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Himalaya

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Abstract

This paper examines the forest diversity and degradation of forest in the Pindar Basin of Uttarakhand Himalaya and suggests the management of forest resources in this fragile mountain terrain, as sustainable management schemes for forests have become increasingly important and timely, because these areas have come under serious exploitation and constant threat of disintegration, following the depletion of forest. The natural hazards and man-induced activities, both are equally responsible for depletion of forest in mountain areas, while, the mountains are having the highest biodiversity of fauna and flora. In the Pindar Basin, four zones of forests exist according to altitudes. These zones are characterized by eucalyptus and *Dendrocalamus spp.* trees in the low-lying region, pine trees in the mid altitude, coniferous forests along with oak in the temperate zone and extensive alpine meadows. This basin is rich in forest resources particularly in temperate coniferous forest while, the proper management of forest could not take place due to high inaccessibility of forest cover areas on the one hand and over utilization of forest resources, on the other. This study is mainly based upon the primary collection of data, which were gathered through case studies of the villages.

Keywords: Biodiversity, natural vegetation, alpine meadow, vertical zonation, coniferous forest.

Introduction

Forests play crucial roles in the sustainable development of mountain regions because; the entire population is dependent on forest resources for firewood, fodder, valuable timber and food needs. These forests are rich in biodiversity and are distributed according to altitudes and aspect of slopes. On the one hand, they regulate climate, conserve soil and maintain moisture in the atmosphere and on the other, they are the homes to wild lives, birds and wild fruits. Recently, due to high pressure of population on the land, particularly on forestland, the forests are on the verge of depletion and consequently, some species of the forests have been vanished and some are endangered.

The Pindar Basin constitutes an integral part of the Ganges sub-system in the Uttarakhand Himalaya. Characterized by rough, rugged and precipitous slopes, the entire land is more prone to landslide, landslip, mass wasting and slope failure. Ecologically, the whole landscape is fragile. It possesses about 65.6% forestland out of the total geographical area. Ranging from the sub-tropical climate to temperate and alpine meadows, the diversity in the natural vegetation is high. The depletion of forest, due to over exploitation, is creating severe threats for instability of slopes and future catastrophe. This situation can be noticed in the low-lying areas and mid-slopes, where concentration of population is high. During summer, transhumance migrates in the highland for grazing cattle. This practice also leads for degradation of forest at a large scale.

In the present study area, the rate of forest depletion is high, which creates severe impediments, such as instability of land and environmental hazards. Most of the forest patches, on the hilly slopes of the basin, are clearing for agricultural fields due to over population. It is reported that the highest rate of deforestation in any biome is in tropical upland forest, i.e., 1.1% per year (FAO 1993). Apart from the adverse climatic stress, increased human population and the insatiable demand for more natural resources including land, forest and food are major factors contributing to natural resources depletion and losses in biodiversity (Arimoro et al., 2002; Okali 1985).

Materials and Methods

This study is thoroughly based upon the collection of primary data and case studies of the villages, located in different altitudes, were done to facilitate the further interpretation of data. The study of forest types, firewood-fodder need and potential areas of firewood and fodder in the Pindar Basin was done after case study of the villages. Structured questionnaire was prepared to avail the information about the interaction of the people with forest-based products. Interviews were equally done and the author made rapid field visit. Secondary sources of data were also used.

Study Area

The Pindar Basin comprising of 1826.0 km² extends from 30° N to 30° 18' N and 79° 13' E to 80° E. It represents the eastern part of the Garhwal Himalaya with height ranging from 800 m to 6800 m. River Pindar originates from the 'Pindari Glacier' in Almora District (32 km) and flowing an approximate 124 km with its numerous tributaries, confluences into the Alaknanda river at Karanprayag in Chamoli District. The watersheds of the Ram Ganga in the south, the Saryu in the east, the Nandakini in the north and the Alaknanda in the northwest delimit it and give it a distinct socio-geographical identity.

