*Latest Update on*

# Dharamshala Afforestation Project

## *A Joint Venture*

***By***

Conservation ACTION TRUST

**&**

## Himachal Pradesh Forest Department

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## EXECUTIVE SUMMARY

The forests of Himachal Pradesh are presently under great stress due to the impact of economic development and growth in human and cattle population. The growing concern for the conservation of these forests led to the signing of a MOU between the Himachal Pradesh Forest Department and CAT, in 2007. The long term objective of this collaboration is Soil Moisture Conservation (SMC) and Afforestation of the degraded forest in Dharamshala Region, with a view to restore the Reserve Forest to its natural state, to support endemic species, to benefit the local ecology and to support the local community, with their involvement. CAT, till date, has completed four years of plantation and has reafforested 4 acres of one of the most inhospitable terrains under the pilot project.

Amongst the sites recommended by the Forest Department, the site situated near Bhagsunag Temple at Bhagsunag, which is a part of P49K Chakban, was selected. The area has faced severe denudation/degradation over a prolonged period due to slate mining.

Plantation was carried out at the rate of 1,100 trees per hectare. With the onset of monsoon, indigenous trees such as *Quercus leucotrichophora* (Baan), *Cedrus deodara* (Deodar), *Prunus pardus* (Pajja), *Salix spp* (Willow) etc. were planted. After four years, there is a marked increase in the vegetation cover of the area brought under the project as well as the adjoining areas. Of the 2,085 plants planted from 2007 to 2009, 1,475 have survived. The barren slopes have started to develop vegetation cover. The area also shows natural establishment of a substantial number of *Rhododendrons*, along with shrubs like *Rubus, Berberis lycium, Spiraea canescence* and herbs like *Rumex, Trifolium repens* etc. 75% survival rate has been achieved with plantations done in this period. Plantation work for 2011 has been completed on 3rd July.

This pilot project has generated a number of direct and indirect benefits. Direct benefits include generation of employment (for the duration of the project) for a number of locals and permanent employment to a local, appointed as the care-taker of the project site. Once the trees are established, the area can be open to the locals to meet their need of fuel and fodder. Indirect benefits include stability of the ground due to reduced occurrence of land slides, substantial increase in the vegetation cover and water retention capacity of the soil, increase in the biodiversity of the area and increase in the aesthetic value of the area, which will attract more tourists to the area. Once the planted trees are established, they will also increase the carbon sequestration potential of the forest and will provide nutrients by adding leaf litter. It will also curb loss of soil cover due to erosion.

The main aim of this exercise is to provide support to the natural regeneration of forests by providing means to curb soil erosion and by increasing the soil moisture.

## INTRODUCTION

The rich variety of life on Earth has always dealt with a changing climate yet climate change now poses as one of the principal threats to the biological diversity of the planet. The resilience of ecosystems can be enhanced and the risk of damage to human and natural ecosystems can be reduced through the adoption of biodiversity-based adaptive and mitigative strategies. Increasing the forest cover is one such strategy.

The relevance of forests is greater in a country like India where over a billion people are struggling to find breathing space. With nearly 200,000 villages classified as forest villages, there is obviously large dependence of communities on forest resources (Ravindranath and Sudha 2004). India has 2.3 % of the world' s land area, 1.72% of the world's forests and supports 16.7% of the human population, 16% of world's goat and cattle population and 56% of world's buffalo population. (Dadhwal 2009). As against a need of over 33% of forestland to maintain the ecological balance, the country today has only 21.02 % of forest-land. In terms of the quality of the forest cover, 2.54% is dense forest, 9.71% is medium dense forest, and 8.77% is open forest (SFR 2009). Also, as against a world average of 0.64 hectares, the per capita forest cover in India is only 0.064 hectares, thereby making the people of India living in a polluted atmosphere (Dadhwal 2009). Forest ecosystems in India are already subject to socio-economic pressures leading to forest degradation and loss, with adverse impacts on the livelihoods of the forest-dependent communities. (Ravindranath *et al.*, 2006).

