WILDLIFE MANAGEMENT PLAN
PAR HEP (52 MW)
Papum Pare District, Arunachal Pradesh

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BIODIVERSITY CONSERVATION & WILDLIFE MANAGEMENT PLAN

1. INTRODUCTION

Biodiversity is part of our daily lives and livelihood, and constitutes resources upon which families, communities, nations and future generations depend. Every organism and its variation are unique and have its own role to play in a particular ecological niche. During the last few decades, the pace of species extinction has increased dramatically as a result of human activities. Ecosystems are being fragmented or eliminated, and several species are in decline. The fragmentation, degradation, and loss of habitats pose serious threat to biological diversity. These losses are irreversible and pose a threat to our own well-being, considering our dependence on food crop and medicines and other biological resources.

The main objective of Biodiversity Conservation and Management plan is sustainable use of natural resources which involves scientific management of natural wealth vis- à-vis developmental activities is likely to affect these resources. Therefore, Biodiversity Conservation & Management plan has been formulated for the conservation and management of the forest ecosystems in PAR HE Project area. The recommendations are designed to promote long term stand level maintenance and recruitment of important structural attributes such as: wildlife, diversity of species, special or unique habitats for floral and faunal wealth, riparian areas and wetlands, coarse woody debris, horizontal and vertical structural diversity

Biodiversity management is considered as a difficult task as it refers to diversity at all levels like genetic, species and community. The implementation of biodiversity conservation strategy is a challenging job especially in North-eastern part of India like Arunachal Pradesh as the area is predominated with various tribal populations, which consider themselves as an integral part of the forest ecosystem.

The formulation of a biodiversity management and wildlife conservation plan for a developmental Project is one of the steps towards the environment conservation. Human activities like agricultural expansion, road construction, urbanization, and other

developmental activities are supposed to be major threats to biodiversity and wildlife, therefore, the most effective and efficient mechanisms for conserving biodiversity is to prevent further destruction of degradation of habitats. Four strategies required for the biodiversity management are *in situ* strategy, *ex situ* strategy, reduction of anthropogenic pressure and rehabilitation of endangered species.

2. PROJECT DESCRIPTION

The proposed Par HE Project (52 MW) is being developed by KVK Par Power Pvt. Ltd. The proposed HE project is located in Papum Pare District in the State of Arunachal Pradesh. (**Figure 1**). It envisages utilization of the flow of Pare River, a tributary of Brahmaputra River, for generation of electrical power in a run-of-the-river scheme.

The Par hydroelectric project is the first project from upstream in the cascade development of hydroelectric projects on the Pare River. From upstream to downstream of Pare River, the development of the projects are in this order – Par Hydroelectric Project, Turu Hydroelectric Project, Dardu Hydroelectric Project and Pare Hydroelectric Project (project under construction by NEEPCO Ltd.). It envisages utilization of the flow of Pare River, for generation of electrical power in a run-of-the-river scheme. The main components of Par hydroelectric project are described below:

- A 26.5 m high barrage dam is proposed to divert water of Pare River into the water conductor system. The top level of the barrage is at El 850 m;
- The Full Reservoir Level (FRL) and minimum draw down level (MDDL) of the reservoir are El 848m and El 845m, respectively, with live storage of 0.35 MCM;
- The intake is located on the left bank of Pare River, upstream of the barrage axis. The intake system consists of two (2) inlet tunnels which later combine to form the headrace tunnel;
- One headrace tunnel of 8636m length with design discharge of 28.49 cumec;
- One steel lined pressure shafts of 2.5m diameter and two (2) nos. of penstock with 1.8 m diameter size and 27 m length;
- Surface powerhouse is proposed with Francis turbines at axis level of El. 626.25m;
- The installed capacity of the power house will be 52 MW (26X2 MW).

3. BIODIVERSITY OF THE STUDY AREA

The project area falls under Sagalee Forest Division and forests are characterized by Tropical semi-evergreen forests. The entire area is covered by dense forests along the river banks or degraded open forests interspersed with settlements at upper reaches. The main feature of these forests is the heterogeneous mixture of species. In general the top storey is open and is comprised of a mixture of evergreen, semi-evergreen and deciduous species. Pure patches of bamboos are also common and are scattered all over the forest area. These forests can be grouped in the **Sub group- 2B Northern Tropical Semi Evergreen Forest** and **Sub group-3C North Indian moist deciduous forests** according to Champion and Seth (1968) - Revised Survey of Forest Types of India. The forests can be described in following sub-groups and types:

a) 2B/C1a: Assam Alluvial Plains Semi-Evergreen Forest

The forest type is comprised of mixture of evergreen and deciduous tall tree species with dominance of evergreen species. Middle and lower storeys consists of mainly evergreen species with dense undergrowth. The dominant trees of top storey are: *Terminalia myriocarpa* (Hollock), *Altingia excelsa* (Jutuli), *Amoora wallichii* (Amari), and *Ailanthus grandis* (Borpat). Main species of middle and lower storeys are: *Castanopsis indica* (Hinguri), *Bischofia javanica* (Urium), *Dysoxylum binectiferum* (Banderdima), *Kydia calycina* (Picholi) and *Talauma hodgsonii* (Boramthuri). Ground flora is comprised of *Clerodendron infortunatum*, *Erianthus ravennae*, *Musa* spp., and *Phrynium imbricatum*. *Bambusa pallida* (Bijuli) and *Dendrocalamus hamiltonii* (Kako) are the main bamboo species along with canes like (*Calamus floribundus*) and (*Calamus flagellum*) and palm *Livistona jenkinsiana*.