Results and Discussion

Forest diversity in the Pindar Basin

The Pindar Basin is very rich in terms of forest resources and diversity. From the valley region to the highly elevated alpine meadows, locally known as *Kharak* or *Bugyal*, the rich diversity in plants is found. In the mid slopes, *Chir* (pine) is common, while in the upper reaches, temperate coniferous forests, mainly *Banj* (oak), *Tilonj* (*Quercus dilitata*) and *Devadar* (*Cedrus deodara*), are found extensively. Except these forest types, many other fodder plants also grow along with the edges of agricultural fields. Oak is the predominant flora of moist temperate forest, which starts growing from 1676 m with Rhododendron trees, a very rich fodder and ideal fuel has been an inseparable part of folk life in hills. The oak forest of the Pindar Basin appears to be thriving due to the imposing presence of pine trees. A note in The Hindustan Times by a correspondence, 'will oak disappear from Nainital' is a real story in the hills of Uttaranchal (The Hindustan Times 2000). According to an altitude and forest types, the basin can be divided into the following zones (Table 1):

Table 1: Forest diversity based on altitude

Belt/altitude	Geographical area	Main species
Valley regions/below 1000 m	Along the valley of Pindar River	Eucalyptus, <i>Dendrocalamus spp.</i>
Middle altitude 1000 m to 1600 m	Slope of the various streams such as Kaver Gadhera, Ming Gadhera, Pranmati and Atagarh	Pine dominate (blue pine and chir forest)
Temperate zone 1600 m to 2000 m	Watershed regions, Love-Kush tope, Kanpur Garhi, Khankhrakhet, Shubhtal-Chhaltal, Kurur-Kwarad and Sol-Dungri	Deodar forests (<i>Cedrus deodara</i>), oak forests (<i>Quercus species</i>), fir (<i>Abies pindrow</i>) & spruce (<i>Picea smithiana</i>), ringal (bamboo) forests (<i>Dendrocalamus spp.</i>)
Alpine meadows/between 2600 m to snow line	Bedni Bugyal, Roopkund and Shail Samunder	Dominated by herbs

Sources of Data: Adopted from Vishwambhar Prasad Sati's paper on " Natural Resource Conditions and Economical Development in the Uttaranchal Himalaya, India" published in 'Journal of Mountain Science', 2005, Vol 2, No 4, Pp. 336-350 (modified).

(1) Low-lying river valleys (below 1000 m) are comprised by the areas, which are located along the valley of the Pindar River (from Karanprayag to Tharali). Presently, the campaign for afforestation is carried out by the Department of Forest to control landslides. The main species in this region are eucalyptus and *Dendrocalamus spp.*

(2) Middle altitude lies between 1000 m and 1600 m. Pine is the main tree species. There are many patches, where dense pine forests are found. These patches start from Bagoli to Dewal, on the course of the Pindar River and also both sides of its tributaries, such as, the slope of Kaver Gadhera, Ming Gadhera and Pranmati Gad. Presently, the pine trees are invading the temperate evergreen coniferous regime, particularly on the south-facing slopes of the basin. The pine forests are divided into two types. The first is blue pine forest (*Pinus wallichiana*), which is locally known as *Kail* and mostly found mixed with *deodar* (*Cedrus deodara*) forest. The second is chir forest (*Pinus roxburghii*).

(3) Temperate belt is ranging between 1600 and 2000 m, and it constitutes Love-Kush top, watershed of Pindar and Ramganga, Kanpur Garhi, Kankhrakhet, Shubhtal and Chhaltal, Kurur-Kwarad and Sol- Dungri areas. The region is very rich in economically viable forest wood. The forest timbers are fully unutilized due to inaccessibility of the places. The main forest includes; (i) Deodar forests (*Cedrus deodara*), which are found between 1650 m and 2300 m in the basin. *Deodar* is a tall coniferous tree used for house construction and also for paneling. It is much prized for its wood. Ancient temples of the region have deodar beams with a length not found in present time owing to large-scale felling in the past; (ii) Oak forests (*Quercus* spp.) are found in entire Pindar Basin between 1325 m and 1625 m. It is used for firewood and charcoal manufacturing. It is the best firewood with high caloric value. It is a broad-leaved tree; (iii) Fir (*Abies pindrow*) & spruce (*Picea smithiana*) forests are found mostly between 2300 m and 2950 m. They are mostly used for interior decoration and packing cases. These are coniferous trees and represent high intensity of snowfall in their region; (iv) Ringal (bamboo) forests (*Dendrocalamus* spp.) are found mostly in the highly elevated watersheds of the main river and its tributaries between 2200 m and 2500 m above sea level.

