



ENVIRONMENT MANAGEMENT PLAN FOR HYDROPOWER PROJECT: A CASE STUDY OF KOL DAM FROM HIMACHAL PRADESH, INDIA

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ABSTRACT

The present investigations were carried out to develop a comprehensive and socially acceptable environment management plan so as to minimize the harmful impacts of Kol dam hydroelectric project in *Bilaspur*, Himachal Pradesh. The dam construction resulted in loss of natural resources as it lead to the acquisition of 1068 hectares forest & 442 hectares of private land & thus ultimate loss of flora & fauna due to habitat destruction. Acquisition of land by dam has also resulted in the loss of trees which was maximum 80.60 per cent in Kasol followed by Kyan, Harmora and Jamthal i.e. 52.84, 44.04 and 38.93 per cent respectively. It was minimum (37.45 %) in Ropa. Recommended tree species for green belt management plan includes *Acacia catechu*, *Grewia optiva*, *Morus alba*, *Celtis australis*, *Ficus roxburghii*, *Bauhinia racemosa*, *Albizia lebbek*.

KEYWORDS: Kol-dam, Satluj River, Environment management plan, Green belt management plan

INTRODUCTION

The Environmental Management Plan (EMP) should assist planners and government authorities in decision making process by identifying the key impacts/issues and formulating mitigation measures. Due to fragile nature of topography and delicacy of ecology of the Himalaya, it results in lot of disturbances because of high degree of human interferences like construction of major hydropower projects. Kol dam construction has also been resulted in the acquisition of 1068 ha forest and 442 of private land which resulted in loss of flora & fauna due to habitat destruction (Sharma et al. 2007). The change in any form of land use is largely related either with external forces and the pressure built up within the system (Bisht and Kothyari, 2001). The land use system is highly dynamic which undergoes significant changes according to the changing socioeconomic and natural environment (Kam, 1995; Luque, 2000). Hydroelectric projects cause displacement of people, damage to land use system, local ecology including flora and fauna, surface and ground water resources. Hence studies on monitoring and determining the impact of hydropower projects on people and other resources existing on and around the sites of such projects are necessary for developing plans and policies to rejuvenate the degraded resources. Thus the primary purpose of Environmental Management Plan (EMP) is to encourage the environmental consideration in planning and decision making process (Anjaneyulu, 2002). The acquisition of private land along with setting up of the project will result in changes of socio-economic aspects and lifestyle of the local people. EMP is beneficial in

reduction of potential adverse environmental impacts of project and institutionalization of environmental values on government and corporate planning & decision making (Pawar, 2007). During the construction period various activities like road construction, blasting, excavation for tunnels, quarrying, dumping of excavated material and human population pressure on land and biological resources are likely to exert tremendous pressure on the biological resources of the region and management plan will ensure mitigation of such impacts. In view of the impact that the Hydel Power plant has on environment, it is necessary to conduct detailed Environmental Impact Assessment studies enables the project authorities to take necessary steps for safeguarding the environmental quality in surrounding (Siddiqui et al. 2008). EMP is beneficial in reduction of potential adverse environmental impacts of project and institutionalization of environmental values on government and corporate planning & decision making. Looking in to this, the present investigations were carried out to develop a comprehensive and socially acceptable environment management plan based on rehabilitation opportunities, livelihood options available and conservation needs so as to minimize the harmful impacts of Kol dam hydroelectric project.

MATERIALS AND METHODS

Study Area

The study area is located between 31°21'54" to 31°05'13" N latitude and 76°51'31" to 77°23'51" E longitude at an altitude range of 580-1074 m amsl on *Satluj* river in *Bilaspur*, Himachal Pradesh..

Sampling procedure and data collection

The present analysis is based upon the primary information collected through field survey and multistage simple random sampling technique was used to for the study (Leslie Kish, 1995). The sampling scheme has been

depicted in Fig. 1. Finally five target villages were selected. Five households were selected randomly in each village for gathering the information on socio-economic attributes.

