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Impact of Kashang Hydro power project on Socio-Economic and Environmental status of Pangi Village in Himachal Pradesh

Sohan Singh and Kiran Devi

Abstract
India has a difficult time finding a balance between its rising energy needs and the desire to preserve the environment of all major nations, this one has the highest rate of increased energy demand. Geo-morphologically, India offers great sources of hydropower with well-defined regions, which are topographically favorable for the run-off river hydro development. Himachal Pradesh is blessed with abundant water resources in its five major rivers i.e. Chenab, Ravi, Beas, Satluj and Yamuna, which emanate from western Himalayas and flow through the state. The most isolated, roughest, snow-covered, inaccessible, scenic, and unspoiled tiny river valley in Himachal Pradesh is Pangi. In the very north of the state, where time and space have taken on new dimensions, lies a minor administrative subdivision of the Chamba District. It is a remote valley that is sandwiched between the Pir Panjal in the south and the Zanskar in the north. The need for the integrated Kashang HEP, located in the Sutluj basin which stores 9412 MW power potential being 46% of the total hydro power potential of the state, has therefore been considered in context of power shortage in Northern Region. The discharge characteristics of Kashang and Kerang khads is also favourable with unique parameter i.e. the difference between the minimum and maximum discharge is less due to the orientation of their catchment whose major portion is permanent snow cover resulting into more winter discharge.

Keywords: Socio economic Impact, Flora, Fuana, HEP, Climate Change

1. Introductions
In total, India produced 8.8 quadrillion Btu (quads) of energy in 1995. In contrast to China's total energy output, which was 11.7 quads in 1970, 35.6 quads in 1995, and is projected to increase to 64 quads by 2010, India's energy output is estimated to reach 16.4 quads by 2010. By 2010, it is anticipated that India's population would be expanding at a predicted annual pace of 4.6 percent due to the country's strong economic expansion and expanding population. In the current situation, infrastructure development is crucial for the welfare of people living on the planet because it improves societal comfort. However, it should be especially noted that excessive resource use for a significant increase in comfort has a negative impact on the environment. Developmental activities are undoubtedly crucial for the greater good of humanity, but when natural resources are overused in the process, some criteria that would ordinarily need to be met in order to achieve sustainable development must be reconsidered. Around the past century or more, numerous river valley projects have been carried out all over the world. Along with flood protection, these projects also produce electricity to raise the Region's or the nation's overall output. Even if efforts in this area are still ongoing, it is believed that 99 percent of precipitation—including rain, snow, and other forms—directly mixes with the seas rather than being appropriately utilised on the way. To use it for the ultimate good of humanity, this undoubtedly takes honest thoughts and efforts. "Integrated Kashang Hydroelectric Project" is the name of the proposed project, which will be carried out by Himachal Pradesh Power Corporation Limited, a division of the Himachal Pradesh State Electricity Board (HPSEB).
The Ravi Valley, which includes Chamba and Bharmour sub-tehsils (area between water sheds of Dhaula Dhar and Pir Panjal with river Ravi and its tributaries), and the Bharmour sub-tehsils are the two natural divisions of the district Chamba, between mountain ranges) Chenab or Pangi Valley, includes Pangi Subtehsil of the Chander Bhaga River and its tributaries, the Pir Panjal, and Zanskar). Because of different development projects including modernization and building of the entire Himalayan range, dams and highways,