b) 2B/C1/IS1: Sub-Himalayan light alluvial Semi-Evergreen Forests

The composition is almost similar Assam Alluvial Plains Semi-evergreen forest with dominance of deciduous species. *Altingia excelsa* (Jutuli) and *Terminalia myriocarpa* are the most dominant tree species. In addition species like *Magnolia* spp. (Sopa), *Phoebe goalparensis, Canarium resiniferum* and *Toona ciliata* are also found.

c) 2B/2S1: Secondary moist bamboo brakes

This type of forest occurs in scattered patches throughout the area in the Forest Division. *Dendrocalamus hamiltonii, Bambusa pallida* and *Schizostachyum polymorphum* are the main species.

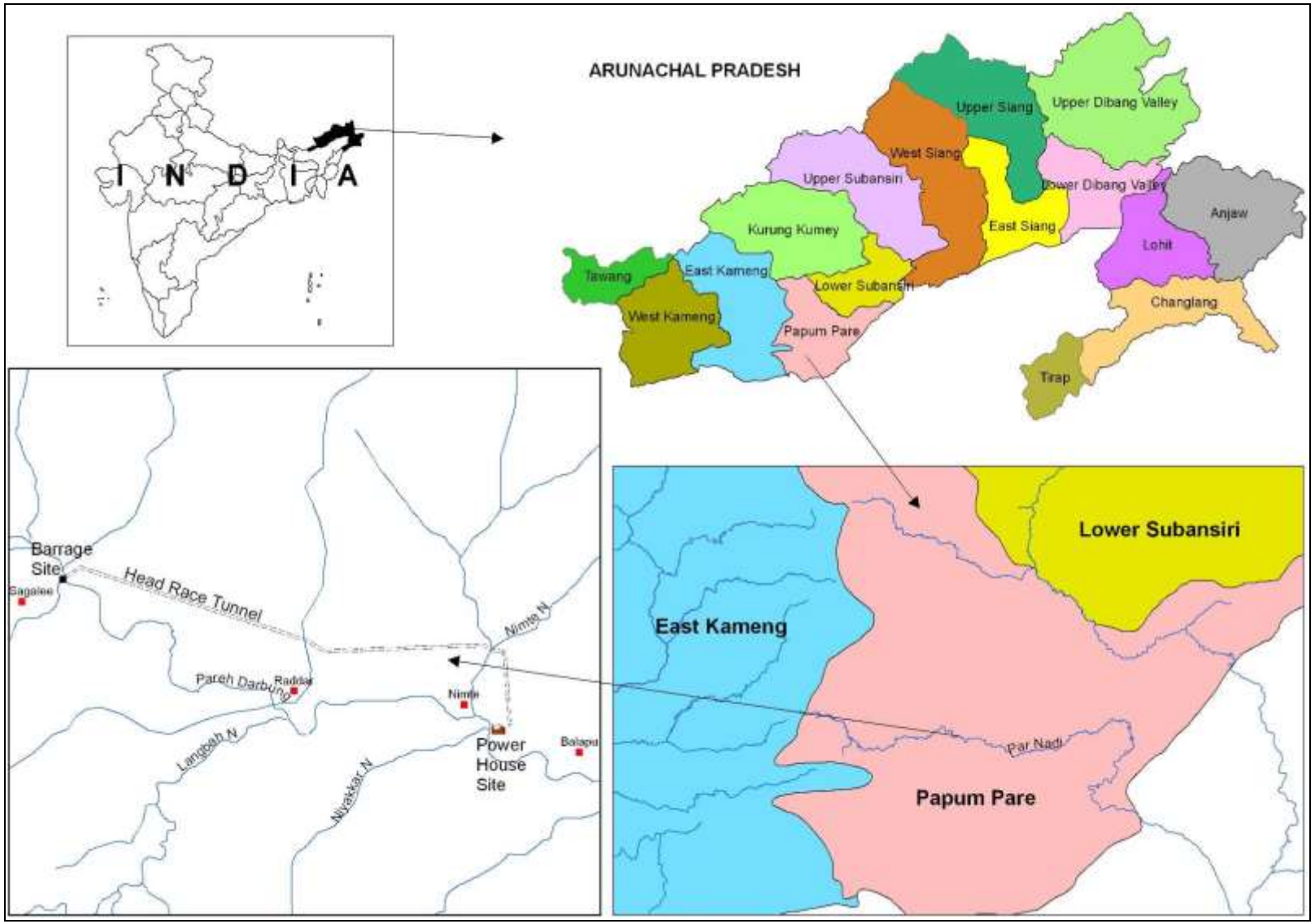

Figure 1: Location Map of Par HE Project

4. FLORA OF THE STUDY AREA

The vegetation of the study area can be classified as tropical semi evergreen and wet evergreen. Pure patches of bamboos are quite common in almost all the area. The hill slopes are steep to very steep. The vegetation in the area in general is semi-evergreen and wet evergreen. The forests of the area are heterogeneous mixture of the species with the merging of evergreen and semi evergreen forest into each other. In most of the area patches of bamboo are common. The most common bamboos found in these forest areas are *Bambusa pallida* (Bijuli) and *Dendrocalamus hamiltonii* (Kako). Tree species like *Duabanga grandiflora* (Khokan), *Amoora wallichii* (Aman), *Toona ciliata* (Poma), *Magnolia* spp. (Sopa), *Schima wallichii* (Makrisal), and *Castanopsis indica* (Hingori) are found in the forest. Grasses species found here are *Saccharum procerum*, *Saccharum spontaneum*, *Andropogon assimile*, *Phragmites karka*, and *Alpinia allughas*.

5. FAUNA OF THE STUDY AREA

Methodology for the faunal study in the study area:

Field visit was carried out on both the bank of Pare River during day hours. Mostly trails were used to survey the wild animals in the study area. The survey of wild animals conducted by using 10x50 prismatic field binocular and hand held GPS 72 in different habitat. The presence of wildlife was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the catchment and study area. In addition to these, secondary sources mainly literature was also referred for preparing checklists and other analysis in the study of animals and wildlife in the region.

The methodology followed for the current survey is as follows:

- Direct sighting and indirect evidences such as calls, signs and trophies of mammals were recorded along the survey routes taking aid from Prater (1980).
- Interviews of local villagers for the presence and relative abundance of various animal species within each locality.
- Data collection on habitat condition, animal presence by direct sighting and indirect evidences.

Birds were sampled on the same transect and trails marked for mammals. Sampling was carried out on trails wherever the terrain permits and point counts were carried out at a fixed

