NEPAL AUSTRALIA COMMUNITY RESOURCE MANAGEMENT AND LIVELIHOODS PROJECT

Participatory Approaches to Fodder and Forage Development and Management in Sindhu Palchok and Kabhre Palanchok Districts of Nepal

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Executive Summary

Degraded and sloping land improvement works, based mainly on improved forage species were initiated in 1994 by the Nepal Australia Community Forestry Project (NACFP) through the District Soil Conservation Offices (DSCOs) of Sindhu Palchok and Kabhre Palanchok to help farmers maintain or improve agricultural productivity. From 1997, the Nepal Australia Community Resource Management Project (NACRMP) continued a similar process for forage development in selected sub-watersheds. With the start of the Nepal Australia Community Resource Management and Livelihoods Project (NACRMLP) in January 2003, focus has been shifted towards developing and testing a participatory holistic approach to land-use management using forage species for soil conservation and sub-watershed management and integrating farming systems within and outside the selected sub-watersheds.

Communities were organised into Community Development Groups (CDGs) and Community Forest User Groups (CFUGs) in order to prepare community development and livelihoods improvement plans. Forage development and management activities were then implemented based on these plans. Communities contributed voluntary labour and local materials, while the Project and the DSCO provided forage seeds, slips and seedlings, and technical know-how. The forage program on degraded community land and sloping terraces has not only helped reduce soil erosion but also stabilized landslides, roadsides and gullies. Some CDG and CFUG members have generated income from the sale of forage seeds, slips, cuttings and forage produced in forage resource centers and community forage blocks.

Community forage blocks were effectively established with sub-groups of women, the poor and disadvantaged groups (DAGs) within CFUGs and CDGs. This approach to community forage programs should be adopted by the DSCO, DFO (District Forest Office) and DLSO (District Livestock Support Office) and by other projects such as the Leasehold Forest and Forage Development Project and the Community Livestock Development Project. In addition, soil conservation and degraded land, landslide and village roadside improvement programs using improved forage species have proven to be cost-effective. By using this technique as a major soil conservation and watershed management strategy, the DSCWM can cover a wide area with the limited resources available.

1 Background

Degraded and sloping land improvement works using forage species were initiated in1994 by the NACFP through the DCSOs of Sindhu Palchok and Kabhre Palanchok to help farmers maintain or improve agricultural productivity. From 1997 the NACRMP continued a similar process for forage development in selected sub-watersheds. With the start of the NACRMLP in January 2003--focus has been shifted to developing and testing a participatory holistic approach of land use management using forage species for soil conservation and sub-watershed management integrating with farming systems within and outside selected sub-watersheds.

Communities were organised into CDGs and CFUGs to prepare community development plans, which DSCOs then used to prepare their annual programs. The major activities implemented under the DSCO included water source protection; gully control; landslide treatment; construction of water conservation ponds; improvement of irrigation canals, foot trails and degraded lands; establishment of user groups, home nurseries and forage resource centers; and community and private plantation. In addition, the DSCO supported on-farm conservation and income generation activities, including growing a variety of seasonal vegetables and off-season cauliflower; mushroom cultivation; and the establishment and management of forage legumes and grasses, and fruit seedlings.

This paper discusses some of the key results of soil conservation and watershed management using forage species in Kabhre Palanchok and Sindhu Palchok districts.

2 The Planning Processes

The DSCOs of both districts selected sub-watersheds and organised communities into CDGs and CFUGs. Using a bottom-up process, each group prepared a community development or livelihood improvement plan. First, sub-groups comprising the poor, DAGS and women prepared separate plans; then they negotiated among themselves to prioritise activities. The plan ultimately agreed upon was endorsed in a group assembly. User groups review and re-prioritise their plans annually, keeping in mind resource availability, users' needs and interests, and target groups. All plans are implemented giving first priority to internal resources, but if they are unavailable or insufficient, support is sought from local service providers such as DSCOs and Village Development Committees (VDCs).

In communities outside the selected sub-watersheds, forage programs were initiated to improve degraded community lands based on Livelihood Improvement Plans (LIPs) or Women's Empowerment Programs (WEPs) of targeted CFUGs.

3 Implementation of Plans

In order to carry out the soil conservation, degraded land improvement and sub-watershed management activities planned, communities contributed voluntary labour and local materials. The Project and DSCOs, for their part, contributed non-local materials such as forage seeds, slips and seedlings, and technical know-how. The fact that community groups contributed about 70% of the total expenditure required to establish forage plots demonstrates that, for soil conservation, degraded community and private land improvement and sub-watershed management, there is a high level of voluntary community participation.