The conversion of natural terrain to agricultural use. Ecosystems are thought to be seriously threatened. The area seems to be more vulnerable currently to flooding, landslides, cloud bursts, and melting glaciers, which pose a hazard has numerous and endemic plant and animal species.
The "Population Explosion" and its effects on agriculture, over-exploitation of forests for daily necessities, over-grazing and illegal logging, shifting cultivation, and development activities like irrigation and building are the main causes of biodiversity loss. Therefore, rational resource use is crucial for managing biodiversity, habitat, species, and gene fads that are common in a region since once they are lost, it is difficult to turn the tide. Therefore, a thorough understanding of the area's variety is undoubtedly helpful in managing the area effectively and using the best techniques.
Surveying current conditions, or the baseline environment, is a fundamental and crucial stage for visualising and understanding the system's response to any project activity. The baseline survey must give the required details on the project's site-specific environmental settings. It must also cover the various seasons, migrations, breeding, and other important events. If possible, the baseline survey should be long enough to establish pre-project patterns. It is becoming more widely accepted that biodiversity assessment is a requirement before beginning any significant developmental effort. The main goal is to catalogue biodiversity, not only on a global or national scale but also on a regional one. Floristic surveys are crucial to understanding the region's biodiversity because they help us understand how species are distributed across a range of complicated environmental variables. In comparison to bigger areas that experience greater diversity, the link is probably stronger within smaller geographic bounds when environmental factors are generally uniform.

2. Study Area

Integrated Kashang Hydroelectric Project is proposed for development using waters of Kashang and Kerang streams, right bank tributaries of river Sutlej. The project is located in Kinnaur district of Himachal Pradesh, India and is owned by Himachal Pradesh State Electricity Board (HPSEB). In the project region, a high altitude ridge divides the Kashang and Kerang River Valleys from one another. Topographic features allow for the diversion of Kashang Khad, which is located at an altitude of roughly 2830metres, to an underground power plant on the Sutlej River's right bank, developing a head of about 830metres. The concept is really well thought out in terms of capturing and using the extra water during monsoon season in the future. A thorough study of the region is necessary to address the ecological effects of the changing terrain and the submergence of fertile agricultural and forest lands along the river's banks. This will allow implementers to come up with effective tactics. The study area has a temperate climate with summers from May to October and winters from November to April. Strong variations with elevation exposure to the sun and shelter effect from neighboring ranges are typical of the Himalayan range. Due to the area's height, the winter season is a little longer. The rainy season is part of the summer season. The Bay of Bengal provides moisture for the majority of the annual precipitation, which occurs from late June to late September.

The project area is close to Rekong Peo which is around 314 km from Kalka, the nearest rail head, to which it is connected through National Highway-22. The nearest airport is at Shimla, some 224km from Rekong Peo. The project sites are connected to Rekong Peo by road, some of which would require widening / re-grading as below

- Kashang Diversion and Head works Area: This area is connected to Rekong Peo via Pangi village. Road from Rekong Peo to Pangi is generally good and would only require some upgrading. Beyond Pangi, the road is narrow and unmetalled and requires major upgradation for use during project construction.
- Kerang Diversion and Head works Area: This area is connected to Rekong Peo via Akpa, Jangi and Lippa villages. Road from Rekong Peo to Lippa is generally good. Beyond Lippa, the road is narrow at places and unmetalled and would require upgradation for use during project construction.
- Kashang Powerhouse Area: Kashang powerhouse is located just below National Highway 22 and is easily approachable.
- Pangi valley is irregularly triangular in shape. The river Chandrabhaga, which passes through the landscape in a deep, narrow gorge before entering the Doda region of Jammu and Kashmir, is primarily responsible for its formation. It provides a diverse spectrum of scenery and vegetation with its deep river gorges and bare mountain peaks. This valley, whose road connectivity to the rest of the state was only created in the mid-1990s, was until recently the most isolated tribal region in Himachal Pradesh.