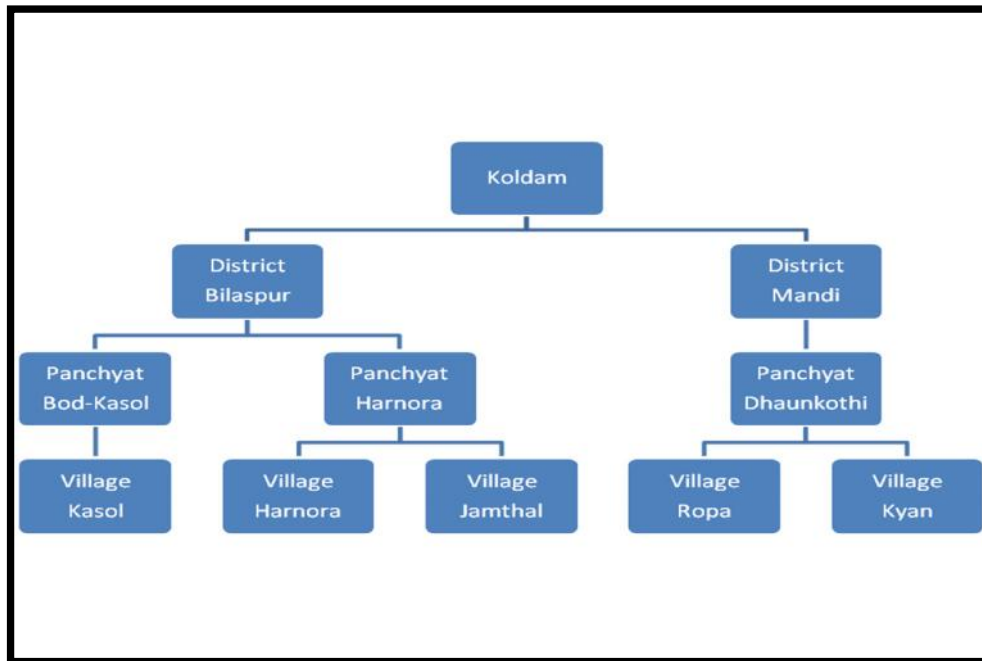


FIGURE 1: Sampling procedure adopted for the selection of study area

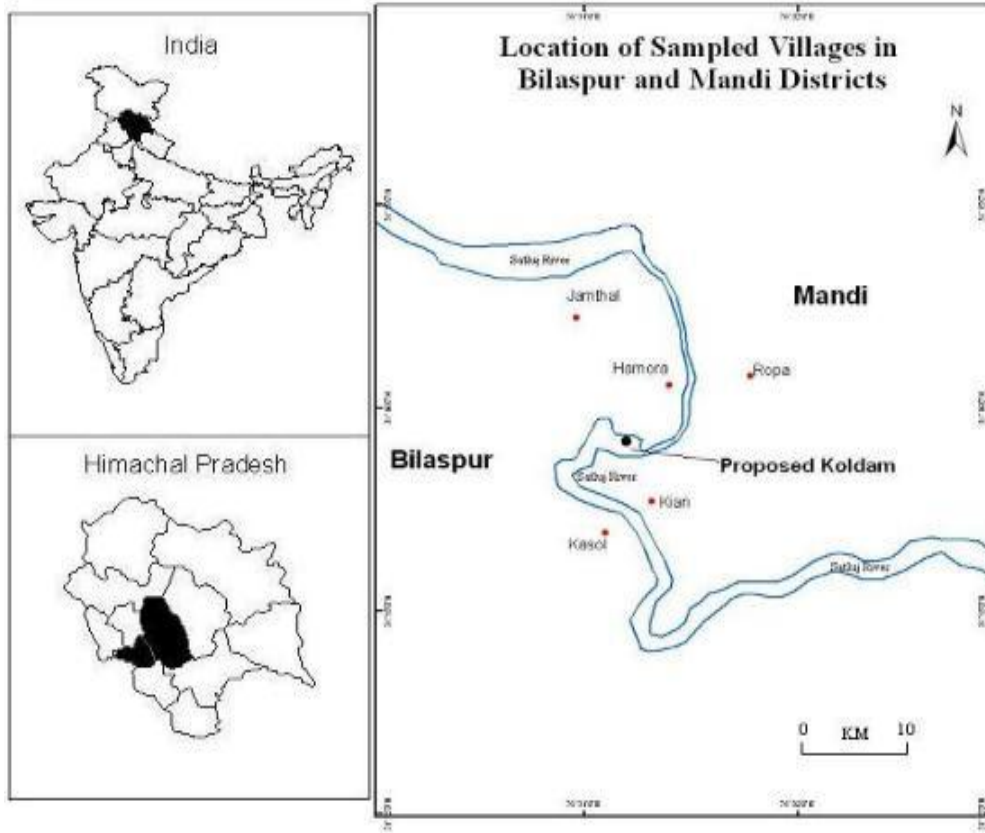


FIGURE 2: Map showing location of Kol-Dam affected sampled villages

RESULTS & DISCUSSION

A comprehensive and socially acceptable environment management plan based on rehabilitation opportunities, livelihood options available and conservation needs was developed. During the construction period various activities like road construction, blasting, excavation for tunnels, quarrying, dumping of excavated material and human population pressure on land and biological resources are likely to exert tremendous pressure on the biological resources of the region and environmental management plan ensure mitigation of such impacts.

Education facility

Special provision of school up to secondary level should be there for the children of project affected families so as they can get better education for the sustenance of their future livelihood.

Health and sanitary facility

Hospitals should be open so as to provide medical aids and for the better health of project affected families as there are more chances of spreading diseases.

For Change in land holdings

A direct loss of on-farm income of the people has been recorded from agricultural sector as a result of acquisition of cultivated land. Maximum 67.36 per cent loss of area under crop was in Kyan followed by Kasol, Ropa and Harnora where it was 63.23, 56.41 and 50.95 per cent respectively. It was minimum 36.15 per cent for Jamthal (Fig.3). Therefore to compensate the land loss, financial assistance to project affected families rendered land less on account of acquisition of