4 Organisational Arrangements

The Project worked with DSCOs to implement forage development and management activities within selected sub-watersheds. In particular, in scattered areas, it worked through CFUGs and other groups to develop forage plots. Training in forage seed and slip production and marketing was organised through the DSCOs of Sindhu Palchok and Kabhre Palanchok. Field information about this work was collected using World Overview of Conservation Approaches and Technologies ((WOCAT) (a technique being promoted by ICIMOD in Nepal)) tools and other techniques presented below.

5 Purposes of the Programme

The main purposes of using forage species for soil conservation and sub-watershed management are:

- To conserve soils by adopting cost-effective measures.
- To convert degraded community and private lands, landslides and roadsides into fodder and forage plots.
- To increase the supply of forage for livestock farming.
- To generate income from the sale of forage seeds and slips, and green forage.

6 Location and Land Use

Forage development and management works for soil conservation and degraded land improvement purposes were carried out in different parts of Sindhu Palchok and Kabhre Palanchok districts. Table 1 shows the various areas where CDGs and CFUGs, DCSOs and the Project carried out intensive forage development and management and other bioengineering works to improve degraded land, including community lands, landslides, gullies, newly constructed roadsides and sloping terraces.

Table 1: Areas with forage development and management works for soil conservation and degraded community land improvement purposes

S.NO	Sindhu Palchok District	Kabhre Palanchok District
1	Upper Jhyari sub-watershed (10 CDGs and CFUGs)	Ansikhola sub-watershed (7 CDGs and CFUGs)
2	Sikar khola sub-watershed (15 CDGs and CFUGs)	Dapcha sub-watershed (14 CDGs and CFUGs)
3	Upper slope areas in Chauatara and Dandapakhar (15 CFUGs)	Chaubas, Pachkhal, Katunje, Dhungkharka and Ryale (12 CFUGs)

In general, women, the poor and DAGs are involved in fodder and forage development and management activities. The Project and DSCOs provided technical know-how as well as seeds and slips of improved forage species to sow or plant on communal pasture land, degraded community forest, degraded community or private lands, landslides, gullies, newly constructed roadsides, cultivated lands and terrace bunds. More than 195 ha were planted. Species grown successfully at lower altitudes (800-1500 m) include molasses, Aztec atro, stylo, joint vetch, axillaris, wynn cassia, gamba, and signal. Above 2000 m cocksfoot, ryegrass, clover and lotus flourished. Mott napier, mulato, forage peanut, setaria, desmodium, and stylo thrived on farmland. (See Annex 1 for a list of the major species planted.)

7 Description of Targeted Areas

Most of the targeted areas lie in tropical and sub-tropical zones between 800 m and 1800 m altitude which get between 1200 and 2500 mm of rainfall annually, though some work was done in temperate regions. The soil is fine clay with some loose stones, the amount of organic matter in topsoil is medium to low, drainage is low to good drainage, and soil depths are moderate (50-80 cms). The gradient of most hill slopes is between 8% and 30% but landslides and roadsides are steeper. Under the programme, degraded communal and private lands were established to improved forage species. Most user group members practice a subsistence farming system, but some farmers have started selling vegetables, milk, timber, non-timber forest products (NTFPs), forage seeds and slips, and green forage. Forage development and management work was carried out through organised groups such as CFUGs, CDGs and women's groups.

8 Benefits of Growing Improved Forage Species

The forage species used for various degraded land improvement activities have helped not only to reduce soil erosion but also to stabilise landslides, roadsides and gullies. Topsoil loss by water and wind erosion and soil compaction has also been reduced. Soil fertility has been improved through the use of forage legumes. Subedi *et al.* (2001) give the following values for the nitrogen fixation capacity of legume forage species: 900 kg/ha/year for desmodium, 40-70 kg/ha/year for style, 52-77 kg/ha/year for white clover, 60-168 kg/ha/year for centro and 63-342 kg/ha/year for ipil ipil. The supply of green forage has increased and provided a corresponding boost to livestock farming. Previously un-utilised land, such as terrace bunds and risers, landslides, gullies, roadsides and degraded lands, are now being utilised efficiently. The plantation of climbing forage legume species such as axillaris, Aztec atro, and desmodium has helped control the growth of banamara. A benefit to some community members has come in the form of income generated through the sale of forage seeds, slips, and green forage. The over-exploitation of community forest resources for forage collection has been reduced in some areas through enhancements in the production of cultivated forage. The programme is cost-effective. A low outlay of funds results in significant progress in soil conservation, degraded community land improvement and sub-watershed management. If this practice is included in DSCWM policy as an efficient approach to soil conservation, wide areas can be covered at low cost and the capacity of the DSCO as a district-level office will be enhanced.

Interest in on-farm forage programs is greatest among women, the poor and DAGs. In fact, this is one of the best programs the DSCWM has for providing more support to these groups.

