

NEPAL AUSTRALIA COMMUNITY  
RESOURCE MANAGEMENT AND  
LIVELIHOODS PROJECT

Lessons Learned from the Soil  
Conservation and Sub-Watershed  
Management Program



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## ANNEXES

Annex 1: List of Fodder and Forage Species

## Acronyms

CDGs	Community Development Groups
CFUGs	Community Forest User Groups
DAGs	Disadvantaged Groups
DFO	District Forest Office
DSCOs	District Soil Conservation Offices
DSCWM	Department of Soil Conservation and Watershed Management
MFSC	Ministry of Forest and Soil Conservation
NACRMLP	Nepal Australia Community Resource Management and Livelihoods Project
VDC	Village Development Committee

## Executive Summary

In 1994 the Government of Australia initiated its work in Nepal in soil conservation and sub-watershed management by supporting the Department of Soil Conservation and Watershed Management (DSCWM) of the Ministry of Forests and Soil Conservation (MFSC) in implementing field activities in Sindhu Palchok and Kabhre Palanchok districts. From 1994 to 1997 it focused on constructing infrastructure to help farmers maintain or improve agricultural productivity. With the start of the Nepal Australia Community Resource Management Project (NACRMP) in early 1997--, the focus shifted to the development and testing of methodologies for participatory sub-watershed management. The Nepal Australia Community Resource Management and Livelihoods Project (NACRMLP) started in February 2003. It supported the development and testing of a participatory holistic approach to land use management with a view to integrating soil conservation and watershed management into farming systems.

The District Soil Conservation Office (DSCOs) of each district selected one sub-watershed in which to focus efforts--Sikar Khola in Sindhu Palchok and Dapcha Khola in Kabhre Palanchok. Then communities were organised into Community Development Groups (CDGs) and Community Forest User Groups (CFUGs)--15 in Sikar Khola and 14 in Dapcha Khola. Using a bottom-up process, each group prepared a community development or livelihood improvement plan. The process was designed to encourage participation by women, the poor and disadvantaged groups (DAGs). These community development plans outlined a range of human and natural resource development and management priorities, as well as target groups, available internal resources, support requirements, support institutions and a time schedule. Activities like forage development and management, vegetable farming, fruit seedling plantation and degraded land improvement through plantation are more cost-effective than infrastructure development when it comes to soil conservation and watershed management.

To encourage sustainability, a process for self-monitoring was designed and tested by NACRMLP. User groups of Sikar Khola and Dapcha Khola sub-watersheds were encouraged to monitor their activities using the established procedures. DSCOs and CDG and CFUG members are making their activities more transparent and facilitating the deliverance of more benefits from soil conservation activities to women, the poor and DAGs. CDG and CFUG networks were established in both Dapcha and Sikar Khola, and regular meetings were held to discuss pertinent issues, share experiences, learn from each other and develop an attitude of mutual cooperation. NACRMLP also assessed the main effects of soil conservation and sub-watershed management activities carried out within and outside selected sub-watersheds using a variety of criteria including environment improvement, sustainability, lateral adoption, cost effectiveness, gender and social equity, and livelihood improvement. Implementing land-use management practices such as compost manure preparation, animal urine collection and use, waste water conservation in small plastic-lined collection ponds, home nurseries and agroforestry plantation, kitchen gardening, and fodder and forage development and management works is more cost-effective and efficient than constructing expensive infrastructure.

# 1 Background

In 1994 the Government of Australia initiated its work in Nepal in soil conservation and sub-watershed management by supporting the DSCWM of the MFSC in implementing field activities in Sindhu Palchok and Kabhre Palanchok districts. From 1994 to 1997 it focused on constructing infrastructure to help farmers maintain or improve agricultural productivity. With the start of the NACRMP in early 1997 focus shifted to the development and testing of methodologies for participatory sub-watershed management. The NACRMLP started in February 2003. It supported the development and testing of a participatory holistic approach to land use management with a view to integrating soil conservation and watershed management into farming systems.