land should be given as land less grant. Loss of cultivated land has also resulted in decrease in area under different crops that was found to affect the income from farming avocation. To compensate it, provision of vocational training along with compensation money should be there. Project affected people should be provided with training in different avocation according to their interest for sustainable future livelihood. Different vocation in which trainings should be given are as follows; floriculture, mushroom cultivation, poultry, computer training, sewing tailoring, electrician and mechanics etc.

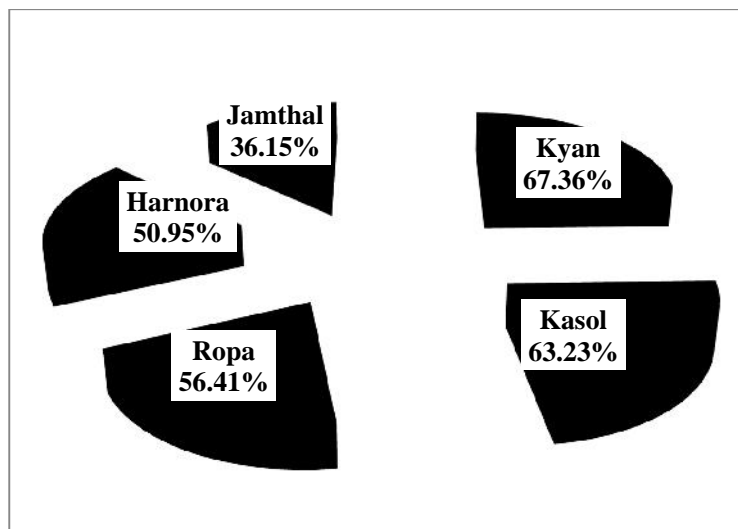


FIGURE 3: Loss of area under crops per family in different project affected villages

Loss of tree resources from farm land

Acquisition of land by dam has also resulted in loss of timber, fodder, fuel-wood and fruit tree resources from village farm land. The loss of trees due to project was recorded maximum 80.60 % in Kasol followed by Kyan, Harnora and Jamthal i.e. 52.84 %, 44.04 % and 38.93 % respectively. It was minimum 37.45 % in Ropa (Fig.4).

As a result people will face problem of fuel timber and fodder for their animals. Therefore to compensate the loss of tree resources following species are recommended for

planting under green belt management plan or compensatory afforestation (Table 1).

For Loss of assets

Dam construction also resulted in the loss of assets like residential structure commercial structure and cattle shed. Compensating measure for the loss of residential structure should be houseless grant, resettlement colonies and free plot should be allotted for houseless families for the construction of houses.