3. Methodology

Quadrats of size 10m x10m, 3m x3m and 1m x1m were laid out randomly for enumerating trees, shrubs, herbs and regeneration respectively in the above mentioned areas. The seedlings were considered as herb while saplings as shrubs. The vegetation data was analyzed for density, frequency and abundance as per the standard formulae given by Curtis and McIntosh (1950) [2]. The relative values of density, frequency and dominance were summed to get importance value index (IVI) of individual species. The abundance to frequency ratio (A/F) of different species was determined for eliciting the distribution pattern. This ratio indicates regular (<0.025), random (0.025 to 0.050) and contiguous (>0.050) distribution (Curtis and Cottam, 1956) [1].
The species diversity was calculated by using Shannon-Wiener diversity index (H), (Shannon-Wiener, 1963) [4].

$$H = -\sum_{i=1}^{s} (Ni/N) \ln (Ni/N)$$

Where Ni = importance value of species i and N = total importance value of all species for both the species.
Concentration of Dominance (C) was measured by Simpson's index (Simpson, 1949) [5].

$$C = \Sigma (Ni/N)_2$$

Where Ni = importance value of species i and N = total importance value of all species for both the species.

Richness Index was estimated as per Margalef (1958) [3] i.e. R = S-1/ln N

Evenness Index was calculated as per Hill (1973) i. e. E = H/ ln S

Where S= total number of species, N= total number of individuals of all the species, H = Index of diversity.

4. Results

Phyto-sociological Analysis

4.1 Trench Weir Stage-I at Dollo – Dogri

A total of 3 tree species were encountered from the area (Table-1). *Cedrus deodara* was dominant species having maximum density, frequency and abundance. This was followed by *Juglans Regia* and *Salix Alba*. *C. deodara* recorded highest value of IVI (195.55) followed by *J. regia* (64.36) and *S. Alba* (40.09). The community identified as result of survey was *C. Deodara – Juglans regia*. The distribution of all the species was contiguous.

In case of shrubs and tree saplings, total number of species was 7 (Table 2). *Indigofera Gerardiana* was dominant shrub having maximum density, frequency and abundance. On the basis of IVI, I. Gerardiana recorded highest value (112.07) followed by *S. Alba* (68.65) and *Sorbaria tomentosa* (60.93). The distribution patterns of all the species was contiguous.

Amongst the 37 species of herbs (Table 3), *Polygonum polystachya* was the dominant herb with maximum density and frequency. This was followed by *Cherophyllum reflexum* and *Thymus Linearis*, in terms of density. *T. Linearis* recorded the highest value of abundance followed by *Equisetum arvense* and *Artemesia Dracunculus*. *P. polystachya* recorded the maximum value of IVI (59.43) followed by *T. Linearis* (22.21) and *A. Dracunculus* (16.58). The distribution of all the species was contiguous.

The value for concentration of dominance for trees, shrubs and herbs were 0.489, 0.245 and 0.064 whereas, index of diversity (H) for trees, shrubs and herbs showed respective values of 0.878, 1.598 and 3.248, respectively. The values of Richness Index for tree, shrub and herb were 0.52, 1.02 and 5.47, respectively whereas values for Evenness index for these categories were 0.80, 0.87 and 0.89, respectively.

Table 1: Phyto-sociology of Tree encountered at Trench Weir Stage-I, Dollo Dogri

S. No	Species	Density / Ha	Frequency	Abundance	Abundance / Frequency	IVI
1	Cedrus deodara	300.00	27.78	3.60	0.13	195.55
2	Juglans Regia	83.33	11.11	2.50	0.23	64.3
3	Salix alba	66.67	11.11	2.00	0.18	40.0

C = 0.489 H = 0.878

Table 2: Phytosociology of Shrub encountered at Trench Weir Stage-I, Dollo Dogri

S. No	Species	Density / ha	Frequency	Abundance	Abundance / Frequency	IVI
1	*Desmodium tiliaefolium*	648.15	16.67	3.50	0.21	13.38
2	*Indigofera gerardiana*	8796.30	66.67	11.88	0.18	112.07
3	*Lonicera hispida*	1203.70	16.67	6.50	0.39	17.24
4	Rubus sp.	277.78	8.33	3.00	0.36	5.95
5	*Salix denticulata*	1388.89	25.00	5.00	0.20	21.08
6	*Sorbaria tomentosa*	4166.67	33.33	11.25	0.34	60.93
7	*Salix alba (s)*	3981.48	41.67	8.60	0.21	68.65