## HIGH ALTITUDE FORESTS:

It is crucial to consider mountain regions as all of the world's rivers originate in them and flow to the oceans, sustaining the life of all beings. Though all forests play a crucial role in climate regulation, mountain forests are of paramount importance due to their regulation of the Earth's river sources. When these forests are extensively cut, massive problems relating to erosion occur and water tables diminish, leading to extreme drought. It is essential to look at what can be done to restore Earth's high altitude forests and to preserve what we have, while there is still time. Restoring mountain forests is particularly difficult when the old forests and top soils have been so severely diminished. Hence action should be prompt and intense. These forests need to be of indigenous biodiversity to function completely and effectively and therefore must be carefully managed, in order to maintain their ability to provide fresh water.

## HIMACHAL PRADESH

The Forests of Himachal Pradesh, known for their grandeur and majesty, are like a green pearl in the Himalayan crown. The forests of the State can be broadly classified, on an ecological basis as laid down by Champion and Seth, into Coniferous Forests and Broad-leaved Forests. Distribution of various species follows fairly regular altitudinal stratification. The vegetation varies from Dry Scrub Forests at lower altitudes to Alpine Pastures at higher altitudes. In between these two extremes, distinct vegetation zones of Mixed Deciduous Forests, Bamboo, Chil, Oaks, Deodar, Kail, Fir and Spruce, are found. The richness and diversity of the flora can be gauged from the fact that, out of the total 45,000 species found in the country, as many as 3,295 species (7.32%) are reported in the State.

These life supporting systems are presently under great stress. In Himachal Pradesh, nearly 1000 small to medium-sized slate mines have stripped upto 60 percent of the forest and have triggered countless landslides.

## KANGRA

Kangra district of Himachal Pradesh is situated in Western Himalayas between 31° 2 N to 32° 5 N and 75° E to 77° 45 E. The district has a geographical area of 5,739 $km^2$ which constitutes 10.31 per cent of the geographical area of the State. It has varying altitude ranging from 427m to 6401m above mean sea level. Kangra has considerable diversity in its soils, physiography, land use pattern and cropping system and has further been divided into five sub-situations i.e. Pir Panjal, Dhauladhar, Kangra Shiwalik, Kangra Valley and Bias Basin. The monsoon rains are heavy and well-distributed and 70 percent of the total annual rainfall is received from July - September.

The forest of district Kangra consists of vegetation right from Scrub forest at low elevation, to Alpine pastures at higher altitude. In-between interspersed are the forests of *chir*, *ban* oak, mixed conifers (kail, spruce and fur) and *kharsu* oak forests.

**Table 1: Types of forests found in Kangra.**

| Sr. No | Forest Type | Altitude (metres above sea level) |
|---|---|---|
| 1 | Miscellaneous Scrub forest | 600-1200 |
| 2 | Chir forests | 800-1700 |
| 3 | Ban oak forests | 1600-2300 |
| 4 | Deodar forest | 2000-2500 |
| 5 | Mixed conifers | 2100-3000 |
| 6 | Kharsu oak forest | 2300-3800 |
| 7 | Alpine scrub and alpine pastures | Above 3800 |

## DHARAMSHALA REGION:

The town is situated on the southern slopes of Dhauladhar ranges. The northern slopes of Dharamshala have undergone rapid urbanisation and as a result have experienced extensive deforestation to accommodate residential, tourist and commercial establishments. These human interventions have laid bare sensitive slopes, which often fall during the monsoon and winter rains. Large tracts of land bear very thin soil cover that is unfit to support any type of vegetation. Hence there is an urgent need for scientific and systematic afforestation which will accelerate the process of re-establishment of forest in these areas.