distances at more or less regular intervals. A Nikon made 10x50 prismatic field binocular was used for the bird watching during transect walk as well as during the morning and evening hours nearby the habitation of study area. Birds were identified as per the literature given by Ali & Ripley (1983), Grimmett and Flaming et al. (1984), Krys Kazmierczak (2006) and Grimmett (2007).

Among the mammals Mithun, Grey Mongoose, Barking deer, large Civet, Jungle Cat and Porcupine are commonly reported from the study area. However, their number is gradually decreasing due to increasing expansion of human settlement leading and occurrence of forest fire due to jhumimg and hunting in the study area. The mammalian species like, Indian Elephant and Tiger are categorized under endangered while, Assamese macaque and Common Leopard reported in near threatened category of IUCN. Besides that Capped Langur comes under vulnerable category and rest of the mammals belongs to least concern category by IUCN.

Maximum number of mammals reported in the study area are belongs to order Carnivora, Cetartiodactyla, Primates and Rodentia respectively. List of wild animals and birds reported in the area tabulated below:

Mithun (Bos frontalis), Indian porcupine and Gray Mongoose are the commonly observed mammals in the study area. Besides these no other wild animal was sighted during field investigation.

Table 1: List of Mammals reported from the study area

S. No.	Family / Scientific Name	Common Name	Conservation Status	
			Schedule as per WPA 1972*	IUCN Ver. 3.1
	ORDER: CARNIVORA			
	CANIDAE			
1	*Canis aureus*	Golden Jackal	II	LC
2	*Cuon alpinus*	Wild dog	II	EN
	FELIDAE			
3	*Felis chaus*	Jungle cat	II	LC
4	*Panthera tigris*	Tiger	I	EN
5	*Panthera pardus*	Common Leopard	I	NT
	HERPESTIDAE			
6	*Herpestes edwardsii*	Grey mongoose	II	LC

	VIVERRIDAE			
7	*Viverricula indica*	Small Indian Civet	II	LC
	ORDER: CETARTIODACTYLA			
	BOVIDAE			
8	*Bos frontalis*	Mithun	-	-
	CERVIDAE			
9	*Muntiacus muntjak*	Indian muntjac	III	LC
	SUIDAE			
10	*Sus scrofa*	Wild Pig	III	LC
	ORDER: PRIMATES			
	CERCOPITHECIDAE			
11	*Macaca assamensis*	Assamese macaque	II	NT
12	*Trachypithecus pileatus*	Capped Langur	I	VU
	ORDER: PROBOSCIDAEA			
	ELEPHANTIDAE			
13	*Elephas maximus*	Indian Elephant	I	EN
	ORDER: RODENTIA			
	HYSTRICIDAE			
14	*Hystrix indica*	Indian porcupine	IV	LC
	MURIDAE			
15	*Mus booduga*	Field mouse	V	LC

Note: EN: Endangered, VU: Vulnerable, NT: Near Threatened, LC: Least Concern

Due to the excess pressure on the environment created by human population, the once flourishing wildlife is now threatened and pushed into some very small pockets lying in the fringe of the Sanctuary. Even the birds and small herbivores are disappearing fast due to the occurrence of fires which has become a regular event due to jhumimg and hunting.

