A Technology Assessment & Development Brief
by the
NATURAL RESOURCE MANAGEMENT TEAM
PRAGYA

DEVELOPMENT INTERVENTIONS FOR COLD DESERTS

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1. COLD DESERTS - FEATURES & NEEDS

1.1 BACKGROUND

Cold deserts are a significantly distinct biome of the world. Lands of high elevation in the rainshadow of some mountain range, they are characterised by extremely cold winters, moderately hot summers, and arid or semi-arid conditions. The main form of precipitation is snow - but only ten inches or less per year. They are typically covered by sand dunes and pebbles and rocky soil, and often contain large deposits of minerals and gemstones as well; flora and fauna are typical of each distinct cold desert region, and include some rare varieties. These regions experience two pronounced seasons - a short, cloudless, arid summer and a long, windy, freezing winter. Blizzards, snowstorms and avalanches are common. The soil is very fragile not very productive and the climatic conditions allow a very short growing season. Water resources are minimal with glacier-fed streams being the only source of irrigation. In terms of habitation, they are usually sparsely inhabited, although this is now changing. Development and modernisation is stepping in to improve the quality of life of the host communities. With the growing attraction of the remote frontiers for tourists, the pressure on the environment is also increasing.

Cold deserts face serious disadvantages to their development associated with an interplay of factors such as limited natural resources, remoteness and fragile ecosystems. Therefore they are even more vulnerable than other regions to any impacts on their ecosystems. Apart from the distinct natural characteristics, they are resource deficient and difficult habitats in terms of natural hazards as well. Cold desert communities face the problems of extreme dryness and inadequacy of freshwater resources, inadequate irrigation potential and low soil productivity, high wind and water erosion, destruction by glaciers and rock-falls, etc.

Secluded in their high habitats, the indigenous population had managed to eke out their needs and adapt to the harshness of their chosen habitat for this long with the application of indigenous eco-development practices. Progress however has brought with it its stresses. Accessibility has improved and so have the desires of the indigenous population for the comforts of the modern-day world. As development and tourism impacts them, the ecosystem integrity of these cold deserts is under great pressure. Damaging forms of development are also bringing about significant environmental changes. Although the indigenous people of this plateau had developed a code for protecting their wildlife and flora far in advance of the west centuries ago, these traditional wisdoms are gradually being eroded, lost in the highway side villages and receding in the inner villages as well. The indigenous systems of land tenure, water allocation, grazing rights, and hunting limits are little in use today. Desertification is escalating, the utilisation of resources turning unsustainable. Pressure brought about by increasing human and animal population is causing further degradation - the little vegetation is getting depleted. Accelerated erosion, loss of regeneration capability, and a drop in the productivity of vegetative ecosystems are cold desert issues today. Cold deserts have rich deposits of minerals and semi-precious stones. Indiscriminate quarrying from mountainsides for these has had adverse effects as well with the loss of land that could have been put to more productive use and of the productive top soil. The already sparse vegetation cover is also removed for this purpose. In the absence of a network of roots to hold the soil, landslides are a common phenomenon in cold deserts. This is aggravated by inappropriate methods of road

construction, like blasting. The unique flora and fauna of this region is also being impacted heavily due to excessive hunting and collection - for instance, the valuable medicinal and aromatic plants of these regions have received excess attention from drug manufacturers and collection is reaching unsustainable levels.

Cold deserts need a special and concerted effort in terms of natural resource management in the light of their especially vulnerable ecosystems and highly deficient natural resource status. However, the understanding of this distinctive biome is highly inadequate. Its very remoteness and severity of conditions have made this region little studied. Natural resource management interventions for these regions are frequently designed similar to hot desert and drought-prone regions. Every ecosystem is unique and has its own unique problems. Therefore any strategy aimed at effective intervention in an ecosystem has to be focussed and geared towards solving the problems of the particular ecosystem. A generalist approach will not be effective. What is needed therefore is an objective and scientific evaluation of the interventions in cold deserts in the context of the distinctive features of this biome, and to develop strategies, processes, institutions and infrastructure unique to the cold desert regions of India.

1.2 COLD DESERTS OF THE WORLD

Two major mountain systems span the Earth's surface - one separates Eurasia from Africa and India and stretches from the Atlas beyond Kerinci in Indonesia; the other circles the Pacific Ocean and reaches to Antarctica, and includes the Andes, the Rockies and Brooks Range, the Central Range in Siberia, and ranges in Japan, Australia, and New Zealand. Cold deserts of the world exist in both these mountain systems: the Atacama on the coasts of S. America, the Gobi Desert and the Taklamakan in Northern and Western China, the Tibetan Plateau, Turkestan in Southwestern Russia, the Great Basin in Western USA. Although alike in various environmental aspects, they differ in degree in terms of natural resource availability, as well as in socio-cultural aspects of indigenous communities and their environment management practices.

The major cold deserts of the first mentioned mountain system, in which the Indian cold deserts lie, include -

a. *The Moroccon Highlands* - This is a valley in the High Atlas range in the Moroccon highlands.
b. *Iranian* - This region lies in the Hindu Kush Ranges covering parts of Iran, Afghanistan and Pakistan.
c. *Turkestan* - This region stretches from the Caucasian Mountains across the Pamirs to the Tien Shan covering parts of the Middle East and Southwestern Russia.
d. *The Gobi & the Taklamakan* - This region comprises two contiguous cold deserts in northern and western China.
e. *Tibetan Plateau* - This region lies in the Himalayas & Karakorams, covering parts of India & Nepal and all Tibet.

The Iranian, Turkestan, Taklamakan and Gobi deserts, and the Tibetan Plateau are in reality a continuous belt. In terms of the socio-cultural aspects of these regions, running west to east in the mountain range under focus, the cold desert pockets beginning at Morocco and reaching up to the Turkestan cold deserts are inhabited by communities that are primarily of Persian descent and follow Islamic traditions. The Gobi and Taklamakan have a mix of the Persian-Islamic communities and the Chinese-Buddhist communities, while the Tibetan Plateau is inhabited by communities that are primarily of Mongolian descent and follow Buddhist

traditions.
Cold deserts in India are a part of the Himalayan cold desert stretch and have been formed primarily due to the rainshadow effect of the towering main Himalaya mountain wall and its offshoot ranges which run in an arc from the Indus gap in the north-west to the Brahmaputra gap in the north-east. The average elevation of this imposing barrier is more than 6000 mts, thus creating an effective barrier against the movement of the rain-bearing SW monsoons to the regions lying to the north of it. There are two physiographic classes of cold deserts in India: the trans-Himalaya which lies across the main Himalaya and is part of the vast Tibetan plateau and the inner dry valleys within the main Himalayan range which lie in the rainshadow zone.

Two physiographic classes of cold deserts in India:

a. *Trans-Himalaya*: The Trans-Himalaya lies across the main Himalaya and physiographically forms a part of the vast Tibetan plateau which lies further north. The average elevation of this region is more than 3000 mts, eg., Ladakh, Lahaul, Spiti, and Pooh.
b. *Inner Dry Valleys*: These are smaller valleys within the main Himalayan range which lie in the rainshadow zone, and are arid regions although not a part of the Trans-Himalayas, eg., parts of Uttarkashi, Chamoli and Pithoragarh in Uttaranchal.

The cold deserts in India are as follows:

- *the Ladakh region* - This includes the districts of Leh and Kargil in the state of J&K. It comprises the valleys of Indus, Gilgit, Shyok, Zanskar, Markha, Rumbak, Drass, Shigar, Suru, Nubra, Khaplu, Salt Lake, and Puga.
- *the northern Himachal region* - This includes the districts of Lahaul & Spiti, Kinnaur, and the Bharmour region in Chamba district in the northern part of the state of Himachal Pradesh. It comprises the valleys of Chandra, Bhaga, Chandra-Bhaga, Spiti, Pin, Sutlej, Hangrang, Ropa, Sangla, Bhaba, Tirung, Gyanthing, Pejur, Keshang, Mulgoon, Yula, and Bharmour
- *tracts in northern UP* - This includes Nilang, Mana & Niti, and Upper Pithoragarh in the state of UP. It comprises the valleys of Jahnvi, Goriganga, Kuti, Chandans, and Darma.
- *North Sikkim* - This includes the Lachung and Lachen valleys in the northern part of the state of Sikkim.

1.3 COLD DESERTS OF THE WESTERN INDIAN HIMALAYAS

The cold deserts of the Western Indian Himalayas are by far the largest cold desert stretch in India. Given below are brief descriptions of the four districts that comprise the cold desert stretch in the Western Indian Himalayas:

a. Lahaul & Spiti

The district of Lahaul & Spiti lies in the state of Himachal Pradesh in northern India. It has an area of 13,835 sq. kms. and a population of 31,294. Keylong is the district HQ. It is one of the frontier districts of India and has a very difficult terrain with ice-fields, snow-covered peaks and a most inhospitable climate. Lahaul comprises the three valleys of Chandra, Bhaga, and Chandra-Bhaga, one great mass of mountains and the Lingti plain of about 260 sq. kms. area. Spiti comprises four distinct regions - Sham is the lower region situated on both sides of the river Spiti between its confluence with Lingti and its junction with Pare, Pin is the valley of the same river located on both sides of the river with about ten inhabited villages, Bhar is the middle region located midway along the river above the

town of Kaza, and Tud is the higher region and includes all the areas above the river Spiti and the waste tracts of Tsarab. The main amongst the numerous rivers in Lahaul are the Chandra river and the Bhaga river which amalgamate into Chandra Bhaga or Chenab river. In the Spiti valley, as the name indicates, the main river is the Spiti. The other famous river joining it is the Pin river which has its source near Bhabha Pass and ultimately joins Spiti Lingti, Gumto and Parechu. The total area of Spiti is 710,081 hac, of which 482 hac is forested, 51 hac is under shrubberies, 1214 hac is the total cultivated land, 158,086 hac is desert land & grasslands and 549,807 hac is the total uncultivated land. The total area of Lahaul is 911,162 hac of which 135,369 hac is under forests. The irrigated, cropped area is 3,375 hac, with 139 hac sown more than once, and 319 hac under miscellaneous tree crops and groves. 218,835 hac are permanent pastures and 4,416 hac is barren uncultivable land.

The economy of the region is at a subsistence level and based primarily on agriculture. Agricultural operations begin in April and end in September before the snow sets in. The traditional crops on the uneconomic holdings used to be barley and buckwheat and pulses like peas, oil-seeds, etc. These are the cash crops even today. However, with the opening of the vehicular roads, people have shifted from cereal crops to commercial crops like seed potatoes. Kuth has also been introduced in the region. Apricots, strawberries, cherries and apples grow wild, although horticulture has not been too successful. Although agricultural productivity is low, due to the intensity of the cold crops do not have to suffer the typical diseases. While, Lahaulas primarily lead an agro commercial life, the Spitians are predominantly agro pastoral, with livestock population outnumbering the human population.

b. Kinnaur

The district of Kinnaur lies at the south-eastern tip of Lahaul & Spiti and consists of an area of 6,401 sq. km. The population is 71,270 (1991 census). The district consists of a series of mountains and precipitous ravines descending rapidly to the bed of the Sutlej. It is bounded on its northern frontier by spurs of snowy mountains which separate it from Spiti and on the east by similar spurs by which it is shut off from Tibet. Sutlej, the principal river of the district arises in the Himalayas and has plentiful and perennial sources of water. It enters Kinnaur district from the Tibetan territory. The main feeders of the river in the district are Lee or Spiti, Baspa, Tidong, Wangar and Darbang, apart from various other small streams, some of which are seasonal.

Traditionally, Nichar and Kalpa sub-divisions were known for their stately cedars and kail trees. This apart, beyond Karchham, large wild forests of chilgoza trees abound and its edible nuts fetch a handsome price and are the main source of income for the locals. Of late, there has been an indiscriminate felling of trees by the ever growing local population and the forest lessees, creating massive erosion problems in the district. Out of the gross area under cropping, as much as 9,659 hectares were under cereal crops. In Kinnaur, the local variety of millets are grown as cereals. In fact, Kinnaur is a highly deficit district as far as cereals are concerned and depends upon import from the other parts of the country through private trade or Government agency, to meet the local demand. This apart, experiments are being carried out for the production of improved varieties of vegetables and pulses, etc. The traditional 'Kinnauri Peas' are being replaced by latest high yielding varieties called Lincoln and Arkel introduced particularly in the villages of Ribba, Rispa, Mebar, Barang, Pawari, Purbani and Lippa. Kinnaur district has a distinct place in the country in terms of quality of apples and temperate fruits like walnuts, almonds, raisins, chilgoza, apricots, etc. Ever since the creation of a separate district, horticulture has been emphasized and encouraged so as to commercialise the traditional agrarian economy. This is evident from the fact that fruit production grew from 300 tonnes in 1960-61 to 4,500 in 1978-79; during the same period,

the area under horticultural production increased from 290 hectares to 2,463 hectares. The state Government is trying to commercialise dry fruits like almonds, chilgoza, raisins, and to popularise it amongst the people. Though the entire Kinnaur district is ornamented by perennial foaming rivers and rivulets, due to the difficult topographical conditions, not much headway has been made in matters of irrigation.

c. Kargil

The district of Kargil has an area of 14,036 sq. kms. and a population of 81,067 (1991 census). This district is distinctly marked as one of the backward areas of the state of Jammu & Kashmir. The altitude of inhabited areas range from 8,500 ft to 13,000 ft. The climatic conditions are severe during winter and snowfall in the Drass region is exceptionally heavy. At times the temperature touches -40°C. This results in the blockade of the roads for more than six months every year from December to June. At other places, rain and snowfall are scanty, on an average not exceeding 15 inches per year. The difficult terrain and topography of the district is a big dampener in the development of the district. There are two tehsils in the district, *viz* Kargil & Zanskar, and seven blocks, namely Kargil, Chiktan, Drass, Sankoo, Zanskar, Shergole and Taisuru. There are a total of 127 villages in the district, out of which 102 are in Kargil and 25 in Zanskar tehsil.

Agriculture is the main occupation in the district and about 91% of the working force is engaged in this pursuit alone. The major crops of the district are wheat and millets. The main source of irrigation is canals and agricultural operations continue to be based on primitive and traditional lines. The introduction of new agricultural methods and distribution of improved varieties of seeds are the main focus of the government for giving the district a boost in agricultural production. Improvements in and extension of minor irrigation facilities are receiving top priority. Considerable attention is also being given to the development of horticulture in the area. The Halman variety of apricots suggests a promising market outside the state. Distribution of budded apricot plants to the fruit growers, fertilisation of fruit trees, sulphur fumigation and hygienic sun-drying demonstration of apricot (Halman variety), and supply of polythene sheets at 50% subsidy for protection of the apricot from rain and dust, are the various measures being taken to improve the export of the fruit to other parts of the country.

d. Leh

The district of Leh in the Ladakh region of Jammu & Kashmir state of India is a culturally and ecologically unique land in the course of transition. 45,110 sq. kms. of land composed of different river valleys amidst high mountain ranges, with the elevation of inhabited areas ranging from 8,500 ft. to 13,000 ft. A cold desert with scarce water and rainfall - among the lowest in the country -, and hot summers at 36° C and freezing winters at -32° C. Hemmed in by the highest of mountain ranges, this region has lived largely undisturbed and self-contained for centuries, much as the neighbouring Tibet. Traditional wisdoms made spirituality and harmony between man and nature a way of life. The two rivers Indus and Shyok flowing through the district do not presently contribute much to irrigation; only the snow-fed nallahs in the district provide water for irrigation purposes. There are five administrative blocks in the district *viz* Leh, Khaltsi, Nyoma, Nubra and Durbuk.

The main source of livelihood for the people in the district is agriculture, supplemented to a large extent by animal husbandry. In view of the climatic conditions of the region, agricultural operations are possible only during summer. These are confined mainly to river valleys and nallah plains. The main crops cultivated are wheat, barley, vegetables and fruits like apple, apricots, etc. Smaller millets are also grown to some extent apart from oil

crops in some pockets as a double crop. The total area under cultivation in the district is 15,338 hectares. To improve the quantity and quality of fruit, good varieties of fruit plants are being supplied to the farmers at nominal charges. Ladakh has great potential for the development of livestock in several rich rangelands in the high altitude areas of the district. The climatic conditions also necessitate the use of animal protein in the form of milk, meat and eggs. The main feature in the livestock of the district is the unique species of animals which are not found in other parts of the country. These are pashmina-bearing goats, yaks, the dzo and dzomo (cross between yak and cow) and Zanskari horses. The livestock is commonly reared in the belts of Changthang (Nyoma Sub-Division), Khaitsi and Nobra. The Changthang belt is famous for its pashmina goats. The altitude of this area varies from 12000 to 16000 feet. A quickly developing sector in the area is that of tourism. Although currently restricted to Leh and some other habitations like Alchi, Padum, Lamayuru, etc., tourism provides supplementary income to several families through transport services, hotels, guide services, and also associated sectors like handicrafts.

1.4 COLD DESERT CHARACTERISTICS

1.4.1 Climate

The climatic conditions prevailing in the cold desert regions vary from dry temperate to arctic. These regions experience two pronounced seasons - a short, cloudless, arid summer and a long, windy, freezing winter. The great Himalayan mountain has a profound influence on the climate of the cold deserts. It blocks the SW monsoons, which are gigantic land and sea breezes, thus making the cold deserts devoid of rainfall. The extra-terrestrial weather systems of Central Asia also have a bearing on the prevailing climatic conditions of the cold desert regions. In winters a high pressure system builds over Central Asia and a low pressure over the Indian Ocean, resulting in the flow of winds from north to south. This causes precipitation in the form of snow in the cold deserts. Blizzards, snowstorms and avalanches are common. Snowfall is very heavy in the upper reaches. Winter sets in early and the first snowfall of the season may be received in mid-October. Winter temperatures of inhabited regions touch -40 degrees Celsius. The northern cold dry winds and western disturbances affect the cold deserts during these winter months, bringing on even more cold since there is no barrier between these and Central Asia. The summer season begins in May depending upon altitude, latitude, aspect and topography, and continues till September. The snow cover in the lower tracts melts, but the higher reaches lie above the line of perpetual snow. With summer, conditions become conducive for vegetative growth and this heralds the start of cultivation. Summer temperatures vary widely and have been known to shoot up to 35 degrees Celsius during the day; night temperatures however drop fairly rapidly. Summers are cloudless and arid and the period from May to October experiences low relative humidity and are generally the drought periods. A short autumn season follows summer, beginning in late September and continuing till the onset of winter in early or middle November. This is the harvesting season for the cold desert inhabitants. Winter is the longest and the most severe season in the cold deserts and it continues from middle November to April. There is heavy snowfall and many rivers, lakes and streams freeze during winters. There is a short spring season between winter and summer. Strong winds blow throughout the year and blizzards, snowstorms and avalanches are also common.

1.4.2 Soil & Water Conditions

There is a vast variation in the geology of the cold desert areas which causes significant changes in the soils of these tracts. The principal soil types of these regions are red & black soils, ferrugenous red soils, brown forest soils, mountain and hill soils, high altitude meadow soils and alpine soils. The nature and composition of soils in the cold deserts depends on- prevailing climatic conditions, nature and type of vegetation, parent rock and dominant geology and topography and terrain. The soil is very fragile and not very productive and the climatic conditions allow a very short growing season. It is shallow, rocky, impervious, has high silt content, and lacks organic matter. The cropped area typically has red and black soils, while pastures and grasslands have brown soils.

Water resources are minimal with the glacier-fed streams the only source of irrigation. Rainfall is very low and in the core zone, it may be restricted to a few showers each year. The total annual rainfall in these regions is usually less than 50 cms, and even lower in some tracts. The bulk of the precipitation received each year is in the form of snow. The glaciers and glaciermelt are the main source of water is the region. The rivers that run through the region are wide and fast-moving, but their high silt content and position vis a vis habitations (typically lower than habitations) disallows their usage for water requirements.

1.4.3 Forests & Terrain

The slopes of the cold desert region are totally barren, with the exception of a few species of shrubs, which are the main soil binders of the region. The lower altitudes experience higher temperatures and water availability is better. This facilitates the growth of broad-leaved species like alianthus, poplars and nitrogen fixing plants like rubenia. Shrubs like Rosa webbiana and seabuckthorn are also common. At higher altitudes the vegetation is sparse with grasses dominating the floral diversity. Willows and poplars grow in the 9,000-12,000 ft. zone. This zone has a huge diversity of plants like Rheum australe, Arnebia euchroma, Aconites, Asters, which are known for their medicinal properties.

The principal forest types found in the cold desert regions are as follows:

- *Himalayan Moist Temperate Forests:* These forests are found mainly in the transition zone between the cold deserts and the main Himalaya. The main species are those occurring in the wetter parts of the Western Himalayas like *Cedrus deodara, Pinus wallichiana*, *Quercusspps, Abies pindrow, Picea smithiana, Rhododendron arboreum, Berberis spps, Princepia utilis, Deutzia spps, Vitis spps, clematis spps, Geranium spps, Senecio spps, Angelica glauca, Heracleum candicans, etc*.
- *Himalayan Dry Temperate Forests:* These forests are found in the drier areas receiving less rainfall. The bulk of the precipitation in this area is in the form of snow, though the elevation may range from 1800 mts to 3000 mts, depending upon local site conditions. The main species are *Pinus gerardiana, Juniperous macropoda, Populus spps, Salix spps, Quercus spps, Alnus spps, Rosa spps, Lonicera spps,Ephedra gerardiana, Artemesia spps, etc.*
- *Sub-Alpine Forests:* These forests are found near the snowline in the cold deserts and the transition zone between the cold deserts and the Himalayas. This zone has the species of *Quercus semecarpifolia, Betula utilis, Pinus Wallichiana, Rhododendron,* etc., and herbs like *Anemone spps, Potentilla spps, Rheum spps, Gentiana spps, etc.*

The growth of trees is stunted in this region because of the extreme climatic conditions.

- *Moist Alpine Scrub:* These forests are found in cold and dry conditions. In this zone *Salix spps, Juniper spps* and *Rhododendrons* dominate and species of herbs like *Bergenia, Potentilla, Aconitum, Asters,* are also common.
- *Dry Alpine Scrub:* These are open scrub grasslands occurring near the snowline in the drier parts of the cold deserts. These are the most common type of vegetation in the core areas and extend upto the line of perpetual snow. The vegetation is mainly dominated by the species of *Juniperus, Ephedra, Rosa, Arnebia, Hyoscyamus, Aconitum, etc*.

The entire area is highly mountainous with several peaks, valleys and passes, and a severely undulating terrain. The region begins from an altitude of 9,000 ft. and altitudes of the peaks soar to beyond 20,000 ft. Habitations are found uptil 16,000 ft.

1.4.4 Socio-Economic Conditions

The cold desert districts have an agro-pastoral economy with potatoes, green peas, hops, millets as the main crops. The cropping season is of 4-5 months and allows a single crop only. The main source of irrigation are the glaciers and water is brought into the fields by the system of kuhls. Kuhls are the traditional system of irrigation, consisting of channels, through which water is drawn from the entry points of the glacier fed streams to the agricultural fields. Horticulture is predominant in parts of the cold desert, for instance Lahaul and Kinnaur with the people growing hops, seed potatoes, peas, apples, apricots, and also kuth in their fields.