(4) Highly elevated regions from 2600 m to snow line are accounted for herbs. They are extensive grasslands and locally called *kharak* or *bugyal*. The main *bugyals* are Khankhrakhet, Bedni Bugyal, Roopkund and Shail Samunder. Bedni Bugyal and Roopkund are world famous spots and they are being developed as the major tourist places. Varieties of herbs are found in these *bugyals*. The alpine and temperate forests that cover most parts of the basin make natural habitats of some of the best-known wildlife creatures of India.

The Pindar basin contains 65.6% forestland. Out of the total forestland, pine and oak forests dominate. [[Table 2]] exhibits total area (ha), forest cover area (ha), population according to census of 2001 and per-capita forestland in the six development blocks of the Pindar Basin. Mostly, the trend of forest cover areas is increasing with increasing height. Kapkot and Dewal development blocks are located in the remote areas of the basin having 79.8% and 80.8% forest cover while Tharali and Karanprayag development blocks have 25.2% and 52.2% forest cover because the development activities and concentration of population is high in these two blocks. Gairsain and Narain Bagar developmental blocks have 74.0% and 67.2% forest cover respectively. When we look upon the per-capita forestland we find that the areas where population is high the per-capita forestland is comparatively low. For example, Karanprayag development block has highest population (61150 persons), while per-capita forestland is only 0.14 ha, which is lowest after Tharali development block (0.06 ha). Similarly, Dewal and Kapkot developmental blocks have less population (34315 and 32088 persons respectively), while per-capita forestland is highest (0.43 and 0.47 ha respectively). It indicates that the dependency of the people on forestland is high.

Table 2: Forest cover area and per-capita forestland

Development block	Total area (ha)	Forest cover (ha)	Forest cover (%)	Population 2001	Per-capita forestland (ha)
Karanprayag	16515	8620.83	52.2	61150	0.14
Gairsain	18138	13422.12	74.0	45502	0.29
Narain Bagar	13538	9097.54	67.2	46607	0.19
Tharali	12555	3163.86	25.2	50442	0.06
Dewal	18394	14862.35	80.8	34315	0.43
Kapkot	19203	15323.10	79.8	32088	0.47
Total	98343	64489.80	65.6	270104	0.24

Sources of data: Statistical Diary of Chamoli and Bageshwar Districts (2002)

Degradation of natural forest

Degradation of natural forests is a global problem (Guppy 1984; Sayer & Whitmore 1991). Mankind has been destroying forest for millennia even since agriculture was discovered (William

1989). In the Himalaya too, deforestation is argued to be not a recent phenomenon. It has a long history, being well established in late eighteenth century at least (Mahat et al. 1986). However, extent of impairment of various processes attributed to vegetal degradation depends upon a range of other factors including past histories, intensity of removal of natural vegetation, patterns of natural regeneration and /or other human interferences (Valdiya & Bartarya 1989; Gilmour et al. 1989; Ramakrishnan et al. 1992; Alford 1992).

Over the centuries, forests have been converted into agriculture fields and grazed by increasing animal population. They are divided up and utilized for the following major unsustainable human uses: poor arable farming and terracing, monocropping and livestock grazing; extensive archaeological, mining, quarry and other exploration activities; and huge construction of buildings, roads, bridges and other infrastructures. Such areas of land use associated primarily for economic activities and pursuits create serious challenges for conservation and good management strategies (Zimmerer and Young 1998). The close relationship among population growth, expanding area under subsistence crops and increase in livestock numbers is closely related to intensifying demands on the forests. While there are serious problems in determining total available forest cover, biomass productivity, biomass demands and actual consumption, there are also conflicting estimates of the amount of forest/support land needed to support one unit of cultivated land. Ives & Messerli (1989) put such estimates for forestland to fourth-fifth times of cultivated land. But the quality of such support land is not defined. Rao & Saxena (1994) indicated that there was little conversion of forest to agriculture during the last sixty years in central Himalaya.

The other aspect of deforestation is growing firewood demands are the cause of receding forest perimeters around the habitations in the mountains (Bajracharya 1983a, b). Most of the degradation of forest to unpalatable weeds stage is due to increased human and animal populations (Jackson 1983).

