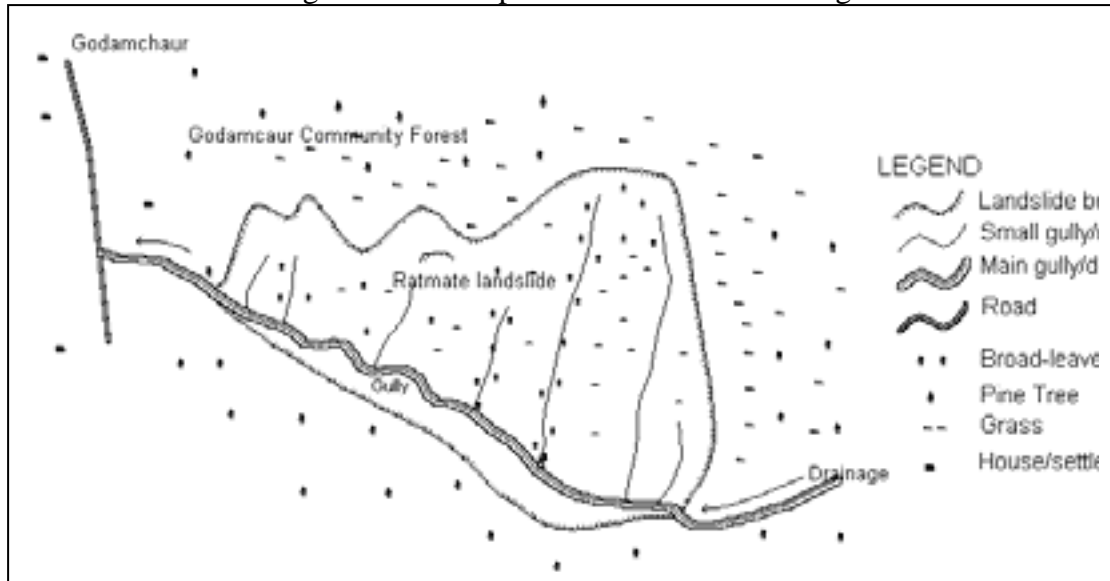


Figure 1. Sketch map of Godamchaur Soil Conservation Demonstration Site including Ratmate landslide.

Thus, the landslide was initiated mainly due to anthropogenic cause steep scarp of the landslide collapse every year during monsoon rain fall. Rills and gullies have been developed on loose soil mass. Drainage at the toe part eroded the soil displaced from the head scarp. Red soil mining from the landslide area by the local people further aggravated the problem. The eroded red soil is transported by drain water that goes to an irrigation channel which is used by local people to irrigate their more than 100 Ropani paddy field in the down stream area. Ultimately, soil eroded from the landslide area deposited in the farmers' field which adversely affects agricultural land's fertility and crop production.

Objectives of the Demonstration Site

The general objective is to develop and disseminate appropriate soil conservation technology packages through testing, research and demonstration.

Specific objectives are:

- to develop appropriate soil conservation (landslide treatment) technology packages through test and research.
- to rehabilitate heavily eroded or degraded site and convert it into a productive area with simple/low cost techniques, which can be replicated by the District Soil Conservation Offices and local people.
- to disseminate the technology through demonstration, training, seminars, workshops and study tours.

Observed Site Condition before Starting the Conservation Work

Following site conditions were observed in the beginning:

1. Toe cutting by main drainage that has been converted into gully
2. Run-off concentration from upstream on the main scarp of the landslide causing accelerated soil erosion
3. Shallow landslide expanding upstream and north western part
4. Rills and gullies developed on accumulated soil mass
5. Cracks developed above scarps in Northern and Southern part
6. Red soil mining continued from bottom of the very steep scarps
7. Very low soil moisture content and sparse vegetation (upstream and within landslide)

Stakeholders and Community Participation

It has been appreciated that local community is actively participating in community forest management and SCWM activities and getting benefits from them.

DSCWM, District Soil Conservation Office Lalitpur and GCFUG have been working together since 2006 to meet the objectives of the demonstration site. DSCWM has been taking lead role in technical matters. DSCWM and DSCO Lalitpur have provided technical, material and limited financial support. GCFUG is responsible for people's participation to implement the activities and protection of the site. An agreement has been signed by all the stakeholders during the planning phase.