The DSCO of each district selected a single sub-watershed for the NACRMLP to work in. Sikar Khola in Sindhu Palchok has an area of 18.56 km<sup>2</sup> and is home to about 4554 people in 650 households, while Dapcha Khola in Kabhre Palanchok has an area of 25.96 km<sup>2</sup> and is home to about 6070 people in 1045 households. The communities were organised into CDGs and CFUGs, 15 in Sikar Khola and 14 in Dapcha Khola. Using a bottom-up process, each group prepared a community development or livelihood improvement plan. The process encouraged the participation of women, the poor and DAGs. Each plan outlined a range of human and natural resource development and management priorities, as well as target groups, available internal resources, support requirements, support institutions and a time schedule. To implement the plans, first priority was given to internal community resources, but if they were unavailable or insufficient, the plans proposed to seek support from local service providers such as the DSCO, the District Forest Office (DFO), and Village Development Committee (VDC).

This paper discusses some of the key results of the participatory land-use management practices for soil conservation and watershed management in Kabhre Palanchok and Sindhu Palchok districts.

The issues considered in the report include the planning processes of CDGs and CFUGs and their implementation during the NACRMLP, monitoring and evaluation of field activities, good governance in CDGs and CFUGs, the effects of CDG networking on field activities and farmers' livelihoods, an assessment of NACRMLP field activities, problems and recommendations for further improvement of soil conservation and sub-watershed management activities.

## 2 The Planning Process

The planning process entailed the identification and prioritisation of development activities through interactions with all community sub-groups. First, a sub-group community development plan was prepared by each sub-group. Then, these plans were integrated into a single community development or livelihood improvement plan which incorporated the needs of each sub-group. This process encouraged the poor, DAGs and women to participate; and involved negotiation among community groups in order to prioritise activities. Next, the integrated plan was endorsed by an all-group assembly. User groups review and prioritise their activities annually based on resource availability, users' needs and interests and prioritised target groups. Plans are implemented giving first priority to internal resources, but if they are unavailable or insufficient, the concerned CFUG or CDG will seek support from local service providers.

To support this initiative, the DSCOs of both districts prepared and implemented their annual programme according to the five major categories described below:

### ***Land use planning:***

This component includes community development or livelihood improvement plan preparation and revision as well as sub-watershed management plan preparation.

### ***Land productivity conservation:***

This programme promotes the restoration and improvement of the productivity of community and private land, and includes planting of forage grasses and legumes, cardamom; and fuel, fodder and fruit trees.

### ***Infrastructure protection:***

This includes measures which help protect and stabilise basic development structures such as reservoirs, irrigation systems, trails and roads. Bioengineering measures are used to stabilize slopes, control roadside erosion and protect irrigation canals.

### ***Natural hazard prevention:***

This component focuses on reducing the damage to life, property and valuable natural resources caused by different types of natural hazards. It includes landslide treatment, gully and torrent control, stream bank protection and degraded land improvement using various structural and vegetative measures.

### ***Community soil conservation:***

This includes water source protection for clean drinking water supply, user group nursery production and community plantation, soil conservation extension, school conservation education, soil conservation and user group capacity-strengthening training and study tours, conservation and Environment Day celebrations, and support for income-generating activities.

### 3 Implementation of Activities

The DSCO is the local government institution which supports soil conservation activities. It is supported by the NACRMLP. For each soil conservation activity, community groups and DSCO staff prepared a design and estimate outlining the plan of action, the costs of materials and skilled labour, and user's contributions and the total budget. This plan was then submitted to the DSCO for approval. The sub-watersheds selected were amongst the most degraded in the districts and since the target groups were the poorest communities within these sub-watersheds; hence except in a few rare instances, no internal funds were raised.