In the entire Pindar Basin, degradation of natural forest is the main phenomenon particularly in the recent period. Due to excessive use of forest as a form of timber, firewood and fodder, and furthermore fragility of the terrain accentuated deterioration of natural forest resources. Human induced activities such as grazing animals, lumbering, construction of roads, dams and settlements are more prone to deforestation in the basin. Degradation of forest in the basin is mainly taken place due to the following activities:

(1) Firewood is required for cooking food and warming rooms. Mid slopes and highlands are characterized by temperate and cold climates. Therefore, the firewood needs in these regions are high, particularly during the winter, when highlands receive snowfall. Inaccessibility of the settlements does not provide a base for consuming other means of fuel such as liquid petroleum gas (LPG). Therefore, the dependency on the forest for firewood consumption is high and it is the major cause of deforestation in the basin. However, in the areas, which are located on the road heads, LPG is being popularized slowly. Table 3 reveals the per-day consumption of firewood in the basin.

Table 3: Per day firewood consumption (in kg)

Name of village	Elevation (m)	Distance from the road head	No. of families inhabited	Forest type	Per day firewood consumption (kg) Summer	Per day firewood consumption (kg) Winter	Ratio (per family consumption) (S+W)
Dimri	550	1 km	145	Scarce pine and bushes	400	580	6.8
Kaiwar	1200	2 km	150	Pine	700	900	10.6
Khainoli	1900	11 km	150	Oak, buransh, tilong and pine	1000	1400	16
Kwarad	2200	15 km	130	Oak, buransh, tilong and pine	900	1300	17
Lolti	1800	0 km	120	Oak dominated	600	840	12

Sources of Data: Adopted from Vishwambhar Prasad Sati's paper on " Natural Resource Conditions and Economical Development in the Uttaranchal Himalaya, India" published in 'Journal of Mountain Science', 2005 Vol, 2 No 4, Pp. 336-350.

Table 3 reveals that the elevation and distance from the road play a crucial role for determining per day firewood consumption in the basin. The author did a case study of five villages of the basin. The villages were selected on the basis of their elevation and distance from the road. It is penetrated that the highly elevated villages consume more firewood than the low-lying villages. Firewood consumption also depends on the availability of forests. The areas, which obtain dense vegetal cover, the firewood consumption is high comparatively to the other areas. Except small service centers, fuel consumption is thoroughly made from the forest.

(2) Highlands and lowlands have multiple and diverse ecological and environmental linkages. The fundamental basis of highland - lowland economic linkages is provided by the differences in their natural resource endowments and potential production and exchange opportunities they generate. Equally important are the man-made arrangements, ranging from infrastructure and institutions to technological and human capabilities, which shape the pace and pattern of harnessing the above opportunities. The biophysical conditions also play a crucial role in determining the above man-made arrangements. In the basin, the lowland-highland interaction is basically practiced for the purpose of grazing animals, which is based upon the availability of fodder and grassland. During the summer, the migrants reach in the highland along with their animals and in the winter, when the high reaches receive snow, the migrants move towards lowland. This practice leads a way for large-scale depletion of forest.

Table 4: Potential areas of fodder and grassland during the summer

Location	Height (in m)	Nature of slope	Forest type	Human population (persons)	Animal population/ type
Bedani Bugyal	3200-3400	Gentle to moderate /south-east facing	Alpine meadows & extensive grassland	100-120	300-350/ goats, oxen and buffalos
Ghais-blan region	2400-2600	Moderate to high/south-east facing	Coniferous/oak forest and grassland	80-100	300-320/ goats, oxen and buffalos
Khankharakhet region	2800-3000	Moderate to high/north east facing	Coniferous forest and grassland	100-120	300-350 goats, cows, oxen and buffalos
Kanpur garhi region	2400-2600	Gentle to moderate /norht-east facing	Coniferous/oak forest and grassland	100-120	300-350 goats, cows, oxen and buffalos
Love-kush top	2200-2600	Moderate to high/north east facing	Coniferous/oak forest and grassland	60-80	150-170 cows, oxen and buffalos
Bhararisen region	1900-2100	Moderate to high/north east facing	Coniferous/oak forest and grassland	60-80	150-170 cows, oxen and buffalos
Naini Danda	1900-2100	Moderate to high/north east facing	Coniferous/oak forest and grassland	60-80	150-170 cows, oxen and buffalos

Sources of Data: Collected by the author

Table 4 shows potential areas of fodder and grassland in the highlands, where the people of lowland migrate during the summer. A case study of seven locations of the highland is carried out. Altitude of these areas varies from 1900 m to 3400 m. The table incorporates height, nature of slope, forest type, human population and animal population/type. The number of animals is high along with high forest depletion in the high altitude in comparison of low altitude. The highland-lowland interaction in the basin is mainly done for grazing animals and the areas, which are having comparatively high elevation the interaction is high. Presently, the interaction is slowly converting into other economic activities such as cultivation of herbs and off-season vegetables and also leading a way for frequent forest depletion.