The people also rear cows, sheep, goats, yaks and churus for milk, wool and meat, and horses and mules are generally used for transportation purposes. Although there are no natural forests, plantations are raised by the Forest department and progressive farmers of the place, and the timber used for house construction and fuelwood, and the leaves used for fodder. Weaving woolen articles - shawls, carpets, rugs, socks, etc. - is the main craft of this region which keeps the women busy during winters.

People stock all essential items before snowfall. Outdoor activities are not possible during winters and the most common activities include clearing of accumulated snow from the roof tops, looking after cattle and domestic animals, weaving and handicrafts, and social activities like marriages, chankas, etc. The houses are kept warm by burning bukharis using wood, dried plants and kerosene. Majority of the people of the HP cold deserts migrate to warmer places like Kullu and Manali, leaving a few household members to look after the house and the cattle.

Most of the population is into subsistence cultivation. Cash crops, wherever they are grown, provide handsome returns to the farmers. 10% of the population is employed in the government, while another 15% is involved in services and trades, viz, tourist guides, transport and hotel business, masons, etc. Since the arable land is very little, many are involved in petty jobs such as drivers, road labourers, etc., as well. Lack of employment and income opportunities is leading to migration of the better educated from the region.

The society is patriarchal, and a majority of the indigenous population follows Buddhism, although Lahaul has a quaint admixture of Hinduism and Buddhism, and Kargil is predominantly Muslim. All cold desert areas are characterised by strong

cultural values. Having been isolated and insulated for very long, the communities are rather closed and the cultures quite unique. The communities tend to be self-reliant. Marriages and most social interactions are restricted to being within the community. The seasons and the climate are very much a part of community life and even determine it. Summers are used for agriculture and income generation, while winters are used for ceremonies and festivals. People are god-fearing and believe in evil spirits, ghosts, and exorcists. The gompas have a profound influence on daily lives and decisions and the lamas are called in for all celebrations and problems. Although, it is now eroding, in some of the area like in Spiti, the traditional society was polyandrous with all brothers marrying a single woman.

1.5 DEVELOPMENT ISSUES OF COLD DESERTS

Cold deserts face serious disadvantages to their development associated with an interplay of factors such as limited natural resources, remoteness and fragile ecosystems. Therefore they are even more vulnerable than other regions to any impacts on their ecosystems. Given below are some of the key developmental issues of cold desert areas:

1.5.1 Erosion of Traditional Wisdoms

Despite the severe conditions, in the past the people of these cold desert regions not only managed to survive, but were also able to enjoy a life of greater prosperity than that of many other peoples. This is because a strong fabric of practices of sustainable natural resource management. These traditional wisdoms are gradually eroding however, lost in the highway side villages and receding in the inner villages as well. The power and influence of the local level institutions that managed the application of these traditional practices have also eroded over time. The younger generations do not follow these traditional institutions and their norms as the elders did. Many of these wisdoms are documented in the traditional tests of the region; the younger generation however do not know the language of the texts either.

Another factor that affects the application of these wisdoms is their applicability for modern day problems and environment. The pressures of modern civilisation have led to problems not encountered in the past and thus probably not addressed by the traditional wisdoms. The loss of efficacy of these traditional wisdoms have thus led to the disregarding of these as well.

The success of traditional Ladakhi life for instance, is the result of the most prudent and frugal use of the very limited natural resources:
The almost total lack of precipitation means that irrigation is a major problem, and is in fact largely responsible for determining the location of each village. In the absence of pumps, the many rivers that run through Ladakh's deep, barren valleys cannot be used for irrigation purposes, and so the farmer has to rely instead on melt-water from the snow-capped mountains far above. This water is led down through a wonderfully ingenious series of channels (yura) up to five kilometres long, to small patchworks of fields which have been painstakingly constructed out of the very dust and rocks of the desert. Every last square patch of irrigated land is used, since the severe climate allows cultivation for only five or six months out of twelve. In this time the Ladakhis have not only to meet their day-to-day needs, but also to provide enough food for themselves for the long winter months. Although

the land is used to the utmost, no attempt is made to work it beyond its capacity, and the Ladakhis are scrupulously careful to ensure that what is taken from the land is returned. Human nightsoil as well as animal dung is used as fertiliser so that, even without fallowing or crop rotation, good yields are rendered possible year after year. The trees that are grown - the poplar and the willow - are reforested, and not lopped indiscriminately. The glacial streams that provide the water for domestic use are categorised - one may be reserved for drinking, another for washing. The agricultural cycle begins in February and follows the path of the sun. On an eastern exposure high above each village, a large pile of stones in the form of an obelisk (nyitho) acts as an agricultural calender. The point on which its shadow falls below determines when various activities should start. Sowing, irrigating, harvesting are all represented by specific landmarks. In most villages, irrigation is regulated by a churpon, who is appointed or elected from within the village. He operates the flow of water, blocking and opening the canals as required. Householders are allotted a certain period of time every week when they can divert the main channels into their own fields.

1.5.2 Climatic Conditions

a. Harsh, Severe Climate

The climatic conditions of cold desert regions are very harsh. As mentioned earlier, winters are extremely severe with temperatures touching -40 degrees Centigrade in inhabited areas. Bitter winds blow in from the Central Asian plateau, and the terrain lies completely frozen. There are raging blizzards that block the sun out for days. In summer the mercury rises to touch even +30 degrees Centigrade during the day. These temperature extremes and wide variations distress humans and animals, and also cause enormous damage to all infrastructure. Most infrastructure is unable to withstand the stresses of these variations. The area is characterised by very high wind velocities which also does considerable damage to all infrastructure. The working conditions are extremely tough. Atmospheric oxygen is very low. The area is snowbound for a good five to six months of the year and no work is possible during these months. These reduce the work output.

b. Changing Microclimate

The climate of the cold desert region is undergoing subtle changes that is disturbing the life patterns of the inhabitants. Snowfall has been reducing and becoming more unpredictable and untimely. At the same time, precipitation in the form of rainfall has been increasing. These changes are leading to the vegetation and crops being damaged. It is also leading to damage of the houses and buildings and architectural monuments.

1.5.3 Ecological Fragility & Natural Resource Deficiency

a. Land & Soil

The region has vast tracts of wastelands but they cannot be cultivated/afforested due to non-availabilty of water and also some inherent qualities of the soil such as its highly acidic nature (pH 4.5 - 6.5), loamy to sandy texture and primitive stage of weathering. Virgin soil, it has very low organic matter content, and similarly low water retention capability. Although 95% of the population is dependent on

agriculture, the low soil fertility results in low productivity and yield and hence low returns from agriculture. Due to the rugged, mountainous terrain, arable land is limited, and the lack of water for irrigation and irrigation infrastructure is a hurdle for creating more arable land. The hydraulic gradients and rapid stream responses lead to flash floods, destroying land and agricultural produce. High wind erosion and avalanches also cause damage to the land.

b. Vegetation

The cold desert region is ecologically fragile. Geographically recent, it has a high degree of endemic flora & fauna. The climatic conditions support only shrubs & bushes and few trees. The predominant vegetation types are Himalayan moist temperate forests, Himalayan dry temperate forests, sub-alpine forests, moist alpine scrub and dry alpine scrub. There is a very high demand for fuelwood for cooking as well as space heating in the winters. The supply/availability however is highly inadequate in comparison to the demand, and this outstripping demand is fast denuding the hillsides of the little vegetation of shrubs and bushes that they possess. Fodder available for livestock is inadequate and steadily depleting as the common property resources and high altitude meadows are degraded due to overgrazing and the depletion of water resources. The physical burden on women is also increasing due to depletion of water and fodder resources. Access to/collection of these resources requires greater effort today, as the sources are becoming more and more distant. The inadequacy of water also prevents undertaking of wasteland development for energy plantations or afforestation. The region is a habitat of a variety of rare, endangered & endemic plant species that have medicinal & aromatic value. Indiscriminate fodder/firewood collection and lack of conservation measures has resulted in the depletion of this natural wealth. With the degradation of this natural heritage, the related indigenous traditional knowledge is also depleting with few repositories left.

c. Water for Irrigation & Drinking

The main sources of water in cold deserts are glaciers, snowmelt, springs, lakes and streams. Precipitation is very low and evaporation rate very high. Water is an important and scarce resource and thereby affects the status of other resources as well. The region had developed a unique distribution system of construction of kuhls (channels carrying water) and zings (water storage reservoirs) and an effective system of water rights and sharing. They have also developed techniques for creating artificial glaciers and snow harvesting. These traditional techniques however are not as effective given today's escalating water inadequacy. With global warming, glaciers are receding, and streams & springs are drying up. The depleting water resources for irrigation is leading to reducing yield and frequent crop failures, and resulting in impoverishment of the small and marginal farmers. Water has to be drawn over long distances and evaporation losses are very high. The soil has very low water retention capacity, hence percolation ponds have not worked. The water channels - kuhls - are affected by silting and choking in summer and damaged by avalanches in winter. This also results in high seepage and wastage of water. Although sowing has to be done early in summer, given the short cropping season, the glaciermelt is typically not available then, and presowing water is a continual battle for the region's farmers. Although extensive river systems exist, they cannot be harnessed as the terraced fields are located at a higher elevation than the riverbed. The silt content in the water flow is very high as a result of wind and water erosion, and this causes enormous clogging of any lift irrigation mechanism,

rendering it a failure.

Scarcity of water for irrigation and domestic usage is a severe problem in the region. In summers, the glaciermelt which is reducing by the year due to global warming, has to be managed for all water requirements. In the frozen winters, there is an acute shortage of water for drinking; snow has to melted for domestic requirements. Piped distribution of water is also not feasible due to sub-zero temperatures. Women play a key role in managing the water flow/sharing/usage, and have to undergo considerable physical stress due to the scarce water resources. The reducing water resources is leading to crop failures and thus affecting the economy. Decreasing water resources is also depleting the vegetation in the wild. There are serious drinking water problems as well. Water is frequently taken from contaminated sources leading to a high incidence of water-borne diseases.

d. Irrigation Infrastructure

Kuhls and zings are the traditional irrigation infrastructure. Kuhls are essentially channels of great length that channel water from glaciers/streams/rivers to the agricultural fields and village tanks. Since water has to be brought from great distances, there is considerable effort required and cost invested to construct these long kuhls. Local, traditional kuhls are 'kuccha' where the channels are not plastered with cement. Running water cuts the edges and sides of the kuhls, and winters typically damage them because of rockslides or glaciers. Every summer begins with kuhl maintenance which is typically a community activity. Sand and pebbles that flow with the flowing water in the kuhls, tend to block the kuhls or form a layer at their base which causes the waterflow to diminish or overflow to other unwanted directions. Besides, there is considerable seepage and wastage also from the kuhl floors. 'Zings' are tanks used to store water for irrigating the plantations and fields. These tanks are usually of the size of 10m x 10m and located at hill tops. Water is brought into the tanks through pipes from water sources on ridge tops; the water is gradually released downwards into the plantations/fields as it begins accumulating in the tank. Tapping water sources below the field level frequently becomes a problem however. Although certain technologies like hydraulic rams were implemented in certain sites, they have not been successful in the long term. The high silt content in the river water chokes the pipes and prevents waterflow. Most of these hydraulic rams are lying non-operational today.

1.5.4 Environmental Threats

Floods are also a cause of concern in these regions and the region has witnessed devastating floods in the past causing large scale damage to habitations, crops and livestock. For instance, Shansha village in Lahaul has suffered from flood damage to 25-30 bighas almost every year which implied an expenditure of Rs. 45,000-50,000. Moreover the running water also cut into the boundaries of fields causing a shrinkage in the cultivated land. The landmass gets cut from the base and gradually weakens as more water seeps in and cuts off the sides, and ultimately get washed away. The terrain of this region is rugged and the absence of vegetation on the slopes enhances the rate of erosion and also the risks of landslides and avalanches. The high wind velocity also leads to high levels of wind erosion.

1.5.5 Welfare Inadequacies

a. Basic Minimum Services & Facilities

The region has a paucity of the basic minimum services and facilities - for health care, higher education, communication, power, water. Because of the sparsity of population, the providing of these facilities is far more expensive than in other regions, and their reach and coverage is also very low. The establishment costs of infrastructure is very high, due to the terrain, its remoteness, lack of transportation, greater effort required in construction, etc. The operation of whatever exists is hampered by the difficult physical conditions. Maintenance needs are also high due to this, but maintenance is made difficult because of the physical conditions and high costs. The situation is especially pathetic in the snowbound winters- health care centres lie unmanned and unreachable because of blocked roads; schools close completely; communication and power breakdowns cut off the region for months; water in pipes gets frozen. The harsh climatic conditions dissuade competent staff especially in health & education services, leaving several basic minimum services/facilities unattended. Infrastructure for power is especially weak, and there are long periods without power during winters, when infrastructural breakdowns cannot be mended. Communication and contact between habitations also breaks down completely during the winters.

b. Low Development Index

The low levels of literacy and awareness that help a society evolve and become mainstreamed have been limited in these remote and insulated regions. Most women were not educated, although primary education is today common for the girl child as well. There are few graduates and even fewer people taking to professional education. Several inequities and negative customs have therefore tended to persist.

1.5.6 Subsistence Economy

a. Incomes & Livelihood Options

The livelihoods of the people are completely dependent on the natural resource base of the area which is however rather deficient and fragile. The economy of the region is based primarily on agriculture. The climatic conditions allow only one crop, and the shallow, nutrient-deficient soil and inadequate irrigation possibilities restrict the crop yield. Cash crops which fetch higher incomes require more water, and hence can rarely be grown. Landholdings are also small. Hence incomes are limited. There is a considerable amount of dependence on wages from government contracted labour to supplement family incomes. The area is also characterised by a closed economy. Markets for primary produce are far off thus increasing the product price and consequently decreasing the market share & spread. The lack of a market disallows the emergence of any other occupation or livelihood stream, for products would lack viability because of logistical costs. Employment and other livelihood opportunities are very few except in tourism and government contracts; these too are seasonal. The human resource capacity for enterprise development, and professional level of products/services is very low. The sparse population, difficult terrain, fragile ecology and seasonal variations make it difficult to set up large scale industries.

b. No Industrialisation

There are no industries at all in the cold desert region. The conditions of low availability of raw materials, power, water, etc., as well as inadequate labour due to sparsity of population and low technically skilled human resources, makes industrialisation a difficult proposition for cold deserts. The fragility of the environment on the one hand and the difficult logistics and marketing of products also compound the issue. This however limits employment opportunities which typically industries can provide.

c. Short Working Season

As mentioned, the cold deserts are snowbound for half the year. Since cultivation is the sole occupation, livelihood activities can be carried out only for the six summer and autumn months. The period of photosynthesis and plant growth is very limited. This naturally limits the output and hence the incomes.

c. High Cost of Living

Since it is a closed and subsistence economy, material and products produced outside the area is typically not available in the area, and if available, is extremely costly. Cash revenues are also very low since sale of products produced within the area is very low, most of it being consumed by the producers themselves. Labour is expensive since most local people work on their own farms, and hired labour is only available from among the migrant population. Therefore the cost of living, if one were to live a life like in places outside the area, would be very high.

1.5.7 Technology Inadequacy

a. Appropriate Technology for Cold Deserts

Cold deserts because of their features face problems of technology transfer. The closed system makes it almost completely dependent on indigenous and traditional technologies. The uniform development framework applied by the government on the other hand, does not recognise the uniqueness of the cold desert region, both in terms of the problems and the potential. Various technologies for natural resource management or livelihood generation that are in use in other parts of the country, fail in this region, and attempts have not been made to appropriately adopt them to the region's requirements. For instance, solar energy has potential to solve the problems of firewood and power, but the existing technology is suitable only for lighting, although space heating is also a major requirement in the region; during winters, sunshine for recharging of the solar cells is also unreliable. Wind velocities are high and can be tapped, but maintenance is a problem during winters. As mentioned earlier, irrigation technologies like hydraulic rams have also not succeeded because of excess silting. Generation of power and maintenance of most systems is difficult in winters. Large scale power projects cannot be set up mainly due to siltation and high seismic activity.

b. Low Technical Infrastructure

The cold desert areas also lack the facilitative infrastructure that encourages technical improvement and enterprise building. Quality and testing services are not

available, and credit facilities and marketing services are minimal. As a result, the cold desert areas and their products tend to remain in a technological time warp of the past, and risk-taking is low and development pace very slow.

1.5.8 Socio-Cultural Issues

a. Closed Societies

Insulated for years, these cold desert regions have developed highly closed societies. While much that is culturally unique and beautiful has evolved in these insulated conditions, information flow and awareness have been limited. The society has therefore tended to be quite inward-looking and traditional, not evolving at the same pace as other better connected areas.

b. Dependency Culture

Like other tribal areas, cold desert areas too have been provided substantial subsidies in various forms by the government. While this probably facilitated the area to rise out of the poverty trap, continued availability of these subsidies has created a dependence culture among the people. There is a tendency to expect benefits without making the requisite effort for it.

c. High Migration

Since cold desert areas have so many inhibitors of development, the more progressive and ambitious among its inhabitants tend to migrate out from the region to seek their fortunes in the hills and plains south of the region. The effect of this for the cold desert regions themselves are that they lose some of their best human resources who could otherwise have probably taken them further up the development ladder.

d. Border Area Syndrome

Since all the cold desert districts lie along the Indian border, they suffer from several associated problems. Several of the areas have restricted entry to outsiders and are somewhat constrained in terms of freedom of action and movement, compared to other non-border areas. This makes trade and free commercial interactions and logistics rather difficult, which in turn limits economic development of the people of the region. Frequent war-like situations and conflicts and border skirmishes cause damage to life, property and business as well. Further, there is typically a large contingent of the army in the area which is also a drag on the already limited resources of the region.

1.5.9 Pressure on the Ecosystem

Pressure brought about by increasing human and animal population is causing further degradation. The little vegetation is getting depleted. Desertification is escalating, the utilisation of resources turning unsustainable. Accelerated erosion, loss of regeneration capability, and a drop in the productivity of vegetative ecosystems are cold desert issues today. Cold deserts have rich deposits of minerals and semi-precious stones. Indiscriminate quarrying from mountainsides for these has had adverse effects as well with the loss of land that could have been put to more

productive use and of the productive top soil. The already sparse vegetation cover is also removed for this purpose. In the absence of a network of roots to hold the soil, landslides are a common phenomenon in cold deserts. This is aggravated by inappropriate methods of road construction, like blasting. The unique flora and fauna of this region is also being impacted heavily due to excessive hunting and collection - for instance the valuable medicinal and aromatic plants of these regions have received excess attention from drug manufacturers and collection is reaching unsustainable levels.

1.6 MAJOR NEEDS OF COLD DESERTS

The top development needs as expressed by the respondents in the primary data survey, have been classified and presented below.

1.6.1 Ecological Needs

a. Energy Availability

- timber availability from authorised sources to reduce collection from wild
- introduction of alternate energy technologies like solar energy and wind energy
- harnessing the water resources for mini hydel projects

b. Vegetation & Agricultural Land Improvement

- establishment of nurseries for plant resources
- grassland and plantation development for enhancing green cover
- improving utilisation of agricultural land by bringing more land under cropping through land development and irrigation improvement
- enhancing the agricultural/growing season through establishment of greenhouses

c. Environmental Protection

- establishment of infrastructure (check dams/walls) for protection from environmental threats to life and property, viz, avalanches, floods, river water encroachment, landslides
- fencing of plantations and fields to save from encroachment and destruction by animals

1.6.2 Economic & Technological Needs

a. Income & Employment Enhancement

- development of high income employment/livelihood options, for instance, tourism development, horticulture development, and handicrafts development
- facilitating entrepreneurial capabilities and promoting sustainable local enterprises
- facilitating the marketing and logistical aspects for products/services of the region

b. Technology Improvement

- modification of existing practices for improved results, for instance constructing cemented kuhls, distributing improved seeds/breeds
- training to develop technical knowhow in the community
- introducing new technologies like those for alternate energy
- introducing new technologies related to building materials and house construction
- providing facilities for improving technologies and quality of produce/products, viz, testing, technology transfer, quality control services

c. Inputs Availability

- creation of efficient and adequate irrigation infrastructure - lift irrigation for river water, reducing seepage from irrigation channels, creating water storage facilities, and helping to bring more land under irrigation
- helping access to improved quality of inputs- high yield/growth seeds and saplings, fertilisers, good breeds of cattle, nutritious fodder
- improving quality and production, as well as productive season of local resources and produce

1.6.3 Socio-Cultural Needs

a. Community Mobilisation

- mobilising and guiding the youth to constructive activities through youth clubs, and career counselling, guidance & training
- building awareness in the community on rights and responsibilities, areas for development and potential means, and providing training & skill development

b. Culture Preservation

- preservation of antiques and examples of traditional crafts by establishing local museums
- introducing training on traditional arts and crafts and language for children and youth
- preservation and restoration of gompas and palaces by retaining walls, etc.

1.6.4 Welfare & Infrastructure Needs

a. Basic Minimum Services & Related Infrastructure

- ensuring education quality and access to higher education, setting up of high schools in the region
- improving communication and transportation- enhancing road access, enhancing bus service facilities, improving telephone services and enhancing access to them
- improving health, potable water and housing & sanitation facilities- creating perennial potable water sources, improving quality of and access to healthcare facilities, setting up health centres in locations cut off during winters, creating drainage and water treatment infrastructure, improving housing facilities

- improving power availability and establishment of alternate energy for domestic heating and lighting

b. Maintenance of Created Infrastructure

- setting up processes and systems to ensure the regular maintenance and operation of available/created infrastructure

1.7 RESOURCES OF COLD DESERTS

Although the cold deserts are extremely tough areas and have a host of issues that hinder development, they also possess features that have a significant potential in development. Some of these are given below.

a. Alternate Energy Potential- solar, wind, micro/mini hydel

Although the power available is inadequate and its quality is poor, the cold deserts are blessed with various alternate energy possibilities. The level of insolation in cold deserts is very high and sunlight hours are long. Solar energy could therefore be harnessed. Wind speeds are also very high and near habitations, would be relatively stable to enable harnessing for wind turbines. The rivers of the cold desert region have the potential of being harnessed for mini or micro hydel units. The high silt content in the rivers and sand particles in the wind would tend to cause considerable damage to any alternate energy equipment, and this would require some appropriate modifications.

b. Abundance of Land

Most of the cold desert areas (except Lahaul) have an abundance of unutilised land. Although barren wastelands, these vast stretches may be reclaimed for extending agricultural and horticultural activities.

c. Cohesive Society

Several different communities coexist in harmony in the cold desert areas. Unlike other regions, the extent of conflict and strife between these communities and within them is relatively low. Thus for instance, Lahaul has both Hindu and Buddhist communities and Ladakh has several different ethnic groups. This diversity however has not led to the dysfunctionalities commonly observed in such cases. This allows development interventions to be carried out with greater ease. Consensus is developed more easily and in-fighting is rare.

d. Participation of Women

In most of the cold desert communities (except in the case of Kargil), women enjoy a considerably better status than in other parts of India. Since women have proven to be the frontrunners in most development interventions, this is a decided advantage. Women participate freely and can even influence their societies.

e. Habitat for high value medicinal and aromatic plants

Cold deserts are also a habitat for many rare and high value medicinal & aromatic plant species. Several of the species are even endemic to the region. The demand for plant parts is escalating rapidly, and while this is a threat to the cold desert biodiversity if the current practice of wildharvesting continues, it could also constitute an opportunity if commercial cultivation of these species is taken up. Cultivation of the endemic species in the same habitat would bound to be successful, and would also enable closer control on quality and uniformity of the harvested material.

f. Potential for high value horticulture crops

Although the agricultural productivity of the cold desert regions is much lower than plains areas, the dry and cold climate of the region has its benefits. Plant diseases are rare and thus crop failures are less common than in humid and warm areas. The climatic conditions are favourable for several horticultural crops. Apples have been experimented with and proved extremely successful in Kinnaur and the lower reaches of Spiti valley. Kargil grows some excellent apricots and almonds. Leh and Lahaul valleys have been found to have very good potential for cultivation of exotic vegetables.

g. Rich natural & cultural heritage and unique local handicrafts

Cold deserts are also awesomely beautiful lands. The mountains and rivers and high altitude pastures and lakes have enormous tourism potential. These areas also have unique cultures which are additional attractions. Ladakh has already established itself as a world renowned tourist destination. The other cold desert districts too have similar potential and could be developed as high quality tourism destinations. Apart from direct tourism, several tourism associated sectors too have potential for developing as cottage industries, for instance, handicrafts and fruit processing.

h. Rich and extensive high altitude pasturelands

Cold deserts have the largest expanse of high altitude grasslands that grow very high quality fodder for livestock like pashmina goats. Several nomadic communities inhabit these grasslands and rear their pashmina goats on these, producing the highly valued wool. If managed in a sustainable manner these grasslands can support a large-scale wool production enterprise.