The growing concern for the protection of forests in this area led to the signing of a MOU between the Himachal Pradesh Forest Department and CAT, in 2007, whereby CAT agreed to carry out systematic and scientific Soil Moisture Conservation (SMC) and Afforestation in P49K Chakban area of Dharamshala Region. Through this on-going project, CAT not only aims to assist in restoration of the forests in Dharamshala but also aims to establish a model that will help in the protection of the environment and biodiversity of high altitude forests, which is under pressure due to increasing human interference. CAT will carry out soil moisture conservation using the most suited techniques and systematic afforestation, thereby helping natural regeneration of forest.

## OBJECTIVES:

- To formulate a method that will help in increasing the vegetation cover of selected degraded areas at high altitude, by using the most suited techniques.

- To prevent soil erosion and increase the soil moisture content by means of construction of check dams, absorption pits, gabion structures etc., and afforestation.

## SELECTION OF AREA:

Three sites were recommended by the officials of Forest Department for the project. Achieving results on these sites posed as a real challenge as these sites were highly degraded and difficult to work on and hence were not taken up by the Forest Department.

**Site One:**

This site, situated at Gallu, is on the route that is taken twice a year by the migratory grazers. The approach to the said area, especially the last 3 kms., is extremely difficult.

**Site Two:**

This site, at Dharamkot, admeasuring around 4 hectares has been subjected to lime-stone quarrying for a prolonged period.

**Site Three:**

This site is situated near Bhagsunag Temple at Bhagsunag admeasuring 270 hectares and has been severely degraded due to slate mining.

This site, being close to a water-fall that is visited by large number of people during tourist season, would help in creating awareness. This site, being close to the village, is regularly visited by the forest guards, and is better protected. Hence this area was selected for the soil water conservation and afforestation work.

The site was closed to all types of mining activities since 1999. Large tracts of land remain devoid of any type of vegetation cover and as a result the area faces heavy run-off during the monsoon. This, in turn, causes landslides that damage the existing flora in the upper section of the forest area and losses to human property in the adjoining areas. Working in this difficult terrain has been extremely challenging.

**Abandoned Slate mine in May 2008**

## WORK PROPOSED TO BE CARRIED OUT

The work of soil moisture conservation and afforestation of the selected area will be carried out in several phases. Each phase will comprise of Soil Moisture Conservation (SMC) and Afforestation.

### A. SOIL MOISTURE CONSERVATION

Water is essential for life and is also part of the larger ecosystem on which biodiversity depends. Precipitation, converted to soil water and groundwater and thus accessible to vegetation and people, is the dominant pre-condition for biomass production and social development.

### TECHNIQUES USED FOR SMC

A variety of essential soil moisture and water conservation techniques must be adopted to increase the moisture content of the soil. Techniques can be selected and modified based on the conditions prevailing on the respective sites.

1. **Check dams:** Check dams are the most suited technique for SMC in areas that are very steep and have very shallow soil cover. These can be temporary or permanent structures.
2. **Percolation Ponds:** A percolation pond is constructed by excavating a depression, forming a small reservoir, or by constructing an embankment in a natural ravine or gully to form an impounded type of reservoir.

3. **Contour bunds:** This is a suitable method to reduce the run-off loss of water and increase the effectiveness of the rainfall in areas where the elevation is more and most of the rainfall is lost through run-off.
4. **Absorption Pits:** Depending on the gradient of the land, pits are dug at regular intervals to allow collection of rain-water that is slowly absorbed by the soil thereby increasing the soil moisture.

Depending on the topography of the area and the conditions prevalent, the techniques mentioned above can be used singly or in combination for effective Soil Moisture Conservation.

## SMC AT PROJECT SITE

After a detailed study of the project area, check dams were selected as the most suitable technique for Soil Moisture Conservation (SMC). Check dams built by compactly piling stones are called *Dangi* and are long-lasting. Stones lying around the area were used for the construction. This serves a dual purpose; firstly it is cost-effective and secondly it does not cause an undue increase in the weight of the hill.