9 Approaches to Forage Development and Management

The approaches developed and used for forage development and management for soil conservation, degraded land improvement and sub-watershed management include forage resource centre establishment; community forage programs; on-farm or backyard forage production; and landslide, roadside and gully treatment. The steps involved in implementing each of these approaches are discussed below:

9.1 Forage Resource Centre Establishment

- Identification and selection of individual farmers, CFUGs and CDGs interested in establishing forage resource centres, and of line agencies that can provide potential sites such as office compounds.
- Provision of forage seeds and slips and technical know-how to interested farmers and CDG and CFUG members.
- Establishment of forage resource sites.
- Monitoring and follow- up.
- Supplying forage materials from forage resource centers to nearby households.

9.2 Community Forage Programs

- Selection of interested CFUGs and CDGs that have community development and LIPs, WEPs, action learning, and other programs from within sub-watersheds, corridors and clusters.
- Identification of potential sites for forage development after consultation with CFUG and CDG executive committee and other members.
- Formation of forage sub-group(s) within CFUGs and CDGs, focusing on DAG and women members, and incorporation of community forage programs in integrated forest operation plans.
- Facilitation of user groups in the formulation of forage management working and benefit-sharing guidelines.
- Orientation and demonstration of the forage programme to local CFUG and CDG facilitators and other members.
- Provision of forage seeds and the technical information needed to establish forage blocks with minimal tillages.
- Facilitation in the protection, management, harvesting, and use of forage materials and in the self-monitoring of forage development and management works.

9.3 On-farm forage production

- Selection of interested CFUGs and CDGs that have community development and LIPs, WEPs, action learning, and other programs from within selected sub-watersheds, corridors and clusters.

- Identification of potential CDG and CFUG members by executive committee and other members, CDG and CFUG network members, and DSCO, DFO, DLSO, and Project field staff.
- Provision of technical information, forage mini-kits, and slips / cuttings through local facilitators, CDGs and CFUG members, and Project field staff.
- Facilitation of land preparation, seed sowing and slip and cutting plantation, protection, management, harvesting, and utilisation of forages, and of self-monitoring of forage development and management works.

9.4 Landslide, Roadside and Gully Treatment using Fodder and Forage Species

- Identification and selection of potential landslide, gully and roadside areas for treatment with the help of CDG and CFUG members; DSCOs, DFOs, and NGOs; and Project staff.
- Provision of technical information, forage mini-kits, and slips and cuttings to CDG and CFUG members through local facilitators, CDG network members, NGO staff, DSCO and Project field staff.
- Sowing of forage seed mixtures on landslides, roadsides and gullies.
- Facilitation of the protection, management, harvesting, and use of forage materials and of self-monitoring of forage development and management works.

9.5 School Forage Programme

There are 1,105 schools (449 in Kabhre Palanchok and 556 Sindhu Palchok) with a total of 145, 662 students (89,285 in Kabhre Palanchok and 56,377 Sindhu Palchok) (CBS 1997). A programme designed to reach 200 of the total schools was initiated with the support of the District Education Offices of Kabhre Palanchok and Sindhu Palchok. Its goals were to create awareness about the importance of improved forage crops and to broaden the scale of the forage cultivation programme. Implementation involved:

- Selection of resource centers to be operated by the District Education Office.
- Identification of participating high schools through meetings with headmasters at the resource centers.
- Provision of technical information, forage mini-kits, and slips and cuttings to school students.
- Facilitation of land preparation, seed sowing or slip and cutting plantation, protection, management, harvesting, and use of forage materials whenever needed.

10 Implementation Strategies

10.1 Incorporation of Forage Programs in Operation Plans

Most CFUGs and CDGs, in particular those that have LIPs and community development plans, adopted forage development programs as one of several essential components of their forest operation plans. Groups that have established a separate forage block include Sungure, Siddiganesh, Jalpa, Bhedigoth, Bimrene, Ansetar, Salleneghari, Jamune, Dublidanda, Bolde Kharka and Simkhola CFUGs, Lagansil women's group and Panchakanya CDGs of Sindhu Palchok District and Saparupa, Nauli, Pandula and Thuli Ban CFUGs and Nangekharka, Panchakanya and Chandani CDGs of Kabhre Palanchok District.

10.2 Through Line Agencies, Schools and NGOs

Some line agencies and other organisations established forage resource centers in their barren compounds or on their degraded lands to use for the demonstration and distribution of vegetative materials and seeds to interested CFUG and CDG members. The Project provided forage vegetative materials and seeds in order to establish these plots. TUKI, for example, has successfully stabilised field sites using mott napier, stylo and other forage species. Schools in Katunjebesi and Tinpiple in Kabhre Palanchok District grew forage peanut and mott napier in their compound.