Local communities contributed voluntary labour and local materials. They raised a maintenance fund which was used to pre-finance the costs of paying skilled labourers and a local supervisor. For their part, the Project and the DSCOs contributed non-local materials, the cost of skilled labour, and technical know-how. In most cases community groups contributed between 35% and 65% of the total funds needed to carry out soil conservation and watershed management activities. The Project's contribution was the greatest in those activities which required the most non-local materials, such as water source protection and irrigation canal improvement, and the least in activities with a large component of unskilled labour, such as foot trail improvement, landslide treatment and conservation pond construction, kitchen gardening, organic manure preparation and use, and on-farm conservation and fodder and forage development and management.

Field experience demonstrated that, in terms of soil conservation and watershed management, forage development and management, vegetable farming, fruit tree seedling plantation and degraded land improvement through plantation, gully control using brushwood layering techniques, and fodder and forage growing programmes are more cost-effective than infrastructure development programmes. Seedlings, slips and cuttings for community



Gully control using vegetative measures

and private plantation were produced in user group and home nurseries and in forage resource centers. User group nurseries and forage resource centers of both districts produced good quality seedlings, slips and cutting of various

species, including *lapsi*, *ipil ipil*, *tanki*, *koiralo*, *uttis*, mulberry, pine, fruit seedlings, mott napier, forage peanut, desmodium, setaria and mulato (see Annex 1 for a list of major species). The plants are established on terrace bunds, borders, and slopes, and on marginal private lands and degraded community lands.

Soil conservation infrastructure development includes stream bank protection, landslide and gully treatment using gabion stonewalls, irrigation canal improvement, water conservation pond construction and water source protection using concrete. These are more costly programmes than vegetative conservation measures such as forage development and plantation programmes. Sustaining soil conservation infrastructure is difficult as often large amounts of money are needed to repair damages. To make sure they have the money for both emergency and regular maintenance, user groups save money in their bank accounts.

Training, study tours, workshops, celebrations of Environment and Conservation days, school education programmes, extension materials production and distribution, and street drama were planned and implemented as a part of the soil conservation extension education component. About 4000 people of both sub-watersheds have received information, knowledge and skills related to soil conservation and sub-watershed management through these processes.

## 4 Monitoring and Evaluation

To promote sustainability, a process of self-monitoring was designed and tested by the NACRMP in Upper Jhyari and Ansikhola sub-watersheds. Based on that experience, the user groups of Sikar Khola and Dapcha Khola sub-watersheds were advised about how they could monitor their activities themselves. User groups have developed various monitoring indicators on the basis of the operational stages of soil conservation and watershed management activity. For example, in forage development and management practices, the operational stages are seed or seedling arrangement, land preparation or pitting, seed sowing or planting of seedlings or slips and cuttings, and protection of fodder and forage plots. Selected CDG and CFUG executive committee members monitored each operational stage and reported back to the committee. This process succeeded in encouraging the on-going systematic and critical review of soil conservation infrastructure construction work as well as forage establishment work with the aim of taking timely corrective action whenever needed. An attempt was also made to monitor such aspects as gender and social equity so that more of the benefits of soil conservation and watershed management practices could be passed on to women, the poor and DAGs.

## 5 Good governance

DSCOs, and CDG and CFUG members are making their activities more transparent and facilitating the deliverance of more benefits of soil conservation activities to women, the poor and DAGs. The processes which were adopted to make soil conservation and sub-watershed management work more transparent and to promote gender and social equity are as follows:

CDGs and CFUGs prepared their community development plans keeping in view the needs of women, the poor and DAGs, and CDG and CFUG executive committees carried out their work based on those plans.

DSCO staff also made their programmes and budgets transparent and selected activities keeping in view the needs of women, the poor and DAGs. They discussed these issues at CDG and CFUG network meetings and suggested to the CDG and CFUG participants to discuss the same issues in their group meetings before selecting and prioritising soil conservation and watershed management activities for the year.

