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Improving the efficiency and effectiveness of the Committee on Science and Technology
Final report of the Group of Experts

Case studies on conservation and rehabilitation for users in implementing the Convention

Note by the secretariat

Introduction

1. During the fourth session of the Committee on Science and Technology (CST), discussions on soil and water conservation and on control of land degradation concluded that although much good work on these matters had been done in many countries since the 1960s, the successes had not been properly documented. Hence, these successful efforts could not be replicated in other countries.

2. In an effort to rectify this situation, the CST resolved to document some of the case studies so that the work can be replicated elsewhere under national action programmes to combat desertification. Subsequently, under the terms of reference provided by the Conference of the Parties at its sixth session, the Group of Experts (GoE) of the CST was requested to identify and assess existing and ongoing work on conservation and rehabilitation for users in implementing the Convention.

3. The annex to this document, prepared by the GoE, contains descriptions and analyses of the following seven case studies:

(a) Community-based conservation and rehabilitation by TBS (Tarun Bharat Sangh), India;

(b) Rehabilitation and conservation of assigned lands by BIRD-K (BAIF Institute of Rural Development – Karnataka), India;

(c) Joint forest management by Ministry of Environment and Forest, Government of India;

(d) Greening of wastelands through bio-diesel and paper pulp production, India;

(e) Conservation and rehabilitation of Lavalle Desert, Mendoza, Argentina;

(f) Forestation in Sierra Espuna mountains, Spain;

(g) Rehabilitation of degraded peatlands, Belarus.

4. The document is presented as received, without editing by the secretariat.

Annex

Report of the Group of Experts on case studies on conservation and rehabilitation of degraded lands for users

1.0 INTRODUCTION

About two billion ha or 15% geographical area of the world is subjected to various forms of land degradation of which erosion by water is the chief contributor followed by wind erosion, chemical degradation and physical degradation (Olderman, 1991). Water erosion is the major source of land degradation in India as well as in the globe (Table 1). The total geographical area of India is about 329 million hectare (M ha). Sixty three per cent of the net sown area (142 M ha) is rainfed, where crop production suffers from rampant land degradation mainly by runoff (**Plate 1**). Cultivable wastelands, current and old fallows, which occupy 38.4 M ha forms the first category of degraded wastelands in India followed by degraded forest. Out of the total 67.9 M. ha of forest area, 29.3 M ha is highly degraded and has less than 40% canopy cover (GOI, 1995).

Table 1. Land degradation – Global & Indian scenario

Type	Global		Indian	
	Extent (Billion ha)	% of total	Extent (Million ha)	% of total
Water erosion	1.10	55.8	148.9	79.3
Wind erosion	0.55	27.9	13.5	7.2
Chemical degradation	0.24	12.2	13.8	7.3
Physical degradation	0.08	4.1	11.6	6.2
Total	1.97	100	187.8	100

Source (Olderman, 1991)

Food security and poverty are strongly co-related (Panjab Singh 2004). Green Revolution in India has solved the problem of insufficient food production but at the cost of deteriorating resource base. The grain belt of the country is now experiencing the threat of land degradation due to indiscriminate use of irrigation water. At least 260 million people are living below the poverty line. The inability to buy enough food will not be mitigated by just producing more. The question today is not of food grain production but of improved livelihoods through efficient management of natural resources and diversified land uses for environmental safety and sustainable production. Improving the use efficiency and maintenance of existing resources such as land and water will be crucial for future agricultural growth and food security. Enabling the poor to access natural resources for improved livelihoods, land use diversification, suitable policy framework and higher investment could prevent land degradation.

Box 1. Water and Poverty

- Land degradation means less water captured and less food produced. Land degradation (expressed in percent of agricultural land) is estimated to be about 35% in Asia, 45% in South America, 65% in Africa and 74% in Central America.

- An estimated 630 million rural poor live in marginal agricultural, forested and arid lands – areas that are particularly prone to degradation.

(Source: CGIAR Challenge Program on Water and Food)

2.0 NATURAL RESOURCE MANAGEMENT – CURRENT SITUATION IN INDIA

Natural resource management is a key issue that affects the socio-economic scenario of a nation. Livelihood and well being of the people are inter-related with natural resources. In India, the degradation of resource base is rampant due to over-exploitation of land, water and vegetation for feeding the burgeoning population, which is estimated to touch 1,255 million human, and 600 million livestock by AD 2015. About 57% of India's geographical area is suffering from various forms of degradation such as water erosion, wind erosion, chemical and physical degradation. Out of 400 M ha-m precipitation in the country, 115 M ha-m is lost as runoff resulting in moisture stress drought in the catchments and floods downstream. Over 5.3 billion tons of top-soil is lost annually resulting in a loss of around 8 million tons of plant nutrient and 3 million tons of food grains. Soil resource base is shrinking at an alarming rate of 0.25 M ha annually due to industrialization and urbanization. The per capita availability of water will touch stress level of 1700 m^3 in the next two decades. The water resource is dwindling in quantity, quality and equitable availability.

In most rainfed areas, the potential evapotranspiration exceeds rainwater inputs for 8 to 9.5 months in a year resulting in a negative water balance. The effective crop-growing period is 75 to 120 days – just sufficient to grow a single crop. Availability of sufficient soil moisture during the crop growth is a major limitation. In addition, soil degradation is a major cause for low productivity. The torrential character of the seasonal rainfall creates high risk for the cultivated lands. Thus, erosion leaves behind an impoverished soil on one hand, and siltation of reservoirs and tanks on the other. Degradation induced source of carbon emissions also contribute to climate change. Therefore, soil health care, fertility enhancement and environment protection are vital for increased productivity and sustainability of the rainfed agro-ecosystem.

Agricultural development with positive growth and long-term sustainability cannot thrive on a deteriorating natural resource base. The degradation of land, water and vegetation calls for a framework of long-term policies of conservation, management and utilization of natural resources on sustainable basis. It is imperative to strengthen resources for their conservation, improvement and efficient utilization with due consideration to equity issues. Natural resources should not be seen in isolation and a holistic approach should encompass the cost-effective, traditional and indigenous wisdom along with improved technologies.

Current crop productivity in rainfed areas in India is around 1.0 t ha^{-1}. However, there are ample evidences in the country suggesting that the productivity of rainfed areas could be significantly enhanced with an appropriate mix of improved technologies and institutional support. Most farm families practice integrated crop-livestock tree systems, with livestock being as important as crop production for their livelihoods. The concept of rural development is undergoing paradigm shift from soil conservation to commodity to cropping system to farming systems productivity. However, there should be more emphasis

on enhancing livelihood security that involves agriculture (crop-livestock, crop-fish, agroforestry, agri-horticulture, silvi-pastoral systems, etc) and non-farm or off-farm income generation activities. The focus has to be on rainwater conservation through arrest of runoff, harvesting and recycling and improving the soil health.

