Chapter 7

STRATEGIES FOR RECLAMATION, CONSERVATION 
AND MANAGEMENT OF WASTELANDS

This chapter presents a set of reclamation, conservational and management practices needed for the restoration of degraded lands in the Sirmaur district.

The degradation of land in the state and for that matter in Sirmaur district is not a new phenomenon. It has been operating since time immemorial. But the rate and intensity of degradation in the past was slow so that its impact was not noticeable because the main factors of the degradation were largely natural in nature. The human population of the time with its very little requirement for life had adjusted itself to the fragile and highly sensitive environment of respective areas. The increase in population and growing demands led to large-scale anthropogenic activities. The basic life supporting resource base such as agriculture, pastures, forests, and other land uses / land cover faced degradation problems. It induced imbalance in nature and generated large-scale degradational landscape in the area. The process of degradation of environmental quality of land is continuing in the area and irreversible damage has taken place in the form of land degradation. It has become pertinent to check this degradation of land, along with the reclamation of already degraded land. The various strategies that may be adopted to achieve this objective are discussed under the following subheads:-

1. Reclamation, Conservation and Management Practices for Different Types of Wasteland
2. Land Reclamation Classification

After discussing these strategies a comprehensive development plan has been suggested for the district.

1. Reclamation, Conservation and Management Practices

Reclamation is the first step to ameliorate the wastelands. It involves different remedies for the restoration of degraded lands. After reclamation, conservation of reclaimed land is
important. It is necessary for future improvement in land cover status. Active participation and cooperation of the local people is urgently needed for effective restoration of the degraded land.

The various reclamation and conservational strategies may improve the degraded land for a short period. The process of degradation can be stopped permanently if a harmonious relationship is built up between man and nature through well designed, scientific and eco-friendly land use practices. This can be achieved by adopting sound management land use planning system. Land management is a highly technical issue, which involves active participation of experts such as geographers, geologists, climatologists, land use planners, economists, soil scientists, horticulturalists, agriculturalists and a host of other experts. It also involves the active participation of public institution at different levels. However, there is no such type of professional management in place for land resource planning and execution of policies in the district. Due to this several types of wasteland are found as such in the area.

The various reclamation, conservational and management strategies for each type of wasteland found in the district are discussed as under:-

(I) Degraded Forest Land

This is the most prominent type of wasteland (covering 54.09 per cent area) present in the district. It has come into being due to excessive exploitation and biotic interference (human and bovine) into the thick forest, along with natural calamities such as fire. Due to degradation, the original eco-system is destroyed with severe implications for environment, economy and society in the district.

Environmentally, the degradation of forest has created serious soil erosion in some parts of the district particularly in Shivalik hills and pied mont very low hilly parts. About 40 percent of total area of the district suffers from very severe to severe soil erosion. The large-scale deforestation, which affects the infiltration rate of water into soils has resulted into poor
ground water potentiality and flood problem in the adjoining plain areas. Another problem related to this soil erosion is siltation in low-lying parts and water bodies.

Degradation of forests has caused increased incidences of landslides and soil erosion in different parts of the district. The government has to invest huge money to check landslide and soil erosion. As the district is known for various tourist places such as Renuka, Churdhar etc., the loss of scenic beauty has a great environmental as well as socio-economic impact of forestland degradation. The society in the area has also been adversely affected due to large-scale deforestation. The inhabitants are now facing severe problem of fuel wood. They have to travel longer distances to bring fuel wood. Beside fuel wood, the rural people are also facing the shortage of fodder and tree leaves for their animals particularly during winters. As a result the livestock population particularly the sheep and goats are decreasing day-by-day. This phenomenon has been noticed during the field visits in many villages.

Thus the degradation of forest land has seriously impacted on environment, economy and society in the study district. The reclamation of this degraded land is of utmost importance for people as well as for maintaining ecological balance. The local people need to be educated about the importance of forests as during field survey it was found that many people do not have much knowledge about the adverse impacts of forest degradation. Through people’s awareness, further degradation of forestland may be stopped. In addition to this, illicit cutting of trees in the district was noticed. This has to be stopped either by making the people aware or by implementing appropriate forest legislations. Beside this strict measures should be adopted to save forests from forest fires which are a regular phenomenon in the district. People should be motivated to grow trees on marginal lands in their fields so as to meet their daily requirement of fuelwood.

The reclamation of degraded forestland in hilly terrain involves huge efforts. The cost of reclaiming 10 sq.m. area on the basis of the prevailing rate of 2005 quoted by the Department of Forest, Government of Himachal Pradesh has been calculated to be around Rs. 1.18 lakh for the initial year. It includes the land preparation, nursery and plantation process (Table 7.1).
Table 7.1

District Sirmaur: Reclamation Cost of Degraded Forest Land

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Work details</th>
<th>Cost (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Earth cutting spade work</td>
<td>1830.00</td>
</tr>
<tr>
<td>2.</td>
<td>Surface dressing spade work</td>
<td>700.00</td>
</tr>
<tr>
<td>3.</td>
<td>Soil conservation work</td>
<td>21920</td>
</tr>
<tr>
<td>4.</td>
<td>Seed collection (Tree, Grass truff)</td>
<td>30800</td>
</tr>
<tr>
<td>5.</td>
<td>Nursery Preparation</td>
<td>9908</td>
</tr>
<tr>
<td>6.</td>
<td>Fencing</td>
<td>30731</td>
</tr>
<tr>
<td>7.</td>
<td>Plantation</td>
<td>22384</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,18,273</strong></td>
</tr>
<tr>
<td><strong>Maintenance cost for next two years</strong></td>
<td>Irrigation, fertilizer, insecticides, replanting and watch services</td>
<td>144,220</td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td></td>
<td><strong>262,493</strong></td>
</tr>
</tbody>
</table>


In this way the total reclamation cost up to three years is to the tune of about Rs. 2,62,493 for an unit area of 10 sq. m. degraded land. This seems to be an affordable figure keeping in view the importance of this land for ecological balance and economic benefits.