2. DESERT DEVELOPMENT INTERVENTIONS - I

2.1 NATURE OF DEVELOPMENT INTERVENTIONS IN COLD DESERTS

Lying in the rainshadow of mighty mountain ranges, difficult and remote, cold deserts have been neglected by the policy-maker, the development worker and the researcher alike. The few, scattered interventions that have been implemented in the cold deserts in India and in other parts of the world may be assessed to deduce the development activities that lead to the desired impacts and those that are required.

Development interventions being implemented in the cold deserts may be categorised into four kinds based on the nature of the implementing agency. These have been studied and an analysis is presented of each. The four categories are:

a. the traditional techniques and practices evolved through generations and followed by the local communities, although eroding currently

b. interventions in use by the voluntary sector functioning in the region, although these are extremely few and scattered

c. interventions in use by various state government departments and other government agencies, which are the primary forces of development in this region

d. national level interventions under the central government, the largest schemes, as for instance the DDP, that are being implemented in the region

For a comprehensive understanding, strategies and interventions being followed in other parts of the world for cold desert development, have also been studied.

In this chapter, a description and evaluation of the first three kinds of interventions, has been provided.

2.2 TRADITIONAL INTERVENTIONS

Traditional techniques of water, land, and vegetation management continue to have value in managing cold desert natural resources. A considerable amount of indigenous research and development has gone into creating this knowledge. They continue to be among the most appropriate methods for local conditions, although some modern inputs could probably be blended with them, to make them more effective for today's conditions and problems.

a. Water Management

Water sources like glaciermelt streams, rivers, and springs would be harnessed. Village locations were usually close to some water source, and every village tended to have a few such water sources that they could access. Glaciermelt would be harvested and channelled

into irrigation canals called 'kuhls', often many miles long, that would carry the glaciermelt to the distant fields. The locals had the skill of divining the best route for a kuhl- a source point and a landing point would be identified and the locals would divine the route that would be shortest, allow continuous flow, and reduce seepage, by putting their ear to the ground. Smallish water storage tanks called 'zings' were used that would harness the glaciermelt through the night, so that water could be released in adequate quantities to the fields during the day. These were also designed so as to allow a natural flow. Grass & soil were used as packings to reduce seepage from kuhls and zings.

The problems with these traditional techniques were that the clay structures were more vulnerable to environmental damage and required considerable labour for annual repairs. Improvements have involved creating cemented kuhls and zings of larger size, which however face the problem of cracking as a result of expansion and contraction due to climatic extremes. Community structures for water sharing are highly evolved, with water rights depending on the status of a family in the community. Typically the water rights depend on the landholding. In Spiti alone, the system has in-built inequity with the 'bada ghars' or the families of the eldest sons having the first right to water; only then do the younger sons get a chance. This has led to a certain amount of conflict in natural resource sharing, as the traditional joint family system is today breaking up.

b. Land Management

All land with irrigation potential, was cultivated. Land development involved terracing on hill slopes. The terrace boundaries were never linearised, but followed the shape of the land; so did the beds on flat stretches. This enabled water to flow in its natural course and reach all parts of the field. Sowing and harvesting followed the sun's movement, and not months and days. Certain sun's position identifying points were marked on the earth by elders (for instance, a stone, or a pole), and when the sun reached that, sowing could begin. Land preparation typically begins in March-April, and sowing is completed by April-May. Harvesting typically takes in October. The land is ploughed post-harvesting and kept ready for the next season. Only local, hardy varieties were grown. The broadcasting method was used for sowing. Only farmyard manure was used; no chemical fertilisers were used. FYM was typically made from a mix of animal and human excreta. Harvesting would be a community effort with all landowners helping each other to harvest. Land rights are inequitous in Spiti (not in other areas) where all land is inherited by the eldest sons alone. The younger sons have to depend on the elder sons, or on fresh allotments by the govt, and this has caused some problems with the break-up of the traditional joint family system.

c. Vegetation Management

While land in and immediately around a village was cultivated, some land about 4-5 kilometres from the village would be demarcated for village use for grazing and fodder collection. These were managed for sustainable by the community through a system of grazing rights. Willow plantations were set up as long as 200 years back in Lahaul- in and around the villages and in fallow areas to address the problem of fuelwood and lack of vegetation. Two poles used to be planted together, and the more successful would be retained. The saplings used to be covered with jute sacks or tins to protect the tender bark and leaves from animals.

2.3 NGO ACTIVITIES

Survey revealed very few NGOs functioning in the area. The sparsity of population, the high transportation and material costs, the difficulty of receiving funding support, the lack of intrinsic capability, are among the issues which deter the growth of the voluntary sector in these districts. In several of the areas, awareness about the existence of the voluntary sector itself does not exist.

2.3.1 NGOs in the J&K Cold Deserts

Ladakh and Kargil have a moderately well-developed voluntary sector. Although the number of NGOs are very few and vast areas are completely unaddressed, the quality of the NGOs, in terms of the level of formalisation and programming, is quite good. Several of these NGOs have been catalysed and even facilitated in the early years by Western tourists visiting the area. The strong programming base and the continuing connections with Western philanthropists and funding agencies ensures funding as well as technical capability updation for programming. These NGOs have established a good rapport with the community and enjoy high credibility. They work in almost all sectors- in fields of sustainable development issues, preservation of the local culture, demonstration of renewable technology in rural areas, promotion of traditional and modern handicrafts, and sustainable agriculture, promoting the cultivation of cash crops such as vegetables and dairy farming, conducting craft training programmes and helping in marketing of the handicraft products, carrying out child focussed activities and environmental interventions.

Among the significant interventions being carried out by NGOs in Leh and Kargil districts are:

a. Food and Farming

NGOs are working on raising awareness about the importance of diversified production for local consumption. This includes among others: a seed-saving programme to promote the cultivation and protection of local varieties of grains and legumes, networking with farmers' groups elsewhere, campaigning about the hazards of pesticides, fungicides and chemical fertilisers, introduction and demonstration of solar greenhouses, enabling villagers to grow vegetables the year round.

b. Renewable Energy

NGOs have developed and demonstrated small-scale, energy-saving technologies, most of which can be built and maintained locally. These include: hydraulic ram pumps for lift irrigation and drinking water, solar room-heating systems to combat the freezing winters, solar water heaters and cookers and photovoltaic power for lighting, micro-hydro installations and small wind turbines for electricity production. This work has helped to generate something of a renewable energy revolution in Ladakh. Many of the technologies have been taken up on a large scale by the government as well.

c. Women's Empowerment

Women of Ladakh have been organised with the twin goals of raising the status of

rural women and strengthening local culture and agriculture. This groups carries out - annual festivals celebrating local knowledge and skills, traditional spinning, weaving and dyeing and the preparation of indigenous food, regular 'clean-up' campaigns aimed at encouraging community responsibility for the environment.

d. Education and Cultural Exchange

These programmes sponsor Ladakhi community leaders to go on exposure tours, meetings, workshops, community theatre and radio programmes, production of Ladakhi-language schoolbooks and a tourist education programme.

e. Handicrafts

Handicrafts co-operatives and training centres have been set up in villages throughout the region, giving farming families the ability to earn a cash income without having to leave the land. The crafts are sold during the summer season to foreign tourists.

f. War Relief

The Kargil War has also brought in some relief work in the form of resettlement facilitation. Families in distress because of destruction of property due to war are helped to reestablish their livelihoods. Basic amenities are provided for immediate needs. Village infrastructure is rebuilt.

2.3.2 NGOs in the HP Cold Deserts

In Lahaul & Spiti and Kinnaur on the other hand, there is barely any voluntary sector activity. There are just a handful of local-level NGOs who typically lack the funding, the scale and the capacity to effectively implement programmes. The NGOs in Lahaul & Spiti focus on preserving, in particular, the unique Buddhist culture of the region. Education is another sector on which NGOs are focussing attention. Health and rural development too are beginning to be accorded some degree of priority. Only four sectors, namely education, health, environment and culture are being addressed by NGOs in Kinnaur. Women and children are the key beneficiaries of their activities. The system of polyandry has made the issue of women's emancipation all the more necessary. Some NGOs are also working for the benefit of the artisans and craftsmen, and some others are targetting farmers. A national level NGO is also working on promoting the cultivation of medicinal & aromatic plants, preservation of the traditional healing system, preservation of the local culture of language, arts & crafts, and water management technologies.

2.4 INTERVENTIONS BY LOCAL GOVT. DEPARTMENTS

Government interventions have tended to be skewed towards land management, with the agriculture and horticulture departments and their interventions, by far the most developed.

a. Water Management

The Irrigation & Public Health department has attempted to bring more land under

irrigation. Water storage tanks and minor irrigation works have been carried out by the department. The cultivation of much fallow land and new allotments by the government to younger sons has been facilitated by the work of this department. Water is sourced for land in water deficient areas. Attempts have also been made to bring technological advancements to water harvesting and distribution in the region- hydraulic rams and lift irrigation systems have been installed - but they have not been successful, and adaptation to local conditions has not been done. Check dams to restrict the rivers' flow from eroding cultivable land, and check walls for the protection of kuhls and tanks, have also been constructed by this department. The department also works on providing drinking water facilities.

b. Land Management

The departments of Agriculture and Horticulture supply agricultural inputs like improved seeds and saplings for vegetables and fruits, fertilisers and pesticides. Some of these have dubious benefits however- people have been moved from the now recognised more appropriate organic farming methods to chemical fertilisers and pesticides, for instance; some high yield varieties of seeds are also extremely vulnerable and need far greater quantities of water. The Agriculture department also supplies improved implements, bins, and helps in the building of grain houses. Subsidies are provided for soil conservation and bench terracing activities. Demonstration farms and fodder and forage development activities are also carried out by this department. The Horticulture department facilitates the growth of apples, almonds, apricots, peaches, plums, hops. It also conducts tribal fairs and exhibitions that showcase products of the region. Training camps and demonstrations are conducted by both departments on advanced cultivation techniques. The Veterinary department also works on fodder and grasslands development.

c. Vegetation Management

The department of Forestry is the lead department for the management of vegetation. Plantations have been set up on many slopes- of salix, poplars, Robinia, and Alianthus species for increasing green cover. Soil conservation activities include apart from plantations, check walls construction, and raising of vegetation barriers. Nurseries have been set up for raising saplings. This department also looks after wildlife management.

2.5 DEVELOPMENT INTERVENTIONS BY ARMY/OTHER GOVT. AGENCIES

Among the other governmental agencies carrying out development interventions in the area are: the Army, and some research institutes/departments. The DRDO and the RRL are the two agencies with significant interventions; in Kargil the Army has also launched the Sadbhavna Initiative to counter the ravages of war.

2.5.1 Field Research Laboratory, DRDO

Field Research Laboratory (FRL), located in Leh, is engaged in the development of appropriate agro-technologies for the cold desert region. Originally established in 1960 under the administrative control of Indian Council of Agriculture Research, it was transferred to DRDO in 1962 to 'wage war' with nature for making hostile terrain of Ladakh reasonably green and productive, not only to sustain its meagre and sparse population but also military and paramilitary forces deployed in this sector. The

FRL's areas of work are as follows:

- Assessment of agriculture potential of various regions with reference to the uniqueness of Himalayas
- Development of agriculture at high altitude, including introduction of suitable varieties by selection and development of practices for increasing production, particularly of off-season vegetables
- Liaison with agriculture authorities, local farmers as well as Army units for development of agriculture
- Improvement of breeds of various animals in high altitude to improve their meat / milk yield
- Introduction and development of poultry under high altitude conditions

The FRL has had several achievements in its long tenure in the cold desert region:

a. Introduction of Vegetables

Several exotic and other vegetables have been introduced. Some vegetables introduced are- Broccoli, Brussel's sprouts, Chinese cabbage, Spinach, Jerusalem artichoke, Mint, Coriander, Fenugreek, Peas, French bean, Capsicum, Tomato, Celery, Parsely, Broad bean, Soybean, Cucumber, Pumpkin, Bottle gourd, Watermelon, Muskmelon, Bitter gourd. Tomato, spinach, mint, vegetable mustard, karam sag, peas, beans, onion, beetroot have already become commercial vegetables in Ladakh.

b. Vegetable Nursery

Standardised protected cultivation has been introduced for raising early nursery of vegetables in order to overcome the limitation of a short cropping period. FRL provides technical know-how regarding protected cultivation and polyhouse techniques.

c. Seed Production Technology

Seeds of biennial vegetables like, carrot, radish, onion, cabbage, broccoli and knol khol have been successfully produced by storing roots, bulbs, heads, knobs, etc. Seed production of annual vegetables, such as peas, beans, lettuce, palak, coriander, fenugreek has been standardized. Emphasis is being given on true potato seed (TPS) technology to boost potato production in Ladakh.

d. Fodder Production

A package of farm practices has been developed to maximise alfalfa production. Three species of Medicago, viz., M.sativa, M.falcata and M.media are being grown extensively in Ladakh. A package for processing, baling and storage of Lucerne has also been developed.

e. Fruit Crops

The germplasm of high yielding varieties of apricots, apples, etc., is being maintained to provide buds for top working of old and poor yielding apricot trees and other fruit crops like almond, walnut, grapes, mulberry and strawberry.

f. Cereals & Pulses

Select varieties of barley (FRL-2) and wheat (LWS/106) are being promoted to enhance cereal production. Suitable varieties of peas, beans, lentil, gram and soybean have been introduced as potential pulse crops. These pulses are also becoming popular in the cold desert valley.

g. Oil Seed Crops

Mustard, Sunflower, Safflower and soybean have been identified as potential oil crops.

h. Forestry

Success has been achieved in greening the cold desert using Poplar, Willow and Robinia. Techniques of their propagation, planting, and post-planting were developed. Nurseries of appropriate species of Poplar and Willow have been established to provide suitable saplings. Transplantation materials of 2 to 3 years old, 6-7 ft long and 1-3 in. in diameter are supplied to growers and others.

i. Cold Desert Flora

Extensive survey of Ladakh and Lahaul-Spiti was done to identify medicinal, aromatic, emergency food, fodder and ornamental plants. The ethonobotanical and ethnomedicinal information of about 1000 plant species have been gathered, identified and verified. The identified plants have been classified as medicinal, adaptogenic in veterinary practices, edible, fodder, ornamental depending upon their uses by the people.

j. Poultry Technology

A high altitude poultry house capable of harnessing sun and soil temperature has been developed, designed and standardised. Suitable breeds like Hubbard, Poona pearl etc have been recommended for broilers and white leg horn for layers. FRL has also extended a helping hand to the Animal Husbandry Department of the state government and the local entrepreneurs.

k. Dairy Technology

Efforts have been made to improve the local breeds of livestock mostly reared by people in this region to be self sufficient in milk, butter, meat, etc. Higher crosses of Holstein Friesian and Sahiwal cows which produce three times the average milk produced by local breed have been recommended. These cows can be maintained even during prolonged subzero conditions without artificial heating.

l. Societal Mission

Nang village of Ladakh was adopted for making the village self-sustaining. Twenty-five hectares of wasteland have been brought under silvipastoral and fruit orchard cultivation to sustain Nang villagers and their livestock. An Agro-technology Centre has been established to help villagers to improve agricultural productivity and ultimately the quality of life. The Agriculture Department of the state government has selected the village for potato seed production.

The Ladakh Kisan-Jawan Mela is organised annually by FRL. The organisation interacts with agricultural research laboratories of ICAR, state agricultural universities, TERI, BARC.

2.5.2 Regional Research Laboratory

The Regional Research Laboratory is located in Jammu that addresses the cold desert Ladakh region, and an extension centre in Palampur that addresses the HP cold desert districts as well, under its programmes of research and development. The mandate of this institute includes:

- To carry out R&D work with a view to helping in industrial development of the North-western region of the country
- To help in optimal utilization of natural resources
- To explore and exploit hitherto untapped resources of the region
- To provide consultancy, testing and equipment design/fabrication facilities to entrepreneurs, industrial establishments and government developmental agencies

The major R&D programmes of RRL-Jammu relate to natural products and organic chemistry; drugs & pharmaceuticals; process development & engineering design; introduction, improvement & cultivation of medicinal & aromatic plants; plants survey; post-harvest technology; biotechnology; food technology; cellulose pulp & board and utilization of mineral resources.

Its significant achievements include:

a. Development of new varieties

The institute has succeeded in developing a new methyl cinnamate rich variety of Ocimum canum Sims., RRL-Oc-12, and a new improved eugenol-rich variety of Ocimum gratissimum Linn., RRL-Og 14. The latter has been released for commercial exploitation.

b. Cultivation technologies

Cultivation practices have been developed for hops, an important ingredient for the beer industry, and also transferred successfully to farmers' lands in Lahaul. A complete village-level package has also been developed for the production of silk.

c. Propagation technologies

The institute has succeeded in developing protocols for the invitro propagation of saffron.

d. Medplants research

A process has been developed for standardized immuno-restorative fraction from Picrorhiza kurroa. A new immuno-stimulant has also been isolated from Tinospora cordifolia.

e. Processing processes

A process has been developed for the manufacture of improved variety of writing chalk with minimal dust. The fermentation parameters for the production of

gamma-linolenic acid on 50 liter fermented scale have also been optimised. Low-calorie canned fruits and herbal concentrates have been developed.

f. Technologies transferred

The technology for the manufacture of fiber boards utilizing agricultural residues has been developed and transferred with a view to providing wood substitute. This technology is suitable for small-scale production. Agrotechnologies for - hops, CKP-25, an improved variety of lemongrass, and Dioscorea composite - have been transferred. Technologies have been transferred for the production of - menthol, particle boards, boric acid and boron trifluoride, phytochemical podophyllotoxin, foods, jams and jellies for diabetic patients, natural food colours, and solar-cum-agrowaste drier for drying of Toria oil seeds.

The institute has well-developed laboratory and research facilities. It undertakes sponsored/consultancy services related to its areas of activity, and provides equipment design/fabrication facilities to entrepreneurs/ industrialists/government agencies. The laboratory undertakes market surveys with regard to availability of raw materials and requirements of finished products, and prepares techno-economic feasibility reports based on the technologies developed by the laboratory.

2.5.3 Operation Sadbhavna

The Operation Sadbhavna was launched by the 14 Corps from Turtuk to Matayen in Kargil district. The operation has brought about a discernible change in the war-hit areas of Turtuk, Kargil, and Drass. It is popular among the people and they look forward to similar projects. While a primary school has no matting or chairs, the Goodwill School set up by the Army has computers, a television and a music system. These schools also provide mid-day meals. Not only is the Army proud of its achievement but the people of these ignored areas are also satisfied with the programme- whether it is a school, a vocational training centre, a bunker or a hospital in Turtuk, Drass, Batalik or Kargil, the residents perceive it as a well-planned development programme.

3. DESERT DEVELOPMENT INTERVENTIONS - II

Apart from the interventions described in the previous chapter, there are some programmes being funded and implemented by the central government, which are also in operation in the cold desert region. Chief among these is the Desert Development Programme (DDP) of the Govt. of India.

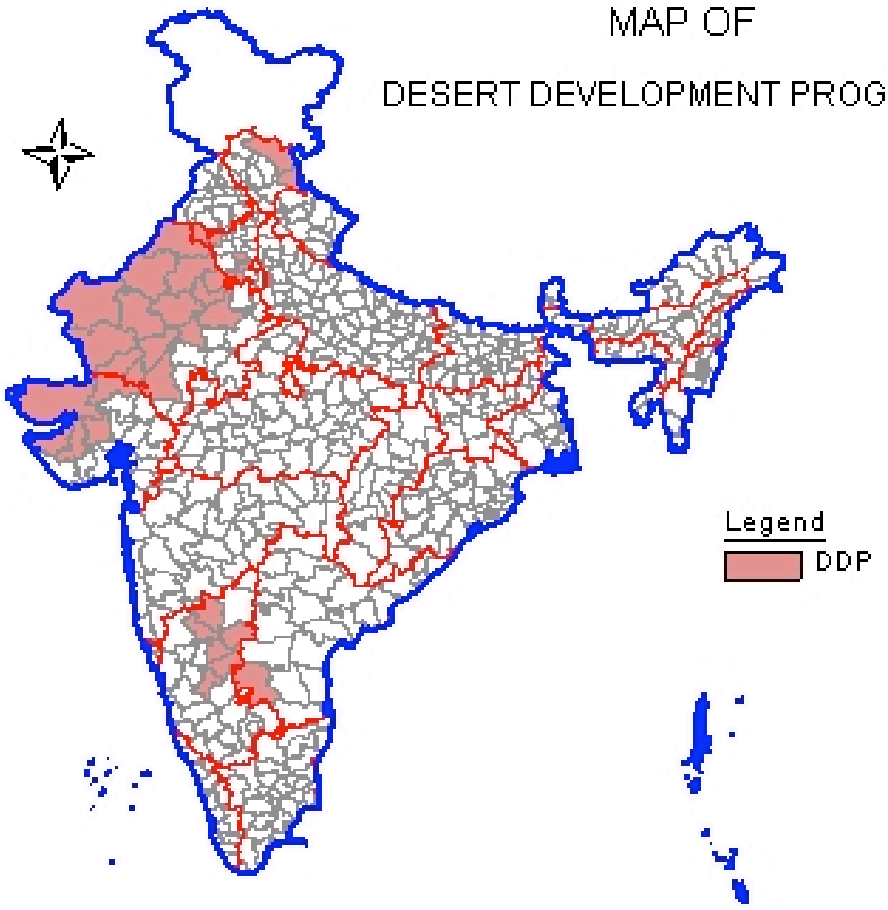
The DDP was started in 1977-78 on the recommendation of the National Commission on Agriculture. The programme was aimed at addressing the issues of increasing desertification, diminishing land productivity and depleting natural resources. The DDP is not just a process of natural resource management. It is a process of total change and development of the target region with the active participation of local communities at all levels from programme formulation and planning to implementation and future management of Common Property Resources. The Programme was started in both the hot desert areas of Rajasthan, Gujarat & Haryana and the cold desert areas of Jammu & Kashmir and Himachal Pradesh. The largest cold desert areas in India are largely in these two states.