Rainfed areas prone to drought are spread over different agro-ecological regions and river basins. There are 35 basins, 500 sub-catchments and more than 3200 watersheds of various sizes in India. The size of an average watershed works out to be 0.1 M ha. However, presently the convenient working scale or operational unit of a micro-watershed is 500 ha. A huge investment is envisaged to rehabilitate about 100 M ha of land on watershed basis, which is under various processes of degradation. The GOI continues to accord high priority to rainfed agriculture. Some of the recent initiatives include (1) increased public investments on integrated watershed programs, (2) higher institutional credit to agricultural sector, (3) farm insurance and crop diversification and (4) National Food for Work Program (NFFWP), etc.

2.1 Livelihood Enhancement using Watersheds as Entry Point for Arresting Land Degradation – Strategies

Natural resource management in isolation from livelihood and production activities does not bring optimized benefits. When coupled with human resource development, improved varieties, land and water management bring in the desired gains on a more sustainable basis (Sreedevi et al. 2004). In India, watershed management approach has evolved over the last three decades. The emphasis has now shifted from mere soil and water conservation to increasing productivity to livelihood enhancement. Building on the foundation led by institutions such as ICRISAT and CRIDA, the State Agricultural Universities (SAUs**)** and the NGOs have developed a consortium model for technical backstopping of the watershed programs. The model has been tested successfully in Andhra Pradesh, Madhya Pradesh and Rajasthan. The results showed that along with common benefits of increased groundwater availability, reduced soil erosion, increased green cover, the income levels of the small-holders and the landless have increased substantially due to improved crop productivity and new employment opportunities at the local level (Wani et al. 2003).

Box 2. Strategies

- Blending of indigenous / and modern knowledge, land use diversification for resource conservation.
- Consortium approach led by R&D institutions comprising NGOs, State Agricultural Universities (SAUs), ICAR Institutes, Local Self Government, Self Help Groups (SHGs), Banking, Insurance sector, etc.
- Watershed as an entry point program with focus on participatory water resource development and management
- Win-Win situation for the landed and the landless – farming system approach for the land owners and micro-enterprises/income generating activities for the landless
- Greening of wastelands through bio-fuel, paper pulp plantations for livelihood, energy and environmental security
- Post harvest processing and value addition at community level with improved access to market through e-networking
- Convergence of various schemes to make best use of available funding and manpower
- Institutions as facilitators and local self government institutions/SHGs as implementers to improve transparency and peoples' participation
- Development of rural agro-industries

2.2 Blending of Indigenous and Modern Technologies for Resource Conservation

New initiatives have been taken up to blend the traditional and improved knowledge for efficient management of the resources. Droughts and floods occur simultaneously in different parts of the country. Soil and water are the basic resources that need to be effectively conserved. Increasing population of human and livestock calls for blending of indigenous and modern knowledge for wider acceptability. Watershed programs have been launched in the country to address the above issues and the sustainable livelihoods approach has been adopted for effective management of natural resources. Central Research Institute for Dryland Agriculture (CRIDA) has documented the Indigenous Technical Knowledge (ITKs) in the field of Soil and Water Conservation (Mishra et al. 2002), and has conducted pioneering research on alternate land use systems (Singh and Osman 1995).

3.0 TOPO-SEQUENCE-BASED INTERVENTIONS TO ARREST LAND DEGRADATION – CASE STUDIES

In Indian scenario, the forests occupy mostly ridge portions on a topo-sequence and the ownership lies with the State government. The interface area is either owned by the State or community while plains by individuals. The ridge is generally covered with trees in sub-humid areas while in semi-arid it is covered with deciduous or thorny vegetation or rock outcrops. Interface area between hills/forest and valley regions is mostly encroached or assigned to landless poor. The degradation is rampant in this area due to poor condition of the soil and presence of resource poor farmers. The accelerated runoff from the upstream causes severe soil erosion requiring larger investment towards rehabilitation. The valley regions have gentle sloping lands and are owned mostly by resource-rich farmers and the problem of degradation is not severe. The first case study of the *Tarun Bharat Sangh* (TBS) a voluntary organization deals with forest dwellers in the Aravalli hills of Rajasthan. The second focuses on assigned lands in interface areas, the third deals with the new initiatives of government for management of degraded forests (JFM) and the fourth describes the government's initiative for rehabilitation of degraded wastelands (public or private) through bio-fuel and paper pulp plantations. All the initiatives are in watershed mode and follow the principles of soil and water conservation in one or other way and give central importance to the participation of the community.

3.1 Case Study 1: Community-Based Conservation and Rehabilitation by TBS

During the last few years, efforts were made by the TBS to revive the past traditions and create environmental awareness by involving local communities. Special efforts have been made for the conservation and management of natural resources. There are 750 villages where TBS (when translated in English the meaning is "The Young India Association") in Alwar district of Rajasthan could revive traditional system of water harvesting through community mobilization. The effort has not only revived five rivers, but has also provided sustainable livelihoods to the people residing in the area.

Box 3. Alwar District - A Brief Profile

Alwar district is located in the northeast of Rajasthan in Western part of India, between 27^0 15' and 28^0 15' N latitudes and 76^0 15' and 77^0 E longitude. Temperatures fluctuate from 0^0C during some cold winter nights to as high as 49^0C during the hot day in summer. Mean relative humidity during the fall is 63% while average annual rainfall is around 620 mm. Ninety percent of the rainfall occurs during the monsoon months (July to September). Topographically, the Alwar tract may be divided into two zones: hilly area, and the remaining parts are more or less plain-like in appearance with small and low hill-like terraces or plateaus. Water scarcity is a common problem in both the zones.