## *DANGI* CONSTRUCTION:

The existing natural contours were demarcated for *Dangi* construction and cleared to create a base of 2 feet to 2.6 feet for the *Dangis*. Care was taken to see that the construction had minimal negative effect on the natural topography.

Locals of Bhagsunag, who are experienced in constructing *Dangis* were employed for the said work. Depending upon the gradient and soil, *Dangis* of varying heights (2 feet to 8 feet) were constructed. A concrete layer of 2 to 3 inches was laid down on every *Dangi* to add further stability to the said structure. After the *Dangi* construction was completed, the slate and rubble lying in the area was cleared and added at the base of the *Dangis*, which further helped in strengthening it.

## B. AFFORESTATION

### 1. FENCING

The area was fenced using 40mm x 40mm x 6mm L iron angles and with five strands of barbed wires to prevent the entry of grazing animals in the area. Further fortification of the fencing was done by interlacing the barbed wires with branches of Barberry.

### 2. PLANTATION

Plantation was carried out at a rate of 1100 trees per hectare, as this is the rate followed by the Forest Department. Good quality cow-dung manure was added to the pits of dimension 1x1x1.5 feet (prepared for plantation). Some pits were left unplanted so that they would serve as absorption pits.

Indigenous plant species were used so that the ecological balance of the area and the biodiversity of the forest remain undisturbed as much as possible. Plantation was carried out with the onset of monsoon.

**Table 2: Some of the species used for plantation are listed below:**

| No | Botanical Name | Common Name | 2007 | 2008 | 2009 | 2011 |
|---|---|---|---|---|---|---|
| 1 | *Prunus pardus* | Pajja | - | 40 | 100 | 100 |
| 2 | *Quercus leucotrichophora* | Ban | 500 | 50 | 200 | 250 |
| 3 | *Aesculus hippocastanum* | Akhnor | - | 30 | - | - |
| 4 | *Cedrus deodara* | Deodar | 10 | 50 | 350 | 350 |
| 5 | *Albizia chinensis* | Ohi | - | 30 | 50 | - |
| 6 | *Poplar spp* | Poplar | - | 20 | 45 | - |
| 7 | *Soymida spp* | Dhuri | - | 30 | 80 | 60 |
| 8 | *Juglans spp* | Walnut | 25 | - | - | - |
| 9 | *Pinus roxburghii* | Chil | 25 | - | - | - |
| 10 | *Salix spp* | Willow | 300 | - | - | - |
| 11 | *Robinia pseudoaccacia* | Robinia | 150 | - | - | - |
| 12 | *Grevillea robusta* | Silver oak | - | - | - | 50 |

The area was sprayed with seeds of the following species of grasses as they are effective soil binders and provide additional vegetation cover to the area.

**Table 3: Grass Seeds Recommended by Palampur Agricultural University**

| No | Botanical Name | Common Name |
|---|---|---|
| 1 | *Festuca arundinacea* | Tall Fescue |
| 2 | *Dactylis glomerata* | Orchard Grass |
| 3 | *Trifolium repens* | White Clover |

## AREA BROUGHT UNDER SOIL MOISTURE CONSERVATION AND AFFORESTATION IN FIVE YEARS (2007-2011)

**2007:**

A total of 298 running metres of fencing was put up. The total *Dangi* work carried out admeasured 4249 cubic feet. The activity of plantation was undertaken in the month of July 2007. Of the 2000 pits made, 1210 pits were used for plantation and the remaining pits were used as absorption pits.

**2008:**

Another 210 meters of fencing was completed. A total of 2629.6 cubic feet of *Dangis* were constructed in this phase. Plantation was carried out at the onset of monsoon. 250 plants were planted this year.