Protecting the plants /trees against different diseases is the second important task in reclamation of degraded forest wastelands. For this purpose, the insecticides and other medicines should be made easily available. The rate of dying of plants due to water shortage during summer months should be checked by applying artificial irrigation and mulching of plant bed. The conservation of reclaimed degraded forest area from forest fire is also an important task. Dried plants should immediately be replaced and new ones may be planted immediately. The forest department needs to play a very active role at various administrative levels. The forest guards should be well trained for implementing the various developmental schemes. Proper attention should be paid to the management of plantations. After new plants are planted in any part of the degraded area, these should be regularly monitored by the field staff or any other institution like the village panchayat.

(II) Degraded Pasture /Grass land
Traditionally, some of the area in the district is under grasslands where animals are allowed to graze. In local language, these grasslands are known as ghasnis and are of two types - the permanent and semi permanent. The permanent grazing land (common grazing land) is administered either by forest department or by the revenue department. There is no restriction of grazing on this land and livestocks graze throughout the year. On the basis of suitability for grazing it is of two kinds, that is suitable for grazing of cows, bulls and buffaloes and suitable only for sheep and goats.

The grazing land suitable for cows, bulls and buffaloes etc. is comparatively moderately sloping area. The area remains covered with grass, bushes and shrub of different types. This land is located near village settlements and is comparatively nearer to second type of grazing land. Large-scale degradation of this type of land has taken place in the district. It has been noted that in some villages this grazing land is completely devoid of trees, grass or other bushes.

The pastures suitable for sheep and goats are located on topographically steep sloping areas where cows and buffaloes cannot graze. These pasture lands are located at a distance of 5-10 kms. from the village settlements. This area is covered with grass, bushes and scrubs of different kinds.

The semi permanent grazing lands are grassland which find place in the village papers. These are legally allocated to the people by the government. Therefore, these are totally under the possession of the private owners and are locally known as malkiyat ghashni. In this type only grass is found. No trees or bushes or other vegetation were found on these grazing lands during field visit. These serve as a grazing ground for six months during October to April and as a protected area for grass for rest of the year. The grazing on this land is stopped only when heavy snowfall occurs. The owners of the land also restrict grazing in these lands on the onset of monsoon. In this period (April to September) these grasslands are protected from grazing and act as a storehouse of grass. This grass is collected and stalled near the village for winter season.
In the district as a whole 302.53 sq. km. grassland is degraded (10.71 per cent of the total geographical area). It is distributed in north-western, central, and eastern parts of the district in addition to few pockets scattered in other parts.

Due to degradation of this grass layer the phenomenon of severe soil erosion has been noticed in the area. This degradation increases the runoff and consequently very limited water penetrates in the soil. Large-scale depletion of grassland has also led to the shortage of grass in the area. The habitants purchase grass from the plain areas during winter season. Not only that, the bovine population has also declined in the affected villages. Even the existing bovines are not getting adequate grass due to which their productivity is low. In the light of these facts, it is important to regenerate these grasslands for sustainable development of the area by applying suitable reclamation measures.

The improvement of degraded grasslands involve a combination of steps like enclosing the area to avoid biotic interference and grubbing the unwanted bushes to promote ecological phenomena of succession. This also involves soil and moisture conservation especially in hilly and mountainous parts of the district.

The protection from biotic interference is essential to give it a chance to regenerate through progressive succession. For this purpose, the government has initiated the concept of social fencing instead of forced wire fencing. But the concept of social fencing has not been well taken by the people. Therefore, forced wire fencing is the only suitable measure in this respect. These grasslands are stressed due to spread of some bush species, the grubbing of which is necessary for better growth of grasses. This can be done by eradication of roots of the unwanted bushes through digging and application of weedicides in the affected parts.

The various agro-ecological techniques for the improvement of degraded grasslands are needed to be applied successfully in the study area. In some parts where original grass has totally lost, methods of receding pastureland with perennial grass species should be applied. This is the only solution to regenerate the grasslands in these areas. For this purpose, some
sort of leveling is done in the grassland and then seeds are sown in these leveled beds. With the passage of time, the grass automatically starts spreading in surrounding area through its root network. Soil and moisture conservation measures are one of the most important contributing factors in the regeneration of degraded grassland in hilly area. Contour furrowing at some distance and pitting in grassland is a best method to protect moisture in the soils. (Das and Yadav, 1979). Soil in the district is generally deficient in nitrogen, potassium and phosphorous. For speedy regeneration of degraded grasslands, the application of these deficient fertilizers is required.

The potentiality of original grass found in the area is very low. In the degraded area improved high yielding perennial grass species should be introduced. These grasses are blue panic, anjana grass, klein grass, love grass, para grass, guinea grass and setaria; as recommended by Himachal Pradesh Krishi Vishav Vidyalaya Palampur. Grass-legumes mixture can also be introduced in the area. The legumes that can be introduced in grasslands are Ban -Kuthi, Stylo and Silver leaf desmodium as suggested by University of Horticulture and Forestry, Solan.

For more appropriate reclamation of grassland the silvi-pastoral systems should be implemented in the study area. Both deciduous and evergreen trees are a good source of green fodder especially during the lean period. Recommended fodder trees are, Kikkar, Babul, Tun, Bans, Arjun, Khair, Ohi, Dhaman, Beins, Kharso etc. Until date, no efforts have been made by any of the agencies to reclaim the degraded grasslands. So the economics of degraded grassland reclamation could not be known. After reclamation, the conservation of reclaimed pastureland is important. It should be conserved from grazing of any kind for sometime. After regeneration of degraded grassland, the method of rotational grazing in all types of grazing land should be adopted. These reclaimed lands should also be conserved from fire, which is a regular phenomenon in these lands.