Grey to green revolution of Gopalpura village: Revival of traditional water harvesting system

Gopalpura is a small, homogeneous village of 52 families, which belongs to the 'Meena' (local tribe) community. It is located in a small valley at the foot-hills of the Aravalli, in the Thanagazi Tehsil of the Alwar district. For livelihood small and marginal farmers rear milch cattle and cultivate rainfed crop during monsoon season. Most of the lands in the village comprise of hilly, rocky terrain with highly denuded forest cover and barren pasture land. In several discussions with the people, the TBS team came to understand that illiteracy, poverty and unemployment were rampant. The basic problem of the area was acute water scarcity. This affected the production of the biomass and in turn the income of the farmers, leading to poverty and the other socio-economic problems. The acute need for water, built bridges of cooperation and solidarity among the people. And, in early 1986, the old irrigation tank or *johad* of Gopalpura, known as the 'Chauntarayawali' *johadi* was selected as the first site for repairs, which was neglected by the community and the government as well. The government officials pleaded their helplessness in doing anything at government expense but assured full co-operation and assistance if the villagers voluntarily undertook the task themselves. The team returned to Gopalpura determined to motivate and mobilize the people to have faith in their own strength and expertise. The efforts led to storage of water in the tank (*johad)* for a much longer period of time than in earlier years, providing instant relief (**Plate 2**). Encouraged by the success of their first attempt, the villagers embarked upon a bigger task, the repair of another irrigation dam, which was in worst state requiring heavy repairs and maintenance. The *shramdan* (voluntary labor) was mobilized and the repairs were carried out. Thus, two tanks were completely renovated, storing as much water as possible from monsoon rains. The recharged water in the *johads* and wells, led to the cultivation of second crop during post-monsoon period. The people of Gopalpura have begun conservation of the forest area to regenerate the lost vegetative cover in the catchment area of the tanks to check soil-erosion and resultant silting of the tank beds and reforested approximately 60 acres of classified barren land.

The people came to visit and see the tanks of Gopalpura from near and far and expressed their desire to make similar efforts to repair and restore tanks in their own villages. This timely support checked the migration of the people and thus employed the human capital to create sustainable financial capital in the village itself. The restoration and the construction of the new tanks, the accompanying activities of gully control and field budding, the self-discipline and regulatory restrictions on grazing, cutting and lopping of trees, complemented each other and led to the formation of natural capital-resource augmentation as

- control of runoff driven soil erosion,
- groundwater recharge,
- improvement in soil moisture,
- increase in the vegetative cover,
- flourishing fodder reserves, and
- increase in crop yields.

Johad of Gopalpura, filled with water, proved beyond doubt as to what can be achieved with a community action, and through the soundness of indigenous knowledge and wisdom. This helped in opening of the door for funding from internal and external agencies. The success has also led to replication of 7500 such similar structures with the co-operation of the community in the regions. The people of Gopalpura are now flooded with milk and grain by following improved practice of agriculture and animal husbandry, which complement each other. Today Gopalpura is famous as 'Pae', implying large stock of grain. From the days of scarcity to days of abundance, the people of Gopalpura have re-established their identity, as the land of water, 'Nehra' and a basket of grain, 'Pae'.

Box 4. Impact

- In spite of two years' chronic drought (1987 and 2002) in the Alwar district, hundreds of villages were flush with water, for they have revived the traditional "water harvesting system" as a way of life.
- Without financial support from the government, largely illiterate villagers have built over 7,500 water-harvesting structures that have benefited 750 villages spread over 0.65 million ha.
- The region's water table, which had dropped to below 30 meters has slowly risen and has stabilized around 12 to 15 meters from ground level.
- According to the Center for Science and Environment (CSE), New Delhi, there has been a 400 percent return on investment on the water-harvesting structures in this area.
- The government of Rajasthan has upgraded the Thanaghazi ground water status as safe from the earlier dark zone area.
- Five rivers, namely, Bhagani-Teldehe, Aravari, Jhajwai, Sarasa and Ruparel, have been revived due to this initiative.

Source: *Dialogue on Sariska,* Tarun Bharat Sangh, Alwar, p. 108

3.2 Case Study 2: Rehabilitation and Conservation of Assigned Lands by BIRD-K

After abolition of landlord (*Zamindari*) system in post-independent India, landowners surrendered large chunks of land to the government to redistribute among landless and those who were tilling the land. The land acquired was generally of the poor quality and mostly degraded. The poor who received land remained poor due to lack of resources and technology to make the lands productive. Besides, some poor people occupied government-owned lands, but received land ownership title after a long struggle with government.

Box 5. Assigned Lands

Assigned lands are those allocated to the landless or poor by acquiring the land from government or community or landlords under Land Ceiling Act. The landless received the rights to cultivate these lands – also called *Patta* lands. Most of these lands are under-utilized or left fallow mainly due to poor resource base of the landless, and partly due to their highly degraded condition.

One such story is of the village Manjunathpura in Tiptur Taluk of Tumkur district in the State of Karnataka. BAIF Institute of Rural Development – Karnataka (BIRD-K), an NGO provided the technical and financial support to improve the livelihoods of 70 families, cultivating 318 acres of such land. The success led to the expansion of program in 10 blocks, each consisting of 3 to 4 villages spread over 10 districts of Karnataka. The focus was mainly on the rehabilitation of degraded lands through tree-based integrated watershed development programme.

Box 6. BIRD-K: Brief Introduction

BIRD-K is an off-shoot of Bharatiya Agro-Industries Foundation (BAIF) founded near Pune in 1946 by late Shri Manibhai Desai, a companion of Mahatma Gandhi. BIRD-K works in Karnataka and Andhra Pradesh.

Box 7. Site Description

Rainfall: 550–600 mm
Peak temperature: 32 to 35 degree Celsius
Slope: 2 to 5%
4 to 5
Soil: Red sandy with pebbles and good drainage
Socioeconomic condition: poor

The Manjunathpura Experience – A Brief Account

In 1963, five families settled on a government owned land in Manjunathpura. Gradually, in search of better livelihood, more and more families from different villages and different castes joined and the number grew to 70. In the early 1980s, the government decided that these people should leave the land. The villagers fought back and demanded land rights. Schedule Caste and Schedule Tribe Joint Farming Society was formed in 1981. The individual families had only usufruct rights over the land they cultivated. Although there was enough land for the people to cultivate, they could not produce enough due to poor condition of the land and mostly relied on wage labor in other villages and towns. Most of the time, there were conflicts on boundary issues as there were no clear cut demarcation and legal right on the land. BIRD-K officials could resolve the conflict and marked their boundaries with equal size plots.

The Path to Sustainable Progress – A Case Study of Mrs. Rathnamma's Family

BAIF approached the village people in 1992 and discussed about tree-based farming system or Agroforestry as the land was of poor quality. At first they were quite reluctant. They felt that the adoption of this system would cost them a lot of time and energy and the efforts many not be profitable and viable, as they had no official land rights. After several meetings and exposure visits, BAIF was able to convince Mrs. Rathnamma and her family to adopt the system.