Conservation Techniques Tested and SCWM Activities Carried out in the Site

A five year site development plan has been prepared. Activities are selected, designed and implemented in each fiscal year based on available budget. Completed activities are:

1. Five diagonal hedgerows of *Flemengia spp* plantated above head scarp of landslide
2. Six stone filled gabion check dams constructed in deeper parts of the gully
3. One hundred fifty seedlings of pioneer tree species and 100 bamboo seedlings were planted. About 70% are still surviving.
4. *Agave spp's* rhizomes were planted by GCFUG in southern border of demonstration site to make live fence
5. Four toe/supporting walls were constructed using loose stone

In addition to above mentioned techniques, fascine, palisade, brush layering and brush wood check dams for rill and gully control are to be implemented in the running fiscal year.



Photo 2. *Flemengia* hedge row



Photo 3. *Bamboo* plantation in soil mine



Photo 4. Loose stone retaining wall



Photo 5. Series of small check dams



Photo 6. GCFUG members and DSCWM Technician observing check dam filled with sediment in one year



Photo 7. Check dam at outlet of gully from landslide area, filled with sediment in one year



Photo 8. *Agave* plantation for live fence

Initial Effects

Although, it is early to assess the significant effects and impacts, the following encouraging initial effects are observed so far:

1. Small check dams are functioning well to stabilize the gully and trap sediment. It is estimated that more than 55 cubic meter sediment has been trapped by the check dams
2. *Flemengia* hedge rows are growing well and part of run-off water is safely draining through hedgerows
3. Local people reported that greenery in the site is increased and run-off water draining out from the site during rainy season is almost sediment free
4. Red soil mining is completely stopped due to closer of the site
5. The site has been used for practical exercise of landslide treatment by ICIMOD during an International Training (2007)
6. Awareness of the local people has been increased and their confidence level also increased
7. Main gully is filling up with sediment and stabilizing

5 Snow Management and harvesting in Mountainous regions; A Case Study from the Central Highlands of Afghanistan

ICIMOD, Andrew Billingsley, Afghanistan
billingsley.andrew@gmail.com

Introduction

Precipitation, in the form of snow, as it falls, flows and percolates through the soil, is as much a socio-political entity as it is an environmental, economic and agricultural resource. Snow management, through “trapping” and harvesting, therefore, is not simply a physical intervention, but occurs in the context of broader land ownership issues, sustainable management and productive need, and must incorporate in its implementation an appreciation of the various dimensions which exist between upper and lower catchments.

Given the topographical diversity of Afghanistan, enormous differences in climatic and precipitation levels exist. The mountains of Afghanistan provide, directly and indirectly, a substantial proportion of the water necessary for agriculture, power and human consumption throughout the country. The bulk of water originating from mountains derives from snow melt, and its management, therefore, is a crucial component of farming systems, livelihood strategies and disaster mitigation.

Snow trapping structures represent the interface between man, water, soil, sun and vegetation. It is the process by which water, in the form of snow is “held” within or behind biological and mechanical structures in order to reduce evaporation, increase the time water has to percolate through the soil, and to counter the erosive effects of flowing snow melt. The process is intended to aid in the creation of biological circumstances in which the rehabilitation of high mountain upper catchments and watersheds can occur.

Opportunistic rain fed farming in the context of a general break down in the legal infrastructure around land ownership, drought, and deforestation for fodder and fuel wood, have left the mountains of Afghanistan often barren, unproductive, and prone to flash flooding, and extensive erosion. Snow management, through snow harvesting, is a tool by which to increase soil moisture content and reduce erosion, permitting the augmentation of biomass cover and increasing the amount of water available for agriculture. Given the extensive degradation of the environment throughout much of the mountain geography of Afghanistan, and the fact that most mountainous regions in the country exist in rain shadow areas, where the bulk of precipitation falls as snow, snow harvesting and management becomes increasingly important.