A small paper packet of a forage seed mixture containing 10 g of seeds, and slips of mott napier was prepared for distribution to students. The mixture comprises 10 species: glenn joint vetch (54.3%), stylo palpa (37.5%), wynn cassia (3.7%), aztec atro (2.5%), centurion (0.25%), desmodium green leaf (0.25%), glycine (0.25%) chloris (0.25%), bahai paspalum (0.5%) and signal (0.5%).. Simple "how to" instructions were printed on the bag. Each packet is sufficient to seed 25 sq m of land. Students were asked to plant the seeds in their backyards.

So far a total of 42,816 packets (23,490 in Kabhre and 19,326 in Sindhu) have been distributed in 161 schools. Some packets were distributed to the CFUG members, like those of Thuliban CFUG, Kabhre, to local NGOs, and to others.

10.3 Preparation of Forage Mixture for On-farm and Community Forage Programs

Forage mixtures were prepared with two aims: to provide a variety of species for various agro-ecological environments, and to maximise the yield per unit of area planted. The percentage composition of the species indicated below was determined largely on the basis of the availability of seeds.

- **Legumes:** joint vetch (glenn 27.5% and villomix 2.08%), stylo (palpa 25%, temprano1.2%, and nina 1.2%), ipil ipil (10.8%), wynn cassia (3.3%), aztec (0.08%), centurion (0.75%), desmodium (green leaf 0.3% and glycine 0.8%).
- **Non-legumes**: molasses (16.3%), chloris (3.3%), gamba (2%), signal (2.08%) and paspalum (higane 0.3% and bahia 0.6%)

Although molasses is very good for degraded land improvement of landslides, gullies and roadsides, it was excluded from the on-farm forage development and management programme because it is too aggressive, and has poor nutritive value.

10.4 Forage Resource Centres Programme

Forage resource centres were established to reproduce forage slips and cuttings and produce forage seeds. Forty-four forage resource centres were established and operated. For the most part, these centres produced slips and cuttings of mott napier, forage peanut, setaria, mulato, and desmodium and supplied them to nearby CDG and CFUG members. This is a cost-effective and efficient programme for expanding on-farm forage programs using vegetative propagation techniques.

Forage resource center to produce slips and cuttings

For example, a small forage plot established in Janune CFUG, Sindhu Palchok District in early March 2004 had produced 4000 mott napier cuttings from 100—a four hundred-fold increase in just four months. In that time, a healthy mott napier cutting can produce 18 tillers five to six feet high. Cuttings from these mott napier plants were planted along terrace bunds.

Mulato was introduced in 2004. Seedlings produced on DFO nurseries were given to CDG and CFUG members to propagate. Twenty-five days after being planted in Chautara, one seedling had produced 30 tillers. These were separated and planted as part of the mulato multiplication process. One mulato plant can produce up to 100 tillers. By June 2005, the forage resource centre owner of Katunje CFUG, Kabhre Palanchok District, produced about one truckload of slips of mulato from this process. These slips were distributed in different areas of the Project districts.

10.5 Forage Production on Farmland

According to Central Bureau of Statistics 2002, there are 128,978 households in the Project districts: 70,509 in Kabhre Palanchok and 57,469 in Sindhu Palchok. The average land holding of a household in Kabhre is 0.81 ha; in Sindhu, it is 0.62 ha. Most households practice subsistence agricultural farming and rear a few heads of livestock. There are 216,188 cattle, 130,314 buffalos, 23,114 sheep, 295,603 goats, 15,163 pigs, and 638,146 fowls. Most animals in the lower hills are reared on agricultural by-products, while those raised on upper slopes (above 2000m altitude) graze under migratory

Forage production on farmlands

systems. The shortage of forage, especially during the winter, is a main factor working against enhanced production of the individual animals. The practice of on-farm forage production is rare in traditional systems.

On-farm forage development work was initiated in June 2003. Two years later, there are a number of widely scattered establishments of on-farm sites and local resource centres. The main species grown along terrace bunds and borders and in backyard forage blocks are erect grasses such as mott napier, mulato, setaria and guinea, and a range of leguminous species including forage peanut, stylo and green leaf desmodium. These species are multiplied vegetatively through slips and cuttings. In June/July 2005, about two millions slips and cuttings of different forage species produced in 52 forage resource centres were provided to CDG and CFUG members, who planted them along terrace bunds, in back-yard areas, and on community lands.

The photograph above shows women members of Katunje Pakha CFUG, Kabhre Palanchok District, taking forage slips and cuttings from a forage resource centre to plant on their terrace bunds and ridges. This work not only helped reduce topsoil loss from sloping terraces, but also assisted in increasing the supply of green forage. Women participants in this programme say that it has reduced their workload; they now spend much less time on forage collection. Similarly, some farmers of Sugure CFUG, Sindhu Palchok District have established stylo plots on their degraded farmlands to produce forage and forage seeds and to improve soil fertility.