The Agroforestry Model Developed at Manjunathpura
The model comprising plantation, soil and water conservation, horticulture, irrigation, crop and animal husbandry, is discussed below (**Plate 3**).

Plantation on bunds
Live fences were first erected around the plots to keep away stray cattle. The family members planted mainly fuelwood, fodder and biomass producing species at an average spacing of less than one foot between trees. The fence was regularly pruned. The prunings were used for feeding the cattle, fuel and compost production. The family now produces more than enough firewood and Rathnamma no longer needs to go to the distant forest area, which saves a lot of her time. There are few *Acacia auriculiformis, Tectona grandis* and *Eucalyptus tereticornis* trees, which are left to grow tall so that they can be sold as construction wood. The family has already harvested 18 trees of *A. Auriculiformis*, 10 trees of *Albizia lebbeck* and 100 trees of *E. tereticornis* which could fetch them Rs 3000[1].

Soil and water conservation measures
In the following years, they built eleven trenches cum bunds (750 m) across the slope and planted a large number of trees such as teak, eucalyptus at a spacing of 2 m and green capped the bunds with fodder grass. They constructed a gully plug to prevent further degradation with the project assistance on their own after seeing the success of the first, which made the land productive.

Horticulture
The family planted 150 mango, 15 cashew nut, 10 custard apple and 10 tamarind trees. Gap filling was done in mangoes, (about 30 plants).

Irrigation
The trees needed supplemental irrigation, and as there was no water source near the field, the family had to fetch water from the village. The project assisted the SHGs with seven donkeys and a cart to help them carry the water. After three years, the mango trees started yielding. The first harvest was not sold, but was distributed among relatives and friends as per the local tradition.

[1] 1US $=45 Indian Rupees (Rs.)

Crops
The information and training provided resulted in the use of seed of high yielding varieties of ragi and other crops and improved methods of cultivation. At the end of May, green gram is sown on 0.6 ha, and sorghum on 0.4 ha. After two and a half months (i.e. middle of August) the green gram is harvested. A few weeks later the sorghum is harvested. After the harvest of green gram, finger millet is sown by the end of August. Instead of mono-cropping, Rathnamma and her family now use green gram and sorghum as intercrops; six rows of ragi and one row of green gram and sorghum are mixed. They have enough for consumption as well as marketable surplus and are able to sell about 700 kg of finger millet. A small plot (35 m x 20 m), in the center of the field, is used as a vegetable garden. The family members are now well aware of making vermicompost and compost making which is recycled for fruit trees and vegetables.

Livestock
In 1997, the family purchased three-crossbred dairy cows, which costed them Rs 28,000. Two of them were artificially inseminated by BAIF in the first year, resulting in two female calves. The three cows were sold in 1999 with a profit of Rs 12,000. Rathnamma used the money to dig a borewell in her field, which cost her Rs 16,000. The water was used to irrigate the coconut trees, vegetables, and a small plot of rice. It was also used for the livestock. Two cows produce 7 liters of milk a day. The family uses half a liter, and the rest is sold to the nearby milk collection society.

The changing quality of life
The family was living in a small one-room house. In 1999, Rathnamma reconstructed her house, investing Rs 15,000. They now have a large living room, a small room, a storage room, a kitchen, a bathroom, and a cattle-shed. Behind the house, the family has a small garden where they planted two curry leaf trees, two lemon varieties and a sapota tree (*Achras zapota*). Rathnamma knew little about the use of medicinal plants. Thanks to the training course on the 'use and preparation of herbal medicines' that she underwent at BAIF; she now has many medicinal herbs in her backyard. Before the project, family could afford no more than one meal a day, but now they are well fed.

Land rights
The greatest achievement of the SHGs in Manjunathpura has been their winning battle for land rights. Until recently, the villagers had no individual land rights. Since their fields were becoming more and more profitable, they decided that usufruct rights were not sufficient. Under Rathnamma's leadership, the group members – all women – spent months making frequent visits to Tiptur, the district headquarters (Tumkur), for dialogue with the government officials and BIRD-K. Finally, in the year 2000, the people of Manjunathpura got official land titles for the land they had developed.

A remarkable change has taken place in the village, and especially in the case of Rathnamma. She used to be a shy lady who did not dare to speak up for herself, let alone take an initiative like this. Now she fears no one. She has spoken to large groups of people about her experiences with agroforestry. She is now inspiring and motivating people on their visit to her field.

3.3 Cast Study 3: Joint Forest Management (JFM) by Ministry of Environment and Forest, Government of India

The widespread process of deforestation and degradation of forests in recent decades eventually led the government to recognize that forests could only be protected and managed effectively if local communities were involved in that process. Thus, 1 June 1990 was indeed a land mark in the history of India's forest management when the MoEF issued policy instructions, consistent with the National Forest Policy of 1988 to all state forest departments (FDs) insisting greater participation of village community and NGOs in the regeneration and management of degraded forest lands. The present shift in forest management practice favours people's involvement, social fencing, empowerment of community, sharing

of authority, focus on Non Timber Forest Products (NTFPs), and rights over usufructs. The philosophy and concept is well mature whereas its systematic development and replication is still in evolutionary phase. Twenty-two states have passed resolutions for the implementation of JFM in pursuance of the GOI circular dated 1 June 1990. In order to further strengthen JFM, the guidelines were further revised in February 2000.

Box 8. Revised guidelines for the implementation of JFM

- Registration of all the Forest Protection Committees (FPC) as Societies under the Societies Registration Act, 1860.
- Give uniform nomenclature to such committees, viz., the JFM Committees.
- Ensure at least 50% of the members in the JFM general body and at least 30% in the executive committee should be women.
- Bring also good forests (with crown density above 40% except the Protected Areas) under the scope of JFM. The activities should concentrate on NTFPs, which can be given free, or on concessional rates as per existing practice in degraded forest areas under JFM.
- Felling of trees and harvesting of timber will be as per the provisions of the Working Plan.
- Provide for overlapping working circle in new working plans for incorporating broad provisions of mircroplans.
- Emphasise a marketing linkage for better return of NTFPs.
- Ensure that no less than 25% of the share of village community should be contributed to the Village Development Fund for long-term sustainability of resources.

The following are JFM's key characteristics:

- Encourages the development of partnerships between local people and FDs to manage forest lands jointly;
- Provides state approved access for the local communities to nearby forest lands;
- Encourages local people to protect forest areas, to prevent free grazing of livestock and to assist in preventing illegal activities by outsiders.
- Assures local people of a certain proportion of the intermediate and final harvests from the forestlands protected by them.