Afghanistan can quite proudly claim a history of often extraordinary water and soil conservation technologies. However, due to the distance that snow traps are often located from habited areas, the difficult terrain of upper catchments, the potential cost involved and in the wider context of social fragmentation through war and migration, snow has been generally been left unmanaged. Traditional, effective, time tested methods for snow harvesting, such as “*Nawoors*”, gully plugs and snow filled pits covered with soil, do exist, but they tend to be close to villages and are largely not employed in rangeland areas in the upper catchments, where snow needs to be

initially managed in order to increase percolation to the lower catchments and to mitigate the forces exerted on soil through snow settlement and melt.

In the Afghan situation, however, a number of options, both economically and physically, are possible. These technologies are often simple adaptations of existing technologies to specific snow bound environments, the characteristics of which are high evaporation rates in response to sharp sunlight, shallow soil depths, high rates of rill erosion, heavy, compacted snow for extended periods, strong swirling winds and cold temperatures. Crucially, the structures highlighted in this case study accrue greater significance in areas of erratic rain and snow fall, where every drop of water is important, needing only to be adapted to specific circumstances.

Punjab and Waras, Southern Bamyan

Predominantly agricultural, the two southern most districts of Bamyan Province in the Central Highlands, are isolated, largely barren, and predominantly agricultural. They lie north of the Kotal-i-Qonoq and to the south of the shadow cast by a central spine of high, snow covered peaks and ridges rising to almost 5,200 masl, known as the Koh-i-baba mountains. Roughly eight hours drive from Bamyan centre, the provincial capital, the two districts are fed by three major roads, all of which are closed by snow through prolonged winter periods. Both districts are part of a complex of mountains which form the watershed of some of Afghanistan's most important river systems.

Both Punjab and Waras are characterised by extensive denudation of their natural resource base, with pronounced, widespread erosion, significant reductions in biomass cover, and pervasive deforestation, deriving in large part from a general break down in traditional tenure regimes and the un-controlled cultivation of fragile mountain ecosystems amidst increasing population pressure.

Landscape features and soil architectural stability vary greatly in both Punjab and Waras, with high elevation, tight valleys deeply shadowed valleys, uneven topography and low organic matter commonplace. In most areas, the soils' tenacity for water retention is limited through extreme reductions in soil porosity, a feature promoting run-off and consequent erosion. In ever increasing rainfed farming instances, tillage aimed at loosening the soil to allow the infiltration of more precipitation, exacerbates the problem, compounding a series of land management issues. This situation has been exacerbated by the repeated plundering of the rangelands for fodder and fuel, the removal of shrubs through browsing and trampling by increasing numbers of livestock. Many of these practices are directly or indirectly related to the maintenance of livestock, an essential component of the agro-ecosystem in both districts. Land above the irrigation canals is subject to largely uncontrolled grazing and rainfed crops, a process which is transforming the landscape from one bearing a diverse set of shrubs to an artemesia dominated, desert-like landscape for much of the summer season.



Picture 1: Bamyan, Afghanistan.



Picture 2: Qonoq, Waras District, Bamyan, Afghanistan.

These processes, set amongst the general deterioration in the management of the rangelands, increasing population and exploitative land ownership relations have led to a significant degradation of soil quality, reduced infiltration rates and exposure of soils to the impact of rain and snow melt. This has produced, in many areas, quite extensive erosion complexes, and established a self-reinforcing phenomena of increased soil loss through surface erosion, gullyng, and land slides.

Biophysical variability assumes particular significance in such contexts, describing a complex tension between people and nature, where the extensive ecological, physical and cultural heterogeneity in the region makes it crucial to find single, simple solutions to any one problem.

Watershed management programme

Given that community based stewardship of upland resources generally yields greater and more sustainable environmental and economic returns, both to the people living in the mountain areas, and to the immediate downstream economies, the Aga Khan Foundation, Afghanistan, conceived a watershed management programme premised on a comprehensive understanding of the range of factors that promote reforestation/afforestation in livestock dominated areas. The programme had at its core, community derived ideas and planning processes. Given the range of biological, ecological, institutional and social environments and the diversity of tenure arrangements, the programme was structured in such a way as to consider a number of complimentary and interrelated approaches in order to derive more complex, nuanced, yet actionable conceptual framework.