10.6 Testing of Bajara and Sorghum for On-farm Forage Production

Kabhre Palanchok is noted for being the highest milk-producing district in Nepal. In fiscal year 2003/04 it produced approximately 70, 800 mt milk, each litre at an average cost of about Rs. 20 (District Livestock Service Office, Dhulikhel). The high cost is attributed to the concentrate feed used, and to the low supply of green fodder and forage. To improve the situation, the Project has been testing two annual fodder crops, bajara and sorghum, in Thuli Ban, Kaji Ko Dhaireni and Bhasme CFUGs of Panchkhal VDC. The seeds were provided by the Green Sector Support Seed and Consultancy Pvt. Ltd (GRESSCO) in Kalimati, Kathmandu. through the Environment Division of the MFSC, Singha Dabar, Kathmandu. (New perennial grasses including Mott Napier and Setaria spend acv Splendida were also distributed.)

In April 2005 ten progressive members of the CFUGs listed above were provided with 25 grams of bajara seeds and 50 grams of sorghum seeds as well as with technical advice on how to grow these crops as fodder. Most of them sowed the seeds along with coffee and other agricultural crops such as maize and vegetables. This year's test has shown poor results: only 10-20% of the seeds germinated due to the severe drought in April, May and June 2005. However, one farmer, who planted the seeds in the shade of coffee plants reported that 90% of the seeds had germinated and that he had harvested green fodder four times in the annual growing season. This farmer has suggested that the fodder from these species be taken when plants are about two feet high. Bajara and sorghum plants left for seed production support for bean and cowpea production. Almost all the farmers involved left some plants to produce seeds so they can continue the work in the coming years.

10.7 Forage Production in Landslide and Roadside Areas

Village roadside stabilisation using forage species

There are hundreds of landslides, gullies and newly constructed roadsides in the Project districts. All have the potential to be a site for the plantation of different forage species which resource-poor and landless households could collect. Unfortunately, most sites are covered by *banmara* weeds, which are unpalatable to animals. Sowing forage mixtures not only provides forage materials for livestock but also helps stabilise fresh landslides, gullies and roadsides. A total of 48 landslide, gully, and roadside sites were developed by sub-groups of women and poor households under this strategy. This low-cost degraded land improvement and soil conservation technique should be included by the Department of Soil Conservation and Watershed Management (DSCWM) as part of its "land care" approach to soil conservation and its policy to cover wider areas.

10.8 Forage Production on Degraded Community Lands

Forage production in degraded community lands

Most community forests in Sindhu Palchok and Kabhre Palanchok districts have been planted with pine species. Degraded community lands and some open areas dominated by bushes, shrubs and weeds offer ample opportunities for forage development. Most poor households depend on community forests for forage collection. To increase the supply of forage available on community lands, about 45 FUGs and CDGs, including Sugure, Siddhiganesh, Jalpa, Bhedigoath, Bemreni, Asetar, Sallenighari, Jamune, Dublidanda, Bolde CFUGs, and Simkhola and Lagansil women's groups and Panchakanya CDG of Sikar Khola sub-watershed, Sindhu Palchok District, and Saparupa, Nauli, Pandula and Thuli Ban CFUGs, and Nangekharka, Panchakanya and Chandani CDGs of Kabhre Palanchok District were selected to test this approach.

The outcomes of this programme demonstrate that community forage programs can play a vital role in improving the livelihoods of marginalised group members. Some CFUGs and CDGs have started generating income from the sale of forage slips, cuttings and seeds, and of green forage. For example, Bhedigoath CFUG forage sub-group generated about NRs. 14,000 and Panchakanya CDG earned about NRs. 5,000 from the sale of green forage and forage seeds and slips. In the Project districts, large areas are covered by *banmara* and other unwanted vegetation. Conversion of such places into green forage plots will certainly help nearby CFUG and CDG members collect the forage needed for livestock farming. Improving degraded land also helps control soil erosion and increases environmental benefits. To facilitate this programme, Project and DSCO staff have only had to provide technical support and seeds and slips; the rest of the work has been carried out by CFUG and CDG members.

11 Forage Establishment, Maintenance and Management Measures

The DSCO and the Project have provided forage seeds and slips/cuttings and technical know-how to CDG and CFUG members, who themselves have contributed labour free of cost to prepare lands by manual digging, to sow seeds and plant slips and cuttings, and to look after forage plots. Table 2 shows the operations carried out to establish and manage community forage blocks within and outside selected sub-watersheds areas.