CDG and CFUG members discussed these issues in their user group assemblies and, keeping in mind the needs of women, the poor and DAGS, selected two or three priority soil conservation and sub-watershed management activities from their community development plans. They then submitted a list of prioritised activities to the DSCO. Using this list for a given CFUG or CDG, DSCO staff and the group CFUG members prepared a design and estimate for approval by the DSCO. Once a plan was approved, the DSCO provided non-local materials and the cost of skilled labour to the concerned user group. The money to pay labourers was deposited in the group's bank account.

During the implementation of soil conservation activities, user groups themselves monitored their field activities and made suggestions to CDG and CFUG executive committee members for timely corrective action.

CDG and CFUG members adopted a public auditing mechanism. In this process, a group's executive committee member organised a group meeting and explained to all those present about the field activities implemented. Users were made aware of material and money received from the DSCO, users' contributions, the total expenditure on each activity, and the balance in the group's account.

The CDG and CFUG members of Dapcha sub-watersheds started 32 women's empowerment classes in order to make women more active in user group decision-making processes and thus promote better soil conservation field activities. About 700 women had the opportunity to learn more about soil conservation and sub-watershed management and agriculture-based income-generating activities.

The CDGs and CFUGs of both sub-watersheds started generating group funds from resource development and conservation and management activities. Some user groups wanted to mobilise these funds as saving and credit funds to provide loans to the women of poor and disadvantaged households so they could implement income-generating activities.

## 6 Networking

Soil conservation and sub-watershed management efforts have little meaning if there is no networking among neighbouring communities. CDG and CFUG networks were established in both Dapcha and Sikar Khola sub-watersheds and regular meetings were held to discuss pertinent issues, share experiences, learn from others and develop an attitude of mutual cooperation. The network helped individual community groups to link up with service providers, especially those at the district level. DSCOs and the Project provided capacity-building training to these networks.

## 7 Impacts of Sub-watershed Management Activities

The major soil conservation activities implemented under the DSCO annual programmes in both sub-watersheds included water source protection; gully control; landslide treatment; construction of water conservation ponds and pit latrines; improvement of irrigation canals, foot trails and degraded lands; user group and home nursery establishment and community and private plantation; and on-farm conservation and income generation. On-farm conservation and income-generating activities included growing a variety of seasonal vegetables as well as off-season cauliflower; planting grasses, legumes, and fodder and fruit seedlings; and bee keeping.

Both male and female saving and credit schemes were established. In some cases the community decided to provide some funds to sub-groups by allocating a percentage of its savings from DSCO-supported activities to provide loans to the women of the poorest households. In Dedithumka CDG of Ansikhola sub-watershed, for example, loans were given for income-generating activities such as vegetable cultivation, goat-raising and village-level shop-keeping.

Rural development in Nepal is famous for organising training, study tours and workshops, but these activities alone cannot improve the livelihoods of poor people. The annual progress reports of both DSCOs and the actual fieldwork done show that about 82% of the total programme budget provided by the Project is spent on conspicuous soil conservation and watershed management field activities such as seedling production and plantation on degraded lands, forage development and management, fruit seedling plantation, bamboo plantation, vegetable farming, organic manure preparation, clean drinking water supply, irrigation canal improvement, water conservation pond construction and landslide and gully control. This figure clearly indicates that DSCO field programmes are helpful in improving rural livelihoods. To verify this claim, the Project assessed the main effects of the soil conservation and sub-watershed management activities carried out within and outside selected sub-watersheds using the criteria including environment improvement, sustainability, lateral adoption, cost effectiveness, gender and social equity, and livelihood improvement. The major effects of DSCO-supported soil conservation and sub-watershed management field activities are as follows:

- Upstream soil erosion and downstream silt accumulation problems were reduced due to the increase in soil cover in gullies, landslides, roadsides, degraded community lands and sloping terraces, and to strengthening of livestock stall-feeding practices.
- Forage development works for soil conservation were carried out on private farmland, degraded community land, landslides and newly constructed roadsides. The