During the survey, 20 species were directly sighted in their natural habitat composed by small bushy vegetation, bare stone grounds and nearby the human habitation. On the basis of primary survey, an inventory of avifauna was prepared which is enlisted in Table 2. The area supports suitable habitation for birds which mainly feeds on berries and insects. The birds like Great Barbet, Fulvous and Breasted Woodpecker recorded in the forest area because they feed mainly on wild fruits, berries and insects. Some birds like White capped water red start and Plumbeous Water Redstart feed generally on insects like mayflies, stoneflies etc. and hence were recorded mostly near the river and other water sources.

All reported bird species belongs to least concern category by IUCN.

Table 2: List of Avifauna reported from the study area

S. No.	Family / Scientific Name	Common Name	Conservation Status	
			Schedule (WPA 1972)	IUCN Ver. 3.1
	Apodidae			
1	*Collocalia brevirostris*	Himalayan Swiftlet	-	LC
	Columbidae			
2	*Columba livia*	Blue Rock pigeon	IV	LC
3	*Streptopelia chinensis*	Spotted Dove	IV	LC
	Corvidae			
4	*Corvus macrorhynchos*	Large Billed Crow	IV	LC
5	*Dicrurus macrocercus*	Bronzed Drongo	IV	LC
	Lanidae			
6	*Lanius schach*	Grey Backed Shrike	-	LC
	Megalaimidae			
7	*Megalaima virens*	Great Barbet	IV	LC
	Muscicapidae			
8	*Chaimarrornis leucocephalus*	White-capped Water-redstart	IV	LC
9	*Rhyacornis fuliginosus*	Plumbeous Water Redstart	IV	LC
10	*Copsychus saularis*	Oriental Magpie Robin	IV	LC
	Nectariniidae			
11	*Nectarinia asiatica*	Purple Sunbird	IV	LC
	Passeridae			
12	*Passer montanus*	Eurasian Tree Sparrow	IV	LC
13	*Passer domesticus*	House sparrow	IV	LC
14	*Motacilla alba*	White wagtail	IV	LC
	Phylloscopidae			
15	*Phylloscopus maculipennis*	Ashy Throated Warbler	IV	LC
	Picidae			
16	*Dendrocopos macei*	Fulvous breasted Woodpecker	IV	LC
	Pycnonotidae			
17	*Pycnonotus cafer*	Red Vented Bulbul	IV	LC
	Sittidae			
18	*Sitta cinnamoventris*	Chest nut billed nuthatch	-	LC
	Sturnidae			
19	*Acridotheres tristis*	Common Myna	IV	LC
	Timaliidae			
20	*Leiothrix argentauris*	Silver Eared Mesia	IV	LC

Note: LC=Least Concern

6. PROXIMITY TO PROTECTED AREA

Itanagar Wildlife Sanctuary is located at a distance of about 7.35 km from the proposed power house of Par HE Project and falls within 10 km radius of the project components (See **Figure 2**).

6.1 Itanagar Wildlife Sanctuary

Itanagar Wildlife Sanctuary is one of the eight sanctuaries of Arunachal Pradesh. The Itanagar Reserved Forest was declared as Itanagar Wildlife Sanctuary vide Govt. Notification No.FOR 118 / 78 dtd. 14. 06.1978 comprising an area of 140.80 Sq. Km

❖ North & East boundary of IWS

From (G R 9005.4195) which is the confluence of the unnamed tributary of the Pam N and which is about 2 Km. West of Takaranam village, along the right bank of the tributary up to its confluence (G.R. 034.434) which is about 1.5 Km. North East of Takaranam village. Thence an artificial St. line of about 250 (m) length runs across of foot path till it meets the source of the unnamed tributary of Chingke N (G.R. 939.434). Thence across the left bank of this unnamed tributary up to its confluence with Chingke N, downstream up to its confluence with Senki N. Thence along the right bank of Senki N upstream up to its source till it meets the Rei Riah foot path. Thence along the foot path it crosses Niorch N. Thence along the bank of Niorch N down steam till it meets the Pachin rivers.

❖ Southern boundary:

Thence along the left bank of Pachin river up to the confluence of Senkhi N, with Chimpu N. Thence upstream Chimpu N along its left bank to its raw source (GR. 959.362). Thence along an artificial straight line about 250 (m) along up to the source of its tributary of Pam river (GR. 959.362). Thence along with the right bank of this tributary downstream up to its confluence with Pam N. which is also height point 246.

❖ Western boundary:

Thence along the right bank of Pam river upstream upto the straight point.