The JFM has received a lot of attention during the last decade from both researchers and development practitioners, and has become the principal alternative to direct state management. The resolution on JFM empowers financial and managerial powers to the member secretary, who is a forester, is much against the principle of participatory management. There is a provision to delegate the powers of member secretary to an educated villager. There are growing demands like enhancing the institutional development of JFM societies for addressing issues such as their decision-making power, sharing mechanism in the usufructs rights, their boundaries and changes in the monopoly rights on particular species by tribal cooperatives.

Community forest management

Community forest management (CFM) can be described as a system where a community has "developed institutions, norms, rules, fines and fees to sustain forest resources. The CFM in India is still in infancy stage. The case study describes the new initiative of the Department of Forest, Government of Andhra Pradesh, which did pioneering work in the area of JFM and is moving towards CFM.

Shift from Exploitation to Protection of Forest: Kishtapur Village

Kishtapur is a small, homogeneous village of 132 households with a population of 765. The villagers belong to a migrant community called "Mathure". The village is a part of Neradigonda mandal of Adilabad district in Andhra Pradesh, and the villagers are mostly dependent on agriculture and forest. Seasonal migration of men is common. The community, which was once involved in indiscriminate felling and grazing, is now protecting the forest under the JFM. The area of the forest is 419.43 ha. A 15-member forest protection committee called "*V*ana *Samarakshana Samithi*" (VSS) has been established with women member, Mrs. Yamuna Bai as chairman (**Plate 4**). The President and the Chairperson of the committee are selected in a village meeting called "grama sabha". The village has adopted social patrolling and could control the thefts in the forest, which is rich in valuable timber - teak (*Tectona grandis*). They could control the thefts by imposing Rs 7000 as fine and by collecting the logs from the violators. The members trained by the FD are now able to impart training to others and implemented silvicultural practices such as high stump cutting, non-commercial thinning which could fetch them more than Rs 1,50,000 as 50% share of the community after deducting the expenditure. The amount was utilized in creating the physical assets in the village such as borewell, diesel engines and pumpsets for lifting water and a community hall. Soil conservation works such as continuous contour trench (CCT) and staggered trenching costing Rs 1,00,000 across the slopes, and sunken pits for temporary storage of water (Rs 75,000) were carried out, besides loose boulder structures and rock filled dams.

The works carried out by the community supplemented their income and thrift groups (SHGs) which are eight in numbers (7 women and 1 men) are now in a sound financial position. The total amount of Rs 2,52,000 is with these groups and no member is a defaulter. The amount taken by the individuals was utilized for the inputs like seed and fertilizer and will be repaid at the time of harvest. All the villagers are now out of the clutches of money-lenders, which used to give money at an exorbitant interest rate. Now the banks have come forward to lend the support because of credit worthiness. Implementation of soil conservation works by the FD and construction of five check dams in the village under watershed works have increased the groundwater level. One borewell in the village could supply drinking water to the mandal headquarter during the lean period of summer indicating the beneficial effect of these measures. The construction of the CCT not only improved the groundwater through sub-surface flow but also reduced over land flow and soil erosion. The farmers are now able to go for second crop because of improvement in the groundwater status. In another program, through USAID-funded ICRISAT-SuTRA, a network of irrigation system has been laid to irrigate 25 acres of land @ one acre per member during off-season.

Implementation of various programs has reduced migration, improved sanitation and roads. New houses have come up which earlier used to be huts. Convergence of various programs and community participation has made the village prosperous and developed a model for the others.

3.4 Case Study 4: Greening of wastelands through bio-diesel and paper pulp production

Thirteen categories of wastelands in India constitute about 20.17% of total geographical area. The GOI has identified 146 districts in 20 states for micro-planning of degraded lands (TERI 2004). Nearly 83% of wastelands in advance stage of degradation are in the states of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh. Six categories of wastelands have been identified by the MoEF under National Wasteland Identification Project (NWIP) in collaboration with National Remote Sensing Agency (NRSA) and Survey of India (SOI), as potential areas for greening through cultivation of *Jatropha curcas*, a perennial bush yielding non-edible oil suitable as bio-diesel. *The plantation is not aiming at utilizing good agricultural land but focus is primarily on wastelands, therefore, there is no immediate threat to area under food crops*. The total area of wastelands with potential to cultivate *jatropha* is about 40.0 M ha and these include:

- gullied and/or land with ravines,
- upland with or without scrub,
- underutilized degraded notified forestland,
- shifting cultivation area,
- degraded land under plantation crops,
- degraded pastures/grazing land,
- mining: industrial wastelands,
- sand/desert/coastal, and
- steep sloping area.

The MoEF has plans to popularize bio-diesel plantations in waste and degraded forest lands under JFM/CFM. Land outside forest areas owned by community (CPRs) and fallow/degraded lands owned by individuals, organizations, government agencies, etc, will be brought under tree cover utilizing the funds of various programs of the Ministry of Rural Development (MoRD) and the Ministry of Agriculture (MoA). Women SHGs are encouraged to raise biodiesel nurseries of *Pongamia pinnata* and *Jatropha curcas* as an income generating activity (**Plate 5**). Government and non-government agencies procure these seedlings raised by women SHGs for planting on wastelands and field boundaries. Integrated Tribal Development Agency (ITDA) in Adilabad district of Andhra Pradesh is making efforts to involve women SHGs in raising and planting of biodiesel plants on their fields as well as on degraded forests.

CRIDA-ITC- Farmer partnership for paper pulp production

Agroforestry system involving *Leucaena leucocephala* was perfected by CRIDA and later promoted on farmers' fields for biomass production for industrial use in collaboration with the industry, ITC-Paperboards and Specialty Papers Division (ITC-PSPD), Bhadrachalam in Khammam district of Andhra Pradesh. The plantations have been promoted with an assurance of buy back on the prevailing market price by the industry. The price of biomass is showing an upward trend and the farmers are gainers by not entering into an agreement for sale at fixed price as followed in the buyback practice. The paper industry is mainly meeting their demand for raw material through production of biomass on farmer's fields rather than forests. ITC-PSPD has hitherto successfully promoted the clonal technology of producing Eucalyptus clones. The saplings are marketed at Rs. 8 per saplings, which is the main cost in plantation programme. On-station work at CRIDA has demonstrated that *Leucaena leucocepaha* (var. K-636) is equally productive, cost effective and improves the soil quality in the long run. The cost of seedling is bare minimum, just Rs. 1/- per plant for *Leucaena* compared to Rs. 8/- for *Eucalyptus* clone.