Village roadside stabilisation using forage species

germination and establishment of valuable fodder and forage species was much better in these areas than in shady areas of maize cultivation. The Project initiated fodder and forage development programmes on wasteland such as roadsides and landsides to

promote soil conservation as well as to support livestock farming among poor communities in the vicinity. Forage species grown along roadside and on landslides include mott napier, stylo, joint vetch, desmodium, axillaris, glycine, wynn cassia, leucaena, molasses, and gamba. Stylo, molasses, joint vetch, wynn cassia and ipil ipil seeds germinated and took hold well on landslides and roadsides in both districts. Farmers in the vicinity collect forage from these lands.

Experienced farmers in Sikar Khola sub-watershed who grow forage species on sloping terrace bunds and risers say that the supply of on-farm green forage has increased about 20%. (Note, this figure based on a limited sample and may not apply to broad-scale activity). In addition, user group members in both sub-watersheds have begun to strengthen livestock stall-feeding practices, which has impacted positively on the protection of the environment and on livestock production. Farmers in Kabhre Palanchok District who sell milk say that they have previously spent about 50-60% of their income from milk sales on the purchase of concentrated feed. Soil conservation and sub-watershed management works using nutritious forage are helping to reduce production costs.

- Fruit seedlings (mango and jackfruit), fodder (badahar and willow) and about 30 different forage species were planted on degraded community land by Panchakanya Devi CDG of Dapcha Khola sub-watershed. The survival rate of the seedlings was about 90%. In the future, this site could be a good source of regular income for the CDG and could ensure the sustainable continuation of their community development activities.
- Income-generating activities included the cultivation of a variety of seasonal vegetables as well as some off-season varieties including cauliflower.
- Some farmers of Rajabampokhari and Panchakanya CDGs in Dapchakhola sub-watersheds earned more than Rs 50,000 in one year from the sale of vegetables. Vegetable farming can be a major livelihood improvement enterprise in Dapcha khola sub-watershed because access to Kathmandu markets is good and farmers are interested and knowledgeable about growing vegetables. With a little support from the Project, the livelihoods of the poor and DAGs can be improved through vegetable farming.
- Through the kitchen gardening component introduced by the Project and the DSCOs, vegetable farming became more diversified and thus improved family nutrition.
- Women and DAGs in both sub-watersheds benefited greatly from soil conservation training, study tours and workshops. In Sikar Khola sub-watershed participation reached about 73%. In Dapcha sub-watershed, 32 women's empowerment classes ran, providing about 700 women knowledge and skills about soil conservation and sub-watershed management and boosting family finances with income-generating activities. Women of all community sub-groups are benefiting greatly from forage development and management, water source protection work and vegetable farming activities, especially due to the time saved in collecting forage and drinking water, and the cash income generated from the sale of vegetables.
- The productivity of farmland appears to have increased because, with more forage and stall feeding practices, better and more farmyard manure and compost were produced. Other reasons for the better harvests are irrigation canal improvement and other water management works.
- Both the networking of groups in both sub-watersheds to promote communal development and management of natural resources as well as the institutional strengthening of CDGs and CFUGs were key activities in helping to implement soil conservation and sub-watershed management activities smoothly (even during this period of a security crisis). Networks also helped individual community groups link up with service providers, especially those at the district level.

- CDG and CFUG members of both sub-watersheds are becoming aware of the benefits of land use management for soil conservation. About 4000 people of both sub-watersheds have received information, knowledge and skills related to soil conservation and sub-watershed management through training and extension.
- Communities outside the DSCWM-supported sub-watersheds are observing the process and becoming interested in soil conservation activities. Some cost-effective and sustainable activities such as growing of grass and legume forage, planting fodder, fruit, fuel wood and timber trees, growing vegetables and preparing compost, and establishing waste water management works have been adapted by some farmers of nearby communities.