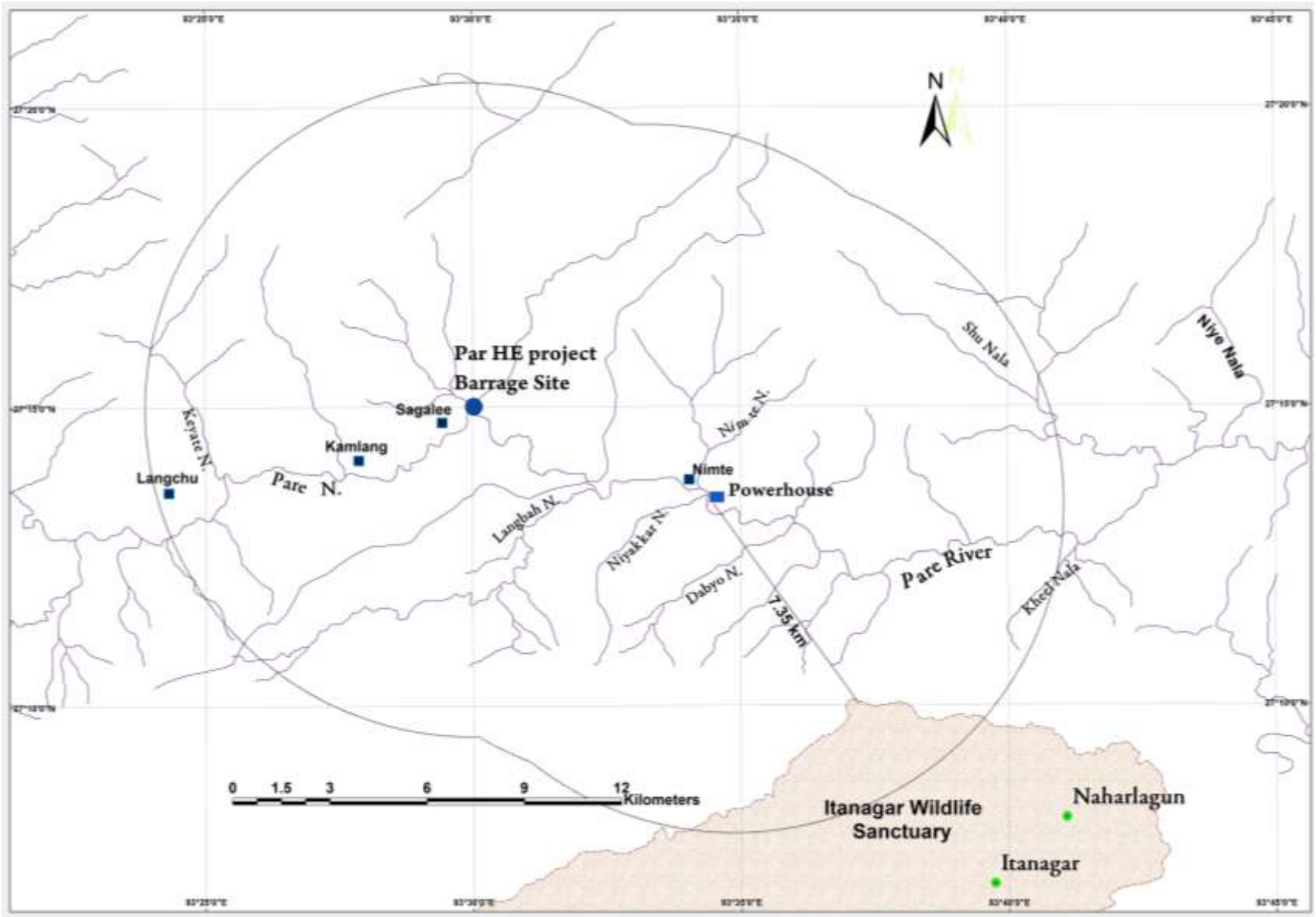

Figure 1: **Location of Par HE project vis-à-vis Itanagar Wildlife Sanctuary**

7. THREATS TO BIODIVERSITY & WILDLIFE

The fragmentation of forested landscape in the area is happening due to degradation activities like shifting cultivation (jhum), clear felling for timber, encroachment into forest land, man-animal conflict, introduction of exotic species and uncoordinated infrastructural development. Population explosion, over exploitation of forest resources, urbanization, unscientific management, encroachment of forest land, illicit felling, lack of regeneration of forests and outdated laws are major factors responsible for the degradation and depletion of forests in area. Deforestation may led to reduction of rainfall, silting of rivers and dams, increase soil erosion, dryness in the air and increase in temperature, adversely affecting not only forestry but also agriculture and horticulture, etc. Therefore, major threats to biodiversity and wildlife in the project area are as follows.

a) Jhum Cultivation:

It's a traditionally agriculture practice in the entire area. Shifting cultivation is the main cause of degradation and depletion of forests cover. This result to habitat loss, degradation, and fragmentation are important causes of known species-populations extinctions.

b) Hunting and poaching:

In Arunachal Pradesh hunting and poaching is associated with culture in most of the communities. Animals are hunted mainly for meat, skin, teeth, feather, beaks and other parts, which are used as a part of traditional dresses and ceremonies. Pheasants, Hornbills, Barking Deer are the commonly hunted wild species for food and for trophies. Awareness about wildlife laws is extremely low. Some believe that hunting would continue because this is part of their traditional practice

c) Illegal cutting of trees:

The local tribal from the study are dominantly depends upon forest for their day to day timber needs. This results in tremendous pressure on the forests. The demand for timber and other wood produce is very high in the area for various activities like the construction of houses, agriculture and other development activities

d) Grazing pressure:

The forest area is also under heavy grazing pressure by the livestock and is susceptible to damage by semi domestic Mithun and other animals. Mithun is considered as the main culprit for the failure of the plantations due to heavy browsing and trampling of seedlings.