As regard the management, there are no management agencies to improve the quality of pastureland at the state/district as well as local level. Animal husbandry and forest
department do very limited work. The joint responsibility is also hampering the management of pastureland. However, the works of these agencies are consultative in nature. Grassland falls under the ownership of government and private people. Grasslands under private ownership remain closed for six months. Therefore, the degradation of this privately owned grassland is less as compared to government owned grassland.

(III) Steep Sloping area

This is the third major type of wasteland in the district. The steep slope affects the possible use of this type of land. In this area vertical escarpments are also included. These areas present unique type of ecosystem, supporting different types of flora and fauna.

There is presence of several joints and fractures in these very steep sloping areas. Water remains stagnant in these joints and crevices for most part of the year. Due to this many types of bushes and climbers grow during monsoon period. In the big crevices, several wild bees make their colonies. This type of land also acts as a nested area for several endangered species of birds such as vulchers (Gidh). Therefore, it is a separate type of eco-system which can be termed as ‘Steep Land Ecosystem’. This type of land can hardly be reclaimed and all efforts should be made to protect this unique ecosystem as steep lands are exploited for stone and in some parts people are exploiting these for commercial extraction of stones.

(IV) Land Without Scrub

There is no record of this type of land with the revenue as well as with the forest department. This type of land has a thin cover of grass, weeds or bushes and sporadic tree growth. In Sirmaur district this land is present in very small patches but its concentration is more in the north-western and central parts. This degraded land covers 87.42 sq. km. area which is 3.09 per cent of the total geographical area of the district. The impact of this degraded land on environment, economy and society has been assessed through interaction with the common people and with government functionaries, during field visits to the area.
Environmentally, this area is suffering from soil erosion particularly where the slope is steep. The scrubs and bushes provide good grazing ground for sheep and goats. Large-scale degradation of these bushes and scrub has a negative effect on the availability of green forage for sheep and goats. Bushes near villages are a good source of fuelwood which is collected by women and children. It has been observed that many villagers generally use the small collected sticks of bushes as fuel for preparation of tea and midday refreshment. These bushes are also used for burning of fire in the ovens (chullas). Therefore, the degradation of this land cover leads to the shortage of grazing ground for sheep and goats and increases the burden on forest for fuel wood.

In the study area, no efforts have been made by any agency to reclaim this degraded land. The concerned department does not even have the knowledge of this land use category. However, some attention has been paid by Soil Conservation Department to protect these lands from soil erosion by constructing breast wall and check dams in the affected areas. No fresh plantations have been raised. Even no efforts have been made to protect the original bushes and scrub. Therefore, measures for the reclamation of this degraded land are suggested on the basis of information gathered through personal interaction and experience. It is suggested that the grazing of sheep and goats should be completely stopped for at least 4-5 years. Sheep and goats eat the buds and flowers of bushes and hence affect seed formation. Due to this the future growth of new bushes and scrubs is almost negligible. By stopping grazing this vegetation can be maintained during flowering and seed generation period. It is suggested that these bushes should not be gathered during flowering and seed formation season as people cut these for whole of the year. In addition to these measures, efforts should be made to protect these bushes and scrubs from fires which are a common phenomenon during summers.

This degraded land can be reclaimed for forest, agro-forestry, silvi-pasture, and social forestry according to its location in relation to a settlement. This would reduce the burden on forestland. In high hills and mountainous parts of Sirmaur district, this land should be reclaimed only for forest purpose.
The cost of reclamation of degraded scrubland has not been estimated by any agency in the district. However, a rough estimate of expenditure for reclaiming an area of one sq. km. of such land has been made in consultation with the experts from Soil Conservation Department of the district and has been shown in Table 7.2.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Description</th>
<th>Cost(Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leveling of ground and making of terraces</td>
<td>20,000</td>
</tr>
<tr>
<td>2</td>
<td>Collection of bush seeds (Rs. 50 per Kg for 6 kg seeds)</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>Seedling in nursery beds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) Preparation of nursery bed 15'x15'</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>ii) Seedling in the beds</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>iii) Watering and look after for one year</td>
<td>27,375</td>
</tr>
<tr>
<td></td>
<td>iv) Transfer of bush nursery to degraded land and plantation</td>
<td>20,000</td>
</tr>
<tr>
<td>4</td>
<td>Fencing of area (1 Sq. Km)</td>
<td>25,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total Expenditure for first year</strong></td>
<td><strong>93,775</strong></td>
</tr>
</tbody>
</table>

Source: Prepared in consultation with Soil Conservation Department, Sirmaur, 2005.

The total cost for first year comes out to be Rs 93,775. The district has 87.42 sq km. of land without scrub. The reclamation of this much area in the district as per the estimate would be around eighty-two lac (81,97,810). This much amount is not difficult to manage provided the government in association with civil society organizations and local people takes the initiative. After plantation of bushes, weeds and other vegetation the area should remain closed for at least five years so that the bushes are mature enough. For this purpose additional expenditure is needed. After reclaiming, this land should be protected from biotic interference and fire in order to conserve it. This land should also be properly recorded in the revenue books to justify its legality and to manage it better on sustainable basis.

(V) Mining Wasteland
This wasteland is the outcome of various mining activities being undertaken in the district. This land is highly localized in eastern and central Sirmaur where limestone is mined. It not only includes the mining area proper but the land which gets degraded due to mining dumps and fall of mining waste downward under the impact of gravitation. Depending upon the availability of limestone, there are seven specific areas (zones) where mining activities are undertaken. The description of these is as under (Table 7.3, Map 7.1).