The impacts of sub-watershed management activity are assessed below. The criteria considered were environment improvement, sustainability, lateral adoption, efficiency and cost-effectiveness, gender and social equity, and area covered.

## 7.1 Environmental Impacts

The impact assessment of Project-supported sub-watershed management works shows some encouraging results in terms of environment and livelihood improvements. They include the commercialisation of vegetable farming in all four sub-watersheds, increased livestock production due to the increase in quantity and quality of forage, the control of upstream soil erosion and the reduction of downstream silt accumulation through forage development and management, fruit seedling plantation, gully and landslide treatment, and stall-feeding; increased productivity of farmlands due to better management of farmyard manure and water management works; the provision of a supply of clean drinking water; the plantation of forest areas; the establishment of community forests; the creation of saving and credit programs; and the networking of user groups. The conditions of degraded forests and grazing lands have improved through the implementation of stall-feeding practices.

Water source protection, conservation pond construction and irrigation canal improvement works were linked with income-generating activities such as vegetable farming. Some progressive farmers in Hile and Kaphalbot CDGs of Ansi Khola sub-watersheds and Panchkanya Devi and Gopal Pokari CDGs of Dapch Khola sub-watersheds have earned more than Rs 50,000/year from the sale of vegetables. They continued to sell vegetables even after the DSCO withdrew its support. A single training in vegetable farming brought a significant change to local communities.

## 7.2 Sustainability

Sustainability is a major concern of people who work in the soil conservation and watershed management sectors. It embraces the regular maintenance and use of infrastructure developed through Project and DSCO support, and the institutional management of user groups' once Project support is withdrawn. Most CDGs and CFUGs have money in their bank accounts to spend on maintenance, but CDGs are not as well-prepared as CFUGs. Project and DSCO interventions, including the conversion of CDGs into CFUGs, saving and credit schemes, CDG and CFUG networking, and commercial vegetable farming have helped make CDGs more self-reliant. The CDG and CFUG network of Ansi Khola sub-watershed is actively mobilising CDG and CFUG members in various activities. Its effort at honeybee keeping, however, was not a success because of the excessive application of insecticides on farmland. The CDG network in Dapcha Khola

sub-watershed ran women’s empowerment classes with support from the NACRMLP in the form of facilitator training and with support from the VDC for facilitator's salaries. WEP also helped CDG and CFUG members to make their efforts more sustainable.

### 7.3 Lateral Adoption

Collett (1999) reported that communities outside the DSCO-supported areas are observing and showing interest in soil conservation activities. The results of the impact assessment study show that indeed a few cost-effective activities have been adopted. These include planting trees, growing vegetables, and establishing and managing forage, practicing other vegetative measures for soil conservation, and constructing water conservation ponds. Soil conservation practices like gully control and landslide treatment using gabion wire and building infrastructures with concrete have not been replicated because these are not affordable. Collett (1999) analysed infrastructure development activities for soil conservation and watershed management and presented their advantages and disadvantages as follows:

Advantages	Disadvantages
Provides tangible benefits and is easier to design and implement than social development activities. Is a very good entry point for working with new communities. Increase cooperation and motivation, and benefits can be achieved immediately. Supported by politicians and community leaders. Easy to monitor with quantitative indicators. Requested by communities. Improves standard of living, quality of life, and health and sanitation through drinking water and irrigation projects. Generates income when water management work is linked with vegetable cultivation. Provides a base for vegetative soil conservation measures in areas with serious soil erosion problems.	More expensive to implement than vegetative methods. Never-ending as there are always more infrastructure required and more communities to satisfy. Not always sustainable. High maintenance costs. Increases dependency. Raises expectations. Not always equitable. Require technicians to design. Needs correct technical designs to succeed and a lot of supervision to ensure good quality work.