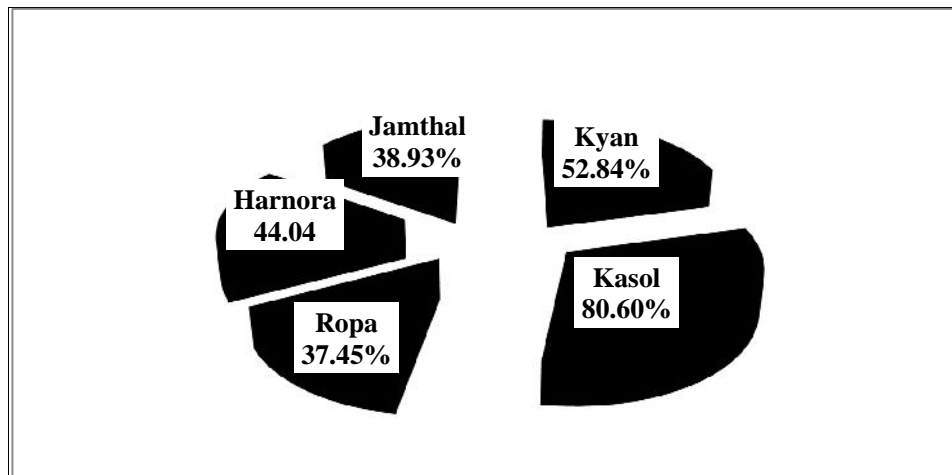


FIGURE 4: Loss of forest trees from village farm land in project affected villages

TABLE 1: Tree species recommended for planting under green belt management plan

S.No.	Tree Species	Uses
1	<i>Acacia catechu</i>	Fodder, fuel-wood, timber, medicinal
2	<i>Albizia chinensis</i>	Fodder, fuel-wood, timber
3	<i>Bauhinia variegata</i>	Fodder, fuelwood
4	<i>Celtis australis</i>	Fodder, fuelwood
5	<i>Emblica officinalis</i>	Medicinal, fuelwood
6	<i>Grewia optiva</i>	Fodder, fuelwood
7	<i>Morus alba</i>	Fodder, fuelwood, timber
8	<i>Melia azedarch</i>	Fuelwood, timber
9	<i>Toona ciliate</i>	Timber, fuel-wood
10	<i>Terminalia bellirica</i>	Medicinal, fuelwood
11	<i>Terminalia chebula</i>	Medicinal, fuelwood

For the loss of commercial structure

In case of commercial structure 100.00 % loss was recorded for Kasol and Kyan, each. However there was no loss of commercial structures in rest of the villages. To compensate it following measures should be followed by the project authority includes one time financial assistance (displacement grant to the displaced shopkeeper) and additional financial assistance to the displaced shopkeeper in case shops are not allotted.

For the compensation of fuel-wood availability

Loss of fuel-wood trees due to project resulted in decreased fuel availability. To compensate it special provision of fuel in the project affected villages, subsidy on the kerosene, LPG and electricity for project affected families and plantation of fuel-wood trees under compensatory Afforestation plan on the remaining village land.



FIGURE 5: Effect of quarrying operations on land and flora during Kol-Dam construction phase in 2011.



FIGURE 6: View of Kol –Dam reservoir after completion of project during 2014.

For the loss of flora

Dam has also resulted in the clearance as well as submergence of vegetation. There will be decrease in number of native species which can be compensated through additional plantation of native species which are socially accepted, ecologically adapted and economically beneficial, should prefer in the afforestation plan and should cater to the fodder/forage, fuel-wood, timber and fit into edaphic conditions / climatic conditions and socio-economic realities. Mixture of species would be able to fulfill fodder/forage, fire wood, food and small timber demand of community. If the planting area in the vicinity of habitation in that case the fuel, fodder and timber species mainly the native species of that particular area should prefer. Poplar species should be preferred in riverine region especially.

CONCLUSION

Thus the study was useful to encourage the environmental consideration in planning and decision making process. The acquisition of private land along with setting up of the project has changed the socio-economic aspects and lifestyle of the local people. This result of study will certainly be helpful in designing the environmental management plan for sustainable development and conservation of dam sites and is a vital step in ecological planning.

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