**2009:**

The area enclosed this year admeasured approximately two acres. A large single *Dangi*, of dimension 188 feet X 2.5 feet X 4.88 feet, was constructed at the base of the site. This *Dangi* will serve three major purposes. It will impart stability to the entire stretch of land, prevent goats from entering the site and negate the requirement of fencing on a large stretch. Seven smaller *Dangis* admeasuring 955 CFT were constructed in two *nallahs* that are the path for heavy run-off during the monsoon. Fencing was done in areas that were prone to land-sliding as construction of *Dangis* in these areas was not advisable. Plantation work began on 16th July 2009. 825 plants were planted on this site. Soil, from areas where Deodars were growing, was transported up the site and this soil was added along with cow-dung to some pits in which Deodars were planted. This was done to ascertain if this technique can help increase the survival percentage of Deodar.

**2011:**

The area enclosed so far admeasures approximately 4 acres. A single main *Dangi* of dimension 180 feet x 2 feet x 4 feet was constructed at the base of the site. This year also seven small *Dangi's* were constructed admeasuring 160 feet in length in the path of heavy run-off during the monsoon. Fencing was done on the western side of the site. Plantation work was started on 30th June, 2011 and was completed on 3rd July, 2011. Total number of plants planted in this phase was 810.Cow-dung manure was added at the base of the plant. Deodars, Pajja, Ban and Dhuri were planted at the site. A new specie, Silver oak was also planted this year as suggested by the Forest Department.

## RESULTS OBTAINED FROM THE PROJECT

Prior to the initiation of the project, the area experienced frequent landslides and heavy run-off during the monsoon. Soil erosion not only caused the rocks to move, causing heavy damage to the sparse vegetation, but also caused damage to the forest present on the upper periphery of the site. Post completion of two phases, substantial numbers of *Rhododendrons*, along with shrubs like *Rubus, Berberis lycium, Spiraea canescence* etc. have established themselves naturally on the site indicating that the water retention capacity as well as stability of the site has increased. Plants like *Rumex, Trifolium repens* etc. have also established themselves. 75% survival rate has been achieved. The forest on the upper periphery of the site has started moving downwards and hence natural regeneration is being provided a boost by this project. Determination of the results of plantation of 2011 will be possible only after October 2011.

**SITE ONE**

**June 2007**

**May 2009**

**May 2011**

## SITE TWO

**June 2008**

**May 2009**

**May 2011**

## SITE THREE

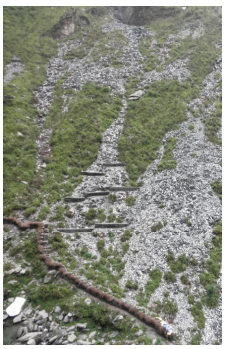
**June 2009**

**November 2009**

**June 2011**

## SITE FOUR

**May 2011**



**June 2011**

**July 2011**

## Result achieved in last 5 years

## BENEFITS ARISING FROM THE PROJECT

**Direct Benefits:**

- Has and will generate employment for a number of locals during the project
- Has and will provide permanent employment to one local, who has been appointed as the care taker of the project site
- The area can be opened to the locals to meet their need of fuel and fodder, once the trees are established

**Indirect Benefits:**

- Ground stability as the occurrence and intensity of land slides has reduced
- Substantial increase in the vegetation cover of the entire hill indicating that the land has stabilised and water retention capacity of the soil has increased substantially
- Increase in the biodiversity of the area
- Increase in the aesthetic value of the area and hence more inflow of tourists to the area

**Table 4: Number of people employed for the project in five years (2007-2011)**

| **No.** | **Category** | **Number in each Category** | | | | **Number of man-days in each Category** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **2007** | **2008** | **2009** | **2011** | **2007** | **2008** | **2009** | **2011** |
| 1 | Mason | 4 | 3 | 3 | 2 | 148 | 78 | 75 | 20 |
| 2 | Labourers | 10 | 7 | 9 | 5 | 420 | 203 | 279 | 50 |
| One person is in permanent employment as the care taker of the project site | | | | | | | | | |

## SOIL CONSERVATION

Soil plays an important role in carbon sequestration by increasing the soil organic carbon. Soil conservation measures, to protect the top layer of the soil, are an important management strategy. This is useful to resort to for large-scale restoration efforts in degraded forests and wasteland as a climate change mitigation option in the short-term.