Table 2: Operations carried out in establishing and managing forage blocks

S. No	Activity	Energy	Equipment	Timing	Frequency
1	Land preparation	Manual	Spade and sickle	May-June	1
2	Seeds/slips sowing/planting	Manual	Spade (broadcasting/ planting)	June/July	1
3	Weeding	Manual	Spade and sickle	July-August	1
4	Fertiliser application for early establishment	Manual	Broadcasting	July-August	1 (a few groups)
5	Seed collection	Manual	Sickle, stick and plastic	November-March	1

Seeds sown in late May and early June had very good rates of germination and forage plots were successfully established. Weeds which germinated in forage blocks were removed in late July to early August and a chemical fertiliser such as di-ammonium phosphate was applied to promote early growth and establishment. User groups have adopted animal stall-feeding practices to protect forage block from grazing animals. Some CDG and CFUG members collected seeds from these plots and sold them to generate income. Forage plants were harvested and fed to animals after seeds had been collected or had dropped on the ground.

12 Forage Block Establishment and Management Costs

The cost of establishing and managing forage plots was calculated based on per hectare cost of operation. Table 3 shows that user groups contribute 70% of the total costs, significantly more than the contributions of the DSCOs and the Project.

Table 3: Per ha costs for community forage block establishment.

S.No	Categories	Input	Quantity	US $	Contribution by
1	Land preparation	Manual labour	30 persons/ha	50	Users
2	Seeds	Project supply	6-8 kg /ha	30	DSCOs/ Project
3	Seed sowing	Manual labour	2 persons/ha	3	Users
4	Weeding	Manual labour	4 persons/ha	6	Users
5	Di-ammonium phosphate application	Manual labour	25 kg/ha	11	Users
Total cost (US $)				**100**	

In places where fodder and forage seeds germinated but could not grow well due to the very poor soil quality, chemical fertilisers such as di-ammonium phosphate were used to promote the early establishment of forage plots (on very limited areas only). We emphasized species with tolerance of very low oil fertility, including the stylos, Aztec atro, jointvetches, and Wynn Cassia to improve forage growth, weeding was carried out in July/August.

13 Botanical Composition

The number of plants per square meter was counted in three different forage plots of Asetar CFUG, Sindhu Palchok District. A total of 16 samples in Pandhera Pakha, Ahal Kharka and Devisthan were evaluated in November 2005. Molasses plants formed the highest percentage, with stylo and joint vetch second and third most common respectively (see Table 4). Both stylo and joint vetch are leguminous plants which improve soil fertility and increase the protein content of animal diets.

Table 4: Botanical composition of forage blocks established in June 2004

Items	Legumes			Grasses		Total
	Stylo	Joint vetch	Others (ipil ipil, wynn cassia, Aztec atro etc)	Molasses	Others (signal, gamba, chloris, paspalum, etc)	
Plants/m^2	50	12	6	172	7	247
Percentage	20.24	4.86	2.43	69.63	2.84	100

Since the proportion of naturally occurring legume species on Nepal's grazing lands is normally very low, the DSCOs and the Project emphasised legume species in their own fodder and forage development and management works. Table 4 shows that legume species constituted about 28% of forage block areas. These species not only improve soil fertility but also increase the protein content of animal diets.

14 Measurement of Forage Biomass

The weight of the green matter of forage species grown on degraded community lands was measured, and then the relative proportions of legume and non-legume grasses were estimated by considering each species harvested separately. Following methods were used for the estimation of forage biomass:

- A measuring square one square meter in area was prepared locally using a bamboo framework.
- The forage inside the square was harvested in November; four months after the forage blocks were established.
- The green matter was weighed immediately on a spring balance.
- The harvested forage was packed in a plastic bag labeled with its name, number and sample size.
- The forage species in each sample were separated according to botanical species and the numbers of each species per square meter was counted and recorded.

The biomass production of an established community forage plot was measured in Asetar CFUG using 16 measurement plots in three different blocks (Table 5). Forage production from legume species was low, only about 9%, suggesting that the DSCOs need to promote leguminous species by giving opportunities for stylo, wynn cassia and joint vetch seeds to mature in its promotion of natural reseeding processes in community forage blocks.

NB I think this kind of biomass measurement is a complete waste of time!!

Table 5: Forage biomass production in Asetar CF of Sindhu Palchok District

S.No	Species	Green weight (g/m^2)			Mean (gm/m^2)	Percentage
		Pandhera	Kharka	Devisthan		
1	Legumes	116	148	43	102	9.16
2	Non-legumes	1440	583	1010	1011	90.84
Total (g/m^2)		1556	731	1053	1113	100

Table 5 shows that about 11.13 mt/ha of green forage biomass was obtained in the first harvest; four months established a forage block.