(3) Development activities like construction of roads, dams, terraced agricultural fields and stone mining are the major factors for forests depletion in the basin. After creation of Uttaranchal State, construction of roads and dams got tremendous pace in the economic activities. A road connecting Gwaldom and Gairsain (about 75 km) is being traversed from the dense oak forest, which already led a worst situation of landslide and huge forest depletion. A plan for construction of a diversion road from Kulsari to Karanprayag, due to construction of two dams on the course of the Pindar River in Bagoli and Simli is the top agenda of present government. Stone mining in the areas of dense forest, particularly in the mid and high altitude is also a major cause for forest depletion. Due to increasing population in the basin, people are searching for additional agricultural land and making terraced fields in the hilly slopes. Electrification in the rural areas is also causing for forest depletion because the line is passing though the forest areas.

Sustainable forest management Sustainability has recently become a fashionable concept in relation to everyday life (Gane 1992), the management of renewable resources including forests

(Sanwo 2002) and human development (U.N 1997). UNEP further describes sustainable living as the lifestyle of an individual who feels the obligation to care for nature and every human individual who acts accordingly. A sustainable forest management approach to the conservation of mountain forest resources will greatly contribute to human welfare in the Himalaya. The most recent innovation and key factor in forest management, which conforms to a sustainable forest management, is the use of new forest practices that will enhance the maintenance of forest ecosystem in a sustainable way. In other words, human activities in the forest should not negatively affect the ability of the forest to continue in the way it was originally (Franklin 2001). This can only be achieved through the promotion of self-reliance amongst the rural people through their active participation in natural resource and forest activities (FAO 1985).

Most of the world's mountain communities are strongly influenced by surrounding lowland and urban areas with regard to timber extraction. The interests of these outside forces, which are mainly economic, do not necessarily include a sustainable future for either mountain forests or mountain communities. There is a tremendous need for balance between the demands of lowland populations (e.g. timber, clean water) and the needs of mountain communities (e.g. sustainable livelihoods, opportunities for youth). There is also a strong need to balance productive use of forests with their protection. This need for balance applies equally to developing countries and many countries in transition, where many mountain people depend on forest products for subsistence and survival; and to the industrial world, where short-term profit-taking may conflict with conservation values.

The forests of the Pindar Basin have great importance both for economic growth and environmental restoration, because the basin is economically backward and environmentally fragile. Proper management of forest will serve both purposes. However, the rate of forest depletion is high due to its high demand as a form of timber, firewood and fodder. Meanwhile, the entire region is characterized by plenty of forest resources, which have great economic value and are comprized by sub-tropical, temperate and alpine species. The management of the forest resources on the other hand did not take place properly, partly due to lack of rational planning and because of inaccessibility of the forest cover areas. The economic viability of forests, which are found in highly elevated regions of the basin is high but due to inaccessibility of these regions, forests are utterly unutilized.

In the basin, rural people are fully dependent on variety of forest species for food, fodder and medicine. Sacred or religious values are also important attributes of some forest products. People of the region recognize sacred forests, groves and trees. Traditional natural resource management knowledge and close cultural links between people and their forests and trees combined as appropriate with technical or science-based approaches can be essential elements in ensuring the mountain forests and trees are sustainably managed. Management of the basin's forest is being done on the following manner for sustainable use and environmental protection:

(1) Watershed Management Department was established during the 1980's as a part of Forest Department. The key characteristics of the basin's forest are that they are controled by the Forest Department. The community and private forestland is very less or negligible. Extensive grazing land is owned by community people. The people grow trees to meet their specific household needs, which often change over time the private and community land.