<table>
<thead>
<tr>
<th>Mining Areas</th>
<th>Name (Zone)</th>
<th>No. of Leases</th>
<th>Sanctioned area (Hectares)</th>
<th>Range of elevation (a.m.s.l.)</th>
<th>Location</th>
<th>Production for the year 97-98 (lakh tons)</th>
<th>percent to total production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nohra area</td>
<td>3</td>
<td>15.14</td>
<td>2000-2300 m</td>
<td>53F/5</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>2</td>
<td>Sangrab-Bhootmari area</td>
<td>11</td>
<td>106.97</td>
<td>1250-1950 m</td>
<td>53F/6</td>
<td>0.85</td>
<td>8.80</td>
</tr>
<tr>
<td>3</td>
<td>Manal area</td>
<td>4</td>
<td>570.92(562 hect.area of M/s C.C.I.)</td>
<td>600-1200 m</td>
<td>53K/10</td>
<td>1.50</td>
<td>15.22</td>
</tr>
<tr>
<td>4</td>
<td>Sataun-Kamroo Bohrar area</td>
<td>27</td>
<td>240.72</td>
<td>1200-2050 m</td>
<td>53F/10</td>
<td>5.32</td>
<td>55.08</td>
</tr>
<tr>
<td>5</td>
<td>Pamta-Bohar area</td>
<td>8</td>
<td>69.16</td>
<td>1250-1780 m</td>
<td>53F/10</td>
<td>0.89</td>
<td>9.2</td>
</tr>
<tr>
<td>6</td>
<td>Shiva-Rudana area</td>
<td>5</td>
<td>62.01</td>
<td>1200-1600 m</td>
<td>53F/10</td>
<td>0.85</td>
<td>8.82</td>
</tr>
<tr>
<td>7</td>
<td>Bharli-Rajpura area</td>
<td>4</td>
<td>29.52</td>
<td>800-1400 m</td>
<td>53F/10</td>
<td>2.25</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>62</td>
<td>1094.44</td>
<td></td>
<td>9.66</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Source: State Geological Wing, Shimla

From the table, it is seen that 10.944 sq. km of area is sanctioned under mining leases in the district. All leases except that of M/s Cement Corporation of India in Manal area, fall under small-scale mining sector, as the average employment in each of the mines is less than 150 persons (State Geological Wing, Shimla). The range of elevation from mean sea level varies from 600 m in Manal area to 2300 m in Nohra area. All limestone leases in the district fall under Survey of India Topo-sheet no. 53F. As regard the production of limestone from these
mines, more than half (55.08 percent) is contributed by Sataun-Kamroo Bohrar area followed by Manal area. The district earns a considerable amount (Rs 51 million in 2003-2004) of royalty from these mines.

Mining no doubt is important for the development of the economy, but due to unscientific methods of exploitation, this activity has serious implication for the environment. It has caused damage to forest, grass and scrublands particularly in Monal and Sataun–Kamroo area. The soil erosion has increased in the area. Besides this the transportation of limestone and extensive blasting has led to air pollution. Movements of trucks on unmetalled roads add to air pollution. The effect of air pollution can be judged in the morning in the form of heavy dust depositing on grass and roofs of the houses. Due to extensive blasting, many of the natural springs along the mining area have dried up. Many springs are buried under the down flow of wasted mining materials. It happened almost in all the mining sites. Mining activities also have negative impact on river water particularly in lower catchments of Giri, Tons and Yamuna rivers. The water of these rivers is polluted due to soil erosion and mineral waste falling in the rivers. Land is also badly damaged due to mining activities which can be seen in the form of abandoned land after completion of mining (Nohra region). The other activities of drilling, blasting and transportation of limestone are also a great source of noise. Mining activities have also shown negative impact on the aesthetic environment in this hilly area. It has changed the topography, landscape and other physical attributes of the area.

Mining and associated activities have some socio-economic impact of direct and indirect consequences in the district under study. It has provided job opportunities for the local people. More than 20,000 persons are getting their livelihood from this activity. It has raised living standards of the people. Mine owners of Sirmaur district have formed “Sirmaur Mine Owner Association” and “Trans-Giri-Truck Operators Society”. Both of these are contributing to the development of the area. Beside this the State government is also getting royalty and some of the amount is being distributed as compensation money to land owners. About 300 trucks are being operated by the society carrying minerals at concessional rates. The society has spent more than Rs. 80 lakhs on construction of school buildings, play grounds, dispensaries, electrification of villages, repair of old temples and aid to poor people.
Map 7.1

DISTRICT SIRMOUR
MINING ZONES

1. Nohra Area
2. Saugrah-Bhootmari Area
3. Manal Area
4. Sataun-Kamroo-Bohmar Area
5. Paunta-Bohrar Area
6. Shiva-Rudana Area
7. Rajpura-Kharli Area

Source: State Geological Wing, Shimla, 2003
as per information supplied by the State Geological Wing, Shimla. Infrastructure development particularly road developmental activities have been accelerated in the mining area which enable the farmers to grow cash crop and seasonal vegetables which can easily be transported to the urban area. During field visits opinion of people was gathered from in and around mining areas about the consequences of mining activities. Only few people who are getting better economic return are in favour of continuation of mining activities. Many people in the mining area are suffering from diseases and blame mining activities for their bad health. People away from mining area have strong objection to large-scale mining in the district. In these areas more than 70 per cent people are in favour of a complete ban on mining activities as mining is destroying forests leading to environmental problems, spreading diseases and causing large-scale soil erosion.

In the light of these factors the mining operations in the district need to be seriously looked into. Although for development these activities are important, yet the environmental impact cannot be ignored which is much more important for sustainable development. The concept of eco-friendly mining activities should be taken into consideration in the district. It is also important for reclamation of degraded mining area.