15 Forage Seed Production

Forage resource centers and community forage blocks are the main sources for the production of forage seeds, slips and cuttings. Production of needs to be sustained in order to support the continuation of forage development and management works in the Project districts. To achieve this goal, training in forage seeds and slips harvesting, processing and marketing was planned and organised through the DLSO in Sindhu Palchok and the DSCO in Kabhre Palanchok. The main objectives of the training were to teach forest resource centre owners and CDG and FUG members of community forage blocks about different techniques of forage seed and slip production, harvesting, processing and storage and to make people aware about forage seed and slip markets and market linkages.

Forage seed harvesting and processing training

Participants in the training sessions visited nearby forage blocks to practice collecting forage seeds from mature axillaris, Aztec atro, and desmodium plants. Each training session lasted four days and focused more on practical activities than on theory. The content is described below:

- Identification and classification of forage species.
- Importance of forage development and management.
- Techniques for cultivating forage in different areas (community and private land, landslides, roadsides and degraded sloping lands).
- Techniques of fodder and forage propagation.
- Techniques for producing forage vegetative materials in different sites, including forage resource centers.
- Management of forage for seed production (sites, water, manure, and light).
- Forage seeds harvesting times and techniques.
- Processing of different species of forage seeds.
- Practical experience in forage seed harvesting and processing.
- Seed storage.
- Prices of forage seeds and vegetative materials.
- Markets and marketing of forage seeds.
- Networking for forage seeds marketing.

16 Adoption

About 40,000 household members of CDGs and CFUGs were involved in fodder and forage block development for soil conservation and watershed management purposes as well as for land use management. Of them, 98% adopted this practice using Project incentives like fodder and forage seeds, slips and cuttings. Community forage programs were implemented by CDG and CFUG sub-groups of women, the poor and DAGs. The main reasons behind the widespread acceptance of the programme by user group members are the desires to improve degraded lands, promote soil conservation, increase forage supply, and boost income generation from the sale of seeds, slips and forage produced on private as well as community lands. Other benefits include the strengthening of community institutions, an increase in knowledge about soil conservation and watershed management using forage species, the enhancement of biodiversity, improvements in soil cover, an increase in soil moisture and fertility, and the reduction of downstream siltation problems.

17 Recommendations

- Community forage blocks were established most effectively with sub-groups of female, poor and disadvantaged members of CFUGs and CDGs. This approach should be adopted DFOs, DSCOs and DLSOs and other projects such as the Leasehold Forest and Forage Development Project and the Community Livestock Development Project in their implementation of community forage programs.
- The establishment and management of forage resource centres to produce forage slips, cuttings, and seeds is the best way DSLOs, DSCOs and DFOs, and other projects like the Leasehold Forest and Forage Development Project and the Community Livestock Development Project can promote the development and management of forage and fodder. DFOs, DLSOs and DSCOs can establish forage resource centers in their office compounds so they can provide forage slips and cuttings to visiting farmers.
- Using fodder and forage species to promote soil conservation and degraded land; landslide and village roadside improvement is a cost-effective programme. The DSCWM can use this technique as a major soil conservation and watershed management strategy helping it cover a wider area with the limited resources available to it.

18 Conclusions

- Soil was conserved, the quality of degraded land improved and fodder and forage production increased. The latter, in addition, changed helped support livestock production.
- Some CDG and CFUG members generated income by selling forage seeds, slips, cuttings and forage produced on their farms and community lands.
- Forage development and management is a cost-effective soil conservation and watershed management measure which has great benefits for women.

Annex 1

List of Fodder and Forage Species

Annex 1: List of Fodder and Forage Species

S.No	Common name	Cultivar	Scientific name
Sub-tropical grasses			
1	Alpha		*Bothriochloa insculpta*
2	Biserrula	Casbah	*Biserrula adsurgens*
3	Bisset blue grass		*Bothriochloa insculpta*
4	Brizantha		*Brachiaria brizantha*
5	Chloris	Envirogold (katambora)	*Chloris gayana*
6	Gamba	Kent	*Andropogon gayanus*
7	Guinea		*Panicum maximum*
8			
9	Molasses		*Melinis minutiflora.*
10	Mulato		*Brachiaria brizantha x B. ruziziensis*
11	Napier	Mott	*Pennisetum purpureum*
12	Setaria		*Seteria splendida*
13	Signal		*Brachiaria decumbens*
14	Sunhemp		*Crotalaria juncea*
15	Plantain	Tonic	*Plantago lanceolata*
16	Chicory	Puna	*Cichorum intybus*
17	Turnip	Purple top	*Brassica rapa*
18	Russian comphry		
Sub-tropical legumes			
19	Aztec Atro	Aztec	*Macroptilium atropurpureum*
21	Axillaris	Archer	*Macrotyloma axillare*
22	Butter fly pea		*Clitoria ternatea*
23	Centurion	Cavalcade	*Centrosema pascuorum*
24	Creeping vigna	Shaw	*Vigna parkeri*
25	Greenleaf Desmodium	Green leaf	*Desmodium intortum*
26	Silverleaf Desmodium	Silver Leaf	*Desmodium unicinatum*
27	Tree Desmodium		*Desmodium distortum*
28	Dorycnium		*Dorycnium rectum*
28	Forage peanut (erect)	CIAT 22160	*Arachis pintoi.*
29	Forage peanut	CIAT 18744, 18745, 18747, 18748, 18759, 22159, 22160, 22172	*Arachis pintoi.*
30	Glycine	Cooper	*Neonotonia wightii*
31	Glycine	Tinaroo	*Neonotonia wightii*
32	Joint vetch	Glenn	*Aeschynomene americana*