Although the Programme had created positive impact in the areas treated, the overall impact in the areas identified had not been upto expectations. Although considerable amount had been spent under the programme and several hectares of land had been treated, this however constituted a small percentage of the total geographical area identified as desert/drought prone. With a view to identifying infirmities in the Programme and also to consider the inclusion of additional areas, a Technical Committee on the DDP and the Drought Prone Areas Programme (DPAP) was constituted in 1993-94. The main reasons identified by the Committee for the far from satisfactory results under the programme was that area development was not taken up on a watershed basis, and the involvement of local people both in planning and execution of the programme was virtually non-existent. Besides, inadequacy of funds, non-availability of trained personnel and taking up of too many activities, which were neither properly integrated nor necessarily related to the objectives of the programme, were also identified as contributory factors towards reducing the impact of the programme. In many cases the funds from these programmes were not separate from the existing sectoral schemes but were used to substitute for them. For instance, the PEO evaluation of the DDP in 1994 found that in Gujarat and Rajasthan over 70% of the expenditure in animal husbandry, 90% of the expenditure under soil and water conservation and 96% of the expenditure under forestry and pastures was from DDP. Based on the recommendations of the Committee, new districts/blocks were included under DDP and a fresh set of Guidelines for Watershed Development applicable to DDP, DPAP, IWDP & EAS (50%) were issued in October 1994.

3.1 DDP OBJECTIVES & COVERAGE

The Desert Development Programme is essentially focussed on activities to arrest the spread of hot and cold deserts. The objectives of the Programme have been to combat desertification and restore the ecological balance of the area, as well as to mitigate the adverse effects of desertification and harsh climatic conditions on crop, human and livestock population. The programme also aims at promoting the economic development of the village community and improving the economic conditions of the resource poor and disadvantaged sections of society through creation, widening and equitable distribution of resources and increased employment opportunities. In hot desert areas, sand dune stabilisation and shelter belt plantations were

given greater weightage. On the other hand, in cold desert areas, the main activity was water resources development by construction of channels for diversion of waterflow from the glaciers and springs to the fields.



The DDP objectives:

- developing desert areas on a watershed basis based on land capability, site conditions and local needs
- sustainable utilization of natural resources that will prevent further ecological degradation and desertification and encouraging restoration of ecological balance
- mitigating the adverse effects of drought and adverse edapho-climatic conditions on crops and livestock, and productivity of land, water and human resources
- improving the socioeconomic conditions of the resource poor and disadvantaged sections of the village community viz. assetless, women etc., through creation, widening and equitable distribution of the resource base and increased employment opportunities
- encouraging village communities for sustained community action for the operation and maintenance of assets created and further development of the potential of the natural resources in the watershed
- promoting simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials
- employment generation, poverty alleviation, community empowerment and development of human and other economic resources of the village

The end results of the project are expected to be -

- *Participation* - All activities are carried out with the active participation of the local people.
- *Community Ownership* - The user groups/panchayats have planned and implemented the project and created the assets, and have taken over the operation and maintenance of the assets created.
- *Capacity Building* - The watershed development committees have been trained adequately so as to discharge their duties efficiently on withdrawal of the watershed development team from the project.
- *Economic Benefit* - The village community have been organised into several homogeneous groups for savings and other income generation activities.

The 7 states in which the Desert Development Programme is under implementation are the hot desert regions in the states of Andhra Pradesh, Gujarat, Haryana, Rajasthan and Karnataka, and the cold desert regions in the states of Himachal Pradesh and Jammu & Kashmir.

3.2 THE IMPLEMENTATION PROCESS

3.2.1 Method

In the year 1987, the DDP adopted the watershed approach. Three major shifts were brought about in the design of the scheme at this stage:

- *Watershed Approach*: The region was demarcated into watersheds with one to five villages in each watershed, depending upon the size of villages, and planning and implementation of the development activities was carried out at the level of these watersheds. Thus smaller, physical layout determined areas formed the basis of planning and implementation.
- *Participative & Community-Based*: The approach was made participative. The entire responsibility of implementing the project was bestowed upon the local people with technical expertise from the line departments. Watershed committees with representation from every village in each watershed area were made responsible for the project planning and implementation. The ultimate beneficiaries were to decide on the activities to be carried out based on their needs.
- *Ecological & Economic Development*: The watershed approach also implied a shift from eco-development to comprehensive regional development, including socio-economic development. Activities could include those which addressed the socio-economic development needs of the disadvantaged and marginalised tribal people.

The major elements of the new strategy are:

- area development under the Programme will be on watershed basis only
- in areas where it is not physically possible to demarcate a watershed, the Programme is to be implemented either by adopting a cluster of villages or an Index Catchment as the unit of planning
- there would be direct anticipation of the local people in planning and development of watersheds and maintenance of assets after the project is through
- Panchayati Raj Institutions have the right to monitor and review the programme at the district, block and village level

In the year 2001, the Guidelines of the Programme have been reformulated to ensure:

- programme-specific and focussed project approach

- greater flexibility in implementation
- well-defined role for the state, district and village-level institutions
- removal of overlaps
- a provision for keeping the watershed development projects on probation
- an 'exit protocol' for the PIAs
- a 'twin track' approach to the implementation of projects
- seeking a combination of GO/NGO as PIA
- a greater role of women
- an effective role for the Panchayati Raj institutions
- bringing to centre-stage SHGs comprising rural poor, especially those belonging to SC/ST categories
- establishing a credit facility from financial institutions
- transparency in implementation
- effective use of remote sensing data furnished by NRSA

Under the prescribed approach, areas of the size of 500 hectares, forming a watershed, with three to four villages in it, are selected for implementing the programme. These areas are identified and selected by the watershed development team in consultation with the village panchayats. The Watershed Development Team is a multi-disciplinary team, which assists the PIAs in carrying out its duties. Watersheds are selected on the basis of acute shortage of drinking water, large population of scheduled castes/tribes, preponderance of wastelands and common lands, and low level of wages in the area. All works/activities that are planned for the treatment and development of the identified problems in the watershed areas are to be completed with the active participation and contribution of the user groups. The maintenance and operation of the assets created is the responsibility of the local people and the Government made sufficient administrative and financial arrangements for it. Formation of Self Help Groups comprising of 50% of the watershed community is emphasized; separate Self Help Groups for disadvantaged groups - women, agricultural labour, shepherds, etc. - are also emphasized. All the watershed areas are to have watershed committees comprising of local people/user groups and all the members of the committees will be given orientation and training so as to upgrade their skills to discharge their responsibilities efficiently. There is a nodal project implementing agency at the district level which administers and coordinates the implementation of the programme. The importance of involving voluntary agencies, research bodies, private and public agencies has also been emphasized.

3.2.2 Institutions

At the Central level, the Department of Land Resources, Ministry of Rural Development, Government of India administers the Desert Development Programme in the country. At the State level, there are Departments/Commissionerates of Rural Development / Area Development / Special Schemes & IRD to look after the Programme. In some of the states, the state government Department of Agriculture looks after the DDP. In every programme district, there is a nodal agency like the District Rural Development Agency (DRDA) or the Desert Development Agency (DDA), responsible for the implementation of the programme. These agencies are supposed to play a pivotal role in the overall implementation of the programme. The agency can select voluntary agencies as Project Implementing Agencies (PIAs) or in the absence of any strong NGO, implement the programme through the line department functionaries of the district.

Under the new Guidelines for Watershed Development issued by this Ministry,

Panchayati Raj Institutions also play a key role in the programme. DRDAs / Zila Parishads / Zila Panchayats prioritize and select the villages / watersheds for development under the programme. Panchayati Raj Institutions, if they so decide, can involve themselves in the actual implementation of programme as Project Implementing Agencies (PIAs) as well. Watershed Projects are planned and implemented by the Watershed Association which comprises all adult members of the Gram Panchayat, and a Watershed Committee which is a nominated body of the Watershed Association, with the help of a multi-disciplinary Watershed Development Team (WDT). After completion of the Watershed Project, the Watershed Association and Watershed Committee continue to function for the maintenance of assets through a Watershed Development Fund created by contributions from user groups and Self Help Groups. Apart from Panchayati Raj Institutions, the Watershed Development Programme envisages and ensures a greater role for voluntary agencies in planning and implementation of Watershed Projects as PIAs.

THE DDP CHANNEL

Central Govt. (MoRD)

State Govt.

District Administration

DRDA/DDA

PIA - NGO/Line Dept

Watershed Development Team/ Watershed association/ Watershed committee

Panchayat/Community

The General Guidelines of the Programme in brief:

- Watersheds to be selected for watershed development should have an area of 500 HA.
- Assignment of the watershed functionaries is to take place 6 months before the watershed is taken up for development activities.
- 3 months of multidisciplinary training is to be provided to the watershed functionaries.
- 3 months are to be spent on survey and preparation of the microplan.
- Multidisciplinary Team (MDT) of block level officers. to be based at the taluk/block HQ, will be constituted to assist the WDT with technical aspects of the microplan preparation.
- 25% of the watersheds should be entrusted with voluntary agencies for implementation, for facilitating people's participation in the programme.
- The main thrust of the activities under the programme should be resource regeneration.
- The planning allows for flexibility as per the choice of the people but a list of activities to be discouraged should be prepared and approved by the district level committees.
- Maintenance of plantations may be permitted for 5 years.
- Moisture Index for areas to qualify for implementation of DDP is < -66.7, i.e., ecosystems that can qualify to be called arid ecosystems.
- If the area irrigated is more than 50% of the net cultivated area in an arid ecosystem, such areas should be excluded from DDP.
- In an arid ecosystems, all areas with irrigated land upto 30% can be included in the DDP.
- In arid ecosystems, areas that have irrigated land of 55% and above, but in which resource degradation is severe, can be included in DDP as special cases.

- Within a period of 10 years all the villages may be covered by covering 1/10 of the number of villages every year.

3.3 DDP - ACTIVITIES & INSTITUTIONS

3.3.1 Project Activities

The major activities of the Desert Development Programme prior to the adoption of the watershed approach, was afforestation in the wastelands, village common lands and other government lands. Water was sourced from rivers and streams to irrigate the plots and a 'mali' was employed for the tending of the plantations. Some irrigation works were also done to source water in the deficient areas so that agriculture and afforestation activities could be carried out. Under the watershed approach, people's participation was mandatory and funds were released directly to the watershed committees. All activities were based upon the critical needs of the region and the benefit to the indigenous communities was the main criterion for selection of activities. The watershed committees decided on the activities to be done, and also identified the villages and sites where the work was to be carried. The various activities covered diverse fields in the district and all the important aspects of rural development and ecological upgradation were taken up.

a. Entry Point Activities

This is the first step in the implementation of the project. This component is important to ensure participation of the communities in the programme. Under this, a funding of Rs. 1.5 lakhs is allowed and various need based development works are carried out. Most of the watersheds have built community halls, school rooms, mosques, imambaras, monasteries, cattlesheds, roads, paths, or purchased tents, crockery, or repaired existing structures. In Leh and Kargil, the EPA funds have been utilised for alternate energy projects as well- for instance, solar energy applications. This helps in building goodwill and trust with the community and makes implementation of project activities easier.

b. Forestry

Under this programme, raising of plantations and pasture development have been the main activities. Various plantations of salix and poplars were raised in the village common lands, other wastelands and Government land. In certain areas of Leh and Kargil, individuals were also provided with seedlings for planting in their private lands. The major afforestation works were carried out in areas which had sources of water, and consisted of areas mainly in river beds and in barren areas near streams and rivulets from where water could be channelised into the plots. All the plantations were raised by the local system of planting two poles of one meter length in pits. The poles were watered everyday till they were established and the best of the two poles were retained. Several plantations of seabuckthorn were raised, the fruits of which are used in jams and chutneys. The line deptts employed 'malis' for tending the plantations, where they were the implementing agency, while plantations raised by the community were maintained by the households in the implementing areas. In parts of Kargil the concept of social conservation has been implemented where the community members protect the endangered plants of

the region and also impose fines on defaulters. The afforestation efforts have really helped in greening the deserts but many potential areas still lie barren and should first be treated for soil conservation and environmental protection, and then have plantations established on them.

Pasture development activities have been carried out on village lands for enhancing the fodder availability. Improved seeds of exotic and indigenous grasses have been provided by the Agriculture and Forest departments which have helped in increasing green cover, checking soil erosion and also providing sufficient fodder to the people. Tending has been the responsibility of the local people, and all protection and management measures like boundary walls to prevent grazing animals from entering the plantations, sourcing of irrigation channels, etc., were covered under the scheme.

c. Agriculture

The Agriculture department has facilitated agriculture development through various activities. Superior quality agricultural inputs have been made available. These have included improved seeds of vegetables - for instance, for green peas, potatoes and the like, - distribution of seeds of high yield/fast growth varieties of crops, and distribution of fertilisers (Monosol) and pesticides. Land development has been facilitated for bringing more land under agriculture and thus enhancing local yield and incomes. Terraces have been constructed on sloping hillsides to enable cultivation, and new allotments of previously fallow land have been made cultivable through land development activities. Community farms have been encouraged on such new allotments. Some training has also been provided to farmers on appropriate farming techniques.

d. Horticulture

Horticulture has been a thrust area in the project. People are cultivating new varieties of crops and vegetables like cauliflower, cabbage, spinach, potato, carrot, pumpkin and beans, and the short production duration of these species allows two crops in a year. The returns from the sale is high and people are now confident about cultivating these cash crops. Cultivation of fruits is another thrust area. Apricots has been grown for several years now in Leh and Kargil. People have also started growing strawberries, apples, figs, almonds and chestnuts in these regions. In the lower belt of Spiti, Pooh and most of Lahaul, horticultural activities have been started with the raising of apple and apricot orchards and cultivation of vegetable crops. Orchards have been set up in the land owned by a number of villagers and are known as “community gardens”. The horticulture department has provided the community with information and technology on various aspects of orchard raising and management like selection of site, plantation technology, choice of cultivars, irrigation and plantation management techniques, etc. The people of the district have also begun growing vegetables in their fields apart from the traditional crops of peas and potatoes. The various vegetable crops under cultivation are carrots, hybrid cauliflower and cabbage, turnips, radish, tomatoes and cucurbits. The Agriculture and the Horticulture departments provide the farmers with improved seeds and fertilizers and also technical knowhow on various aspects of vegetable growing. The Horticulture department also provides allowances for land development, pit digging and planting material according to Government norms.

e. Irrigation

As the major problem of the region is the shortage of water for irrigation, every watershed area has worked on building kuhls (irrigation channels) to divert water from the entry point of rivers and streams fed by the melting water of the glaciers to their fields. Construction and maintenance of kuhls is a regular activity taken up under the project. Every house has to send representatives for the construction of kuhls and raw materials are also arranged by them. The size of a family's holdings determines the number of representatives the particular household has to send for kuhl construction/maintenance. In Spiti, only the 'eldest son families' ('bada ghars') or inheritors of land, take part in this activity. In other areas, nearly all families own land and therefore all households have to send members to contribute towards the construction of kuhls.

Water is the most valuable natural resource of these regions and the reduced levels of snowfall over the last three years have resulted in the melting of the permanent glaciers and drying of natural springs and streams. This has resulted in a severe shortage of water for irrigation and in certain villages drinking water has also become scarce. Therefore many existing kuhls had to be extended to the new source heads. The concept of snow harvesting has been introduced in the regions of Leh and Kargil, to counter the problem of reduced snowfall by preserving snow artificially. This technique is also beneficial in providing early season irrigation water after sowing in the month of April, before the melting of the high altitude glaciers. This has resulted in solving the problems of the people of the region to a great extent, and in the district of Leh this is the major activity in almost all the watersheds.

After sourcing of water, its sustainable utilisation is also important. Cemented kuhls have been introduced which are more efficient with lower levels of seepage and less annual maintenance expenditure. 'Zings' have been constructed to store water for irrigating the plantations and fields. Most plantations that have been established under this scheme have accompanying zings constructed. Bigger reservoirs have also been constructed which can service larger areas spread over 9-10 households at a time. Percolation tanks have also been constructed which help in recharging groundwater and in forming water bodies in the lower zones. In the process of transporting water to the lower areas, desilting tanks are constructed, to prevent silt accumulation inside tanks and reservoirs.

f. Soil Conservation

To counter the washing away of agricultural lands by rivers, check dams and spur walls have been constructed. Spur walls are constructed in the areas where river water cuts into the edges of fields and reduces the size of the holdings. These walls are constructed at the base of the soil mass so that the base is stable and the running water is diverted towards the middle of the river. Protection bunds have also been constructed in the slide and avalanche prone areas with the objective of reducing the speed of the rolling mass. Check dams have also been constructed in the areas where seasonal streams flood the areas. These structures are constructed at angles of 30^0 against the flow of the water to divert it from the inhabited areas and agricultural fields towards the original direction of the flow. These structures are also constructed on the road sides and steep slopes to hold the soil and to prevent the movement of the soil and glaciers. In certain watersheds of Kargil vehicular culverts and foot paths have been constructed over the streams and rivulets for easy access to the villages.

g. Animal Husbandry

Animal husbandry is an activity being implemented in several watershed areas. Efforts have been made to introduce improved breeds of cattle and goats in these regions. In Lahaul & Spiti, Jersey cows have been provided for better and higher milk production while yaks and pashmina goats have been provided in the watershed areas of Leh and Kargil. Cattle and animal sheds have been constructed in the high altitude pastures for protection from wild animals. Special sheds, with provisions for addressing the freezing temperature at high altitudes, have been developed for pashmina goats. Pashmina goats are a high priority activity in Leh and Kargil, as they have potential to provide enhanced incomes to the people and goats introduced from the Changthang region of Ladakh have been successfully reared in the lower regions of Kargil. Poultry farming has also been encouraged to boost the economic conditions of the people. For proper tending and nutrition of the livestock population of the district, the local population have set up fodder farms where quality fodder is grown and made available.

h. Protection & Maintenance

The plantations have boundary walls which prevent the grazing animals from entering the sites. The boles of the trees planted are covered with tin sheets or heavy cloth in the younger stages to prevent cows and goats feeding on the bark. The check walls and check dams are covered with cracked wires so that they remain in position and are stable. The kuhls are repaired every year and and the broken parts are constructed anew. A special maintenance fund has been created, comprising of 5% of the total cost of the works.

3.3.2 Institutions Created

- *WDT*: Watershed Development Teams have been constituted in all cold desert districts. The teams include members from the community, i.e., watershed committee leaders, and line department staff as well. The effectiveness of the WDT varies from district to district and is based on the quality of leadership of the watershed committees as well as the technical capability and participative orientation of the line department staff. The training required for developing the required competencies in the WDT members has however not been given to the required level.
- *WA/WC*: Watershed Associations and Committees have also been constituted in every watershed. The quality of operations of these institutions also varies based on the quality of leadership of the WC, the extent of time and attention given by the WC leaders, and of course, the quality of mobilisation by the PIAs. As in the above case, the required training inputs have however not been provided to the WC members towards enhancing their capacity.

3.3.3 District-wise Highlights

a. Leh

- *Innovations for early season irrigation*- The major activities under the project have

been to do with the sourcing of water for irrigation. The major problem of the people of the region is the shortage of water for irrigation in early spring, during the months of April-May. With snowfall reducing every year, the glaciers have receded to greater heights, which melt in the months of June-July. This gap in the requirement of water has been covered by harvesting snow in relatively flat areas and utilising it for the early season irrigation. This has enabled the people of the region to sow their fields at the start of the season before the melting of the glaciers and even get two harvests in a year.