C=0.245 H=1.598

Table 3: Phytosociology of Herbs encountered at Trench Weir Stage-I, Dollo Dogri

S. No	Species	Density / ha	Frequency	Abundance	Abundance / Frequency	IVI
1	*Anemone obtusiloba*	0.07	16.67	3.50	0.21	6.98
2	*Artemisia brevifolia*	0.03	8.33	4.00	0.48	3.50
3	*Artemisia dracunculus*	0.10	25.00	9.33	0.37	16.58
4	*Capsella bursapastris*	0.07	16.67	2.50	0.15	5.32
5	*Cherophyllum reflexum*	0.13	33.33	2.00	0.06	9.72
6	*Cicer microphyllum*	0.03	8.33	1.00	0.12	2.35
7	*Conyza stricta*	0.03	8.33	1.00	0.12	2.35
8	*Corydalis govaniana*	0.03	8.33	2.00	0.24	4.12
9	*Dioscorea deltoidea*	0.03	8.33	1.00	0.12	2.73
10	*Equisetum arvense*	0.07	16.67	10.00	0.60	10.81
11	*Gallium asparine*	0.07	16.67	4.00	0.24	5.80
12	*Gallium asperifolium*	0.07	16.67	6.00	0.36	7.28
13	*Gallium rontundifolium*	0.07	16.67	5.00	0.30	7.07
14	*Geranium pratense*	0.03	8.33	1.00	0.12	2.06
15	*Geranium wallichianum*	0.07	16.67	2.00	0.12	4.97
16	*Heracleum candicans*	0.03	8.33	2.00	0.24	7.91
17	*Lychnis nutans*	0.03	8.33	1.00	0.12	2.61
18	*Malva rotundifolia*	0.07	16.67	2.50	0.15	5.57
19	*Mentha longifolia*	0.07	16.67	5.00	0.30	10.70
20	*Nepeta erecta*	0.07	16.67	1.00	0.06	4.70
21	*Origanum vulgare*	0.07	16.67	7.50	0.45	8.82
22	*Plantago lanceolata*	0.03	8.33	2.00	0.24	2.75
23	*Plantago tibetica*	0.07	16.67	2.00	0.12	5.31

24	*Polygonum paronychioides*	0.07	16.67	3.00	0.18	5.67
25	*Polygonum polystachya*	0.23	58.33	5.71	0.10	59.43
26	*Potentilla argyrophylla*	0.10	25.00	1.00	0.04	7.84
27	*Potentilla atrosanguinea*	0.03	8.33	2.00	0.24	2.85
28	*Potentilla parviflora*	0.07	16.67	2.00	0.12	5.40
29	*Rumex nepalensis*	0.10	25.00	1.00	0.04	12.42
30	*Salvia nubicola*	0.03	8.33	3.00	0.36	5.34
31	*Selinum tenuifolium*	0.07	16.67	3.00	0.18	7.96
32	*Silene inflata*	0.07	16.67	3.00	0.18	6.63
33	*Stellaria media*	0.03	8.33	4.00	0.48	3.61
34	*Thymus linearis*	0.13	33.33	11.25	0.34	22.21
35	*Urtica dioica*	0.03	8.33	3.00	0.36	4.39
36	*Urtica hyperborea*	0.03	8.33	4.00	0.48	6.24
37	*Verbascum thapsus*	0.03	8.33	4.00	0.48	9.70

C = 0.064 H = 3.248

4.2 Trench Weir Stage-I at Dollo – Dogri to Pangi

Eleven different tree species were found in the area (Table 6.25). The dominant species, with the highest density, frequency, and abundance, was *Cedrus deodara*, *P. Gerardiana* came in second place in terms of density. For *Cedrus deodara*, the abundance value was at its peak. The greatest IVI value was observed for *C. deodara* (159.22), followed by *P. Gerardiana* (71.92), and *Juglans regia* (14.43). The *P. Gerardiana - C. deodara* community was discovered as a result of the survey. With the exception of *P. Gerardiana*, all species have a continuous distribution pattern. In terms of density and frequency, *Daphne oleoides* was the leading species among the 14 kinds of shrubs and tree seedlings. In terms of density, *S. tomentosa* and *Lonicera Quinqueocularis* came in second and third, respectively.