It is therefore suggested that no mining should be allowed in the district where the slope angle is more than 40°. It should also not be allowed in thickly forested area. Mines should not be leased out where there is danger to disrupt the ground as well as surface water regime. Strict conditions for the reclamation of degraded land should be imposed on the lease holder and the cost of reclamation should be charged from owners of the mines. Mineral extraction and reclamation work should go side by side. There should be regular monitoring of mines so that there is no neglect of the environmental aspects. Finally the afforestation of mined out area should be done as this is the most suitable reclamation measure for these lands.

(VI) Barren Rocky Land

This is an area of rock exposure of varying lithology. It is devoid of soil cover and vegetation, except in small crevices where very small thorny bushes grow during monsoon
It is very difficult to reclaim this type of wasteland. With heavy expenditure, this land can be brought under vegetation cover only if the slope is moderate. The technique suggested is blasting in the crevices. Due to blasting approximately, 3’x3’ deep holes develop in the crevices. These can be filled with soil, and after that plants can be grown in the pits. But plants require regular water for two or three years for survival. However, it is a costly effort. One blast costs approximately Rs 400-600 as is suggested by the Public Works Department. The availability of water is a great hindrance in these areas.

(VII) River Sands

The river sand is found along the bank of Giri, Tons, Markanda, Yamuna rivers and their tributaries in the district. The total area under this land is 19.71 sq. km. The environmental effect of river sands is seen during dry season when due to wind sand spreads in adjoining areas. Most of the agricultural fields are located in the river valleys of the district. During dry season, the sand spreads on the crop due to wind, thus affecting production of the crop. Secondly, the minute particles of sand enter into different vegetables particularly in cabbage layers which become difficult to be removed before consumption. In some parts the spreading of sand into agricultural fields is more severe particularly in Giri-Yamuna plain and in Kiar-da-dun valley.

The reclamation of river sands is a difficult task in the study area as the flow of the river water is high due to hilly terrain. The reclamation practices being undertaken along banks of the river are washed by the river during rainy season. The best way to check the spreading of sands in adjacent area is to plant trees in rows along the river banks. Locally available bushes can be planted to check the spread of sands and to reclaim the land for forest and silvi-pastoral purposes. It has been noted that this sandy area is auctioned by the government to private contractors for the sale of sand for construction purposes. Therefore, these sandy areas are source of income to the government. The individual farmers who own these sand also sell. For many families living along river Giri, Tons, Markanda and Yamuna, the sale of sands is the major source of income. So neither the government nor the local owners in such
parcels are concerned to protect the area from spread of sands as they sell the (sand) area for income.

(VIII) Waterlogged and Marshy land

Water logging in any area is caused when inflow into the groundwater reservoir exceeds outflow, resulting in rise of water table. The inflow into the ground water reservoir mainly comprises rainfall water and seepages from water bodies like lakes, rivers, nallahs and canals. The waterlogged land in the study area is not situated in the agricultural fields or in any other productive piece of land. It is found around the Renuka Lake, a wetland of national importance. Beside this it is also found on the periphery of Parshuram Tal. The entire water logged and marshy land along Renuka lake falls in watershed no. 2C6C4W1a.

Because of biological richness of the lake, it has been designated as a wetland of national importance. The wetland is well protected, as it is located in the middle of Renuka wild life sanctuary. The government has also passed a legislation to protect the wetland in its natural conditions and no modification can be made around it. Therefore, no reclamation measures can be applied around this wetland.

(IX) Degraded Plantation Land

Degraded plantation lands are found outside notified forest area and have mixed types of distantly located vegetation. In Sirmaur district, these are mostly found near the settlements. These lands are used for collection of fuel wood for domestic use, for use by the community to ceremonize marriages of the girls, and for funeral of the dead etc. These cover a mere 0.02 per cent of the total area and are highly unevenly distributed in the form of tiny parcels in the district.

The impact and reclamation strategies, cost of reclamation and conservation of degraded plantation land are nearly the same as mentioned for degraded forestland. This land can be reclaimed for forest, silvi-pasture and social-forestry. The management of this land is no ones responsibility despite the fact that most of it is under revenue department and is not classified
in the land use records. It is suggested that for maintaining ecological balance at the micro level, the management of this land should either be given to the forest department or to the local communities.

(X) Gullied/Ravinous Land

Gullied/ravinous land is perhaps, the most dramatic form of degraded land. The total area under this type is only half a square kilometer which is scattered in different parts of the district. But this degraded land type has direct impact on the environment. It is found in densely forested area thereby causing loss to the forestland. Severe soil erosion caused by gullies is another serious environmental impact. It leads to heavy siltation problem in low lying areas, which may cause damage to the hydro-dams in these parts. In plain areas, it leads to floods during rainy season. Therefore, the formation of gullies and ravines in Sirmaur is not only affecting the local environment but its impact is also extended to the Indo-Gangetic plain. As far as its impact on the society is concerned, the people are unable to obtain any profit from this wasteland type directly or indirectly. Rather it is affecting the people in an adverse manner.

The various reclamation strategies for this land include control of runoff from marginal lands to gullies; diversion of runoff from gullies by constructing a deep channel at a distance of few meters from the upper end of the gully so that the water does not enter into the gully; contour and graded bunding; broad base-terracing; bench terracing; construction of earthen marginal bond between adjacent area and gully heads to control the spread of gullies; and peripheral bunding along gully side etc. These measures help to increase opportunity time for the rainwater to infiltrate into the soil and reduce the amount of runoff. Earthen marginal bunds help in leading the runoff water to the gully heads, which have been made stable with gully head structure. This stops the extension of gully head into the marginal land.