## NEED FOR *DANGI* CONSTRUCTION

*Dangi* construction is the only technique that can be used for SMC on this site as they are resilient structures. They are extremely effective in preventing run-off and soil erosion for a very long period, as it is evident from the results achieved in two phases of the projects. Landslides and loss of soil cover will be prevented for a long time which will accelerate the establishment of trees, provide a boost to natural regeneration and ultimately lead to the establishment of forest in the area.

## IMPORTANCE OF MICRO-AFFORESTATION

Two pilot projects were carried out on plots admeasuring 0.25 ha. After achieving success, the project was replicated on a plot admeasuring 1 Ha. in the third year. The main aim of this exercise was to provide support to the natural regeneration by providing means to curb soil erosion and to increase soil moisture. Forests on the upper periphery will regenerate efficiently if SMC is carried out on lower ends of the area. The advantage of plantation is that it provides nutrient by adding leaf-litter and curbs further loss of soil cover due to erosion. Planted trees, once established, will also increase the carbon sequestration potential of the forest.

## CARBON SEQUESTRATION AND CLEAN DEVELOPMENT MECHANISM (CDM)

Carbon sequestration is a method for managing the amount of Carbon-dioxide (CO2) that is released to the atmosphere. It describes long-term storage of carbon to defer global warming. Living organisms like trees, micro-organisms etc. uptake the atmospheric carbon and store it into biomass.

Clean Development Mechanism, as defined in Article 12 of the Kyoto Protocol, allows a country with emission reduction or emission limitation commitment to implement an emission reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits. This mechanism supports sustainable development and helps reduce carbon emission, besides giving flexibility to developed countries in meeting their emission reduction targets. The developed countries provide new technologies to the developing ones to reduce their carbon emissions. This

mechanism can be used to estimate the reduction in carbon emission that is additional to what would have been otherwise, without the project. Carbon credits or CER credits can be earned which can be sold to commercial and individual customers who are interested in lowering their carbon footprint.

At present the carbon sequestration rate of the site cannot be quantified as the saplings are very young. With a 75% survival rate of the planted saplings and with a good rate of natural establishment of trees, a fairly good forest will be established over the next 5-7 years.

All the Central Himalayan forests ecosystem studied are aggrading in nature and show net carbon accumulation, generally 6-7 t $ha^{-1}yr^{-1}$. The carbon sequestration rates in degraded and non-degraded sites of Ban Oak range from 1.47 to 6.23 t $ha^{-1}$ $yr^{-1}$ (Rawat et.al. 2008).As non-degraded Ban Oak forest can sequester upto 6.23 t $ha^{-1}$ $yr^{-1}$ carbons, the entire P49K-Chakban area that admeasures 270 ha. will become capable of sequestering 1682.1 t $ha^{-1}$ $yr^{-1}$ carbon if allowed to regenerate.

## IMPEDIMENTS

This project requires construction of *Dangis* for soil moisture conservation. This construction requires large amount of input in the form of funds. In fact the major expenditure incurred on the project was for *Dangi* construction. The terrain is difficult as well as dangerous, hence pit digging also required substantial amount of funds as labourers were not ready to work at a lower cost. The project site is inaccessible by vehicle so transportation of all the required material including plants had to be done by either mules or manually.

## CONCLUSION

The protocol established by CAT for SMC and Afforestation, at its project site at Bhagsunag, has proven to be effective in increasing the moisture retention capacity of the soil as well as in helping natural regeneration of forest. This can be replicated in other degraded areas. However the technique of SMC needs to be modified depending on the topography as well as the problems prevalent in the specific area.