The variety K-636 was identified and promoted on large scale and various planting geometry were tried. The variety K636 was found on-par with clones of the company. Triple rows of *Leucaena* or *Eucalyptus* at 10m x 1.5m spacing was found compatible with crops and yielded highest biomass of cowpea. Earlier experiments involving *Leucaena* have indicated increase in organic carbon content from 0.2% to 0.45% and available N from 122 to 182 kg/ha through litter fall but at the cost of depletion of P and K (CRIDA, 2005). Application of *Rhizobium* and Mycorrhizae did not influence the growth of *Leucaena* significantly while K-636 recorded height and dbh compared to K-8 (CRIDA, 2001). Realizing the potential of *Leucaena* variety K636 and low cost of planting material the company has brought about 19000 ha under K636 cultivation in the last three years on the farmer's fields. It is yielding about 50t of biomass in three years on good soils while it takes five years on poor soils. It is fetching about Rs. 60,000/- per hectare in a span of three to five years depending on soil type and management practices (**Plate 6**). Pruning and loppings of the plantations is effectively meeting the demand of green fodder of small and large ruminants during lean period.

3.5 Case Study 5: Conservation and Rehabilitation of Lavalle Desert, Mendoza, Argentina

The case study is located in the Lavalle desert, Mendoza province, Argentina, an area with natural, environmental and cultural conditions highly representative of the drylands in the Argentine centre west - stretching over 614,000 km^2, of the Monte desert, and of other countries in Latin America affected by desertification.

The desert area has few inhabitants, less than half an inhabitant per square kilometre, and show contrasting activities. On the one hand, subsistence activities (extensive goat breeding only for meat production), have a strong impact on the fields due to overgrazing. On the other hand, the oil and mining industries extract the richness from the substrate without improving the local territory. Oil spilling contaminates the water resources. The people are mainly affected by the lack of water, in both amount and quality. The desert stores water at great depths (in many cases with arsenic), an inaccessible resource for its few inhabitants who have to do with their rudimentary wells and reservoirs.

One of the major desertification processes was the logging of the native woodland. Between 5 and 15 m depth, the water table feeds the dry open mesquite woodland (*Prosopis spp*.), which deserves particular attention. To the present day, it has practically disappeared. Studies conducted on environmental history show the decline of the woodland in the desert. It was cut down and used to build the viticulture and wine-growing oasis. In a 35-year period, from 1901 to 1935, during the railroad expansion, 992,748 metric tons of forestry products were cut down, a total of 198,550 deforested hectares (Abraham & Prieto, 1994). This wood from the desert has been used in the oases as vineyard poles and props.
Another important desertification process was the use of water in high and medium river watersheds for irrigating the oasis, which resulted in the drying of wetlands in the desert. Several important wetlands (one of them a RAMSAR site: "Lagunas de Guanacache") stretched along the margins of the low basin, supporting great biodiversity. The use of river water for irrigation has stopped their course, and now they are mere sand rivers that no longer carry water, with the logical outcome of wetland drying.

Lavalle: a singular and representative case of desertification combat

The context of action is the Lavalle desert (10.197 km^2), with a population of 3,213 inhabitants, (approx. 0.33 inhab/km^2). This is the desert where some of the Argentina aridity poles are located (mean annual rainfall is 80 mm at "El Retamo" locality). The main economical activity is a subsistence production system based on goat breeding for meat and manure. The current productive system is characterized by high territoriality and individualism, low profitability and negative impact on the ecosystem productivity. Only goat meat is produced, with a rate of only 30% of survival of kid goats, because of the winter parturition. Leather is not used, milk is not produced, and actually the goats are only a device to produce manure. Overstocking, overgrazing and worsening of sanitary conditions are the major problems. The use of goat livestock at family scale entails: excessive number of goats, extensive grazing techniques, desertified lands, serious problems in land tenure and property, problems in herd sanitation (brucellosis, tuberculosis), scarce drinking water contaminated with arsenic (HACRE).

North-western region of Argentina, the LaDyOT /IADIZA in the year 2003 began to develop and implement the project *"Strategies for local development and combat of desertification and poverty in indigenous local communities of the Argentinean Monte desert"* through a partnership with the Municipality of the town of Lavalle, and the indigenous Huarpe Community "Paula Guaquinchay" of La Asunción, counting on the financial support of the Argentine-German Technical Cooperation Agency (GTZ), the Federal Investment Council (CFI) and other institutions as the IDB, LADA -FAO, National Secretary of Science and Technology, in the framework of the NAP for Argentina. The main goals of this work are: to combat land degradation and develop a rural sustainable development model with local wisdom to combat desertification with the cooperation of scientists, NGOs and GOs, local governments and communities.

The main causes of desertification in Mendoza drylands are absence of policies for developing the desert, in contrast to the diversity of policies and promotion activities directed to the oases. The objectives related to herd management, preservation and validation of the natural and cultural heritage, reforestation and revegetation of degraded lands, animal and human health, social organization, irrigation efficiency, waste recycling, use of water resources and non-conventional energies, production of organic manure, tourist and cultural services, and fundamentally, obtaining healthy food products.

The methodology is based on the design of a partnership building and associativism of small producers, where each provides the number of parous goats he can, they are housed at the UPYS (Pilot Unit of Production and Services): a sort of "Hotel for goats", designed to keep them most of the year in order to produce milk, milk byproducts, kid goats, sanitation, food supplements, information, basic and applied research and eco-tourist products. The results indicate direct impact on the recovery of degraded lands and the economy of the production unit "puesto". Twenty eight goats incorporated to the system of the UPyS yield the same profit as the one generated by 200 goats in the current mode of exploitation. Therefore, only 56 goats included in the system are needed to double the family's monthly income, versus more than 400 in the current mode of work. That is to say that, besides decreasing the pressure of overstocking rate on the fields, their recovery and improvement is being promoted through a reduction of stocking rate and through reforestation and revegetation with native species.

3.6 Case Study 6: Forestation in Sierra Espuna Mountains in Spain

The project is located in Totana & Alhama counties of Murcia region in Spain. The restoration actions were initiated in 1897 and ended in 1920. The data were gathered in 2004. The area covered was 575 ha. The average annual rainfall of the region is 450 mm while PET is 750 mm. The mean annual temperature is 14^0C and located at an altitude of 650 m. Dry period is confined to July to September. The site is located in the middle of the Segura catchment. The parent material is sedimentary rock comprising mainly limestone and siltstone. Soil depth varies from 20 to 200 cm and mostly loamy in texture. The vegetation type is meso-mediterranean. The major cause of degradation was deforestation that led to soil erosion and flooding of lower reaches. The major reasons for deforestation were poverty, political strife, mismanagement of land etc, besides overgrazing by domestic animals.