- *Irrigation infrastructure*- Kuhls and irrigation channels were constructed for providing water to new sites for land development works and also to augment the existing water supply. Water harvesting and storage structures like tanks and zings have also been developed for both efficient utilisation and storage of water. All infrastructure developed is of superior quality and several innovations have also been implemented. Water reservoirs have been constructed with silt-flushing mechanisms and improved kuhls with raised head works that allow the kuhls to have water in them in spite of changing water levels in the stream have been constructed.
- *Afforestation for fuelwood & fodder development*- Afforestation has involved planting of willows and poplars for fuelwood. Fodder improvement activities have also been among the main activities and has involved cultivation of alfaalfa for fodder. The introduction of this fodder species has significantly mitigated the problem of inadequacy of fodder, and the ease of cultivating it and its palatability as fodder has given it a large scale acceptance. Improved fodder and fodder farms have been provided to the nomadic pastoralists of the region. These activities have eased the problems of fuelwood and fodder and have also saved considerable amount of time in sourcing them. It has helped the pastoralists to be self sufficient and reduced their spending on fodder and fuelwood.
- *Animal husbandry for pastoralists*- Animal husbandry is a major thrust area in the region and people have been provided with improved breeds of cattle, sheep and goats for income generation. The PIAs are also arranging veterinary camps for animal check-ups and treatment in the Changthang region, where pastoralism is the main occupation.
- *Facilitating agriculture*- Direct agricultural development work has not been done in the region. Only facilitative activities for the enhancement of agriculture have been carried out. The project has addressed the problems of water for irrigation and thus contributed to enhancing crop yield.
- *Training on enterprise skills*- Women's groups have been constituted in several villages and these groups are provided training on enterprise related skills like carpet making, tailoring, etc. These are appreciated, although the duration is felt to be too short.
- *Focus on available agricultural land*- The region of Ladakh is characterised by broad valleys and open lands and has a lot of potential for new areas development. People are however concentrating mainly on areas that lie within the boundaries of villages and near inhabited places.
- *Good community rapport and social mobilisation*- The WDTs have built excellent rapport with the community members and all activities are well planned with proper PRA activities leading to microplanning and social mobilisation. The people of Leh are highly motivated and are united in the implementation of the programme.
- *Institution creation*- Watershed committees have been formed in all the project implementing areas and are functioning well. Members understand their role. The level of awareness and participation is very high. Both men and women

participate.

b. Kargil

- *Fighting drought*- The Kargil region has been experiencing extreme drought conditions and the various interventions carried out for sourcing water have not been able to successfully address this problem. Huge areas have been identified and infrastructure has been created for the purpose, but the receding of glaciers and drying up of natural springs have substantially reduced the available water, which is today not even enough for irrigating agricultural fields. People have constructed kuhls, storage tanks etc., but they are dry. The Batalik region especially is facing such a severe drought that the government even has to distribute drinking water.
- *Focus on water management*- The project focus is on sourcing water for agriculture, forestry and pasture development. Apart from kuhls, people have also constructed water storage tanks and percolation tanks, linking these to the kuhls. However as mentioned above the severe drought in the region is a major hurdle for the project.
- *Problems in snow harvesting*- The snow harvesting concept has not been very successful in Kargil excepting for a few selected areas. This is primarily because the terrain of this district is much more rugged than that of Leh. A traditional technique of delaying glaciermelt and thus facilitating glacier enhancement by laying sawdust and charcoal on glaciers, has been attempted, but the paucity of snowfall has rendered this a failure.
- *Plantations*- Plantation and afforestation works have been carried out very well in Kargil, but the present dry spell is drying up the young and new plantations. Fodder trees like Robinia and Poplar and improved fodder grasses like alfaalfa are also being grown.
- *Improved breeds*- Improved breeds of pashmina goats have been introduced in the region and they are performing exceptionally well even under the changed conditions of altitude and temperature. Yaks have also been provided for the purpose of breeding.
- *Animal shelters*- An innovative intervention in Kargil is that of predator proof animal shelters for high altitude areas. This addresses the sudden climatic changes that come about in these regions when pasture site animal shelters are required.
- *Slide control*- Soil and moisture conservation works have been done in the problem areas, by constructing check dams, spurs, cracked walls, retention walls, etc., to prevent landslides and stabilise the soil in fragile areas.
- *Ravages of conflict*- However, after all the efforts to make the programme a success, the Indo-Pak war at Kargil and the continuing conflict in the region has seriously affected the implementation of the scheme. The programme was delayed by more than two years because of the war. All structures created under the project - kuhls, retention walls, check dams, storage tanks - were damaged due to shelling. People had abandoned the villages and all activities had been suspended. Fields dried up and all expenditure on improved crops and fodder was wasted. The watershed scheme has however been utilised to address the problems caused by war as well. For instance, repairs to village infrastructure, winter coaching classes for children who had to miss regular school due to war.
- *High level of motivation & cooperation*- The people of Kargil recognise the value of this programme and are united in the watershed project as it directly involves the community in planning and implementation. They have carried out the works excellently and in a harmonious manner with the entire village population

benefiting.

c. Pooh

- *Effective demonstration plantations*- Community plantations have been raised and forest nurseries have been created in various watersheds. Plantations of poplars and apples have been raised for maximum demonstration effects.
- *Irrigation & moisture conservation works*- Plans have been developed for sourcing water for irrigation from rivers and glaciers. Similarly, moisture conservation and winter vegetable production schemes have been planned and will soon be implemented.
- *Enterprise SHGs*- SHGs have been created for crafts and other enterprises in the area. The SHG members have been educated and awareness and planning sessions have been carried out. As a result, the participation level and the involvement of the people in these SHGs is appreciable.
- *SHG constitution*- SHGs have been formed in many watersheds involving women's groups. These groups have been mobilised and educated and are highly motivated. The revolving funds of the project are used by these SHGs for enterprise development and socioeconomic upliftment.

d. Lahaul & Spiti

- *Community horticulture*- Community gardens of apple have been raised in the lands of farmers The community is taking keen interest in this activity, perceiving its potential in boosting the income of the local population. The conditions for growing apples is favorable in the district and the people are also maintaining the orchards well.
- *Cash crops*- Vegetable growing has been started in a few select pockets in Kardang, Piaso and Shanshah villages in Lahaul, and Poh, Pomrang and Lava villages in Spiti. Inadequate irrigation facilities in other villages have restricted this activity to a few villages only.
- *Irrigation infrastructure*- In keeping with the critical issue in all cold desert areas, irrigation infrastructure of kuhls, tanks and zings have been created and/or strengthened. This activity has had an enormous beneficial impact, enhancing productivity, both human and of the land. New technologies that reduce the annual maintenance required for kuhls are also being attempted with some degree of success.
- *Plantations for fuelwood*- Plantations have been established of the popular willows and poplars in village common lands as well as in some slide prone areas. These have the benefits of binding the soil, reducing erosion and landslides, and providing wood for domestic fuel and for construction works. Some plantations have been established along with irrigation facilities like tanks, and these have demonstrated higher degree of success.
- *Erosion checks*- Spiti has established several check dams where the river cuts into agricultural fields. In Lahaul retaining walls have been created on slide prone slopes, especially those that lie near habitations and thus are a threat to life and property.

3.4 PROGRAMME PERFORMANCE

3.4.1 Programme Effectiveness

a. Positive Performance Activities

- *Entry point activities*: All entry point activities have been implemented successfully. These entry point activities include: construction and repairs to village structures, repairs and refurbishing of schools, and development of village community lands. The reason for the relative success of these activities is that the motivation level and enthusiasm is high at the start of the programme. Most entry point activities are besides those for which there is a very high level of consensus in the community and there are equitable benefits. These activities typically require only establishment effort, not maintenance effort.
- *First stage activities in land & water management and animal husbandry*: The first stage activities in all the interventions associated with land, water and animal management, have been carried out well. Thus saplings have been distributed, HYV seeds have been distributed, boundary walls have been constructed, high wool yielding species animals have been distributed. First stage activities typically require only an intent to work on some activity on the community/beneficiary's part. The only things involved at this stage are funding and coordination by the PIAs.
- *Kuhl construction*: Irrigation is recognised by all as a critical need and irrigation related interventions are felt to provide immediate economic benefits. Hence construction of water channels has been done in several places and in an effective manner.

b. Areas needing Performance Improvement

- *Community mobilisation and capacity building*: Community mobilisation and training for capacity building and empowerment has not been effective. Even if initial mobilisation may have been done for the entry level activities, the sustenance of the community enthusiasm and involvement has not been achieved. In several places, capacity building has been left till the end of the project period. The level of participation and leadership provided in the community is also rather low.
- *Second stage activities in land & water management and animal husbandry*: While first stage activities that initiate any intervention have been carried out well, the second stage activities that actually complete the activity and ensure benefits for the community have not been carried out effectively. For instance, seeds and saplings have been distributed, but plantations have not been established successfully. This indicates lacunae in mobilisation for sustaining community participation and interest and supervision of works.
- *Maintenance activities*: Most older assets are in a bad state of disrepair. For instance, tanks constructed are not maintained, plantations established have not been tended. Neither the community, nor the PIAs have given adequate attention to the maintenance of created assets and infrastructure. As a result, much of the benefits of the programme, tend to peter out with time.
- *Long-term benefit activities*: Activities that do not provide immediate benefits are not attended to and not given adequate importance. Although the community may recognise the value of social forestry for wasteland development for instance, the fact that the activity would not deliver any direct, immediate, economic benefits, makes it neglected.

3.4.2 The Thrust Areas & the Neglected

The physical target and achievement analysis reveals that land development has been the thrust area, closely followed by water management, and afforestation & pasture development. Agriculture, animal husbandry, and fishery, were least targetted, and development research had no funds allocation at all. The financial target and achievement analysis has shown that maximum resources were allocated for land development activities, followed second by water management, and then by afforestation. Project administration came a fourth. Training and community organisation make their appearance only at the end of the five years period, not at the start as would be desired.

<u>Thrust Areas</u>	- land development- *although the focus has tended to be on existing agricultural land*
	- irrigation channels and storage tanks
	- willow and poplar plantations
<u>Neglected Areas</u>	- community organisation and training
	- agriculture & horticulture- development of cash crops
	- animal husbandry- veterinary care, fodder farm establishment

3.4.3 The Good & Not-so-Good Watersheds

Analysis revealed the following major determinants:

a. the appropriateness of the design of the infrastructure/assets created

The quality and sustainability of and benefits given by any asset were dependent on the design used. Several kuhls that had not carried out the routing analysis properly had been destroyed; plantations not sited near water sources had failed. A best case watershed in Billing had on the other hand provided for a tank at the plantation site itself, thus ensuring success. Thus design inputs were found to be of critical importance in watershed success.

b. the community capacity and participation

The level of awareness of the community and the extent of participation of community members in the watershed development activities had a big impact on the quality and quantity of works done. Wherever participation is high, for instance in Mudgrah village in Lahaul valley, several activities have been taken up and these have been quite successful. The below expectations watersheds on the other hand showed relatively low community participation. In several of such cases, most of the community were found to be unaware of the watershed programme and its principles and objectives.

c. the local leadership and its genuine involvement

The quality and sincerity of the leadership of the watershed associations have a direct correlation with the quality of works done. Some of the watersheds have involved and committed leaders who have understood the potential of the programme and put in efforts towards its success, and these have carried out well-designed, good quantity of works which are also well-maintained. On the other

hand, some Lahaul watersheds for instance, have absentee leaders who typically reside in Kullu, and these showed a neglected state.

d. integrity & equity principles

Some of the watersheds revealed a history of mismanagement of the funds by association members/leaders. These had typically used poor quality material resulting in frequent maintenance issues; maintenance too had been neglected. The benefits to the local people from these assets were therefore negligible. In several cases, the benefits were found to be skewed in distribution with the more powerful people in the community accessing a major portion of the benefits. For instance, kuhls were in many cases constructed such that they provided water to the fields of such influential people in the community. This inequity in benefits also led to erosion of people's ownership of the project and faith in it.

e. the extent of mobilisation, monitoring, guidance

A strange (negative) correlation was found to exist between programme success and distance from the district headquarters in the districts in which the programme is being implemented by line departments. This indicated that locations that were easy to access and therefore monitored frequently showed better results. Several remote locations suffered from inadequate mobilisation and technical guidance as well as infrequent monitoring and motivation.

3.4.4 A SWOT Analysis of the DDP

Strengths	*Weaknesses*
- people's participation in development	- no norm differences between hot & cold deserts
- dual focus of ecological improvement and socio-economic development	- inadequate training & capacity building
- means for technology upgradation	- inadequate involvement, supervision, inspection from PIAs & funding agency
- free from biases & skews, is flexible	
Opportunities	*Threats*
- promoting alternate livelihoods	- selfish attitude, low community feeling
- empowering/enabling the marginalised	- tendency of skew to economic/ecological activities
- appropriate research & technology development	- widespread planning & implementation issues
- development of rural infrastructure, and welfare facilities	

3.4.5 DDP Best Practices

a. Artificial Glacier- Nang Village, Leh

An artificial glacier has been constructed near a water source at a level higher than that of the settlement. The site selected is in the shadow of the mountain, which leads to prolonged melting of snow in the summers. The water quantity has been augmented by channelling additional streams, and constructing a bund wall and a water storage tank. Siltation of the water storage tank is prevented by creating an outlet at the bottom which washes away the silt. A wiremesh attached prevents

large stones from getting into the channel. The kuhls are constructed using traditional techniques. "Spang" grass is used to line the kuhls to prevent the sides from collapsing. This artificial glacier has helped the growing of crops such as potato, pea, mustard and barley.

b. Fodder Development- Changthang Area, Leh

The Changthang area is home to pastoralist nomads who rear pashmina goats for their livelihood. The reducing snowfall has impacted the grasslands and been leading to cattle deaths. The project has been working on pastureland development in the area, growing special fodder grasses and establishing fodder farms for supplying to the community. This intervention has helped fill the fodder gap.

c. Passive Solar School- Gormangalpur Village, Kargil

Partial support was provided under the EPA for the construction of this building. The building uses passive solar techniques for space heating thereby reducing the strain on fuelwood. South facing walls are made of glass; the inner walls have been constructed with insulating fibre board. The south facing walls have two openings at the top and the bottom to allow circulation of air. The rooms are comfortable in winters and no additional heating is required. The floors are carpeted for further warmth. This is a private school started by villagers due to poor building maintenance and educational standard of the government school. The school celebrates "Parents Day" every year where children are given exposure to local tradition and culture.

d. Animal Shelter- Gondgomaminji, Kargil

The village has many high altitude grazing lands in the vicinity that the community use to graze their animals. The climatic condition at these high altitudes are however extremely severe, and many a times a threat to the lives of the animals and the nomads. The villagers wanted a shelter to be constructed to be used during such extreme weather conditions. The PIA Social Welfare and Rural Development (SWARDA) undertook the task under the watershed scheme. Due to the rugged conditions and inaccessibilty the cost of construction was high- a helicopter was hired to transport materials and labour. A shed of size 130' x 180' was constructed that has been extremely useful and been hailed by the beneficiary community.

e. Women's SHG- Roopa Village, Kinnaur

SHGs with 8-10 members in each group have been formed. Seed funding has been provided to each SHG. The women have understood the concept of a SHG, but need more training on the technical and administrative aspects. They are planning to tackle the local needs of the community by enterprise creation through their SHGs- such as making Kinnauri shawls, pickles, jams, juices, small trading activities, raising nurseries for saplings etc.

f. Willow Woodlots- Billing Village, Lahaul & Spiti

A plantation of willows has been set up on the hill just across the village, and has helped in greening most of it. The saplings were planted with the entire Billing community. A large tank has been established at the crest of the hill which receives and stores water from a spring nearby. A thick pipeline has been laid bringing water down from the tank to parts of the plantation, from where kuhls run all across

the plantation.

3.5 PROGRAMME IMPACTS

3.5.1 Socio-Economic Impacts

a. People's Participation

There are many development projects being undertaken, for instance the Integrated Tribal Development Project, The District Primary Education Programme, etc. But the unique feature of the DDP is that it is being implemented by the people themselves. It aims at improving the socio-economic condition of the people and addressing the ecological issues of the region, at a community/watershed level. In the beginning the people, accustomed as they were to the Government implementing all development projects, had difficulty in understanding the new approach DDP. With time however, they understood the importance of the project and the benefits it could bring to them. They then began taking interest and many watershed committees did excellent work in their areas and the people benefited from them. The programme has helped develop confidence in the people and in some cases, has helped to develop a sense of unity among the local people. It has also empowered them and built capacity in them. The entire project planning and implementation is being carried out by the people. They decide the requirements and implement it by themselves with technical help from the administration.

b. Enhanced Incomes from Project Wages

All the project activities are done by the local people and wages are paid to them for this. This has helped supplement the income of several households. In much of this region, landholdings are small and agriculture which is the primary occupation allows a limited yield. This is especially true of Spiti, which also has the additional problem of landless younger sons in a family since all land is inherited by the eldest son. Hence, contract labour is a major source of income and livelihood for many. DDP activities have thus provided some additional income opportunities. Rural income has been enhanced by higher earnings from the cultivation of cash crops as well as from the wages earned under the project.

c. Agriculture Expansion & Yield Enhancement

The construction of kuhls has created the most significant effect in the villages. It has helped in the expansion of agricultural fields, facilitating cultivation in previously fallow lands through creating irrigation facilities for these lands. With assured irrigation, the yield of the field crops also increased. Before the initiation of the DDP, the average yield of peas in Lahaul was 10-15 bags per bigha; since improved irrigation through DDP constructed kuhls, the yield has increased to 20-25 bags per bigha.

d. Kuhl Maintenance Savings

The kuhl construction activity has also helped save considerable community time and money. Before the DDP was begun, annual kuhl maintenance work used to

require an average of 600 person days per village; since the implementation of the programme and the construction of cemented kuhls, this annual maintenance time has been reduced to 30 person days only. Kuhl development has thus led to savings in terms of material costs for maintenance as well as cost of labour for maintenance activities. The saved time can now be utilised for more productive activities.

e. Enabling Enterprise

The villagers also get interest free loans from the watershed fund, which they have to return at the end of five years. These loans can be used in any activity depending upon the needs of the person concerned. This has been used by some to set up productive infrastructure for enterprises as well.

f. Welfare Enhancement

The watershed committees have also constructed classrooms in the local schools, cleared land and made playgrounds in the villages for the children and built small local guest rooms for the village guests and for villagers at the time of their need.

g. Income Enhancement from Community Orchards

The trees in the community gardens have not yet reached the bearing stage but are expected to boost the rural income after four to five years.

h. Improved Animal Wealth

The DDP has also helped in the procurement of cattle of better breeds, for instance Jersey cows, and facilitated in their breeding. Although not completely successful, this activity has contributed towards improvement of the animal stock in the region.

3.5.2 Ecological Impacts

a. Protection from Environmental Threats

The villages in the district have been protected from adverse environmental conditions such as landslides, avalanches, floods, etc.. The project has helped the people create protection infrastructure/measures. People have raised plantations and built check walls on glacier prone areas on mountain slopes to prevent slides and to save themselves from avalanches and rolling stones. These have helped to control soil erosion in the slopes to a great extent, arresting the movement of debris and stone in the slopes. This has also helped increase the green cover in the area and the micro water circulation system in the region. Although the created structures may not be able to protect completely, they have definitely reduced and lessened the vulnerability of the villages to and impacts of such environmental disasters.

b. Increase in Green Cover, and Reduction in Erosion & Land Loss

There has been an increase in the green cover which has helped considerably in reducing soil erosion and runoff losses. The construction of check walls in the slide and slope areas and along the rivers has also prevented the loss of land through the collapse of agricultural fields with landslides or their being cut away by the river flow.

c. Firewood & Fodder Availability

The plantations are expected to provide benefits in the form of fuelwood, fodder, poles for construction, etc. These will be divided among the villagers on a equitable basis. The entire plantation area is divided into several blocks and harvesting in a particular block is done once in four years. This rotational harvesting system would provide fuelwood, fodder and poles every year for the people and would also ensure the sustainable use of these resources.

4. INTERVENTIONS IN OTHER COLD DESERTS

4.1 COLD DESERT INTERVENTIONS IN OTHER PARTS OF THE WORLD

Interventions being carried out in cold deserts in different parts of the world, for instance in - Bolivia in South America (average altitude of 14,000 feet), the Great Basin Desert in US (average elevation of 5,000 feet), Atacama Desert in northern Chile (elevations over 8,000 feet), and Central Asia - also help provide learnings for development of cold deserts in India. Some key interventions attempted are mentioned below:

a. Agriculture & Soil Conservation

- cultivation of perennials and intercropping with annuals- perennials provide a permanent vegetative cover, the different spacing leads to better use of light, water, and nutrients, perennials protect annuals from desiccating winds, edible perennials provide food in drought years when annuals fail, and annuals' yields can go up by as much as three times
- use of medicinal/aromatic shrubs as fences for fields and plantations, and fruit tress as windbreaks- these can also be used for rural industries
- promotion of high value and fast growing crops and non-timber forest products on a sustainable basis
- use of special grasses for reclamation of saline soils

b. Water Management

- ensuring water use efficiency through scientific water harvesting and distribution, reducing seepage and run-offs
- establishing water harvesting structures- check dam walls, gabions, terraces, swales, fruition pits- and rural infrastructure drilling wells, rehabilitating existing wells, establishing dams, tanks & reservoirs, providing tractors with trailers for moving water
- establishing plants for wastewater reuse
- runoff agriculture- cultivation of low water requiring plants on areas storing run-off water
- establishing community water gauges to check groundwater status and take appropriate community water conservation actions

c. Afforestation & Biodiversity Conservation

- promotion of community forestry, leasehold forestry and buffer zone management activities
- seedbank establishment for conservation of endemic and endangered species, and nurseries for planting material generation for distribution
- prescribing optimal land allocation for the various uses

d. Animal Wealth Management & Pasture Development

- regulation of livestock grazing and promoting rotational grazing and phasing out of unproductive livestock to reduce pressure on grasslands
- community fodder farms with seed/sapling support to move people from fodder

collection from the wild
- animal wealth development- improving hereditary characteristics and modern techniques in management of herd (veterinary services, nutrition)
- forward integration of animal produce generation- into the dairy industry and wool industry
- change in composition of herds to reduce pressure on grasslands (from sheep & goats to cows & yaks)

e. Capacity Building

- strengthening the institutional capacity through community mobilisation and training in relevant skills and knowledge
- promoting and encouraging the application and development of indigenous knowledge and technology
- community awareness building and greening drives, including reforestation activities by children

f. Rural Infrastructure

- use of solar energy - orientation of buildings, solar lights, air circulation, building clustering
- establishing rural all-weather roads

g. Rural Economy

- export of desert assets (solar energy, cash crops, and wilderness for tourism)
- development of women
- promotion of small enterprises through small loans

h. Research & Environment Management Planning

- environment analysis, zoning and developing activity impact matrix
- developing environment management plans for scientific, sustainable development

4.2 CASE STUDIES OF INTERVENTIONS IN OTHER COLD DESERTS

4.2.1 Development Interventions in Qomolangma, Tibet

The Qomolangma area in Tibet extends from the lush valleys of the Himalaya bordering Nepal to the high, cold dry alpine plateau regions- thus two major biogeographical zones can be seen in the region. These diverse habitats have bred a remarkable wealth of wildlife- the Assamese macaque, the Himalayan palm civet, Himalayan musk deer and Himalayan tahr, kiang (a wild ass), blue sheep, and the elusive snow leopard. Five of the world's highest peaks over 8,000m are inside the Preserve, including Mount Everest (Qomolangma), Lhotse, Cho Oyu, Makalu, and Shisha Pangma. There are vast stretches of rich grasslands at the higher reaches. The climate is cold and arid. The population (totalling 68,000) inhabiting the region are either sedentary cultivators or nomadic herders residing in scattered villages. Animal husbandry is also practiced by the farming population. The region has a rich cultural fabric- numerous monasteries, shrines and other sacred sites including the world's

highest monastery, Rongbuk, at the base of Mt. Everest, and the "Hidden Valley" retreats used by the Buddhist saint Milarepa during the 11th century. The people of the region have traditionally practiced sustainable ecosystem management practices. The burgeoning human populations, in-migration, and the effects of modernization are tipping the balance however.

a. Nature Conservation Program

The Qomolangma Conservation Program aims at building local capacity to conserve the unique natural and cultural heritage of the Mount Everest ecosystem while improving local livelihoods. Under this, the Qomolanga Nature Preserve, a 34,000 sq. km. protected area along the northern slopes of the Himalayas has been established. The area has been zoned into three land use zones, allowing for the needs of people and protected area management. A Master Plan that integrates nature conservation, socio-economic development, and cultural conservation in QNP has been prepared.

The Environmental Conservation and Management Program has been aimed at developing indigenous capacity for participatory community-based resource management of QNP. The program has carried out training programs for the locally recruited preserve and forest staff, imparting inputs on community-based resource management systems; they were also provided English language classes. Participatory workshops were conducted to develop and implement plans for resolving conflicts due to wildlife-caused crop and livestock damage and to improve rangeland conditions. Biodiversity databases were developed through community based mapping and forest protection regulations were developed; clean-up campaigns were undertaken at mountaineering base camps. Conservation education and publicity material were disseminated to schools, county leaders, government decision-makers and tourists. Indigenous knowledge of natural resources of the local residents is fused with the Preserve Managers' ability to systematically conduct wildlife surveys and habitat appraisals. Preserve managers benefit from the local trainees' long experience of the land and its stewardship, while the trainees gather tools and skills that can lead to jobs with the preserve, greater security, and empowerment in the community.

b. Economic Development Program

The economic development program for the region begins at capacity building of the local community and also includes facilitation of development of enterprises based on local resources and skills. It is aimed at providing new economic opportunities to Tibetans to improve their livelihoods and relieve pressure on QNP's natural resource base. A vocational and entrepreneurial skills training center has been established in the Preserve for promoting literacy, numeracy, and such vocational skills as horticulture, handicrafts, carpentry, masonry, vehicle repair, and electrical appliance repair. Vocational training courses are conducted for children too old for primary school and young, unemployed adults, for young farmers and nomads of both sexes. Matching investments are made for integrated resource management, including the promotion of fuelwood and timber woodlots, horticulture, enhanced animal husbandry and tourism activities. Development of environmentally sensitive and socially responsible mountain enterprises, such as production of wool and cheese, medicinal herbs and essential oils, and paper-making using recycled materials, is promoted and facilitated.