S. tomentosa and D. Oleoides had the highest values of abudance. The greatest IVI value was obtained by *S. tomentosa* (73.56), followed by *D. Oleoides* (57.61), and *Indigofera Gerardiana* (28.23). All of the species' distribution patterns were continuous. In the case of herbs, there were a total of 37 species, with *A. Brevifolia* being the dominant herb and having the highest density. *A. Dracunculus* and *T. Linearis* came after this. *T. Linearis* had the highest abundance value, which was followed by *A. brevifolia, Rumex hastatus, and E. Gerardiana*. IVI values ranged from 18.91 to 38.65 for *A. Brevifolia, A. Dracunculus, Urtica Dioica, and Lespedeza Gerardiana, with A. Brevifolia* recording the highest value (38.65), (16.91).

Table 4: Phytosociology of Trees Encountered in Trench Weir Stage-I at Dolo Dogri to Pangi

S. No.	Species	Density / ha	Frequency%	Abundance	Abundance/ Frequency	IVI
1	*Alnus nitida*	30.00	10.00	3.00	0.30	9.36
2	*Cedrus deodara*	330.00	100.00	3.30	0.03	159.22
3	*Fraxinus xanthoxylloides*	20.00	10.00	2.00	0.20	6.73
4	*Juglans regia*	30.00	20.00	1.50	0.08	14.43
5	*Pinus gerardiana*	210.00	80.00	2.63	0.03	71.92
6	*Pinus wallichiana*	10.00	10.00	1.00	0.10	5.93
7	*Populus ciliata*	20.00	10.00	2.00	0.20	7.08
8	*Populus nigra*	10.00	10.00	1.00	0.10	5.15
9	*Quercus ilex*	20.00	10.00	2.00	0.20	6.79
10	*Robinia pseudoacacia*	20.00	10.00	2.00	0.20	6.70
11	*Salix alba*	20.00	10.00	2.00	0.20	6.70

C=0.346 H=1.509

Table 5: Phytosociology of Shrub encountered in Trench Weir Stage-I at Dolo Dogri to Pangi

S. No.	Species	Density/ ha	Frequency %	Abundance	Abundance/ Frequency	IVI
1	*Buddleja asiatica*	925.93	16.67	5.00	0.30	14.75
2	*Cedrus deodara (s)*	92.59	8.33	1.00	0.12	5.30
3	*Daphne oleoides*	3703.70	33.33	10.00	0.30	57.61
4	*Desmodium tiliaefolium*	555.56	8.33	6.00	0.72	13.45
5	*Fraxinus xanthoxyloides(s)*	92.59	8.33	1.00	0.12	4.81
6	*Indigofera gerardiana*	1203.70	25.00	4.33	0.17	28.23
7	*Lonicera hispida*	1111.11	16.67	6.00	0.36	15.64
8	*Lonicera quinquelocularis*	2222.22	25.00	8.00	0.32	27.41
9	*Pinus gerardiana (s)*	185.19	16.67	1.00	0.06	10.00
10	*Pinus wallichiana (s)*	92.59	8.33	1.00	0.12	5.87
11	*Rhabdosia lophanthoides*	740.74	8.33	8.00	0.96	9.20
12	*Rosa webbiana*	462.96	16.67	2.50	0.15	12.72
13	*Rubus sp.*	1203.70	16.67	6.50	0.39	20.60
14	*Sorbaria tomentosa*	2129.63	16.67	11.50	0.69	73.56

C=0.132 H=2.301

Table 6: Phytosociology of Herb encountered in Trench Weir Stage-I at Dolo Dogri to Pangi