The main goal of restoration process was to control erosion and restore forest ecosystem. The species targeted for introduction were mainly *Salix*, *Quercus*, *Pinus*, *Ulmus*, *Populus* and *Ailanthus*. The objective of restoration was to improve the landscape (National Park) and create employment potential round the year. Autogenic restoration process was followed comprising selective pruning of branches, thinning of young seedlings and removal of biomass around the selected trees and shrubs.

Site preparation included trenching to retain the soil on sloping lands. Manual planting/seeding was carried out. Supplemental watering was done when required. There was no pressure of grazing and three rocks were placed around the plant to avoid loss of water from soil.

Impact Assessment:

The assessment of restoration units was carried out in 2004, which indicated a plant cover of 90% comprising mainly herbs (30%), shrubs (40%) and tree species (80%). Survival percent of *Pinus halepensis* was found to be better than *Pinus pinaster*. The project area a century before had 25% *Quercus* and 50% *Pinus* species as against 5% *Quercus* and 85% *Pinus* species at present. During this period, cultivation and grazing by livestock have been abandoned.

As a consequence of restoration, the organic matter content of the soil increased which activated nutrient cycling and improved chemical and physical characteristics of the soil. The restored area generated

employment for 15 people round the year. The recreational and educational value also improved. The participation of local people improved and they got involved in decision-making.

3.7 Case Study 7: Rehabilitation of Degraded Peatlands in Belarus

Peatlands are worldwide regarded as a one of the ecologically significant biospheres and also at the same time extremely threatened. Belarus possesses large area under peat and non-peat wetlands. About 2.9 m ha area is occupied by peatlands, which is 14% of total geographical area of the country.

About 50% of peatlands have been drained without the observance of ecological sustainability principles from 1950 to 1990. About 65% of 1.6 m ha of anthropogenically disturbed peatlands have been used for agriculture, 16% for forestry and 18% for turf extraction. More than 1.0 m ha of peatlands continue to be under the natural condition. The availability of 200,000 ha of degraded peatlands formed as a result of turf extraction and 220,000ha of inefficiently used agricultural lands present the most significant ecological problem for Belarus.
About 17 projects have been contemplated covering 40,000 ha by employing most popular remedial measures. Integrated ecosystem management for degraded peatlands is being adopted for economic use of peatlands and their restoration.

4.0 SUSTAINABLE RURAL LIVELIHOODS FRAME WORK FOR THE ANALYSIS OF CASE STUDIES

The generic livelihood framework adapted by the DFID was applied for the analysis of case studies (Table 3). This includes assets, activities and outcomes, and one of the advantages of this framework is its versatility and can be applied to an individual, the household or the community (Osman et al. 2001). The model can account for factors that modify the context for the assets-activities-outcomes. The framework starts with an assessment of people's strength in terms of various capitals (assets), and provides an opportunity to focus on various strategies (activities) resulting in improved livelihoods (outcome).

Table 3. Analysis of Case Studies

Assets		**BIRD-K**	**TBS**	**JFM**	**CRIDA-ITC**
Natural Capital					
Soil	Loss	Reduced due to intensive plantation	Reduced mostly due to field bunding, stream bank stabilization, etc.	Reduced due to continuous contour trench (CCT)	Reduced due to tree cover
	Quality	Improved due to recycling of pruning from the livefence.	Improved due to use of nutrients for crop production. Control of mining activity in reserve forest area, 470 mines stopped operation	Improved social fencing Higher return of biomass to the soil	Improved due to leguminous character of tree
Water	Surface water (runoff)	Reduced runoff due to vegetation and mechanical measures	Safe harvest of runoff in percolation ponds and check dams	Reduced surface flow but improvement in sub-surface flow	Runoff reduced due to tree rows against slope
	Soil moisture	Improved reduced evaporation due to presence of tree fence as wind break	Increase in frequency of irrigation due to better availability of groundwater	Improved due to CCTs	Improved due to better water intake

Assets		**BIRD-K**	**TBS**	**JFM**	**CRIDA-ITC**
	Ground water	Improved and 1/3rd families own bore well	Water table raised by 15 meters	Round the year availability of drinking water and also supply to neighboring villages	Improved due to arrest of runoff
Vegetation / Land use	Multipurpose trees (MPTS) – and other fruit trees	MPTs – Casuarina, Eucalyptus, Fruit trees- Mango, Sapota, Coconut, Jack fruit	60 acres of barren land reforested, protection of catchment area through regeneration of native species. Forest cover gone up to 40%.	Improvement in survival and growth of trees	Tree cover on hitherto un utilized land, 19000 ha in three years
	Fodder	Improved fodder production	Improved availability of crop residues and tree fodder – *Acacia nilotica*	Social fencing, reduced pressure of illicit grazing	Top feed
	Fuel	Self-reliance in fuel	Improved availability, only the dry and dead wood is allowed to be carried from forest, use of axe is not allowed	Improved availability and no thefts	Fuel supply increased
	Crops	Multiple crops	100% area under double cropping, yield of wheat doubled from 1.8 to 3.7 t/ha.	Not applicable	Intercrops for first two years
	Land use diversifica-tion	Diversified land use - Agri-horticulture	Crop diversification – area increased under mustard	Protection of the native vegetation, maintenance of bio-diversity	Paper pulp production
	Cropping intensity	Mono to double cropping	Mono to double cropping	Improved crop yields due to better use of inputs as a consequence of increased income from JFM	Improved crop yields due to enhanced income and hence greater investment on inputs
Livestock	Composition	Shift from small to large ruminants	Livestock population doubled	Better nutrition of livestock due to availability of fodder from forests	Improved fodder supply and increase in number of buffaloes
	Output	Improved availability of milk	Higher output of milk	Higher yields due to better fodder supply	Higher milk yield
Physical Capital					
	Assets	Houses for living	Improved housing	Community hall, bore well, diesel engines (three)	Only one felling cycle has taken place