Gullies proper can be reclaimed according to the purpose of reclamation, whether for agriculture, horticulture or forestry depending upon the nature of terrain. The reclamation of gullies/ravinous land in Sirmaur district for agriculture purpose is a very difficult task and
involves huge expenditure. So in the study area gullied land can be reclaimed for forestry because most of this land is concentrated in steep sloping area.

As far as the conservation of reclaimed gullied land is concerned, the first and foremost conservational strategy in the district is to keep the reclaimed area protected from biotic interference particularly from grazing animals. Trained persons to judge the improvement in status should be employed for it. If due to some reasons there occurs any damage to reclaimed measures then it should be applied again immediately so that the degradation process does not start again. It is suggested that at least 50 m periphery area around the gully should also be conserved and declared as protected area.

The effective management of this degraded land is a serious draw back in the district. However, some efforts are being made to reclaim the gullies which are near to villages. No attention is given to reclaim the land away from a settlement by any management agency. Forest department, block development office and soil conservation department are doing some work in this regard but there is lack of coordination between these departments. For effective management, therefore, one single authority should be given the job. People’s participation is also important in this regard and they should be made aware about the adverse consequences of gullied land.

2. Land Reclamation Classification

The preceding discussion deals with the measures suggested for reclamation, conservation and management of individual wasteland types. However, the district has marked variations in terrain types ranging from river terraces, alluvial plains to high hills and mountains. As a matter of fact, wasteland in some areas can be reclaimed more easily than in others. Accordingly the wastelands for the purpose of reclamation have been divided into different classes, as follows:

1. Class-I Very easily reclaimable
2. Class-II Easily reclaimable
3. Class-III Reclaimable with moderate difficulty
4. Class-IV Reclaimable with difficulty
5. Class-V Reclaimable with great difficulty

The nature of terrain and areal extent of each class of land is shown in Table 7.4. These classes are discussed in the following pages:

Class-I Very Easily Reclaimable
District Sirmaur has 7.62 per cent wasteland area associated with level terrain which is very easily reclaimable. The river terraces along banks of rivers Giri, Jalal, Nera, Tons, Bata, Markanda, Tarapur, Majhyar, Kandiwala, Somb-Nala and Nimba-wala-khol and the alluvial plain along Yamuna river in south-eastern parts of the district make this land class. It is particularly located in Kandiwala-ki khol and Markanda river in the southern part. The Dun valley and valley fill also fall in the very easily reclaimable wasteland class.

Artificial irrigation can be applied easily to this class of land due to low relief. The ground water availability is good to very good and soils are deep to medium deep. It can be reclaimed for agricultural purposes by using simple techniques.

Class-II Easily Reclaimable
River valley and foot slope area constitutes this reclamation class. The limitation constitutes occasional hindrance in river valley due to flood in rainy days and the presence of boulders. In foot slope terrain unit, debris fall under the impact of gravitation. The soils in such terrain are deep and artificial irrigation can be applied easily. Ground water availability is good to moderate and the slope, local relief and ruggedness are very low.

This class of land falls over Alkali-khala, Parvi-khala and Rana-ka-khala in northern part of the district along Renundar-khala, Nait-khala and Khuniyar-ka-khala in north-western parts while in central parts it is found along the banks of river Giri, Jalal and some other small streams. In south, it is found along Bata nadi, Markanda nadi, Som-nala, Matar-ki-khol and Nimbo-wala-khol. Part of easily reclaimable land (foot slope) is located in the foot of mountains and hills. It is formed due to the process of mass wasting. This reclamation class
can be easily reclaimed by putting minimum efforts and with low economic investment. Like the previous class, this class is also fit for agricultural purposes.

**Class-III  Reclaimable With Moderate Difficulty**

This wasteland reclamation class covering 7.92 percent of the total area of Sirmaur has stepped topography, elevated flat land, plateau, structural valley and plain with widely spaced hills as major terrain types. The wasteland area can be reclaimed with certain difficulties due to various morphometric limitations. However, in these types of terrain people are carrying out agricultural activities in spite of very low production. There are limited chances of irrigation in these areas due to their location in topographically high area. Soils are shallow to medium deep whereas the slope, local relief and ruggedness are low to moderate. The wasteland can therefore be reclaimed with moderate efforts and moderate expenditure. Measures like rain-water harvesting and soil management are needed to reclaim this class. Flat area can be reclaimed for agriculture and growing of vegetables. However, the

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Class</th>
<th>Terrain Units</th>
<th>Area (km.sq)</th>
<th>As percent to total area of district</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Very easily reclaimable</td>
<td>River terraces, Alluvial Plain, Dun valley and, Valley fill</td>
<td>165.86</td>
<td>(7.62) 5.85</td>
</tr>
<tr>
<td>II</td>
<td>Easily reclaimable</td>
<td>River valley and Foot slope</td>
<td>51.3</td>
<td>(2.36) 1.81</td>
</tr>
<tr>
<td>III</td>
<td>Reclaimable with moderate difficulty</td>
<td>Stepped topography, Elevated flat land, Plateau, Structural valley and Plain with widely spaced hills</td>
<td>224.09</td>
<td>(10.30) 7.92</td>
</tr>
<tr>
<td>IV</td>
<td>Reclaimable with difficulty</td>
<td>Flat hill top, Undulating land, Low hills, Rolling hills and Pied mount very low hills</td>
<td>594.87</td>
<td>(27.32) 21.07</td>
</tr>
<tr>
<td>V</td>
<td>Reclaimable with great difficulty</td>
<td>Mountain, High hills and Hills</td>
<td>1140.40</td>
<td>(52.40) 40.40</td>
</tr>
<tr>
<td></td>
<td>Grand total</td>
<td></td>
<td>2176.53</td>
<td>77.05</td>
</tr>
</tbody>
</table>

Source: Prepared after Terrain Evaluation

Note: Figures in brackets are percent to total wasteland area.