The Qomolangma Nature Preserve offers unparalleled opportunities for

developing indigenous ecotourism enterprises. Training courses are also held for guides, lodge owners, and service providers on ecotourism. A workshop-study tour has been conducted for managers to learn how tourism is conducted in Nepal and to develop cross-boundary tourism routes. A small amount of funding is made available to improve camp sites, local lodges and sustainable garbage collection. Courses are being provided to train QNP staff members at three levels: (a) for locally recruited, young, entry level preserve and forest technicians, (b) for QNP staff, on-site, in aspects of preserve management such as local participation techniques, tourism management, wildlife management, community forestry, and ecosystem monitoring, and (c) long-term training scholarships for middle and higher level QNP management responsibilities. English language training is also offered.

Wool, highly prized in Nepal for its Tibetan-style carpet industry, is the major export from the QNP region. Most of it is marketed at prices well below prevailing international rates. Improvements are being made in productivity, and raw wool processing, product development and marketing, all through establishment of locally-owned fiber arts companies selling rugs, bags, sweaters, and shawls, which would also help to increase incomes for a significant number of QNP's residents.

Cheese production, medicinal herbs and essential oils constitute potential additional areas for enterprise development. At present, milk is mostly converted into butter and sold locally for use in tea or for ritual purposes. There is an unmet demand however for Western style cheese from tourists, foreign residents in Asia, and increasingly from Asians themselves. Similarly, the demand for Tibetan medicinal herbs and plants producing essential oils is rising locally and internationally. But with these products, ecological concerns rank very high; for instance the sustainability of plant collection differs markedly from one species to the next. A multidisciplinary team of investigators is being assembled to study opportunities and recommend ways for sustainable harvesting.

c. Cultural Resources Projects in the Qomolangma Nature Preserve

The Conservation of Cultural Heritage Program is aimed at assisting local people and spiritual leaders to renovate and preserve historic monasteries and revered sites. Within the boundaries of the QNP are 17 sacred Buddhist sites, including monasteries, temples and shrines, that are in need of major repair or restoration. Renovating monasteries and historic or sacred sites is thus a major target of the program. Residents are contributing their labor, and financial help is provided to purchase construction materials, especially for roofing, and to pay for skilled craftswork and mural restoration. Restoration has already begun on Rongbuk (Dzarong) Monastery and in several other sites within the QNP. Other activities include, the printing of new texts, or re-printing of deteriorated ones, and the expansion of libraries in temples and monasteries.

Once these sacred sites are restored, new programs will be developed to maintain them. Donations from local residents and pilgrims will be supplemented with income from guest houses, restaurants and retreat rooms for visitors. Carefully planned facilities will include proper sanitation, garbage collection and disposal. Skills training for monks will enhance their ability to contribute to the local economy through diverse activities such as management of visitor facilities, operation of water mills, reconstruction efforts, and papermaking.

4.2.2 Development Interventions in the Gobi

Mongolia is one of the most rural countries in the world. The vast majority of its citizens are nomadic and earn their living through herding sheep, horses, yaks and other livestock. Climatic conditions are harsh, with extremes of +40 degrees celsius in the summer to -40 degrees celcius in winter. As the country transitions to a free market economy and global competition grows for products such as cashmere on which the Mongolian herders' livelihood is based, these people face daily challenges. The collapse of the Soviet system and the change from the state management of herds as collectives to private ownership has been a major transformation, bringing with it new hardships as well as opportunities. The decrease in free services provided by the state has led to increase in private enterprise and competition as well as self-reliance. Households need to become responsible for producing their own goods, obtaining required services, and marketing their products.

a. Regional Economic Growth

The Gobi Regional Economic Growth Initiative (GREGI) seeks to accelerate sustainable, market-led economic growth and development in Mongolia's Gobi region. The GREGI activities are organized and implemented under four strategic clusters:

- *Enterprise Development*: To increase productivity and profitability of selected small & medium-sized (herder & non-herder) enterprises in the Gobi region by enhancing basic and specialized skills of business operators and entrepreneurs, by increasing access to and use of information and improved technologies, and by improving the enabling environment for businesses to operate.
- *Agriculture Development*: To increase the market value of select animal products using sustainable practices by improving herder management practices, by encouraging more effective and sustainable use of land and water resources, by increasing access to and use of information and improved technologies, and by improving the enabling environment for herder enterprises.
- *Rural Financial Services*: To increase access to sustainable, market-driven financial services to Gobi businesses and herders by increasing access to commercial and agricultural credit, by identifying and responding to other financial service needs, by increasing access to and use of market information, and by improving the enabling environment for the provision of financial services.
- *Market Infrastructure*: To improve the efficiency of rural markets by increasing access to and use of market and price information, by improving access to and effectiveness of business support services, and by enhancing the efficiency and transparency of commodity market transactions.

Cashmere is of enormous importance to the Gobi region and the program has already helped to foster business development in the Gobi, restructure the cashmere sector, and increase the availability of rural credit. Business development training modules have been developed and have proven popular among the rural business people. Despite a charge, all training sessions have been over subscribed. Rural credit is also being provided through a non-bank financial institution.

New breeding techniques and herd management tools that produce healthier animals and better quality products to compete on the world market, are being

introduced. This has involved teaching herders about the market system and encouraging them to run their herds like they would run a business. In addition to herd management, better natural resources management is also being taught. This is particularly crucial, as old Soviet-era wells become unusable and herds are forced to graze on increasingly smaller areas of land, impacting the health of both the livestock and the environment.

The challenge in many ways is not in introducing new ideas but in spreading the information to enough people. In a country where a herder can go days without seeing another human being, the dissemination of information is becoming increasingly important. In an effort to strengthen democratic processes and foster economic growth in rural Mongolia, a news magazine and radio program were launched. Programs include "Market Watch," which reports on selected commodity prices from markets in Ulaanbaatar and the Gobi, and "Weather Watch," which delivers three-day weather forecasts for the Gobi and Ulaanbaatar regions. "Policy Watch" program has been started to improve Gobi people's ability to make economic and business decisions by disseminating timely information on laws, regulations, policies, and practices.

b. Agricultural Development Program

The GREGI's Agricultural Development activities are focused on increasing the market value of agricultural products, using sustainable practices. Its goals are:

- increasing the incomes of Gobi people involved in production of animal products;
- improving the quality of animal products, specifically cashmere and other fine fibers;
- promoting operation of herds according to sound business practices,
- developing sustainable, resource-conserving, agricultural practices,
- providing marketing opportunities; and,
- promoting cooperative actions by herders to achieve better results faster.

The activities have included:

- *Herder Management Program*: The Gobi Initiative's Herder Management Program is a key delivery mechanism for activities that increase the market value of cashmere and improve the output of cashmere goats and other livestock. Participants undertake business improvement practices like financial record-keeping, animal health maintenance, regular veterinary care, selective breeding and culling, and cooperative building activities.
- *Cashmere Classing Clinic*: The Gobi Initiative's Cashmere Classing Clinic provides herders with knowledge about product quality and teaches ways for herders to gain a higher sales price for better cashmere. The clinic teaches recognition of higher quality, smaller micron diameter cashmere and a method for separation of raw cashmere prior to sale.
- *Resource Management Instruction*: Land and water resources in Mongolia are abundant, but limited. The Gobi Initiative has prepared training materials and commissioned short term consultancies to design land carrying capacity training specific to Gobi, including identifying best grazing areas and routes that maximize vegetation regeneration, avoiding over-grazing, understanding land carrying capacity in winter shelter areas and around water points. Herders are learning to manage the composition and number of animals in their herds to achieve the best economic return.
- *Cooperative Development*: Development of herder cooperative organizations is

essential to these activities, and to facilitate dissemination of technical assistance and efficiently provide educational experiences that form the basis for agricultural development. The Gobi Initiative is providing information and training to groups of individuals interested in undertaking cooperative efforts that can lead to founding a cooperative.

c. Veterinary Medicine

Mongolia is a predominantly pastoralist country with at least 170,000 pastoralist families and over 33 million head of livestock. The number of animals is growing rapidly with privatization of herds, as is the prevalence of diseases like brucellosis, bubonic plague, foot & mouth disease, and tuberculosis. Land reforms, price liberation, inflation, and decentralization have undermined the nation's pastoral production system and weakened the national and regional veterinary infrastructure. Yet the subsistence economy is now even more dependent on healthy animals and sustainable rangelands. Mongolia has just joined the WTO and development schemes are targeting livestock production to lift its economy. With increased demand for export of livestock products, healthy and productive herds are more critical than ever before.

An educational exchange has been instituted between veterinary students from Mongolia and the US to conduct scientific research on range productivity and livestock health. Baseline data is being gathered on: epidemiology, livestock markets, veterinary extension, wildlife-livestock interactions, attitudes toward conservation, and indigenous medical, veterinary, and rangeland management practices. Advisory teams, comprised of representatives from NGOs, Mongolia Agricultural University and National University, American veterinary schools, and local and regional experts, will work with students to translate these data into pastoral development strategies.

d. The Gobi Women's Project, Mongolia

The 1990s have brought sudden and dramatic changes to Mongolia. The shift from a centralised state-run economy to a market one has required new ways of learning and living for the majority of the population, especially the nomadic peoples of the deserts. These groups, particularly the women, have to cope with heavy family chores, harsh climatic conditions, animal husbandry and the task of regularly moving tents and pastures. With this context of uncertainty, the whole education and learning environment of the country had to be redesigned and redirected especially for the populations most at risk of marginalisation, notably the nomadic women. Learning environments conducive to bettering life conditions and community action had to be formed, and the barriers to educational opportunity had to be removed towards encouraging women to become more self-reliant and active agents in their own learning and that of their families.

Learning outside the formal education was deemed an appropriate solution. Distance education through print and radio, combined with a system of visiting teachers for face-to-face contact to complement the material, was identified as the solution that allowed for the overcoming of the enormous distances of Mongolia. A project, entitled The Gobi Women's Project, targetting 15,000 nomadic women, aged 15 to 45, was accordingly implemented in 1991. The aim was to provide nomadic women with the tools to survive the many and rapid changes affecting their lives through new access to learning opportunities and relevant learning. The appeal of income generation was integrated as an entry point. For many women,

finding and developing the tools to direct their existence meant being able to produce and sell. The learning therefore had a strong earning aspect with subjects of direct relevance to those who were struggling to make ends meet: livestock rearing techniques; family care (family planning, health, nutrition and hygiene); income generation using locally available raw materials and basic business skills, for a new market economy; literacy subjects were grafted on to these.

The project has encouraged the interaction of people and flow of information. After the initial lessons, the women, on their own initiative, wrote to the central radio, asking for details on prices of wool, practical issues concerning animals and health. They also asked for their husbands and children to be brought into the project. Thanks to the women, whole families ended up benefiting from the project. It is the women who passed on their knowledge to their children, who informed their husbands of their new capabilities and saw the enormous potential that could be drawn from using local capacity. Most significantly, the levels of local activity increased. Small information centres were set up. Increased communication and collaboration began to develop between neighbouring settlements and provinces. The women organised local markets with exhibitions of handicrafts and sales of products. Concepts such as learners' needs, feedback, discussion and teamwork were more easily grasped on a local level. Women sent letters to their local radio stations and even to central government asking for new materials, subjects and presenting ideas. The project acted as a catalyst in the formation of local groups and networks of specialists and resource persons (veterinary surgeons, doctors, teachers, local officials) who visited learners at home or organised group meetings. It also opened up new areas of learning directly related to the needs of the women breaking with the past formal education system which was more scholarly in approach and less based on local culture.

4.2.3 Development Interventions in Jumla & Mustang

Almost all of the district of Mustang lies above 2,500 m and is cold, high altitude steppe, caught in the rainshadow of the Dhaulagiri Himal to the west and the Annapurna massif to the east. It is one of the most remote and underdeveloped areas in Nepal. A high altitude cold desert, Mustang has very little vegetation. Growing seasons are very short and most of Mustang remains under snow for 4 to 5 months a year. Basic necessities such as drinking water, health services, schools, and alternative sources of energy are virtually non-existent. The people have adapted to this environment by practicing a form of subsistence agro-pastoralism and trading along the Kali Gandaki river, Mustang's central artery. Farming is done wherever irrigation is possible, but only one crop a year can be produced. Irrigated oases of barley, mustard, and buckwheat lie along the river valley. Salt and grain have been exchanged along this Himalayan highway for hundreds of years. These barely support the local population for 6 months a year however, and the region is a severe food deficit area. As a result, seasonal migration is practiced, with almost 70% of the people migrating to the lower part of Mustang, Pokhara, Kathmandu and India during the winter months, for employment and trading. During this time, the government closes all offices in Mustang including schools, police and border security offices. This harsh environment supports a rich cultural and natural heritage- there are several monasteries, cave dwellings, festivals and artifacts. The area is equally rich in biodiversity and endangered species such as snowleopards, lynx, Tibetan arghali sheep and wild donkeys are found throughout the region.

In contrast to the small human population, Mustang has large herds of cattle, sheep,

goats, yaks and horses. In the past, pastoralists were able to take their livestock to Tibet for grazing. The closure of the Nepal-Tibet border however has led to a severe shortage of pasture land and localized grazing problems. A large number of livestock have died as a result. Fuelwood is another scarce resource in Mustang. There are only few patches of forest left, and people are forced to cut or uproot the scattered junipers and other scrub vegetation for heating and cooking. Local people have begun using yak dung and goat pellets, which have traditionally been used only as manure for agriculture, as a supplementary energy source. This could have the effect of decreased agricultural productivity however.

a. Tourism Development

The Nepalese Government opened up Mustang for trekking tourism in 1990, aiming to plough back part of revenue for Mustang's development and heritage conservation. Initially, a limit of 200 visitors a year was set, later raised to 400 and then 1000. Trekkers were required to be with a registered group organized through an authorized trekking agency, and had to pay a premium fee for a maximum stay period of two weeks in the region. Groups had to be self-sufficient in kerosene and all garbage had to be carried out. Furthermore, each trekking group had to be accompanied by an environmental officer (EO) whose remuneration was also paid by the group. The EO's job was to assure that the group followed the prescribed route and environmental protocols, and that they did not purchase or smuggle any valuable artifacts out of Mustang.

The King Mahendra Trust for Nature Conservation (KMTNC), which had successfully implemented the Annapurna Conservation Area Project (ACAP), was given the task of overseeing conservation and development activities in Mustang. ACAP's northern border adjoins the southern part of Mustang, and upper Mustang was included within the ACAP jurisdiction. The UMCDP (Upper Mustang Conservation & Development Program) focused broadly on five key programmes:

1) Sustainable Tourism Development
2) Natural Resources Conservation
3) Cultural Heritage Conservation
4) Alternate Energy Development
5) Community Development

These programs were carried out via numerous trainings, study tours, and awareness campaigns. Training was provided on lodge management, food preparation, sanitation and hygiene, and handicraft production. In order to raise awareness among the visitors, informational brochures and codes of conduct were developed and distributed with trekking permits. Cleaning campaigns were launched and rubbish pits were dug. Biodegradable and non-biodegradable items were separated as far as possible and burnt or buried as required. Even the local Buddhist monks participated.

Surveys were also carried out for various alternate sources of energy, such as micro-hydro and solar electricity energy. A kerosene depot was established to fulfill the immediate energy needs, and some of the existing micro-hydro facilities that were not working were rehabilitated. In order to meet fodder and fuelwood needs, reforestation programmes were launched by adopting local plantation techniques. Assistance was also provided in irrigation and agriculture. Conservation education and extension programmes were launched to raise environmental awareness among school children and adults alike. Basic infrastructure works were also undertaken, such as the construction of a healthpost, schools, bridges and trails; support was also provided for monasteries and historical renovations.

In order to manage and sustain these efforts, local-level conservation and development committees, lodge management committees and mothers' groups were formed. These are grass-roots level management committees who are empowered and given responsibilities of managing and utilizing their natural resources and tourism industry.

The project has not been an unqualified success however, and several problems plague both the day to day operations as well as the sustainability of the project as a whole. One of the biggest problems has been financial sustainability. The lack of coordination among international donors has also been an issue. There have been several problems with duplication, contrary methods, and even competition for community support. The rapid pace at which tourism was brought to Mustang, without time for proactive community planning and basic infrastructure development, leading to high donor interest, international publicity, and rapid tourism development, resulted in the expectations of local people being raised far beyond realistic levels. This had had several unintended effects which has compromised the potential for both nature conservation and sustainable economic development. The local people responded to this hoopla by charging exorbitant prices for renting horses, camping places and some of their valuable arts and crafts in an effort to make a quick buck. In some cases they even captured wild animals to sell to the tourists. In many cases, the EO, who was supposed to enforce the regulations, never went along with the group, preferring to take his salary and stay in more comfortable accommodations in the low altitudes. The situation has gotten out of control: community cohesiveness is breaking down, short-term gain is overriding long-term development, and the environment continues to suffer.

b. Village Development Services

A ten-year project has been facilitating income generation activities and providing village level services. This has included the renovation of existing community managed irrigation systems and drinking water systems, providing clean drinking water facility to several households. People in the villages have access to clean drinking water, saving time for women folks from spending hours to fetch water from distant sources. The production of barely has since doubled with the renovation of the irrigation system. Farmers in the region have been trained on kitchen gardening, forest development and livestock rearing. Following the implementation of the project, there are several greenhouses in Muktinath and upper Mustang area producing seeds and seedlings for vegetable farming. The project has also brought together 13 village development committees to form a community organization for development in the region. The community organization, through its activities has been successful in collecting donations for development works and for lending to individual families for income generating programs.

c. Horticulture Promotion

Jumla and Mustang districts of Nepal have extremely favourable agro-climatic conditions for producing apples, and apple plantation was introduced in these districts about 30 years ago. The terrain is very rugged and inaccessible however with no road networks. At present, apples from these areas either require air transport, pack animals, or human transport for a number of days. This makes the apples vulnerable to damage and spoilage on the route to market. Strong and good quality packing material can prevent damage and spoilage to a great extent. However, these strong and good quality packing materials are not available in Nepal. They need to be imported from India or abroad. Heavy import duties

discourage apple exporters from importing good quality packaging materials, and this has a direct impact on apple transport and the business as a whole. The Mustang farmers, however, have been successful in diversifying their products (e.g., dried apples, apple brandy) to cater to the flourishing local demand by tourists without any government intervention.

d. Conservation Program

Upper Mustang has the status of an extraordinary refuge for nature and culture, and is under consideration for nomination as a World Heritage Site on these two grounds. The rangelands of Upper Mustang provide habitats for numerous species of wildlife, many of which are endangered, and for a wealth of plant species, including several medicinal species; it also provides an important corridor for migrating birds. The ecosystems and, in particular, the high priority areas that the project seeks to conserve, are interconnected intimately with the livelihood systems of the local communities of Upper Mustang. Despite recent changes in socioeconomic and political environments, pastoralism remains the basic livelihood strategy of Upper Mustang. Herders exhibit extraordinary knowledge and animal husbandry skills in coping with one of the harshest areas of the Himalayas. Rangeland management and pastoral development specialists need to access this vast body of indigenous knowledge. The key to biodiversity conservation strategies in Upper Mustang lies in incorporating and building upon such knowledge and skills when designing a natural resource management plan. Furthermore, the conservation of grassland and forest ecosystems and indigenous pastoral systems is integrally linked to the perpetuation of the people's culture and their religious practices. It is through their indigenous culture and traditional institutions that decisions on management of natural resources are made.

The development objective of the conservation project being implemented in Mustang is to conserve biodiversity of actual and potential value and to preserve globally important habitats and species of Upper Mustang. This involves:

- *Building institutional capacity for effective protected area management and biodiversity conservation specific to Upper Mustang*- This will be achieved through management and organizational development of Lo Manthang Unit Conservation Office (LMUCO) and their staff, and developing the institutional knowledge and skills of local institutions and communities for biodiversity conservation.
- *Developing, through participatory action research and data collection, a base of essential information on biodiversity and establishing community-based planning, management and monitoring systems for protecting the biodiversity to perpetuity*- The information base for biodiversity conservation in the Upper Mustang, including socio-economic and cultural factors, will be established, and Community Resource Strategies will be developed for pilot communities. A Conservation Area Management Plan as well as Tourism Management Plan will be developed for the Upper Mustang area. High priority areas for biodiversity conservation will be demarcated and monitoring systems for keystone species and habitats will be designed and implemented.
- *Developing and testing, particularly in connection to nature and heritage based tourism and pasture & livestock management, replicable income generating activities that contribute to biodiversity conservation*- Community Trust Funds will be set up to fund development and conservation activities in a sustainable manner. Ecologically sound attractions and programmes for visiting tourists and tourism related income generating opportunities for local population will be

developed. Also sustainable rangeland management schemes will be developed to reduce pressure on natural grasslands.

e. Tibetan Medicine

The Medical College in Mustang, Nepal, is implementing the Tibetan Himalayan Amchi Training Program (THAT). This project combines hands-on training in acupuncture with scholarship and institutional support for the education of apprentices and doctors in rural, ethnically Tibetan regions of Nepal and China. By fostering productive alliances between traditional and modern systems of knowledge, supporting local clinics and medical colleges, and informing regional and local public health policy, the health and well being of communities in the Himalaya and Tibet is being addressed.

4.2.4 Development Interventions in the Dolpo

Dolpo, Nepal, is a vast and rugged landscape inhabited by a hardy, enterprising folk, pastoralists and traders who live in some of the highest villages in the world. Altitudes of inhabited areas reach more than 4,000 meters. Temperatures are perennially cold. Growing seasons are short, and annual precipitation is scant. The inhabitants of Dolpo are adept land managers and exploit an incredibly limited environment for their survival, which includes herding animals over vast grasslands areas, trading Tibetan salt for lowland grains, producing dairy products, meat, and wool products, and cultivating barley, wheat, and potatoes.

Development action in this area is still relatively new. The Mustang experiences are however proving useful, and several successful interventions of Mustang are now being extended to Dolpo. Some among these are:

a. Alternate Energy

Fuel sources are scarce in high altitude pastoral communities. Every day, people spend hours laboring to collect what little fuel is available in these harsh climes: thorny shrubs and animal dung. The burning of these fuels in open hearths causes chronic eye, respiratory, and throat infections, particularly among women and children. Furthermore, fuel collection has repercussions on the entire ecosystem through increased erosion and less fodder for livestock. Many of the villages have never seen electricity. But this region receives more than 200 days of sun annually. A development program is working on disseminating solar technology - a clean, efficient and renewable energy source - to some of the highest villages in the world. This technology could control the incidence of disease, arrest environmental impacts from fuel collection, and reduce time spent in hard physical labor.