Two sites were selected for the programme, one each in Waras and Punjab districts. Activities were focused on reforestation/afforestation, through improvements in soil and water conservation technologies and approaches, as a means of increasing water available for agriculture, reducing erosion, and increasing biomass cover. Key to the programme was its integrated, holistic approach, recognizing the many interrelated, dynamic and complex agricultural, hydrological and the heterogeneous socio-political interactions in the catchment areas. As a demand driven and community based approach, in which a wide array of stakeholders could articulate their needs and actively participate in the planning, management and sustainable utilisation of their local resources, the programme sought to ensure the greatest impact and, crucially, a strong sense of community ownership. This approach was underpinned by the

realization that soil and water conservation is not a stand alone activity, but must be complimented with a series of complimentary interventions, such as rotational grazing, the development of alternative fodder alternatives and institutional development.

Traditional water harvesting structures, while innovative, are often inefficient, and are generally owned by individuals. The structural work, of bunds, terraces, pits and trenches, and the demonstration and piloting of new technologies as part of the soil and water conservation component, however, was carried out on community land. This allowed all members of the community to participate in the process, learn new techniques and technologies and benefit directly from their efforts.

Physical soil and conservation works, using both biological and constructed measures, were coupled with extensive community mobilization activities and institutional development activities. The programme worked extensively with Community Development Committees, which, over time, were clustered to form Cluster Level Development Committees (CLDC's). By creating a single institutional entity at the valley level, the communities were better able to facilitate greater coordination of watershed management activities, resolve disputes, organize labour and ultimately, work towards a greater sense of unity and common purpose. This mechanism has been particularly useful in dealing with the often tense relationships between upper and lower catchment areas, user rights, rotational grazing of livestock and conservation areas for biomass regeneration. In 2006, the CLDC's of both watersheds, negotiated with labourers that a percentage of their earnings be returned to the Watershed committee, a sub- committee of the CLDC. Monies collected will be used for maintenance of the various watershed structures and is currently funding the employment of a guard for the treated areas.



Picture 3: Taga Bargh, Punjab, Bamyan, Afghanistan,
 Andrew Billingsley

The Qonoq watershed, at altitudes between 3,100- 3,400m, situated four hours south of the district centre, and in Waras, Bamyan's most southerly district, is the oldest of the watershed sites and covers almost 100 hectares of treated area. Steep slopes, thin soiled, largely dominated by brittle gneiss rock, and shrubs, shadow a ribbon of fast flowing stream in the early Spring, which deteriorates to a trickle in late summer, only to be frozen over in the winter. The region receives little precipitation in the form of rain, with winter snow melt and mountain springs the only source of water for much

of the agricultural year. The Taga Bargh watershed, covering 50 hectares, and spread over a similar altitude, is a concave structure, with a deeper soil horizon and east facing aspect. As with Waras, the region receives little precipitation throughout the summer months, but is subject to prolonged winters with much snow. In both situations, the mountain biota are adapted to relatively narrow ranges of temperature, altitude and precipitation.

In these contexts, the watershed management programme highlighted a number of structures most suitable for the management of snow and the conservation of soil and water resources. While many such structures were identified, five, key structures are outlined below;

- **“Bundee parinda” (Bird Bunds)**



Picture 4: Qonoq, Waras District, Bamyan.

These earthen structures are large pits, up to 1.5 m deep, topped with berms leading to “V” shaped bunds in a downward slope facing direction. The earth is removed to ever increasing depths leading to the pit, so that snow can be collected in the structures’ wings, and melting snow directed to the pit. The bund and berm can then be seeded. The type of species should dictate where the seed is located. The structure in its entirety attempts both to trap snow, as well as

provide shadow to the pit in the early months of spring in order to reduce evaporation. These structures are suitable for moderate slopes.

- **“Hesion bag bunds”** This technology is the combination of a number of elements. A trench of 50 - 70 cm in depth, running up to 20 m in length is created along a moderate slope. The soil and gravel extracted from the trench is then placed insidehesion bags, with the filled bags then placed back in the trench side by side. The filled bags act both as a bund, reducing the flow of water and soil, increasing water percolation. The hesion bags retain moisture when the land around has become dry, thereby allowing seeds, which can be placed inside, to germinate.