The results of above mentioned activities and impact of implementation of the proposed Par HE project will result in:

i. Loss of plant biodiversity;
ii. Shrinkage of potential wildlife habitat due to forest degradation;
iii. Particulate pollution due to increase in traffic density and transportation of equipment by road;
iv. Civil construction and structural installation;
v. Disturbance due to noise pollution and vibration during use of explosive;
vi. Large work force and increase in demand for biomass; and
vii. Unauthorized stone quarries for construction materials.

8. BIODIVERSITY CONSERVATION & WILDLIFE MANAGEMENT PLAN

The state needs growth and a vibrant economy. However, protection of nature and environment and development of economy are not alternatives, not mutually exclusive. Both have to proceed hand in hand so that natural ecosystems are maintained or better, restored for uninterrupted flow of goods and services, on which human survival is dependent. Every entrepreneur need to be sensitive of the ecological impact of setting an industry and forge a connection with natural objects and dependent societies. This will make the development sustainable and bring lasting cheer in the society.

Wildlife management consists of habitat evaluation and assessment, periodic monitoring of vegetation cover and animal population status, identification of habitat factors favourable to growth and which act against the population. Welfare factors are promoted, adverse factors are arrested and limiting factors mitigated so that habitat carrying capacity is optimized and populations attain the equilibrium point intrinsic to the species. Participation and support of local public is enlisted to make the conservation plan work and outcome becomes sustainable.

Conscious of the above and in consonance with the statutory requirement, this conservation plan is made to mitigate the impact on flora & fauna.

8.1 OBJECTIVES

The inhabitants of the project study area comprises mainly of Nyishi tribe. The tribals have traditional rights over the forest and forest products. The practice of shifting cultivation and animal hunting in the region is related not only to food requirement but is also associated with their culture, customs, thrills and festivals. The most effective way of biodiversity conservation in the area is natural resource management, joint forest management and awareness programme involving the local people. State Forest Research Institute, Itanagar has already prepared State Biodiversity Strategy & Action Plan in 2002 (SBSAP) under the National Biodiversity Action Plan – India for the sustainable utilization of biodiversity striking a balance with man and nature. It deals with state's needs for biodiversity conservation concerns and calls for role to be played by every individual, cross-section of society, all the state department, NGOs of the state and other stakeholders like project developers for conservation and sustainable development. The proposed plan is based upon these principles.

Keeping in view of the anticipated impacts, a biodiversity conservation and management plan has been proposed for Par H. E. Project. The main objectives of said plan are as follows:

i. Maintenance of ecological balance through preservation and restoration of wherever it has been disturbed due to project developmental activities,
ii. Conservation and preservation of natural habitats in catchment and project area
iii. Rehabilitation of critical species (endangered, rare and threatened species), if any with provisions for in situ or ex situ conservation of critical/ important plant/ animal species,
iv. Mitigation and control of project induced biotic and/or abiotic pressures/ influences that may affect the natural habitats,
v. Habitat enhancement in project area and catchment area by taking up afforestation and soil conservation measures,
vi. Creating all round awareness regarding conservation and ensuring people's participation in the conservation efforts and minimizing man-animal conflict like human-wild dog; human-elephant and
vii. Creating awareness regarding killing of mithuns by predators leading to socio-economic problems.

9. MANAGEMENT MEASURES

9.1 Wildlife Habitat Preservation & Improvement

9.1.1 Afforestation and Enrichment plantation

Afforestation and enrichment plantation will be carried out in the area. Plantation of indigenous species will be taken up in the in the stretch with an admixture of food and cover plants. Planting of seedlings @ 300 per ha is suggested. Weeding/soil working will be done during first, second and third year respectively. Plantation site will be trench fenced and brushwood fence, for the protected from cattle grazing. With the improvement in habitat of wildlife the incidences of human wildlife conflict will accordingly reduce. The estimated cost for Enrichment plantation and management is **Rs. 40.00 lakhs**.

9.1.2 Bamboo Plantation

Bamboo and canes are the most important forest produce for the local people for their livelihood such as house building, agriculture equipment, etc. and also in the spiritual ceremonies. Many tribesmen make their own hats, which are often extremely decorative, adorned with the beaks and feathers of birds or with tufts of hair dyed red. They also make varieties of baskets, bags and other containers. There is a wide range of cane belts, woven and plain. Cane and bamboo are also used for making baskets for storing and carrying paddy, fuel and water, vessels for preparing local liquor, rice plates, bows and arrows, headgear, mats, shoulder bags, etc. ornaments and necklaces made of fine strips of bamboo and grass are also popular. For all the means local people extract bamboo and canes from forest area. To minimize their dependence on the forest, bamboo and cane cultivation is important.

Bamboo plantation will be done both in private land outside the protected area to maintain the local needs and also in sanctuary to maintain the floral diversity and wildlife habitat.