Table 7.4
District Sirmaur: Wasteland Classification for Reclamation
marginal sloping area can be reclaimed for horticulture, agro-forestry, silvi-pasture and other allied economic activities.

Elevated flat land which is located in Churva-dhar, Dhudam-dhar, Mewog-dhar, right bank of Giri river, Garol-ki-dhar, near Bhangari-nala, near Garog nadi, Singh-dhar and right bank of river Markanda can be reclaimed for agriculture and other commercial horticulture purposes.

The plateau land found near Parvi-ka-khala, Churuwa-dhar, Nati-khala, Sawarinala, Gambar-nala, Chunari-dhar, Kamru-dhar, Bharon-khol and right bank of Giri river can be put to seasonal vegetables and fruits.

The plain area with widely spaced hills lies between Dun-valley and Dharti-dhar ranges. In north-eastern parts, it is located between Lingaru-ka-khala and Dophar-ka-khala, between Dophar-ka-khal and Dholi-ka-khala and between Chilot-ka-khala and Ramnagar-ka-khala. In south, it is located between Shivalik ranges and Gariba-ka-khala. It can be reclaimed for afforestation as most of it is suffering from severe soil erosion.

**Class-IV Reclaimable With Difficulty**

This class of land is associated with varied terrain comprising flat hill top, undulating land, low hills, rolling hills and piedmont very low hills. It covers one fifth of the total area of Sirmaur. Geographically, the flat hill top geomorphic unit is located in Pain-Kufar-dhar, Kufu-dhar, Chur-dhar, Habban-dhar, Dhadham-dhar, Devti-dhar, Nohra-dhar, Manli-ki-dhar, Pilani-ki-dhar, Pawai-dhar, Jauni-dhar, Shalai-dhar and Kamroo-dhar in the Lesser Himalayan parts of the district. It is also found in central Sirmaur in hill ranges like Dharti-dhar, Ram-ki-dhar, Chaunari-ki-dhar, Kotway-ka-tibba, Kaulani-ki-dhar, Devankot-ki-dhar, Kaluwala-ki-dhar, Chikni-dhar and along Shivalik ranges in the south. The wasteland falling over low hills and rolling hills is confined to central and north-eastern parts of the district particularly between the dun-valley and Dharti-dhar ranges. Due to severe restrictions posed by terrain, the reclamation of this class requires higher level of technology and higher costs. There is general lack of natural water resources. The only way to provide water in these lands is by lifting methods which is very costly. In addition, the soils are shallow and somewhat barren rocky. Wherever possible, terraced farming is practiced. Due
to soil erosion, the fertility of land is getting degraded. Under the given constraints of relief, shallow soils, scarcity of water, the wastelands of this class can best be reclaimed for multipurpose tree species and vegetables on the terraced lands.

**Class-V Reclaimable With Great Difficulty**

This class of land includes all those areas where environmental factors are very severe. The slope is steep to very steep and relative relief is excess to very excess. The run-off is very high and available water capacity of soil is very low-to-low. Soil erosion is severe to very severe. It also covers barren rocky and steep sloppy areas of the district. Mountains, high hills and hilly area of the district largely comprise this reclamation class. It shares 40.4 per cent of geographic area and a little more than half of the total wasteland area of the district. More specifically it is found in Chur-dhar, Langra-dhar mountains in north-eastern parts, high hills near Basari river, Kuftu-dhar, near Bhangal nadi, Chur-dhar, Dhudam-dhar, Sew-ki-dhar, Giltu-ka-tibba, Sonth-ki-dhar and Jammu-ka-tibba and hills. The wasteland in these parts can be put under dense forest or it might be developed for recreation purposes. However, this class is best suited for wild life sanctuaries, and hence its reclamation is not possible without the help of government.

**Developmental Plan for Sirmaur District**

Based on overall geographical and agro-ecological conditions the suitability of different areas for various land use activities in the district has also been ascertained. A map has been prepared by superimposing of different maps (slope, relief, drainage, ruggedness, geology, and different soil characteristics maps) of the district, and in consultation with the experts from Department of Agriculture, Horticulture and Forestry; University of Horticulture and Forestry; Solan; State Council for Science Technology and Environment, Shimla and State Geological Wing, Shimla. The map (Map 7.2) clearly shows the six different regions which are suitable for different types of landuse activities.

The area (Region 1) falling over the southern and southwestern parts of the district, occupies the valley of Markanda river, Somb–nala, Dun- valley and alluvial plain of Yamuna which
are as good for cultivation of crops like wheat, barley. Besides these, horticulture crops like citrus fruits, lichi, mango, hill lemon etc. can be grown successfully. A notable part of this region lies in piedmont very low hills and plains and is separated by Shivalik and Dharti-Dhar ranges from rest of the region. However, some of its area located in south adjacent to Shivalik ranges is suffering from steep slope, slight to severe soil erosion, slight to moderately stoniness surface, some what excessive soil drainage, very low available water capacity, sandy soils, moderately acidic soil reaction, low phosphorous and potassium. In this area dense afforestation with thick grasses and bushes is a suitable land use

The second region (Region 2) is located along Dharti dhar ranges of the district. It is conducive for wild pomegranate, peach, kiwi, pecan nut, pear, plum, and fresh vegetables like chills, coriander, ginger, peas, beans, tomato etc. In addition to these, food crops like wheat, maize, barley and pulses grow well. The southern and north central parts of this broad region are suffering primarily from moderately steep slope, high ruggedness, very severe to severe soil erosion, very low available water capacity, coarse loamy soil texture, and medium soil depth, low phosphorous and low potassium. Under these conditions only afforestation and dense bushes are best land cover strategies.