The role of Watershed Management Department is to plan the areas where less forest cover is found. Plantation of trees according to the conditions of the region is carried out by the department. Apart from that the deparmtment has the responsibility to check the illegal felling of trees. There are more than five sub-offices of Watershed Management Department in a development block with its one headquarter. Recently, most of the patches, where complete depletion of forests took place during the past, reforestation is taken place by the help of Watershed Management Department. These patches are located along the courses of small perennial streams such as Kaiwer Gadhera, Meing Gadhera, Pranmati Garh and Ata Garh.

(2) Local poople's participation in both decision-making processes and the implementation of management plans is crucial for sustainable resource management. In the basin, local involvement is achieved in many areas. Extensive community grasslands and fodder trees are managed by the local people themselves and they are also supporting the government forest department.

During the eighties, the popular "Chipco Movement" was launched by the local people in Uttaranchal and that movement spread throughout the basin and people were able to conserve the forest of the region from the hands of the contractors appointed by the Forest Department for mass cutting of trees.

In the basin, Gram Sabha (village assembly), the lowest unit of Governance in federal system of India, works for taking discision on the various developmental works including forest resource

management. It has the control over community forestlands and grasslands and they manage it for the need of the people. At the same time, for the timber need of the inhabitants, a policy was framed by the Forest Department. According to this policy, a needy person will apply to Forest Department mentioning his/her timber need. The department will evaluate the application with the help of Gram Sabha and finally allot a tree based upon the need.

(3) A wide variety of policies affect mountain people and the forests on which they depend. Directing these policies in ways that contribute to sustainable mountain development requires detailed understanding of the broad range of relevant environmental, economic, political and social factors and of the potentials of the different options in moving towards desired goals. Given the long lifetime of most mountain trees and the changing functions of mountain forests, policy-making for these forests has to be a dynamic, flexible and reflective process. A policy made in one century may lead to the effects that were desired then but may be quite inappropriate in the next century when economic and social circumstances have changed. The need for framing relevant policies and planning and its implementation is inevitable particularly in the fragile slope of the basin, where due to mass cutting of trees, stability of slope is on the verge and landslides and landslipes are the common features. Forest Bill of 1982 has been successfully implemented, particularly in the hill areas and its result can be seen in the entire basin.

Conclusions

In the Pindar Basin, forest resource depletion is the part of needs of the people for firewood and fodder while, the irrational policies of the Forest Department toward the forests is also a vital factor for its depletion. It was seen in the decades of sixties and seventies, the dense pine trees in the basin were cut down by the Forest Department at a large scale. In 1982, the Central Government of India passed Forest Bill for conservation of forests. This bill led a way for banning illegal felling of trees in the Pindar Basin also.

In 1980's, Watershed Management Department was established to conserve forests and to control over the illegal felling of trees in the hill regions. As the efforts made by the said department along with implementation of Forest Bill, the condition of forests in the basin is presently better. Similarly, the campaign for afforestation over the fragile slope is also successful.

The basin is characterized by primitive economy, which depends either on the production of subsistence cereal crops, livestock rearing or forest resource for firewood, fodder and food need. For the basic requirement, natural forests are degenerating at a large scale. Use of timber for construction of houses and furniture is also a major factor for degeneration of forest resource. The lowland-highland interaction in the basin as a form of rearing animal is also most prominent feature for deforestation. Mostly, during the summer, the people of lowland migrate to highland along with their animals for 3-4 months and during the winter they move downwards. This movement excesses the timber need and increases the process of deforestation. Over and under use of forest resources is the characteristic features of the basin. Temperate vegetation (coniferous forest) is found extensively in the highland and is under used due to inaccessibility. While, in the lowlands and mid-slopes, forests are over used because of high concentration of population. Under such circumstances, sustainable use of forest resources is inevitable. Forest resource management is also essential to control soil erosion and landslide in an ecologically fragile terrain. The following suggestions are given for forest conservation in the basin:

Reducing the need of firewood through introduction of biogas, which is quite successful in the lowland area.

Pasturelands are required to be conserved and for that community people should plan properly for their management. The areas where instability of land is high, plantation of trees can be done to stop the erosion and restore the vegetation there.

The areas should be selected for plantation of fast growing or slow growing trees according to the need of the region. Community forestland should be taken for the use of fuel and fodder need and the natural forestland should be kept as protected and reserved forest so that the stability of the terrain could be maintained and fragility could be reduced.

Ropeways should be introduced in place of road construction for transportation, which will reduce the unnecessary cutting of trees and control the soil erosion.

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