- **“Triangular pit”**



Picture 5a and 5b: Taga Bargh, Punjab District

A triangular pit is an attempt to reduce the evaporative effects of the sun and wind. The pit, being triangular, exposes less of the snow trapped in the structure to evaporative elements. The shape also reduces the possibility of pit wall collapse, which, depending on the soil, can characterize other pits formed in a circular or square fashion. In addition, earth is piled on the sun facing side of the structure forming a bund, with a berm type structure in which seeds can be placed. This structure provides further shade to trapped snow, reducing evaporation and increasing the amount of water percolation.

- **“Compartmentalized and open trenches”**. The weight of snow, especially over a period of up to six months, can exert a large amount of pressure on bunds, particularly straight bunds. Excessive weight has the potential to break bunds, concentrating the flow of water in specific areas, leading to further soil degradation. In order to reduce this possibility, earthen compartments, or bunds within bunds can be added to the structure, focusing the snow in sections and reducing the pressure across the length of the bund.
- **“Brush wood structures”**



Picture 6a and 6b: Taga Bargh, Punjab District, Bamyān.



Picture 7a and 7b: Qonoq, Waras District, Bamyān.

Made in sections of one metre in length, willow branches are horizontally woven through three thick willow stems/ trunks (2 metres high). The metre long sections are then joined to another one metre woven willow structure forming a two metre structure. The stems/ trunks are then anchored a metre to a metre and a half in the soil (soil type and slope angle should be carefully considered at this point, as must the amount of expected snow). This anchoring is crucial to structural stability.

This structure is ideal for very steep areas, where other structures are not viable. They are used at the top of the watershed. The weight of snow tends to break these structures after two years, if the willow stems/ trunks have not started to grow in the soil. Seeds can be placed behind the structures to add both to the stability of the structure and increase

biomass cover in the area. Metal mesh can also be added to the structure to give it additional strength.

Key learnings from the programme thus far suggest that:

- The integration of activities is crucial. It is not possible to work on physical structures alone, given the necessity to maintain structures over a long time, and to ensure the cooperation of all community members. Social development, institution building and capacity building activities around planning are 90% of the work. In addition, one cannot conserve if there are no viable alternatives. Rotational grazing, bio- briquettes and other such technologies must be incorporated in the programme in order to reduce further pressure on the rangelands.
- One has to be conscious that if too much water is trapped on an unstable slope you can increase the chances of land slide and slip.
- Bunds and other similar structures must respect contours. If bunds are not straight and do not run along contours, water can form in corners of the bund, putting too much pressure on the structure and increasing the chances of collapse.
- Local people know their slopes, their soil types, the flow and melt of water and the weather patterns of their area. Their participation in the planning process is **absolutely essential**. No amount of hydrological data and watershed management experience can compensate for the absence of community based ideas and understanding.
- Snow harvesting/ trapping structures can be implemented anywhere in a watershed, but they are most crucial in the upper catchments. In Afghanistan, most communities live close to valley floors and are therefore far from the areas where snow trapping occurs.
- Land ownership patterns must be considered. The current landownership situation in Afghanistan is both complex and dynamic. Snow is a common resource, and its harvesting and trapping, and the benefits that derive from, must be seen as a common for all in the watershed.
- While most snow harvesting/ trapping structures are found in the upper catchment, their benefits are often found in the lower catchments. It is crucial to ensure that the entire watershed is involved in the process and that issues of upper and lower catchments are discussed, understood and agreed upon by communities before work commences.
- Snow harvesting/ trapping can be an expensive business, and is more often than not labour intensive. It is, therefore, a high investment for communities. Issues of management, beyond the time of the project must be dealt with before work starts.

Join HIMCAT extranet

Visit: <http://extranet.icimod.org.np/himcat/>

The HIMCAT newsletter is distributed two times a year, only by e-mail.

Editorial team: HIMCAT team S. Bhuchar and I. Providoli, ICIMOD, GPO Box 3226
Kathmandu, Nepal

Next issue, autumn 2008

Special topic of the issue will be decided at a later stage. You are invited to send us information about announcements, publications, training courses, and your current WOCAT work on new technologies and approaches etc..

Thank you.