Collet’s analysis clearly indicates that the use of gabion wire and concrete in soil conservation activities should be minimised. DSCOs should emphasise cost-effective development activities for soil conservation and watershed management using forage establishment and other bioengineering techniques.

### 7.4 Efficiency and Cost Effectiveness

Estimates of efficiency and cost effectiveness provide a means by which to compare soil conservation and watershed management activities in order to make the best use of scarce resources and to guard against inappropriately large disparities in the support provided to communities and beneficiaries. The cost of implementing soil conservation activities ranges from Rs 546 per household for degraded land reclamation to Rs 9614 per household for gully control (Hitchcock and Chettri, 1999). The difference is due to the fact that degraded lands are improved with vegetative measures, while gullies are controlled with gabion walls and some vegetative measures. In the future, to ensure equitability and save on expenses, the DSCO should focus on cost-effective conservation measures.

## 7.5 Gender and Social Equity

Livelihood Improvement Plans or Community Development Plans were prepared using the user group development planning process. Joshi *et al* (2002) reported that the process entailed the identification and prioritisation of community development and soil conservation activities through interactions with all community sub-groups. The process emphasises the participation by the poor, DAGs and women; and involved negotiation among community sub-groups in order to prioritise activities. As a result, all sub-groups, in theory, benefit from soil conservation and sub-watershed management activities. However, in the past, while women and DAGs did participate actively in training and study tours, their engagement in decision-making processes was relatively low. As a result, the interests and needs of women were generally overlooked and DAGs did not benefit proportionately (Hitchcock and Chettri, 1999). To address these problems, this Project initiative conducted women's literacy and women's empowerment classes in Ansikhola, Upper Jhyari and Dapcha sub-watersheds.

Khantar Okhaldunga CFUG of Ansi Khola sub-watershed and Bhadgaon CDG of Upper Jyari sub-watershed carried out water source protection works to specifically benefit DAGs. Women, the poor and DAGs had opportunities to participate in training and study tours in all sub-watersheds.

## 7.6 Area Covered

In comparison with their resources and potential, DSCOs serve a very small area. In Upper Jhyari sub-watershed the DSCO worked with 10 groups; in Ansi khola, 5 groups; in Dapcha, 14; and in Sikar Khola, 15. NGOs helped mobilise groups to implement DSCO-supported infrastructure development works in Ansi Khola and Upper Jhyari. The Project also recognised that DSCOs have limited technical manpower (an officer, a soil conservation assistant, a junior technician and an overseer, usually) and that infrastructure development works require frequent supervision by DSCO staff.

The NACRMLP, in recognition of the potential of DSCO staff, helped strengthen their capacity to plan and implement soil conservation and watershed management activities better and to reach more community groups than in the past. The DSCO and the NACRMLP also worked with some scattered groups on landslide and roadside stabilisation using valuable forage species.

## 8 Recommendations

- Land-use management practices such as compost manure preparation, animal urine collection and use, wastewater conservation through making small water collection ponds lined with plastic, (note, in the rainy season these ponds may cause an increase in mosquito populations, therefore the technique should be encouraged mainly in the dry seasons) home nursery and agro-forestry plantation, kitchen gardening, and development and management works are the best practices for further expansion by the DSCOs.
- Water source protection, irrigation canal improvement and water conservation pond construction work should be linked with vegetable farming and other land-use management activities.
- Forage development along newly constructed roads, and on fresh landslides and degraded community lands, promotes soil conservation, applies resource development and management to income generation, and results in improvements in the environment. To continue these innovations, the DSCWM should include newly constructed roadsides and landslides treatment programmes in DSCO red book programmes. The recommended rate of seed dispersal for forage development (on reasonable sites) was about 4 kg/ha. Based on NACRMLP field observations and experience, it should be increased to 7-8 kg of seeds/ha in highly degraded areas.
- The DSCWM should promote the establishment of CDG networks and strengthen their capacity to sustain themselves after the DSCO withdraws support.
- A DSCO typically works in a given sub-watershed for four or five years before it moves to a new sub-watershed. There is, however, no system for bringing older CDGs and CFUGs together with new ones under a single umbrella. To make CFUG, and especially CDG, activities more sustainable and beneficial, the DSCO should establish a network of old and new groups.
- The CDG and CFUG network of Dapcha Khola sub-watershed has initiated a new concept of development: "one community with one technology". To help its programme succeed, the Project has provided a little extra support to those communities committed to developing and managing natural resources, encompassing forage, home nursery and agroforestry, fruit production, NTFP development and management, and vegetable farming. The network's progress was satisfactory. The technology selected should be those which can be supported by the DSCO under its red book programme.