## PLANS for 2012 - 2014

A huge single check dam, like the one made on site 3, can be made at the base and smaller ones can be made wherever necessary. Plantation can be done on the grass patches and seeds of indigenous drought resistant trees can be broadcasted over the rest of the area. Over the next 2 years, using the results achieved in the last 5 years of the project, CAT would like to expand the area under the SMC and Afforestation work. Estimated cost for the project from 2012 to 2014 will be approximately Rs. two million.

**Proposed Site for 2010-12**

**Table 5: Budget for the project**

| BUDGET FOR PROJECT (PER HECTARE) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Break up for 1st year** | | | **Amount (Rs.)** | | |
| **S.No.** | **Heads** | **Rate** | **Number** | **Duration** | **2010** | **2011** | **2012** |
| **1** | **Fencing and Pitting** | | | | | | |
| 1.1 | **Fencing** | | | | | | |
| i | Poles | 50/kg | 1000 | | **50,000** | **55,000** | **65,000** |
| ii | Barbed Wire | 79/kg | 100 | | **7,900** | **8,690** | **9,559** |
| iii | Pole making, fixing and fencing | | | | **35,000** | **40,000** | **45,000** |
| 1.2 | **Material** | | | | | | |
| i | *Dangi* | 22/CFT | 4000 | | **88,000** | **96,800** | **106,480** |
| ii | Stones | 4/stone | 6000 | | **24,000** | **30,000** | **36,000** |
| iii | Cement | 255/bag | 20 bags | | **5,100** | **5,610** | **6,171** |
| iv | Sand and Stones | 20/CFT | 200 CFT | | **4,000** | **4,400** | **5,000** |
| v | Manure | 15 | 100 bags | | **1,500** | **1,800** | **2,000** |
| 1.3 | **Work Force** | | | | | | |
| i | Labourer | 160 | 10 | 30 days | **48,000** | **52,800** | **60,000** |
| ii | Mason* | 250 | 5 | 5 days | **6,250** | **6,875** | **7,563** |
| iii | Pit Digging | 15 | 1000 | | **15,000** | **18,000** | **20,000** |
| **2** | **Travel & Transport** | | | | | | |
| i | Travel within Dharamshala | | | | **10,000** | **12,000** | **15,000** |
| ii | Mumbai - Dharamshala | | 2 | | **5,000** | **5,500** | **6,050** |
| iii | Pathankot to Bhasgunag | | | | **2,500** | **2,750** | **3,025** |
| iv | Dharamshala - Mumbai | | 2 | | **5,000** | **5,500** | **6,050** |
| v | Bhagsunag to Panthankot | | | | **2,500** | **2,750** | **3,025** |
| vi | Transport(Vehicle) | | | | **2,600** | **3,000** | **3,500** |
| vii | Transport (Mules) | | | | **5,300** | **5,800** | **6,380** |
| viii | Transport (Manual) | | | | **2,900** | **2,900** | **3,190** |
| **3** | **Staff Welfare** | | | | | | |
| i | Lodging | 300/day | | 30 days | **9,000** | **10,500** | **12,000** |
| ii | Food | 250/day | 2 | 30 days | **15,000** | **18,000** | **21,000** |
| | | | | | **344,550** | **388,675** | **441,993** |
| **4** | **Contingency** | **5% of the total cost** | | | **17,228** | **19,434** | **22,100** |
| | **SUB TOTAL** | | | | **361,778** | **408,109** | **464,093** |
| **5** | **Administrative Cost** | **15% of yearly cost** | | | **54,267** | **61,216** | **69,614** |
| | **GRAND TOTAL** | | | | **416,045** | **469,325** | **533,706** |

**The increase in the cost for years 2010, 2011 and 2012 has been made based on ground realities**

***** The *Dangis* are constructed under the directions of the mason but he is paid for it separately. The mason is paid on a daily basis for the masonry work of laying concrete mixture over the *Dangis*. The tenure of his employment is throughout the *dangi* construction as well as masonry work.

## ACKNOWLEDGEMENTS

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