Plantation will be carried out the on outer slopes protected area, and on private lands where bamboo clumps are comparatively less and stunted. Bamboo rhizomes with tuft of one year old aerial root will be planted for early establishment. Additional bamboo buffer resources need to be build up, as the species is staple food of elephants and is also subject to gregarious flowering and death soon after. Such buffer stock will have to be created in the sanctuary and

from nearby forest area, from a different seed origin. Proper fencing majors will be done around the planting area to prevent grazing. As bamboo is susceptible to root competition and fire, plantation will be kept properly hoed, weeded and protected from fire for optimum growth. In Bamboo plantation area, weeding will be confined to Chromolaena odorata and climbers. Plantation area will be kept free from congestion by carrying out regeneration cleaning on the year preceding actual plantation. The estimated cost for Bamboo plantation and management is **Rs. 40.00 lakhs**.

9.1.3 Farm Forestry

The project area harbours number of economically important plants. These valuable resources will be directly useful to the people of the area which can form the basis of economic upliftment in study area.

With a view to reduce dependence on the natural forests for biomass and other Non-timber forest products (NTFPs) or minor forest products (MFPs) alternate resources need to be building up. NTFPs/MFPs plantations will be carried out on the community land, degraded land, *jhum* fallow which help in sustainable land management and also a tool for reclamation. Prominent NTFPs/MFPs is bamboo, canes, thatch, broom grass, medicinal plants, condiments, mushroom and vegetables.

Decentralized nurseries will be created, which will raise 10,000 seedlings every year. Species to be raised are primarily to cater to fuel, fodder and small timber needs. Seedlings will be distributed every year to villagers on a nominal rate. The distribution will be facilitated through Forest Range office in the area. Forest department may take up prior survey with the help of local administrative bodies/panchayats to assess the requirement plants. The estimated cost for establishment of nursery is **Rs. 40.00 lakhs.**

9.1.4 Distribution of Artificial Trophies

Tribal people of the area are very affectionate and demonstrative of animal trophies and ornaments (hornbills, skull, jaws, teeth, etc.) using them in their households, for own make up and for other use like case of large knife, etc. For this reason a large number of animals like Common leopard, Black bear, Macaque, barking deer, Wild boar, small cats, hornbill, etc. are hunted throughout the year. In order to discourage the animal hunting, such types of requirements can be fulfilled through distribution of artificial trophies, made up of fiber glasses. During the construction phase, the trophies would be distributed by forest

department and NGO, a part of task force, suggested for Par H.E. Project. An amount of **Rs.10.00 lakhs** would be provided by the Project authorities.

9.2 Establishment of Germ-plasm Bank and Seed Centre

There are fair possibilities of various folk varieties, land races and cultivars growing in the forest area because inhabitants use various forest products as food and medicines. These species are not yet explored. Germ plasm bank and seed centre is one of the important measures for the conservation of these species. Objective of germ plasm bank is to preserve the genetic material of species and replenishes the seeds samples when their germination falls below the acceptable level. The seed centre is the centre of production of seeds of good genetic and physiological quality. The establishment of germ plasm bank and seed center would require infrastructure facilities, laboratory, research scientists etc. State Forest Research Institute (SFRI) and State horticulture department will be consulted for the establishment of seed center. The experts of SFRI and horticulture department will select the location for establishment of seed center. Project authorities would provide the funds for germ plasm bank and seed center. The estimated cost for establishment of germ plasm and seed center is **Rs. 60.00 lakhs** only.

9.3 Contour Trenches

Contour trenches 0.50 x 0.50 x 5m size in a staggered fashion, spaced 5m apart in contours and placed at 1m contour interval will be excavated. For 1:20 slope, the horizontal distance will be 20m. Such trenches will arrest soil wash and improve moisture regime. Degraded area will be tackled in this manner for regrowth of indigenous species. The estimated cost for formation and maintenance of contour trenches is **Rs. 20.00 lakhs**.

9.4 De-weeding and Sowing of Grass

As there are areas which are heavily infested with weeds, it will require de-weeding by manual uprooting of weed plants just before the commencement of rains followed by sowing of grass. The entire task would be completed by July. In order to prevent seeds from getting washed away and to ensure uniform growth of grasses, seed pellets of grasses will be sown at regular intervals of 1m x 1.5m per ha. Pellets are made by mixing powdered clay and farm yard manure in to which grass seeds are mixed. The mixture is then made into balls of and sun dried in summer to be sown soon after de-weeding. This will also help in arresting

erosion to a great extent. The estimated cost for de-weeding and sowing of grasses is **Rs. 20.00 lakhs**.

9.5 Biodiversity monitoring

With a view to closely observe and analyse if there is any change in floristic composition either positive or negative, a baseline study need to be carried out in the first year of the plan and community structure surveys will be done every alternate year. The changes in species and abundance of both plants and animals will be studied. This will be done through setting up of permanent transects selected through stratified random sampling procedure. The estimated cost for Biodiversity monitoring in the study area is **Rs. 10.00 lakhs.**

9.6 Awareness promotion

The success of any conservation plan of this magnitude is entirely hinged on the active support and whole hearted co-operation of all stakeholders with the members of public playing a major role. For this purpose, meetings and workshops will be organised from village to village on regular basis to carry the people along with implementation. Functions like Van Mahotsav, Wildlife Week, World Forestry Day, and World Environment Day will be organised in a befitting manner to which village heads, members of public representatives system at GP level, local leaders and members of NGO may be invited. The discussion may evolve around deterioration of biodiversity, habitat loss, control of elephant damages and other human wildlife conflicts, fire damage control and how best the vegetation can be revamped etc. Members of public will be encouraged to speak. Student community may also be sensitized on various conservation issues.