- *Solar Lights*: Such lights are a tested and trusted technology in the Himalaya and across the Tibetan Plateau. The purchase of solar powered lights is being subsidized in several communities in Dolpo.
- *Improved Stoves*: Fuel-efficient stoves with chimneys are being introduced. Solar cooking is also being introduced.
- *Solar Water Pumps*: Solar-powered water pumps, which have great potential to increase food and fodder supplies by irrigating agricultural crops, providing drinking water, and growing desperately needed winter hay, are being introduced.
- *Training and Local Investment*: Each of these alternative energy programs

includes an extensive training component for local project managers and individual users. In order to promote ownership and sustainability, locals contribute money to a Community Trust Fund that covers the costs of repairs and maintenance, and can also be applied toward the purchase of additional alternate energy systems in the future.

b. Cultural Renaissance

The Tibetan cultural world includes rich, profoundly beautiful artistic traditions. Throughout the Himalaya and the Tibetan Plateau, generations of painters have captured the rich religious images of Tibetan Buddhism in thangka and mural paintings, aesthetically unique works that are also an integral aspect of Tibetan spiritual life. Historically, thangka painters were supported by monasteries and patrons. Today however, adept teachers and economic opportunities have become difficult to find. Some exceptional local entrepreneurs are working hard to ensure that these local art forms are perpetuated. For instance, a painter who hails from a lineage of painters dating back 400 years, and was trained by his father in the refined art of traditional thangka painting, is helping to create a cultural and economic renaissance through his paintings. In addition to his classical talent, he is infusing this classical thangka genre of painting with vivid images of pastoral landscapes and lifeways. He is also training a cohort of apprentices, who will return to their mountain communities post-training to practice their skills by renovating and restoring monasteries and other cultural treasures.

c. Education

Villagers from remote districts such as Mustang and Dolpo have few opportunities to provide their children with education unless they send youngsters to boarding schools in Kathmandu. This is an unaffordable luxury for many families, and one that often creates an even greater educational and cultural gap in the communities of the Himalaya. In particular, many educational institutions only teach in Nepali and English, thereby denying children opportunities to study and speak Tibetan and their local dialects. In recent years, several culturally appropriate private boarding schools have been established in these remote districts, among them Crystal Mountain School, Tapriza School, Dunai Boarding School, Saldang School, Chödyi Monastery School and Lubra Elementary School.

d. Tibetan Medicine

The people of Dolpo have traditionally relies on plant based traditional medicine practiced by the amchis. Presently, this healing tradition is undergoing intense changes however. Tourism, out-migration, development programs, government health policies, and market forces have all deeply affected the lives of amchis and community health. Young people are searching for new ways to make a living, and the number of amchi apprentices is declining in mountain communities. Yet government healthposts and western-trained doctors is minimal or non-existent in these areas. Locals suffer and die from preventable ailments such as diarrhea and ulcers; infant and maternal mortality is high. Many community health issues are paralleled within domestic herds. Veterinary care and livestock services are minimal, and local ethnoveterinary traditions face similar challenges. The medicinal plants on which this traditional medicine is based are also becoming threatened because of their high value in outside pharmaceutical and herbal products companies. In remote pastoral communities, where subsistence depends on the health and productivity of both people and animals, indigenous health care systems

and their plant material must be supported.

Development programs are working on improving the availability and quality of healthcare in the Dolpo villages, and safeguarding the future of Tibetan medicine in general. Two major targets have been selected: (1) to develop a community-based model for conservation and management of medicinal plants and (2) to promote better health-care through increasing the capacities of amchis and women. These two approaches are interrelated, because the amchis are holders of much of the knowledge of the community and are regarded as people of authority. They are well placed to guide the people in a community-based approach to the management of medicinal plants and will certainly continue to be responsible for much of the local health-care at Dolpo.

5. DEVELOPMENT INTERVENTIONS REQUIRED FOR COLD DESERTS

"In so far as the cold desert ecosystem is concerned, it is limited to Ladakh and Kargil in J&K and Lahaul and Spiti and Kinnaur districts of Himachal Pradesh. With regard to these areas the research support is inadequate. But it is urgently required for development of vegetables, horticultural plants and production of vegetables seeds. Plants with medicinal value can be developed, mountain animals need to be given attention, and better ways of water management developed" --IXth Plan Document

5.1 INTERVENTION EFFECTIVENESS ANALYSIS

5.1.1 Programming Issues - arising from the unique features of the area

a. Short working season

The working season in the district is very short as compared to the plains or the mid-hills and high hills. The area remains covered with snow from November to March, and all physical activities can be carried out only from April to October. During the short summers, the locals remain busy in their fields and carrying out other livelihood generating activities, and are generally reluctant to work for long-term community/area development. In the winters however, no work can be carried out; movement is impossible; the more enterprising people of the community leave the area for the warmer hills south of the area; the intervening agency personnel are also usually not available. Thus interventions can only be carried out in the three months of July, August and September, the period after sowing and before harvesting.

b. High cost of materials and difficult maintenance

The location of the cold desert districts is such that transportation is difficult and its cost is very high. This makes the materials to be used for construction and other activities more costly than in the plains. Hence, the per-rupee impact of funds is also far lower than in the plains. A 30 lac budget will tend to go much farther in the hot deserts of the plains than in a remote cold desert in the high Himalayas. The terrain of the region is also such that it is very difficult to maintain the assets created. There are enormous environmental impacts on the assets - glaciers, rock-falls, silting, etc., and regular maintenance is not possible for a major part of the year, the winters. The damages caused to structures created is therefore far greater than in the plains, and a significant amount of maintenance activities have to be carried out every year, involving excess time, effort, and funds. Besides, the critical needs of the region are: efficient and adequate irrigation facilities implying construction of irrigation channels and storage tanks, and protection from environmental threats to life and property implying construction of check walls and check dams. Both these construction activities are expensive.

c. Small size of watersheds

While the concept of a watershed is quite applicable in the region, the accepted size of a watershed is not suitable for the region. The nature of the region - the high gradients, the rocky terrain - makes it difficult to develop 500 hectares together, by the same group of people. Typically a major stream/rivulet addresses only about two-three contiguous villages that form a logical pocket of habitation. Larger streams that address five-six villages or more than one pocket of habitation, have considerable fallow, uninhabited areas between them. This must be considered in the context of the fact that the density of habitation in these regions in very low, far lower than that in the plains. Movement to places away from the villages is extremely hard and so is the maintenance of assets. People therefore tend to work near their own villages and this makes for an inequitable distribution of development activities. The far lower density of population also results in less number of people being available for working. It was found that in watersheds where a greater number of villages were included, the larger villages consumed most of the resources with the smaller hamlets receiving no attention at all. Further, the topography of the place is such that between the two pockets of habitation, the desert area is more prominent and is risky and hazardous and tiring to work in. Thus, actual coverage of area is not even a fifth of the usual 500 hac norm for watersheds. Typically, the area immediately surrounding the habitation pocket(s) in a particular watershed are covered through the watershed development activities.

d. Spread of the Area and Difficulty in Movement

As mentioned earlier, the difficulty in transportation in these areas is a great restricting force. Distances are long; the road network is limited; the existing roads are of poor condition and take a great deal of time to negotiate; there are frequent landslides and rockfalls; and in the winters, movement is absolutely impossible. Apart from increasing transportation costs, this also reduces contact between villages, and between intervention implementing agencies and the communities. Thus, adequate supervision or guidance is not provided, especially to the far-flung watersheds.

e. High rate of illiteracy

The local population is largely illiterate with only the younger generations receiving formal education. This educated population anyway migrates to the lower hills in search of appropriate employment opportunities to satisfy their ambitions. Majority of the office bearers of local committees belong to the older generation and are unaware of the modern developments and the breakthroughs in education, science & technology. As a result they fail to understand the improved methods and technologies for implementing a project and refuse to accept changes. They lack confidence and take time to learn new things for the development of their areas.

f. Lack of technologies

The distinctive features and unique problems of the area are also a hurdle for appropriate development activities. No solutions have been developed for several of the problems of the area. In most cases, the local population has created certain indigenous techniques and practices that bear with the problem and adapt available resources to a certain extent. However as burden of the population and other

climatic changes add their pressure, these practices are also losing their efficacy. While several technologies exist for other areas, they fail in the tough terrain and conditions of the cold deserts, and adaptations have not yet been worked out. For instance, hydraulic rams which are effective for lift irrigation elsewhere in the country fail in the cold deserts because of the high silt content of the cold desert rivers. Windmills that are effective in generating power in other areas with similar wind velocities fail in cold deserts because of the snowfall that damages the windmill blades. Interventions therefore have typically used the same technologies that have traditionally been in use, but which are today lower in efficacy than they used to be.

5.1.2 Programming Issues - arising from programme planning & implementation

a. Lack of attention by the economically developed

The rich and the affluent in the community and those who actually possess the capacity to make interventions and programmes an engine of transformation for the whole community and region, do not take active interest in implementing the project. For instance, a significant percentage of the population of Lahaul is economically developed and have reached high income levels by growing cash crops. They are therefore more interested in working in their fields for a better yield and devote very little time for development activities.

b. Inadequate implementation guidance from PIAs

The lack of staff in the project implementing agencies has made inspection and measurement a difficult task. NGOs are few and although they are typically located in the areas they service and therefore have a close connect with the communities, they are beset with the problem of inadequate staffing, since living in these areas involves a great deal of physical discomfort and rigour. The existing staff are therefore always burdened with work and do not have the time nor resources to supervise or provide their guidance for especially the far-flung watersheds.

c. Poor leadership by local institutions

Success of programme activities depends considerably on the leadership provided by the local institutions. Uninterested office bearers have resulted in very little work being done. The flow of funds and the empowerment of grassroots committees has also made the influential members and office bearers of some committees selfish and corrupt. This is aggravated by the low level of supervision and improper evaluation by the programming agencies.

d. Perception of 'free' government funds

People of tribal areas like Lahaul & Spiti have become accustomed to being beneficiaries of several government schemes in an effort to bring up the tail. For instance, subsidies on fuel, assured 100 days employment in government labour, etc. This has led to a perception of government schemes as a source of free funds for them, available without the investment of any effort.

e. Lack of development perspective & accountability

The local people do not possess the macro and long-term perspective required for designing and carrying out development activities. They lack the technological awareness necessary for a proper designing of methods of change. They also do not have the sense of accountability for the work to be done.

f. Disharmony/lack of cooperation in the community

The local power play of the region also impacts programming causing splits in the community and forming rival groups in the villages. In villages affected by this problem, although the people understand the importance of development programmes and the need of unity for their successful implementation, they are unable to correct their shortfalls and build consensus among themselves for their combined benefit.

g. Inadequate upgradation of basic development requirements

In certain cases, project impacts have been limited and the interest created has been waning because all the requirements for an activity to succeed have not been provided for adequately. For instance, vegetable growing could only be started in a few villages, because of irrigation inadequacies in others. Milch animals have proved to be under productive due to the shortage of quality fodder and improper tending. Scarcity of water does not permit setting up of large scale fodder farms, although there is no shortage of land for this purpose. On the other hand, successful activities have proved that taking care of the basic requirements has been the critical success factor, viz, successful plantations are those that have also had dedicated tanks built for them.

h. Improper pre and post programme activity

The focus on the training provided as a part of any intervention has been rather inadequate, both to project administration staff as well as to the local community. This has resulted in gaps in understanding of the programme in the people; the required skill upgradation to manage the interventions has therefore not happened. In most cases, agencies have not paid adequate attention to the maintenance of the assets/infrastructure created by programme activities. Thus, although plantations, tanks, check-dams, etc., have been created, frequently not much survives because of poor maintenance thereafter.

i. Inequity in Coverage

The larger villages have tended to consume most of the programming resources with smaller hamlets receiving no attention and very little benefits. This has also arisen from a lack of balance in the composition of local institutions with little representation from smaller villages in these.

j. Problems of Coordination & Competence

Proper development requires the addressing of various issues. This however, rarely happens and development activities are typically carried out in isolation. The focus of the activities hence gets too skewed to the implementing agency's line of work and competence area- for instance, an NGO best at education may focus only on education to the exclusion of all other requirements of the area and community.

5.1.3 Critical Success Factors

DESIRED DEVELOPMENT INTERVENTIONS

Activities		*Design/Process*	
Local-	close match of local, watershed -specific needs and programme activities, and focus on integrated development of watersheds	*Specific-*	match between on-the-ground realities of the region and programme norms on size of watersheds, budgets, timescale
Benefits-	clear linkage between activities and community benefits, and demonstration of these	*Focus-*	dedicated structure and focus and technical guidance for programme implementation
Water-	development of water related infrastructure for irrigation and domestic purposes, ensuring efficiency of water use through injection of appropriate technologies for harvesting and distribution of water resources	*Systems-*	proper management of the planning and implementation process, ensuring timeliness, ease of administration, swift pace of implementation, flexibility and adequate checks and guidance by technical experts
Land-	land development and protection, including soil conservation and protection activities, improvement of green cover and crop yield	*Capacity-*	creating community interest and capacity through skill building, information sharing, participation and equity in benefits
Design & Mtce.-	appropriate design & adequate maintenance for long-term sustainability of assets created	*Leadership-*	responsible and dedicated leadership at the community level with adequate capability in and attention from the committee office bearers
Livelihoods-	direct or indirect impact on incomes of people, through technology improvement or institution of alternate livelihood	*Participative Orientation-*	community & rural development agency with aptitude in mobilising and participative & self-effasive, not control & directive orientation
Enablers-	creation of the enabling environment for area & economic development, through feeder activities for above activities		

a. Activities

- *Local*: People's participation is directly proportionate to the extent of addressing of the locally felt needs. The extent of match between local, watershed-specific needs and the programme activities would therefore have an impact on the success of the programme. If the activities do not address the locally felt needs of the people, it is unlikely that the people will perceive the benefits and will regard the development programme as dissociated from themselves, not worthy of their involvement. At the same time, the programme activities should be designed to ensure holistic development. This would in turn ensure that all people in a target area benefit and thus draw in their involvement.

- *Benefits*: There would need to be a clear linkage between the programme activities and community benefits. Especially since the programme focusses on sustainable benefits which would probably be received in the long-term, the activity-benefit linkage needs to be established clearly in the community members' minds for the programme to be effective. The demonstration of the

activity-benefit linkage therefore has an impact on the programme success and sustainability.

- *Water*: Water is a critical resource in the cold desert region. Hence inclusion of activities addressing the water issue have a positive impact on the programme success. Programme activities should target creation of water management infrastructure, both for irrigation and other productive purposes and for drinking and domestic uses. Activities that help inject appropriate technologies for sourcing, distribution and optimal use of the limited water resources would definitely be of value and help programme success.

- *Land*: Land is a much desired intervention target in cold desert regions. It is the major livelihood related resource in the target area since most of the population is dependent on agriculture for both domestic consumption and for sale for cash revenues. Hence land development and crop yield enhancement activities spell programme success. There is also a strong need to protect against soil erosion and landslides which are a threat to human life and property. Erosion control structures and plantations for enhancement of green cover as well as soil binding, are therefore viewed positively by community participants of the programme.

- *Design & Maintenance*: Programme success is also determined by continued programme benefits. Assets that have not been designed appropriately and those that are not maintained as required would tend to be degraded quickly, and benefits reaching the community members from the particular asset would cease. Hence, appropriate design for and maintenance of programme created assets and infrastructure that would ensure long-term benefits is a critical success factor for the programme and would impact programme sustainability.

- *Livelihoods*: Since economics is such a large part of today's life, economic benefits to the community and improvement in the livelihoods they are drawn from, as derived from the programme, are key impactors of programme success. Activities that bring about yield enhancements, technology upgradation, quality improvement, in the community's livelihoods and produce, would be positively connected with programme success. Activities that help the institution of alternate livelihood systems or help bring in supplementary incomes to families, would similarly have a direct correlation with programme success.

- *Enablers*: The success of the programme is also strongly connected to the creation of an environment that provides all the requirements for the final activity, for instance, fodder requirements for animal husbandry. This might involve skill building, infrastructure building or even just feeder activities. Lack of such enablers would doom the particular activity and lead to funds wastage.

b. Design/Process

- *Specific*: A very big factor in the programme delivering upto the expectations from it is the suitability of the programme's norms of size, cost, timescale, etc., for the local conditions. When these are not suitable or not adequate, as in the case of cold desert areas, the programme will be unable to reach the desired levels of success.

- *Focus*: The channel for delivering the programme needs to be focussed on the

programme. The presence of a dedicated structure and staffing with the required technical capability contributes to programme success. This helps the programme get the attention it requires and also the technical inputs that would ensure appropriate, sustainable design of assets and infrastructure.

- *Systems*: The quality of administration of the programme similarly has a strong correlation with programme success. Programme administration that would ensure schedule adherence, ease of administration, pace of implementation, and flexibility as well would help ensure successful implementation. The presence of adequate checks & guidance by technically competent staff would enhance programme success.

- *Capacity*: Focus on community capacity building is a very important and critical factor for programme success. Activities that include community awareness building, mobilisation, skill development and information sharing will definitely induce positive results from the programme. These would generate participation and consensus building for harmonious implementation with community-wide involvement. Such extensive involvement would also ensure equity in benefits which in turn helps generate programme success.

- *Leadership*: Programme success is highly dependent on the quality of leadership of the community institutions created. Responsible leaders with a high sense of involvement and quality time spent for development activities and community mobilisation work will generate quality works. The community leaders should also have the capability to understand the programme and the potential of advanced technologies in the various activities undertaken.

- *Participative Orientation*: An extremely important factor impacting programme success is the orientation of the frontline agency that interacts with the community in implementing the programme. Agencies with a base in rural and community development in the area concerned, a strong participative approach and mobilising capability, will be more effective in delivering success. Local NGOs with established, proven trackrecords and expertise and experience in rural development and social work, have a positive rapport with the target community, realise that community ownership is the key principle of the programme and fundamental to its success, and are easy to approach and flexible in functioning. This helps them generate programme effectiveness.

5.1.4 Best Practices

a. NR management- Water

- *Water sourcing, distribution & storage for productive purposes*
  - reinforced irrigation channels for reduced maintenance
  - lift irrigation systems, for instance hydraulic rams, for drawing water from sources lower in than the agricultural fields
  - tanks for storage of glaciermelt and recharge of underground aquifers and springs
  - snow harvesting techniques, for instance, artificial glaciers, facilitating

	early/delayed meltwater

b. NR management- Land

- *Afforestation for enriching & binding soil & enhancing green cover*	- community woodlots for fuelwood and timber
- *Wasteland development*	- irrigation for unproductive, fallow, waste lands

c. Threat control

- *Check soil erosion*	- check dams & retaining walls- slide-prone areas, river cutting land

d. Economic development

- *New cash crops & yield enhancement*	- horticulture - HYV seeds
- *Pasture development & animal care*	- rangeland & fodder development - veterinary care - animal care shelters

e. Welfare & infrastructure

- *Alternate energy resources*	- passive solar buildings, solar dryers

f. Community capacity

- *Community mobilisation, rapport building*	- SHG formation - NGOs as PIAs - training for awareness & skill building

5.1.5 Gaps & Needs to be Addressed

a. coverage of not inhabited areas

The region has vast tracts of barren and unproductive lands which have not been covered. The existing development programmes are presently addressing village level needs but not the needs of a watershed as a whole. This is especially difficult because of the rugged nature of the terrain, the sparsity of population, and the vast uninhabited stretches. Although plans for the treatment of such areas do exist, most efforts are focussed on village level development. Treating new command areas of rivers, streams and rivulets, would lead to ecodevelopment of the region and could also benefit the community more in the longer term.

b. tendency to focus on agri land

Another major drawback with the implementation of development programmes in the area is that the focus has primarily been on agriculture and irrigation development, with maximum efforts directed towards creating irrigation facilities for the existing fields. Greening projects and soil conservation projects which are nearly as important in the region, have not received the kind of attention

they deserve. Focus on these aspects would enhance the overall benefits to the area.

c. community development

A critical lacuna in project implementation is the inadequate amount of community mobilisation. A programme can only be successful if it has the appropriate level of community involvement and participation and people implement the project with dedication and honesty.

d. feeder facilities

Some development activities have not succeeded as well as they could have because feeder activities to the concerned activities have not been carried out. For instance, animal husbandry is negatively affected by the lack of fodder facilities. To be effective, fodder farms that service the fodder requirements of the additional heads of cattle would also need to have been set up. Similarly, several plantations set up have dried up because adequate irrigation facilities have not been constructed for the plantations.

e. design & maintenance

Adequate attention has not been paid to the design of the created infrastructure in several cases. A research component is critically required to develop appropriate technologies to address cold desert problems and apply them in an effective manner. In most cases however, either established techniques that may not be effective in the concerned area or traditional techniques whose efficacy may have eroded have been applied- for instance, cemented kuhls that crack in the winters. There has been very little focus moreover on the maintenance of the infrastructure and assets created, and many have been allowed to run down, thus delivering little benefits to the people.

5.2 RECOMMENDATIONS FOR IMPROVEMENT

The analysis of the data collected reveals certain potential areas for improvement of development interventions and their implementation in cold desert regions.