## 9 Conclusion

Training, study tours and workshops alone cannot bring changes in the livelihoods of poor people. For this reason, the DSCO has emphasized support for activities like resource development and management among the resource-poor groups of both sub-watersheds. These activities include forage development and management to support livestock farming; degraded land improvement using forage, bamboo and fruit seedlings; and vegetable farming for family nutrition improvement and cash income generation from the sale of surplus vegetables.

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## **Annex 1**

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### **List of Fodder and Forage Species**

## Annex 1: List of Fodder and Forage Species

S.No	Common name	Cultivar	Scientific name
<b>Sub-tropical grasses</b>			
1	Gamba	Kent	<i>Andropogon gayanus</i>
2	Molasses		<i>Melinis minutiflora.</i>
3	Mulato		<i>Brachiaria brizantha x B. uziziensis</i>
4	Napier	Mott	<i>Pennisetum purpureum</i>
5	Setaria		<i>Seteria splendida</i>
6	Signal		<i>Brachiaria decumbens</i>
<b>Sub-tropical legumes</b>			
7	Desmodium	Green leaf	<i>Desmodium intortum</i>
8	Desmodium	Silver Leaf	<i>Desmodium uncinatum</i>
9	Desmodium	Tree Leaf	<i>Desmodium distortum</i>
10	Forage peanut (erect)	CIAT 22160	<i>Arachis pinotoi</i>
11	Forage peanut	CIAT 18744	<i>Arachis pinotoi</i>
12	Joint vetch	Glenn	<i>Aeschynomene americana</i>
13	Joint vetch	Lee	<i>Aeschynomene falcata</i>
14	Joint vetch	Villosa	<i>Aeschynomene villosa</i>
15	Stylo	Nina	<i>Stylosanthes guianensis</i>
16	Stylo	Palpa	<i>Stylosanthes guianensis</i>
17	Velbet bean		<i>Mucuna pruriens</i>
18	Wynn cassia		<i>Cassia rotundifolia</i>
<b>Sub-tropical legume herbs</b>			
19	Calliandra	Best OFI line	<i>Calliandra calothyrsus</i>
20	Ipil-ipil	F1	<i>L. leucophalaX diversifolia</i>
21	Ipil-ipil	Tarramba	<i>Leucaena leucocephala</i>
22	Broom	Gala grazing	<i>Bromus intermis</i>
<b>Temperate grasses</b>			
23	Cocksfoot	Porto	<i>Dactylis glomerata</i>
24	Rhodes	Finecut	<i>Chloris gayana</i>
25	Ryegrass- perennial	Fitzory	<i>Lolium perenne</i>
26	Ryegrass- perennial	Kingston	<i>Lolium perenne</i>
<b>Temperate legumes</b>			
27	Clover- White	Tahora	<i>Trifolium repens</i>
<b>Fodder trees</b>			
28	Kutmiro		<i>Litsea monopetala</i>
29	Gogan		<i>Saurauria nepalensis</i>
30	Dudhilo		<i>Ficus nerrifolia</i>
31	Tanki		<i>Bauhinia variegata</i>
32	Koiralo		<i>Bauhinia purpurea</i>
33	Mulberry		<i>Morus alba</i>

### **Limitations**

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