To the north of the Region 1, lies the third region which is specially suitable for a diverse number of fruits, vegetables and food crops. In this region three different pockets are demarcated that suffer mainly from steep to very steep slopes, moderately excess relief, very low drainage density, high surface ruggedness, severe soil erosion, moderately stony surface, excessive soil drainage, very low available water capacity, moderately deep soils with slightly acidic reaction, low phosphorous and low potassium. These parts cannot be used for carrying out agricultural activities and hence should be brought under dense forest and other plantations.

Lying wholly in Lesser Himalayas, the eastern and north-eastern parts of the district make a distant region, which is suitable for walnuts, pecannuts, kiwi, peach and plum. Vegetables like ginger, peas, beans etc. and suitable agricultural crops like wheat, barley maize and pulses can also be grown. The apple, walnut, pecannut, cabbage, cauliflower, peas, maize,
DISTRICT SIRMAUR
LANDUSE SUITABILITY

Region | Map Symbol | Suitable for Fruits | Suitable for Vegetation | Suitable for Crops
--- | --- | --- | --- | ---
1 | | Citrus, Lichi, mango, hill lemon, mandarin, sweet orange etc. | Tomato, chilli, capsicum, cauliflower, ginger and beans | Wheat, barley, pulses, sugarcane, oil seeds and rice
2 | | Wild pomegranates, peach, kiwi, pecan, nuts, pear, plum, spostadic and walnut | Chilies, Coriander, ginger, peas, beans and tomato | Wheat, maize, barley and pulses
3 | | Stone fruits, apricot, pear, plum, pecan nuts etc. | Beans, peas, ginger, cabbare, potato, corindier | Wheat, maize, barley, pulses and oil seeds
4 | | Diverse, in subtropical floral forest | Khair, semal, ran, behul, ritha, babera, chilli, walnut, kali and khink | Shrubs: Vites bamboo, berberries Grasses: Vetive, sanche, pheum etc.
5 | | Walnuts, peacan nuts, kiwi, peach and | Ginger, peas and beans | Wheat, barley, maize etc.
6 | | Apple, walnut, pecan nut, pear etc. | Cabbage, cauliflower and peas | Maize, wheat, barley and pulses
7 | | Diverse in temperate floral forest | Doodar, fir, spruce, birch, juniper and cypress | Shrubs: lappa, artemesia etc. Grasses: Bromus, clove white etc.

Areas with dot shows severe problem

Source: Prepared After Terrain Evaluation
wheat, barley and pulses can be grown successfully on a considerable area in northern part. But central and northern parts of this region are chiefly suffering from excess to moderately excess relief, steep to moderately steep slope, high ruggedness of surface and moderate to severe soil erosion and hence afforestation is suitable land use here.

The northern part of Sirmaur, south of Giri river constitutes still another region in the district, which is especially suitable for fruits and fields crops like apple, walnut, pecan nut pears, cabbage, peas, maize, wheat and barley. But steep slope, severe soil erosion, slight stoniness, somewhat excessive soil drainage and shallow soil depth are main hindrances in its central part which should be brought under dense forests.

Though small in extent the district has two more region (no. 4 and 7) are particularly suitable for forest cover due to topographic constraints. The former is located in southern part of the district along Dadhu and Renuka Lake. In this area two prominent rivers—river Jalal and Giri meet. A host of other small streams also join their master streams in this part. The tropical tree species like Khair, Semal, Tun, Beul, Ritha, Bahera, Chil, Kail, Walnut and Khirik are suggested for this part. The latter having temperate climatic conditions is topographically located in high altitude (more than 2500 m. amsl) in the district particularly in Chur-dhar mountain ranges. Here due to very high relief and very steep slope cultivation of any type of crops is very difficult.

In addition to these, many parts of the district have good scope for the development of mulberry plantation. The land without scrub, degraded forestland, degraded pastureland and degraded plantation land can be reclaimed with mulberry cultivation. This can facilitate the promotion of seri-culture which is a very promising supporting activity for the local people.

It is also important to be mentioned that the district has varied stock types ranging from buffaloes, sheep, goats, horses, cows, mule etc. The total cattle population was 2,34,405 in 2001. There is general scarcity of green fodder throughout the year. To over come this problem perennial green grasses should be grown on the degraded pasturelands. The high yielding improved breeds of cattle should also be introduced.
There is lot of scope for the cultivation of commercial floriculture particularly in Dun valley and in alluvial plain areas. For this purpose mass awareness programme through extension services is needed. Farmers may be trained to exploit the full potential of floriculture. Closely associated to this is the activity of bee-keeping for which conditions are quite suitable. The Lesser Himalaya region is suitable for apiculture during summer season while Shivalik hilly area is suitable for autumn season. The plain area, mainly Kiar-da-dun valley and Yamuna plain are suitable for winter season apiculture. By migrating bees according to the season in different parts of the district, beekeepers can earn good incomes. Efforts are already being made by the government for promoting bee keeping in different parts of the state as well as in the Sirmaur. The district is bestowed with perennial rivers and streams. Efforts to promote fisheries in these water bodies can also reduce the pressure on land resources. There is ample scope for the development of inland fisheries in the water of these rivers.

It needs to be highlighted here that the district like many other parts of the Himachal Pradesh is bestowed with beautiful landscapes, embracing climate, legendary temples and has potential for development of tourism. Some of the important tourist spots of the district are Renuka ji, Paonta Sahib, Nahan, Jatak hills, Haripur dhar, Trilok pur, Shivalik Fossil Park and famous Chur dhar or Chur-chandni-ki-dhar. Proper infrastructure should be developed to promote tourism to these places in the district.

Therefore for sustainable economic development of the district, focus should not only be laid on reclamation, conservation and management of wasteland, rather the entire land area of the district should be taken into consideration and developmental plans should be introduced according to the suitability of the area so that further degradation of land is checked.