5.2.1 Programming Aims

A programme needs to address the expectations of the various programme partners and beneficiaries through its interventions. The key aims should be as follows:

a. Ecological, Land & Water Development

- *Ecosystem Preservation &* - Preserve the fragile ecosystem of the cold desert region & check the degradation of natural resources
- *Desertification Control:* - Conduct selective afforestation on degraded lands for greening of the desert
- *Water Management*: - Manage the water resources of the area in a sustainable manner, optimising water use
  - Create water access and distribution infrastructure

for both productive and domestic purposes

- *Produce/Yield Enhancement*:
  - Develop agriculture and horticulture with alternate cash crops and enhance production of fruits and vegetables
  - Improve livestock and milk production and develop pastures, fodder farms and animal care services
- *Threat Control*:
  - Carry out soil and moisture conservation works and institute infrastructure towards reducing environmental threats

b. Economic & Community Development

- *Livelihoods Development:*
  - Promote the overall economic development and improve the socioeconomic conditions of the resource poor and disadvantaged
  - Develop new enterprises/livelihood streams towards improving the tribal economy
  - Develop livelihoods with a competitive advantage for the area like medicinal & aromatic plants and ecotourism related
- *Integrated Development*:
  - Promote integrated and sustainable development of the area through a holistic approach
  - Improve the Quality of Life of the people of the area, in terms of basic welfare facilities
- *Community Development*:
  - Develop a sense of unity in the community and enhance community ownership of the project
  - Improve community organization and capacity through education and awareness building
  - Improve equity and participation, including women's empowerment
- *Transfer of Technology*:
  - Promote research and development activities, adaptations of existing technologies, and innovations for addressing cold desert specific problems

5.2.2 Programming Strategy & Design

PROGRAMMING STRATEGY

k discrete & local activities - micro watersheds
k integrated ecosystem/area wide activities - larger watersheds comprising several micro watersheds
k balanced across sectors - ecological and economic activities
k complete value-chain focus - feeder activities & output activities
k addressing traditional areas/occupations & developing new avenues
k technology development, upgradation and infusion
k thrust on training - mobilisation, participation, empowerment, training

The protection and management of the cold desert environment can be approached in one of two ways:

a. Discrete & Local Activities

In this approach, individual components are managed in response to impacts or concerns that are specific to certain sites, organisms, activities or species. Since cold deserts have the problems of sparsity of population and large uninhabited stretches between villages in a watershed, micro watersheds need to be considered for localised activities. These micro watersheds should include groups of contiguous villages that would lie within an area serviced by a stream and are facing the same set of problems - of water, erosion, etc., and thus have a well-focussed set of activities. Activity specificity and localisation, and direct and clear benefits to the community would thus be assured.

b. Integrated Ecosystem/Area Wide Activities

Attention is also required to be given to the temporal as well as spatial properties of the environment, the dynamic links between physical, chemical and biological processes and the need to conserve ecosystem integrity. Management at any one site requires consideration of the overall properties of the system, and integration with other activities throughout the region including research and monitoring. Therefore the cold desert interventions also need to have a large watershed focus. Each such watershed should include a cluster of several micro watersheds, and activities should be those that are not localised or specific to a single micro watershed, but address all the micro watersheds and the uninhabited stretches in between. Activities would include large-scale projects that would comprehensively address a common problem of all the micro watersheds within the larger watershed, for instance, a comprehensive irrigation development scheme serving the entire area under the larger watershed. This strategy would ensure the area development aspect, while the former would ensure people's benefit and motivation.

c. Balanced Across Sectors

Activities need to be designed such that they address all the different problems that beset the cold desert region and its communities. Thus every watershed should have a good mix of ecological development and economic development activities. The tendency for skews towards one or the other should be avoided. The intervention planning must be such that the activities selected along with other interventions in the region, lead to integrated development of the region. At all times, standardised interventions must be subjugated to local, need-based interventions.

d. Value Chain Focus

Activities should also be such that they address the entirety of a problem or a desired state. The treatment of any issue in isolation or through its symptom often leads to a piecemeal approach that fails to consider long-term or cumulative impacts. This leads to the failure or lack of benefits from the particular activity. Therefore the entire value chain of a particular activity or problem should be studied and all gaps/potential gaps addressed. Thus animal husbandry activities should address fodder, animal breeds, veterinary care, shelters, animal produce sales/processing, etc., the gamut of issues that face the pastoralist.

e. Blending the Traditional & the New

Any programme has to have a blend of traditional activities and non-traditional activities as well. The people of the cold desert areas are still almost completely dependent on the natural resources of the area. They are predominantly land based, their occupations being those of cultivation and pastoralism. While the natural resources and the traditional occupations are targetted, certain new areas and avenues need to be developed as well. Thus for instance, certain identified areas are those of cultivation & processing of medicinal & aromatic plants, ecotourism, new cash crops like horticultural crops.

f. Technology Development & Upgradation

A programme must develop and transfer technologies for the appropriate and sustainable management of different resources and aspects. It must move away from pure addressing of a need to bringing in technology to address the issue behind the need. This would ensure that the solution provided is a long-term one; the providing of the solution would also help upgrade the technology and thus take development into the area. There should be some funds allocated for technology absorption and/or development as well, to encourage this aspect. The technologies adopted should be- appropriate, cheap, simple and repairable.

g. Thrust on Training

A programme's principle of people's participation needs to be given a thrust. Rather than focus on participation alone, training on various aspects should be made important. Training would generate participation and involvement by enhancing awareness and skills. This would make people understand the value of participation and make this independent of external agency based mobilisation. Training would also enable the community to participate in a much more effective manner.

5.2.3 Programme Activities

a. New Activities for Changing Environment & Technology

There is a need to design new activities to address changing environmental conditions and bring in advancements in technologies. Thus,

- With the decreasing snowfall, irrigation channels connecting streams/glaciermelt to agricultural fields need to give way to snow harvesting that can directly tap the glaciers and reduce glaciermelt run off and also delay the melting period.
- Lift irrigation or hydraulic rams have to be adapted to the region's unique problems (silting) and instituted for drawing water to higher elevations that could then be brought under cultivation as well. Technologies like drip/sprinkler irrigation, improved tanks and channels, etc., also need to be instituted.
- With depleting forest wealth, it is extremely important to bring in renewable energy options for heating and electrification. Solar, wind and hydel energy could be tapped for generating power for production enterprises which would also facilitate economic development of the region.
- Development in plant varieties and research results of species impact on ecosystems could be utilised- for eg., seabuckthorn or Artemisia plantations help in erosion control and nitrogen fixing. Plantation species could be varied to include medicinal & aromatic plants which are endangered and have high

market value. This could also help preserve precious plant genetic material.

b. More of the Best Practices

The established successes in terms of activities that have been proven to be amenable to proper implementation, have multiple positive impacts, and deliver clear benefits to the communities and the environment, should be continued with, even enhanced. Thus,

- More orchards and willow plantations could be begun for they have the multiple benefits of enhancing greencover, reducing soil erosion, improving rural incomes, and reducing depletion of forest resources for fodder and fuelwood.
- More grassland development activities should also be carried out for they have the dual benefit of reducing soil erosion and improving fodder availability.
- Irrigation infrastructure needs to be greatly enhanced in the form of more storage tanks and more efficient irrigation channels. The best practices of snow harvesting should be replicated.
- Since glaciers are the key water resource for the area, glacier conservation and utilisation interventions should be implemented, viz, creation of artificial glaciers, preservation of existing glaciers, etc.

c. Potential New Age Enterprise Activities

There are great possibilities in venturing into new activities with enterprise potential in the context of the changing markets. For instance,

- With traditional handloom and handicrafts emerging as a line with high market potential, the traditional crafts of the region and the typical winter activity of the people can be developed to enterprise status. Programme activities will need to include training, market orientation, design development, and marketing and logistics management.
- Medicinal & aromatic plants too constitute a potential new age focus area. Programme activities could include distribution of planting material for cultivation of herbs, setting up of herbal gardens, training on cultivation of herbs, as well as proper storage and processing of herbs.
- Ecotourism activities could take advantage of the irreversible trend of tourism influx and probably help in making its impacts less negative and more positive. This would need to include tourist site development and maintenance activities. The watershed teams would need to begin with identification of the tappable potential of their watersheds.

d. Livelihood Enabling Inputs

Encouragement and facilitation could also be provided for various other employment generation activities such that alternate/supplementary livelihoods to the existing agriculture could be developed. This could include:

- Skill training as well as enterprise development training would need to be provided to the potential entrepreneurs to enable them to establish viable and sustainable enterprises.
- Loans could be instituted for productive purposes like equipment or raw material investments. Small-group credit systems could be evolved and seed funding provided for them to initiate activities.
- High quality - high productivity techniques and inputs could be transferred- disease-free seed production, greenhouses for enhancing production period, solar energy based processing, better breed of animals, improved looms for weaving, etc.

- Establishment of cooperatives for free trade and marketing for these livelihoods would need to be an important component as well.

e. Focus on NRs- Land, Water, & Vegetation

Clearly the cold desert is an especially vulnerable ecosystem and requires considerable focus on the three community identified critical natural resources- land, water, and vegetation. Therefore,

- Land development needs to be continued with, the objective of bringing more fallow lands under cultivation strived for. The neglected command areas should be identified and brought under the watershed development activities.
- Greening the desert is perhaps the best way of reducing the negatives of desert zones. Horticulture activities have to be continued with, with greater vigour. Community gardens/plantations of willow and fruit trees. Apricots and apples have been established as successful in the region- more apricot and apple orchards therefore should be set up.
- Endemic species of medicinal & aromatic plants of the region should be selected for economic cultivation. Apart from conservation of the species in the wild, this would help establish an alternate cash crop in which the region would have a very high competitive advantage.
- Appropriate species for cold desert regions need to be introduced. Cash crops and HY varieties suitable for cold deserts will need to be identified and introduced. Frost resistant species also need to be identified and introduced. Nurseries need to be established for planting material.
- Soil conservation activities of plantations and grassland development must be given greater thrust in order to check erosion of the already thin topsoil.
- Water is perhaps the most critical resource in deserts, and as such an even greater thrust needs to be given to providing efficient water harvesting and distribution infrastructure, including channels, tanks, snow harvesting, drip/sprinkler irrigation networks. Reinforced kuhls that are less vulnerable to the annual snowfall and thus need less maintenance need to be established.
- Water conservation activities such as seepage reduction and wastewater treatment and recycling should be begun.
- There are large tracts of irrigateable land available whose potential have not yet been tapped. Irrigation development techniques need to be developed and instituted to harness difficult sources so as to make these lands and also develop alternate water sources.

f. Livestock & Fodder Development

There are nomadic belts in the cold desert region, for instance the Changthang area, in which the primary activities will need to be those to do with livestock, fodder and pasture development. In these areas-

- Improved breeds of animals should be distributed. Provisions need to be made for animal care, viz, veterinary services and animal care camps.
- Animal care shelters that provide shelter for the animals in sudden blizzards and snowfalls in the high altitude pastureland sites and are also predator-proof, should be set up.
- The community also needs to be provided education on appropriate animal care practices.
- Fodder farms with quality fodder species should be established. This will reduce the pressure on grazing lands and also provide for the animals in the case of drought.
- The grazing lands should be conserved with soil and moisture conservation

interventions. The community should also be educated on rotational grazing techniques for sustainable utilisation of the pasturelands.

g. Value-Addition to Produce

The community should be facilitated to move towards processing of the produce of the region. This will reduce the pressure on the land on the one hand and also improve revenues on the other. Thus,

- Processing of horticultural produce and medicinal & aromatic plants into jams, juices, and sauces on one hand, and oils, creams, perfumes and incense on the other, should be facilitated. Small-scale enterprises which use low-cost, simple technologies could be assisted.
- The pastoral community could also be provided training and infrastructure for processing of the animal produce, for instance wool processing. This would help them diversify up the value-chain in terms of occupation, thus enhancing their incomes, maintaining man-animal population ratio and reducing animal pressure on the pasturelands.

h. Contending with Environmental Threats

Protection of life and property from the various environmental threats of cold deserts needs to be a key activity for the region. Cold desert threats include flashfloods, avalanches, river erosion, landslides, and rockfalls, etc.

- More of the flood-prone, slip-prone, erosion-prone, and avalanche-prone spots need to be identified, and appropriate protective structures planned- check walls, check dams, retaining walls, etc.
- Fields and plantations also need to be fenced to save them from destruction by animals.
- Vegetative barriers need to be established to prevent the slide debris from reaching and causing damage to the fields.

i. Energy Infrastructure

Alternate energy has been found to be a critical need as well as a high potential enabler for the region. The cold desert has enormous solar, wind and water energy potential which needs to be tapped for the area's development.

- Solar energy could be tapped for irrigation technologies like lift irrigation as well as for processing and rying of the crop produce of the region. Small lighting and heating arrangements could also be made through solar energy. Passive solar building could be used for space heating. Solar greenhouses could be set up for round-the-year cultivation.
- Wind and hydel power could be used for larger applications, viz, electrification, processing of agro/animal produce.

j. Focus on Marginalised Groups

The assetless and socially marginalised groups need to be given separate focus in the programme. Thus,

- Inclusion of women in all community institutions and activities must be strongly enforced. Women must also be encouraged to take independent stands in meetings and community sessions.
- Special women's SHGs should be constituted and given training. Production centres should be set up for women's activities like crafts, food processing, etc., that would facilitate their economic empowerment.

- The assetless and low economic capacity individuals in society, viz, those who own wastelands or land without irrigation facilities, should be provided benefits under the programme.

k. Facilitating Community Assets & Welfare Facilities

Although the focus has tended to be on ecological and economic aspects alone, the relative insulation of the region and the low level of available facilities and infrastructure, call for some focus on these aspects also. Besides, these also have a bearing on the ecological and economic aspects. These could also be taken up. Thus,

- Sanitation is definitely neglected, and the lack of drainage facilities are impacting water quality. Therefore, basic sanitation facilities need to be instituted.
- Drinking water is gradually becoming a critical issue in the area with increasing pollution of water sources, reducing groundwater resources and the continuing problem of winter water. Year-round potable water solutions need to be developed and instituted.
- The community also indicated a need for community assets like community halls, school rooms, etc. These would in turn help bond the community stronger which could lead to more effective planning and implementation of activities.
- Education is a felt need, and could help in enhancing the capacity of the local population which would also impact programme activities.
- Health centres could be set up for pockets that get cut-off during winters, and these could be manned by the traditional medicine practitioners of the region.
- Inputs in appropriate housing may be called for- the increase in precipitation due to global climatic changes has damaged the houses made of traditional material and architecture.

l. Linkages for Infrastructural Issues

Although not directly, programmes could facilitate the improvement of infrastructure like roads, communication, and power. Thus,

- Community institutions could liaise with the relevant authorities and form a pressure group for accessing these requirements for the region.
- Certain smaller level activities like in-village pavements ('chakkatalai') could also be taken by directly.
- Alternate systems like electrification and heating through solar energy could also be taken up directly.

m. Quality & Maintenance

As has been revealed, although some work has been done and funds expended, much of it is poor quality. It is important therefore to ensure proper maintenance of assets created.

- Annual maintenance of irrigation channels, tanks, and pumps need to be built into the programme design. Check walls and dams need to be annually repaired and reinforced.
- Regular tending of plantations has to be clearly included in the plantation establishment work.

n. Stakeholder Attitude Shift

Stakeholders, direct and indirect, need to be moved beyond the role of usage of

natural resource management alone and towards the role of long-term stewards of these resources charged with the responsibility of their sustainability. Although the desired attitude was very much a part of the traditional way of thinking, it has eroded in recent times, and a more contractual man-nature relationship has evolved.

- Revival of the appropriate stakeholder attitudes would involve attitudinal change workshops for the local communities, detailed natural resource valuation and sustainability action planning, as well as crystallisation of key user roles and responsibilities.

o. Basic Minimum Inputs for Success

Study has revealed that only those regions that possess a certain level of basic minimum facilities and infrastructure show the positive impacts of development interventions, indicating that a threshold level of infrastructure is necessary for development to happen.

- The basic power, health & sanitation and transportation infrastructure that serve as inputs for enterprise development will need to be developed, either directly or through the required liaison with the govt. deptts.
- Within each activity being implemented as well, similar threshold requirements serve as inputs- for instance, irrigation facilities for land development and greening, and fodder availability for cattle breeding. These BMIs should be identified as a part of the planning process and the programme interventions should address these.

Programmes therefore need to focus adequately on these two sets of basic minimums for the intended development to be successful.

p. Basic Minimum Capacity for Success

Another set of basic minimums are required for development to happen, to impact, and to be sustainable- the stakeholders effecting the development need to have a threshold capacity. This implies:

- The community needs to be trained to develop in it the required basic level of competencies and attitudes. It needs to be worked with to develop in it a cohesiveness and a sense of common purpose.
- Office bearers of the community institutions need to be made aware of their responsibilities, and provided training in accounting, project management, as well as the technical advancements in the activity areas.
- The implementing agency staff need to be provided training in participation generation and adequate supervision.

q. Culture & Heritage Activities

Programmes should also help in preserving and promoting the cultural aspects of the region which would in turn facilitate community integrity.

- Awareness sessions should be carried out on the local flora and fauna and the area's natural and cultural heritage. Classes should also be carried out on the traditional languages and arts.
- The community should be encouraged to document the indigenous traditional knowledge that is being lost. Required technical and equipment related help should be provided.
- The traditional systems, for instance the traditional medicine system, the system of buzhens, should be strengthened and promoted.

r. Special Projects

Special, large area benefitting projects should be identified and carried out, especially in the sectors of water and energy. Some such projects could be:
- Establishing mini and micro hydel units
- Establishing large-scale irrigation networks

DEVELOPMENT ACTIVITIES

The Traditional . . .
- Irrigation, conservation, water management- drip/sprinkler irrigation, storage tanks, distribution channels, snow harvesting, melting period delay, early sowing irrigation methods
- Soil and moisture conservation, reducing seepage losses
- Avalanche and flood control
- Livestock & pasture and fodder farm development in nomadic areas
- Development of horticulture - apricot, apple orchards

. . . & the New
- Construction of artificial glaciers and preservation of existing glaciers
- Lift irrigation through solar energy or other appropriate techniques
- Special projects for water and energy- eg., construction of mini and micro hydels (5 - 10 Kw)
- Introduction of more cash crops, frost resistant species for plantations
- Enhancing growing/productive period thro' greenhouses
- Value addition to horticultural and agro produce- viz, processing of apricots for oil, solar drying of apricots
- Economic cultivation of & value addition to high value medicinal and aromatic plants
- Awareness generation about local flora & fauna, traditional heritage
- Promotion/learning of traditional language & arts, documentation of ITK, strengthen traditional medicine
- Skill development in local crafts
- Value addition for Pashmina wool
- Hand pumps for drinking water (esp. in winters)- exploitation of ground water for drinking and irrigation
- Entrepreneurship development and promotion of local enterprises, institution of small group credit system
- Training & production centres for women's enterprises
- Training for community organisation, development

5.2.4 Special Programming Requirements for Cold Deserts

COLD DESERT DIFFERENTIATORS (especially from hot deserts)

- smaller watersheds
- different water sources and hence water harvesting modes
- short working season
- steep gradients with implications for land development, water management, infrastructure creation
- greater soil erosion and water drainage
- steep gradients, rocky soil and inadequate water restrict cultivation
- altitudes and climate are barriers for development

- more difficult transportation, communication, and hence supervision & logistics
- more expensive materials and construction
- snowfall and snowbound winters- higher infra damage

a. Appropriate Watershed Sizing

Given the unique features of cold deserts, the existing norm for watershed area needs to be recast for cold deserts. Watersheds could be addressed at two levels- a micro watershed and a normal larger watershed. This would ensure community specific development, as well as watershed specific development.

- At a micro level, the watershed should be defined in terms of the stream serving a habitation pocket, and development interventions could address the area immediately around the habitation pocket. These micro watersheds could be upto a maximum of 100 hectares in area.
- At a larger level, the watershed should be defined in terms of a rivulet that may be serving several habitation pockets, and development interventions would address the habitation pockets and micro watersheds within the larger watershed, as well as the area encompassing these micro watersheds. These larger watersheds could be upto about 300 hectares in area.

b. Cost & Time Norm Changes

In the context of cold desert uniquenesses, programme cost and time norms need to be recast for cold deserts. The recommended changes are as follows:

- Cold deserts have an effective programme implementation period of 7 to 8 months in a year, i.e., 58-66% of the time available for implementation in other areas. Hence the programme implementation period for cold deserts could be extended by about 40%, as compared to other areas.
- The timing of activities is even more important for ensuring pace of implementation (which is currently felt to be too slow). Winters must be used for training, awareness building and mobilisation, and planning and design activities. The immediate period following the sowing season, and that following the harvesting season could be used for implementation activities.
- Cold deserts have a far higher Cost Index (as established by the PWD) than plains or hot desert areas. Thus while Patiala has a Cost Index of 150 and Bikaner (hot desert area) has a Cost Index of 155, Leh has a Cost Index of 280. This Cost Index is based on the variance in cost of 12 basic materials (eg., bricks, cement, steel, wood, sand, electricals, etc.) typically used for infrastructure creation. Thus in a typical cold desert materials and infrastructure creation could be estimated to cost about 80% more than in a typical hot desert.
- Cold deserts also have an additional maintenance cost for all assets because of the damage caused by every winter. An additional 20% could be estimated to be required for this annual maintenance of assets.
- Project activities must provide for adequate focus on various sectors and aspects. The budget and implementation period should be adequately split for the micro watershed and the larger watershed, as well as for ecological and for economic development activities.
- A need for a separate allocation for major, multiple watershed projects should be considered. Special, larger-scale projects could be taken up under this separate allocation.
- Separate funds should also be allocated for the following:
  - maintenance of project created assets

- R&D and project innovations
- basic minimums for development

e. Agencies & Orientation

Improvements could also be brought about by improving the development intervention delivery channel structure:

- A programme would be greatly facilitated by having dedicated staff for the programme's implementation and administration. This would enable more focus on community mobilisation, capacity building and training, as well as enhanced levels of monitoring and supervision towards ensuring programme effectiveness. Such dedicated staff could have accountability for the programme's success.
- This staff must also be trained and the required attitude, skills and knowledge developed in them. The staff could include apart from technical experts, social sciences specialists as well, to enable proper social mobilisation.
- The actual implementation and grassroots contact should lie with NGOs. This will ensure that community mobilisation and participation is ensured by agencies that have a strong community and rural development orientation and typically follow a participative approach, viz, NGOs. At the same time, it will encourage voluntarism in cold desert areas which have a paucity of voluntarism which typically has a strong association with development and empowerment.

f. Equity & Participation

The project planning and implementation process must lay keen focus on community involvement aspects.

- Community institution composition must ensure that there is balanced representation.
- The process of planning and implementation must have widespread participation from all community members, and not be restricted to a few. Special attention must be given to the involvement of marginalised and especially vulnerable groups like women, landless, etc.
- Training and skill building too must be spread over the whole community.
- The design of benefit sharing from programme activities must ensure equity in distribution, and avoid biases and prejudices, or individual self-interest.
- Time and effort must be spent on awareness building and building cohesiveness in the community.

SPECIAL PROGRAMMING REQUIREMENTS FOR COLD DESERTS

• Longer project period than plains:	- by 40%
• Two levels of watershed sizes:	- micro watersheds of 100 hac, and
	- clusters of micro watersheds totalling 300 hac
• Larger project budget than plains:	- by 80% for the total budget for project works
	- an additional 20% for extra maintenance costs
	- an additional 40% for extra administrative overheads
• Separate funds allocation required for:	- post-project maintenance of assets,
	- R&D and innovation,
	- multiple watershed projects,
	- basic minimums

5.2.5 Monitoring

An essential first step in managing such vulnerable environments as cold deserts is also to define the environmental and other values to be protected and the impact criteria to be used. Analysis identified the following potential indicators:

a. Ecological, Land & Water Development

- *Ecosystem Preservation*:
  - extent of degradation of forest lands
  - extent of pollution of rivers & streams, recharging of groundwater resources
  - area under plantations and pastures
  - extent of green cover and tree cover
  - depth of the top soil
- *Water Management*:
  - area with perpetual irrigation facility
  - irrigation infrastructure quality and efficiency, reduction in water seepage & run-off
  - habitations with infrastructure for water for domestic & drinking purposes
  - habitations with access to water for domestic & drinking purposes during winters
- *Produce/Yield Enhancement*
  - area under cultivation and horticulture
  - area under and production of cash crops, HY varieties
  - length of productive season, infrastructure for year-round production
  - quality & quantity of animal products- wool, milk
  - percentage of improved and HY breeds among cattle population
  - cattle population serviced by fodder farms
  - infrastructure and facilities for services and inputs for agriculture, horticulture, animal husbandry, their coverage
- *Threat Control*:
  - incidence of environmental disasters and destruction
  - extent of damage to life and property through floods, landslides, avalanches
  - infrastructure for protection against floods, landslides, avalanches
  - sites with high environmental risk

b. Economic & Community Development

- *Livelihoods Development:*
  - income levels and percentage of BPL population
  - occupational pattern and percentage of population in non-traditional occupations
- *Integrated Development*:
  - communication infrastructure and percentage of population covered
  - alternate energy infrastructure and percentage of population covered
  - performance on QoL indices- education, health, sanitation, women's status
- *Community Development*:
  - community organisations and their operating quality
  - spread of benefits, coverage of various schemes, areas/population not covered
  - participation of disadvantaged groups- women, low

	income group
- *Transfer of Technology*:	- new technologies developed and extent of successful application

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Pragya is a not-for-profit, non-governmental organization addressing issues of environment conservation and culture preservation in the high-altitude regions of the Indian Himalayas.