S. No.	Species	Density/ Sq m	Frequency %	Abundance	Abundance / Frequency	IVI
1	*Allium Carolinianum*	0.33	13.33	2.50	0.19	7.02
2	*Artemisia Brevifolia*	4.80	40.00	12.00	0.30	38.65
3	*Artemisia Dracunculus*	4.00	46.67	8.57	0.18	36.86
4	*Astralagus Chlorostachys*	0.13	6.67	2.00	0.30	4.19
5	*Bergenia Ciliata*	0.33	6.67	5.00	0.75	15.97
6	*Cannnabis Sativus*	0.20	6.67	3.00	0.45	3.04
7	*Chenopodium album*	0.67	20.00	3.33	0.17	9.75
8	*Chenopodium Ambrosioides*	0.13	13.33	1.00	0.08	3.94
9	*Chenopodium foliolosum*	0.07	6.67	1.00	0.15	2.03
10	*Cherophyllum reflexum*	0.07	6.67	1.00	0.15	1.89
11	*Clematis Barbellata*	0.07	6.67	1.00	0.15	1.87
12	*Clematis Orientalis*	0.13	6.67	2.00	0.30	2.36
13	*Datura Stramonium*	0.07	6.67	1.00	0.15	3.43
14	*Ephedra Gerardiana*	0.67	6.67	10.00	1.50	8.57
15	*Ferula Jaeschkeana*	0.27	13.33	2.00	0.15	7.87
16	*Fragaria Vesca*	0.20	6.67	3.00	0.45	2.44
17	*Gallium Acutum*	0.33	6.67	5.00	0.75	3.21
18	*Gallium rotundifolium*	0.53	6.67	8.00	1.20	4.46
19	*Geranium Wallichianum*	0.20	6.67	3.00	0.45	2.66
20	*Heracleum Candicanse*	0.13	6.67	2.00	0.30	4.76
21	*Lespedeza Gerardiana*	0.93	13.33	7.00	0.53	16.91
22	*Malva Rotundifolia*	0.13	6.67	2.00	0.30	2.23
23	*Melilotus alba*	0.13	6.67	2.00	0.30	2.25
24	*Origanum Vulgare*	0.33	6.67	5.00	0.75	3.38
25	*Plantago Tibetica*	0.20	6.67	3.00	0.45	2.86
26	*Rumex hastatus*	1.33	13.33	10.00	0.75	10.13
27	*Rumex Nepalensis*	0.87	26.67	3.25	0.12	16.25
28	*Salvia Moorcroftiana*	0.53	13.33	4.00	0.30	10.92
29	*Senecio Chrysanthemoides*	0.47	13.33	3.50	0.26	6.42
30	*Silene inflata*	0.13	6.67	2.00	0.30	2.27
31	*Solanum nigrum*	0.07	6.67	1.00	0.15	2.18
32	*Thallictrum cultratum*	0.20	6.67	3.00	0.45	2.69
33	*Thymus Linearis*	1.73	13.33	13.00	0.98	11.95
34	*Urtica Dioica*	1.53	20.00	7.67	0.38	18.91
35	*Verbascum Thapsus*	0.27	26.67	1.00	0.04	13.73
36	*Viola biflora*	0.27	13.33	2.00	0.15	4.18
37	*Xanthium Strumarium*	0.33	13.33	2.50	0.19	7.93