9.7 Strengthening of Infrastructural Facilities of Forest Department

Under this plan Project authority would assist the State Forest Department in strengthening the infrastructure facilities, which are poorly developed in the area. Various activities which are necessary for the forest protection plan are described in the following paragraphs.

i). For improvement of vigilance and measures to check poaching, check posts and watch towers will be needed. In order to strengthen the working capacity the officers of the State Forest/Wildlife Department they must be provided with necessary equipment such as a camera, wireless, binoculars and other minor equipment (altimeter, spotscope, search lights, sleeping bags, health kits, etc.) that would increase their capability and efficiency.

ii). Under the reward for informers program it is proposed to engage the workers of proposed task force who are well acquainted with the area and are resourceful in gathering information for anti-poaching (particularly of wild animals and medicinal herbs) and better vigilance. These people could be hired on a contractual basis.

iii) The construction of bridges, inspection paths for more effective and meaningful patrolling of the staff should be undertaken.

iv). Creation of veterinary facilities and rescue camps for healthcare of wild animals and for controlling diseases. For this purpose it is essential to maintain a stock of medicines in addition to setting up of a *mobile-rescue-cum-publicity-van*.

It would be a joint practice of State forest department and stakeholders. Project authorities would provide funds to State Forest Department. Total financial outlay under this head would be **Rs. 50.00 Lakhs**.

9.8 Safeguard Measures

In addition to the various proposed plans, Project authorities are suggested to furnish appropriate guidelines to their workers as safeguard measures. Some of the measures to be followed are mentioned below.

i. Strict monitoring of laborers and associated workers for any activity related to endangering the life or habitat of wild animals and birds.
ii. Strict restrictions will be imposed on the workers at Project sites to ensure that they do not harvest any produce from the natural forests and cause any danger or harm to the animals and birds in wild.
iii. The Project authorities will be bound by the rules and regulations of the Wildlife Protection Acts or any such agency of the State, which may exist or will be promulgated from time to time for the preservation of habitats and protection of wild animals.
iv. It is to be ensured that the noise levels in no case go above 100-150 dB in the Project area. One of the measures that is proposed to be adopted is that the blasting is to be restricted during nights, early mornings and late afternoons, which are the feeding times of most of the fauna. Blasting will be resorted to only if necessary. For this strict blasting

regime i.e. controlled blasting under constant and strict surveillance is to be followed. The suggested methodologies aim at reducing and mitigating noise so as to cause as little disturbance to the animals as possible:

v. Each worker shall be provided with identity card and would not be allowed access to forest areas without permission.
vi. The workers shall be discouraged for plantation of non native species in the surroundings of labor colony.
vii. Possession of firearms by Project workers shall be strictly prohibited, except for dedicated security personnel.

9.9 Biodiversity Management Committee (BMC)

The monitoring and evaluation of Biodiversity Conservation and Wildlife Management Plan of Par H.E. Project will be carried out by a Biodiversity Management Committee (BMC). The committee will follow the guidelines of National Biodiversity Authority, State Biodiversity Conservation Strategy Action Plans (SBCSAP) and State Forest Department to implement, monitor and evaluate the Biodiversity Conservation and Wildlife Management Plan of the proposed Project. The activities of BMC shall be under the direct administrative control of the Chief Wildlife Warden/Principal Chief Conservator of Forests, Arunachal Pradesh. The BMC will comprise of the following members:

Chief Wildlife Warden/Principal Chief Conservator of Forests, Arunachal Pradesh	Chairman
Manager (Environment), Par HE Project	Member Secretary
DFO (s) (wildlife) of the concerned Division	Member
Two experts form NERIST/SFRI, Itanagar	Member
Local Body's Representatives from at least 3 villages (on a rotational basis)	Member

The Chairman of the committee will have the right to assign various activities to various members for proper functioning and result-oriented tasks. The committee will monitor the progress of the proposed plan. Total financial outlay for the BMC would be **Rs. 10.00 lakhs** only.

10. BUDGET

Total budget for the Biodiversity Management & Wildlife Conservation Plan would be **Rs. 165.00 Lakhs**. The break up of the budget is given below.

S. No.	Particulars	Total Amount (Rs. in lakhs)
1	Afforestation and Enrichment plantation	Cost to be covered under CAT
2	Bamboo Plantation	Cost to be covered under CAT
3	Farm forestry	Cost to be covered under CAT
4	Distribution of Artificial Trophies	10.00
5	Germplasm bank & Seed Centre	60.00
6	Contour trenches	Cost to be covered under CAT
7	De-weeding and Sowing of Grass	20.00
8	Biodiversity monitoring	10.00
9	Awareness promotion	5.00
10	Strengthening of Infrastructural Facilities of Forest Department	50.00
11	Biodiversity Management Committee (BMC)	10.00
	Total	**165.00**