Assets		**BIRD-K**	**TBS**	**JFM**	**CRIDA-ITC**
	Tools and implements	From labor to owner of the land with required tools and implements	Number of tractors increased by 50%	---	---
Social Capital					
	Migration	Stopped	Under control	Reduced due to availability of fodder round the year	Employment during off-season
	Gender disparity	Reduced	Reduced to some extent. A new women organization was formed. Improvement in the enrollment of the girl students in the school.	A woman is chairperson of Forest Protection Committee (FPC).	---
Human Capital					
	Skills	Tree and crop management, (pruning, composing, etc.)	Construction and maintenance of water harvesting structures	New skills – soil conservation works, thinning, felling, book keeping, marketing, (minor forest produce)	New skills tree farming
	Knowledge	Good exposure to various farming systems	Improved knowledge about a number of field and vegetables crops	Forest management techniques	New Agro-techniques for tree and crops
Financial Capital					
	Savings	Investment on creation of assets	Good	Good	Income generated from lands utilized hitherto
	Credit flow	Improved	Improved	Improved, no defaulters	Support from banks
Activities		Tree-based farming system	Revival of traditional water harvesting system	Sharing of benefits through joint management of resource (forest)	Bio-diesel and paper pulp production
Outcome		♦ Control of runoff and soil loss and rehabilitation of degraded lands. ♦ Self-sufficiency in food, fodder, fuel, fruit, milk ♦ Marketable surplus ♦ Protection of environment ♦ Improved livelihoods	♦ Water, food and environmental security. ♦ Control of runoff and soil loss. ♦ Protection of environment improved income and better livelihoods	♦ Fuelwood, fodder, and timber availability ♦ Forest security. ♦ Improved yield of minor forest produce ♦ Protection of land and vegetation from degradation. ♦ Protection of environment	♦ Control of soil erosion ♦ Enhancement of soil quality ♦ Cropping between tree rows for first two years ♦ Enhanced income ♦ Wastelands not only utilized but further degradation is arrested

4.1 The Gaps

Lack of digitized land resource database is a matter of concern. Therefore, there is a need to compile, create and upgrade the database at regular interval using geographic information system (GIS) and remote sensing services. Data should be made available to all at nominal cost. There is lack of convergence and there are many players and schemes, which can be dovetailed into one to improve transparency and accountability.

4.2 Constraints

- Community mobilization is a difficult and time-consuming process, but the programs are time bound with little time allocated for generating awareness.
- Irregular allocation and flow of funds, mostly at the end of financial year.
- Poor support to the R&D institutions for implementation and refinement of programs.
- Rigid guidelines and lack of flexibility to suit varying situations.
- Poor accountability resulting in poor quality of output

4.3 Promoters

Community orientation**:** The programs need to be community oriented with benefits reaching to all the resource users for success of the programme and large-scale adoption.

Benefits: Immediate gains besides long-term benefits need to be ensured. In most soil conservation measures the impact is seen at later stages, therefore, creation of awareness is a must.

Market Forces: Markets are drivers of change, hence need to be seriously considered.

Buy back mechanism: The program on bio-fuel might take off only when industries offer a buy-back facility at a remunerative price. This has been clearly proved by CRIDA-ITC initiative in which a buy-back mechanism is in place.

Replicability: Most of the processes adopted by implementing agencies in the case studies are replicable.

Trees: Plantation not only helps in generating livelihoods but will also protect soil from erosion by water and wind. Carbon sequestration is yet another significant advantage from environmental consideration.

Indigenous Technical Knowledge (ITK): ITKs with desired modification are easily acceptable compared to new technology. Therefore, local wisdom must be blended with modern scientific practices to facilitate technology adoption over large areas.

Spreading of messages: National and international organizations can play a major role in conveying the message of food and livelihoods security linked to water security by addressing the problem of land degradation.

Integrated development: The security of food, water, energy and environment are inter-linked and hence any degradation in the resource base will affect all.

Seeing is believing: Resource losses are difficult to be realized but when demonstrated using a suitable action learning device like a rainfall simulator to simulate the soil erosion process and its control can help as has happened in a project carried out by CRIDA, Hyderabad in promoting the programmes.

5.0 CONCLUSIONS

Community-based conservation is one of the important ways for successful protection of natural resources and biodiversity. The approach to this needs the trust of people, and decrease in the bureaucratic authority. Once the awareness and mutual trust are generated, the local folk will contribute happily to conservation through self-realization. The responsibility for generating awareness, encouraging community-based organizations and conducting training programs, demonstrations and exposure visits will have to be shared by the GOs and the NGOs. The process though allows sharing of the benefits by the communities, also puts the responsibility on them to suitably protect and manage the resources.

Indigenous and modern technologies arrest resource losses, but a large-scale application is necessary. Low, medium and high input technologies by appropriate blending with ITKs need to be adopted on watershed mode and should extend to sub-basin and basin level in a participatory mode. This is possible when needed policy framework and adequate monetary support for grounding the technologies is made available. Work in isolation may deprive the farmers from the fruits of advancement made in agriculture and forestry, and achieving the goal of doubling the productivity from the current level of 1.0t ha^{-1} to 2.0t ha^{-1}. Therefore, a consortium approach of networking research and development organizations at national and international level will help improving the livelihoods of millions who are dependent on this fragile agro-ecosystem, which otherwise is vulnerable to further degradation and poverty.

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Acronyms and Abbreviations

BAIF	Bharatiya Agro-Industries Foundation
BIRD-K	BAIF Institute of Rural Development – Karnataka
CCT	Continuous Contour Trench
CFM	Community Forest Management
CPR	Common Pool Resources
CRIDA	Central Research Institute for Dryland Agriculture
CSE	Centre for Science and Environment
DFID	Department for International Development
FD	Forest Department
FPC	Forest Protection Committee
GIS	Geographic Information System
GO	Government Organization
GOI	Government of India
ICAR	Indian Council of Agriculture Research
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
ITC	Indian Tobacco Company
ITDA	Integrated Tribal Development Agency
ITK	Indigenous Technical Knowledge
JFM	Joint Forest Management
MoEF	Ministry of Environment & Forests
NFFWP	National Food For Work Programme
NGO	Non-Government Organization
NTFP	Non-Timber Forest Products
SAU	State Agricultural University
SHG	Self- Help Group
SuTRA	Sustainable Transformation of Rural Areas
TERI	The Energy and Resources Institute
TBS	Tarun Bharat Sangh
UG	User Group
UNCCD	United Nations Convention to Combat Desertification
USAID	United States Agency for International Development
VSS	*Vana Samarakshana Samithi* (Forest Protection Committee)

Local terms

Johad	Tank or percolation tank
Gram Sabha	Village meeting

Mandal A sub-unit of district covering 10-15 villages

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