C=0.057 H=3.20

5. Socioeconomic impacts of study site

Data on socioeconomic and dependent characteristics were gathered during the course of two phases. In order to get a broad overview of the communities that were situated in the project region, the first stage entailed a quick assessment of the study area. In the villages that will be immediately impacted by the acquisition of land for the project's construction, the second stage of data collection was conducted. The communities that would be impacted by the project construction were surveyed in accordance with the sampling frame that had been initially developed for the survey area. The District Kinnaur includes these settlements. To verify some of the information and to add to the demographic data, secondary sources of information have also been used for data collection. Secondary data was gathered from various government and non-government organisations. The information that was gathered mostly was of a secondary nature and concerned access to resources like PHCs, schools, bus services, LPG distribution centres, types of roads, Information about livestock, land use, demographics of the villages, and the location and distribution of the villages in relation to the project. According to the 2001 census, the Kinnaur District has 660 villages and 62 panchayats, with a total population of approximately 78,334 people. The majority of this population resides in rural areas. The vast majority of people in this district are growers. While Himachal Pradesh as a whole has a sex ratio of 970:1000, the district has a ratio of 979:1000. Compared to the state's approximate 77.13 percent literacy rate, the Kinnaur district's percentage is 75.2%. According to a socioeconomic survey, four communities are located in the affected area. According to the demographic profile of the affected communities' field survey, 11-82-60 hectares of private land in Pangi village will be impacted.

5.1 Identification of project affected families

Door-to-door field surveys at the household level were used to gather information about the affected settlement and population, including demographic data, livestock, and other household assets, while information about the land that may be purchased in the various (project-affected) villages was gathered from the relevant Revenue Authorities and HPSEB. 253 households in Pangi village, Kinnaur district, are expected to be impacted by the purchase of land, houses, and stores for the "Kashang Project", according to land records and a ground truth survey. Other three project-affected communities' land has not yet been purchased. Based on the amount of land that each family still owns after purchasing the land, families were divided into three

groups: those with 0–10 bighas, those with 10–20 bighas, and those without any land.

5.2 Economic profile of project affected people (PAP)

One of the most significant aspects of this survey is the economic impact the project had on the towns and households it affected. In addition, the PAP receives money from a few salaried positions in the public and commercial sectors, small businesses, non-wood forest products, etc. This section of the survey study focuses on the PAP's job profile, their source of income, their ownership of property, specifics of their mobile and immovable property, and their spending habits.

5.2.1 Source of income

The major and most significant source of employment and income for those living in the project's affected area is agriculture and horticulture. The majority of the zone's land is covered by a sophisticated irrigation system that uses pipes to transport water from the region's natural springs to irrigation canals. According to the socioeconomic survey, 11.50%, 8.05%, and 7.78% of people in Lippa, Toktu, and Asrang villages, respectively, are employed in agriculture, compared to 22.09% of people in Pangi village.

5.2.2 Movable Property – Live Stock Population

The primary source of income in rural areas comes from livestock because these communities rely on these animals for milk, wool, meat, ploughing, and transportation. The same is true for the residents of the communities affected by the project. In addition to these primary uses, cattle also give them nutrient-rich dung to use. Due to the availability of a reasonable amount of agricultural waste and food from the surrounding area, the entire project-affected region has a high population of live animals, especially sheep and goats.

Table 7: Details of material assets owned by PAP (%)

Project Affected Villages	TV	Radio
Pangi	44.66	28.85
Lippa	27.90	34.88
Toktu	8.33	4.5
Asrang	23.07	30.76

5.2.3 Immovable Property – Land Holdings

According to the study done on the PAFs of the Kashang project, each family owns between 0.5 and 150 bighas of land.

Table 8: Land holdings of PAP % of Kashang Project

Project Affected Villages	Land Holding in Bigha				
	<5	5-10	10-25	25-50	>50
Pangi	28.45	21.73	20.55	4.34	0.79
Lippa	25.58	27.90	34.88	6.97	-
Toktu	-	13.33	50	16.66	-
Asrang	30.76	15.38	23.07	7.69	15.38

6. Impacts on environment and society

It is anticipated that the building of the proposed project will lead to certain changes in the region's general environmental matrix, including several man-made alterations like the construction of reservoirs, powerhouse sites, and control rooms, among others. In order to mitigate the negative effects of project activities, efforts were also made to study the degree of alternations and management tactics in order to foresee the magnitude of change. This exercise has given a solid foundation for the creation of several management plans, which are contained in the project's EMP document.