S.No	Common name	Cultivar	Scientific name
33	Joint vetch	Lee	*Aeschynomene falcate*
34	Joint vetch	Villosa	*Aeschynomene villosa*
35	Macroptilium	Maldonado	*Macroptilium gracile*
36	Stylo	Nina	*Stylosanthes guianensis*
37	Stylo	Palpa	*Stylosanthes guianensis*
38	Stylo	Temprano	*Stylosanthes guianensis*
39	Velbet bean		*Mucuna pruriens*
40	Wynn cassia		*Chamaecrista rotundifolia*
Sub-tropical legume trees/ shrubs			
41	Calliandra	Best OFI line	*Calliandra calothyrsus*
42	Ipil ipil		*Leucaena leucocephala*
	Ipil ipil	Trichandra	*Leucaena trichandra*
	Ipilipil		*L. leucophalaX diversifolia*
43	Ipil ipil	Tarramba	*Leucaena leucocephala*
44	Tagasaste/tree lucerne		*Chamaecytisus palmensis*
Temperate grasses			
45	Broom	Gala grazing	*Bromus intermis*
46	Cocksfoot	Porto	*Dactylis glomerata*
47	Kikuyu	Whittet	*Pennisetum clandestinum*
48	Paspalum	Argentine bahia	*Paspalum notatum*
49	Paspalum	Hi-gane	*Paspalum atratum*
50	Brunswick grass	CPI 27707	*Paspalum nicorae*
51			
52	Phalaris	Holdfast	*Phalaris aquatica*
53	Prairie grass	Atom	*Bromus wildenowii*
54	Rhodes	Finecut	*Chloris gayana*
55	Ryegrass, Italian	Dargle	*Lolium multiflorum*
56	Ryegrass, perennial	Fitzory	*Lolium perenne*
57	Ryegrass, perennial	Kingston	*Lolium perenne*
58	Perennial mountain Rye		*Secale montanum*
59	Tall fescue	Jesup	*Festuca arundenacea*
	Creeping red fescue	Flyer	*Festuca rubra commutata*
60	Tall fescue	Prosper	*Festuca arundenacea*
Temperate legumes			
61	Clover, Balansa	Paradana	*Trifolium balansae*
62	Clover, Caucasian	Endura	*Trifolium ambiguum*
63	Clover, crimson	Dixie	*Trifolium incarnatum*
64	Clover, red	Astred	*Trifolium pratense*
65	Clover, rred	Renegade	*Trifolium pratense*
66	Clover, rose	Hykon	*Trifolium hirtum*

S.No	Common name	Cultivar	Scientific name
67	Clover, white	Tahora	*Trifolium repens*
68	Clover, east Africa	Decorum	*Trifolium decorum*
69	Clover, strawberry	Palestine	*Trifolium fragiferum*
70	Clover, east Africa	D10111	*Trifolium steudneri*
71	Clover, east Afirca	11552D	*Trifolium rueppellianum*
72	Clover, east Africa	9379D	*Trifolium quartinianum*
73	Clover, east Africa	8635D	*Trifolium tembense*
74	Lotus	Maku	*Lotus penduculatus*
75	Lotus	SA 5020	*Lotus ornithopodioides*
76	Lotus	SA 5019	*Lotus ornithopodioides*
77	Lotus	SA 13255	*Lotus ornithopodioides*
78	Lotus	SA 33841	*Lotus ornithopodioides*
79	Lotus	SA 33729	*Lotus ornithopodioides*
80	Lotus	SA 834	*Lotus ornithopodioides*
81	Serradella, pink, French	Cadiz	*Ornithopus sativus*
82	Biserrula	Casbah	*Biserrula adsurgens*
83	Serradella, yellow	Santorini	*Ornithopus compressus*

Limitations

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