6.1 Impacts on land environment

According to an evaluation of the project's effects on the land environment, the topography near the project site will undergo both temporary and permanent changes to the landscape. The following are the main effects: -

- Terrain modification brought on by access and approach road building.
- Production of solid waste as a result of construction and the employment of construction labour; this includes the production of muck and a localised increase in erosion caused by the excavation of the tunnel, the powerhouse, and other ancillary components.

6.2 Impacts on geology

The geological formations at the project sites that have been chosen are thought to be stable and able to survive the effects of drilling and blasting based on site-specific analyses. However, blasting may result in significant vibrations at any unstable formation discovered during digging, which may then cause soil erosion, subsidence, and loss of flora. For this reason, it is necessary to use controlled blasting in such geologically vulnerable areas. Similarly, it is anticipated that the combined effects of choosing stable sites for the link tunnel's construction and using controlled blasting at sensitive spots will have less of an influence on the geological environment.

6.3 Impacts on Hydrology

As is frequently the case in mountainous terrain, the area's ground water levels could not be determined. No negative effects on groundwater supply are anticipated because the majority of the water used for construction will come from khad water. Additionally, trash disposal must only take place at designated exposed surface places; as a result, there won't be any detrimental effects on the region's groundwater quality.

6.4 Impacts on flora

The baseline survey on the flora conducted during the study in the project and its surrounding area revealed some of the species, including *Hyoscyamus Niger*, *Ephedra gerardiana*, *Ferula jaeschkeana*, *Heracleum candicans*, *Betula utilis*, *Juniperus macropoda*, *Dactylorhiza hatagirea*, *Datisca cannabina*, *Rheum webbianum*, *Dioscorea delto.* These vulnerable plant species are not coincident with project operations and the majority of project activities take place underground. Additionally, plant species found in the project under study and its surrounding areas also exist in other regions of the cold desert of the Kinnaur district, therefore there is no threat to their extinction. There is no threat to the extinction of the plant species present in the examined project and its surrounding areas because they are also prevalent in other locations of the Kinnaur district's cold desert. From the study region, 62 plant species having medicinal, timber, fuel wood, feed, and decorative value were identified. In other words, due of the abundance of species, the proposed project and its surrounding area offer food, fodder, and wood for heating to the locals. Therefore, extensive plantations of species with medicinal, fodder, and

fuel wood benefits should be made in appropriate regions to support the livelihood of the rural population.

6.5 Impacts due to Labour immigration

Around 1200 construction workers are expected to congregate in the project area during the development period, necessitating the need for temporary or semi-permanent housing. Pressure on the land and water resources would result from this. Solid waste and sewage disposal would be necessary. The pressure on the neighbouring forest for fuel wood may occur if the labour force is not given adequate fuel arrangements. The project proponent and contractors will be required to offer the personnel suitable boarding and accommodation in order to lessen their reliance on the forest. Employment issues could lead to conflict between the local community and the migrants.

7. Conclusion

Nature has nourished life since its existence and from the very beginning, life sustained itself on the available resources. However, human beings have always utilized major part of these natural resources than any other organism on this planet. In a country like India, where population spearheaded with low economic status and small land- holdings, poses a very high pressure on the natural resources and the situation further worsens in the hilly region of the country where terrain and inaccessibility becomes the major constraint which then force the people to utilize whatever is accessible in the vicinity of their dwellings. In the study site Dollo – Dogri *Cedrus deodara* was dominant tree, *Indigofera Gerardiana* was dominant shrub, *Polygonum polystachya* was the dominant herb having maximum density, frequency and abundance. In contrast in Pangi valley, the index of diversity (H) for trees, shrubs, and herbs revealed respective values of 1.509, 2.301, and 3.202. The values for concentration of dominance for trees, shrubs, and herbs were 0.346, 0.132, and 0.057. Trees, shrubs, and herbs had richness index values of 2.01, 2.17, and 5.28, respectively, although these groups had evenness index values of 0.63, 0.87, and 0.89.

8. References

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