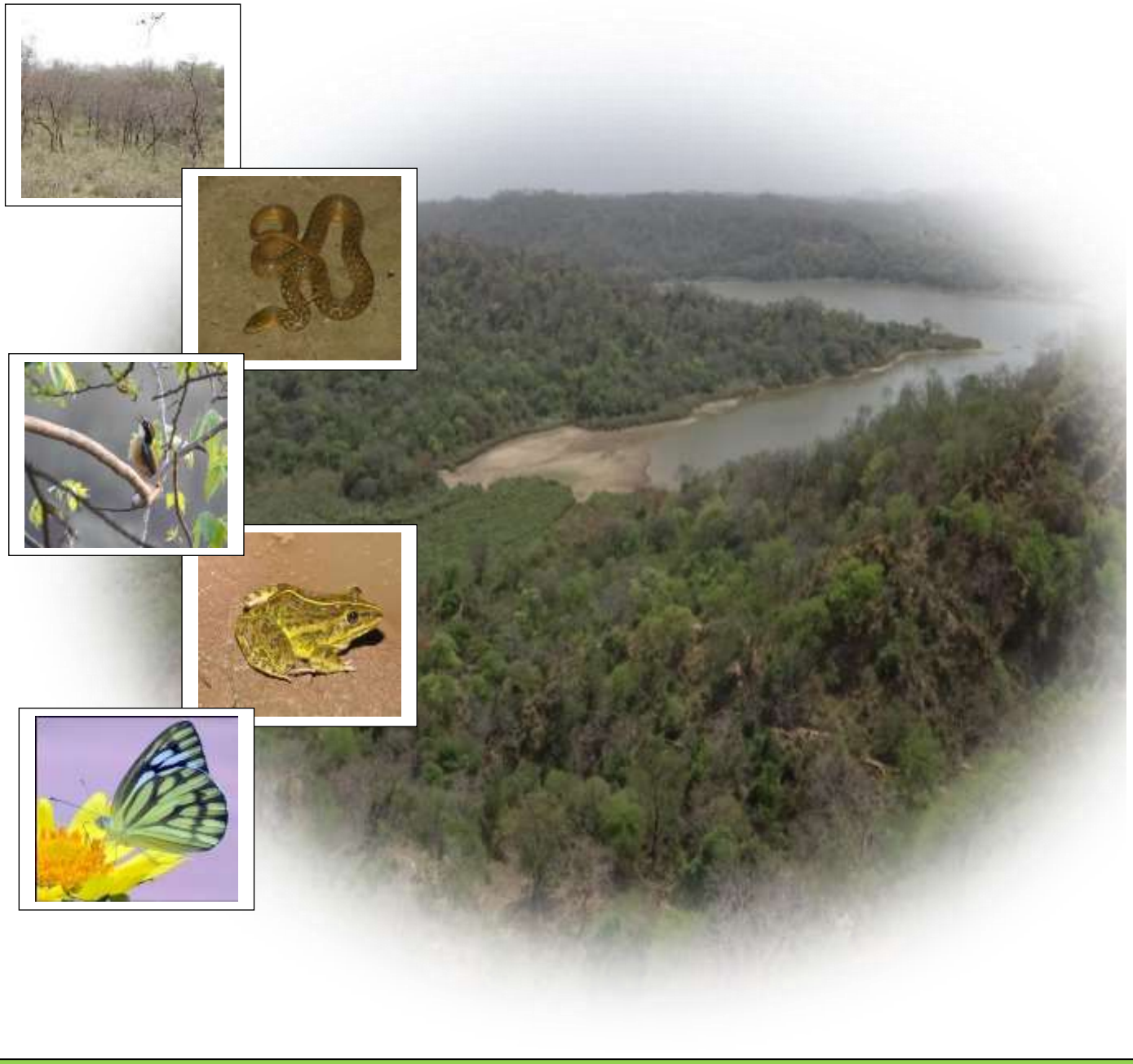

# SISWAN

# MANAGEMENT PLAN
# 2022-23 to 2027-28

## SISWAN COMMUNITY RESERVE

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

# ***SISWAN COMMUNITY RESERVE PUNJAB***

# MANAGEMENT PLAN 2022-23 to 2027-28

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

DEPARTMENT OF FORESTS AND WILDLIFE PRESERVATION
GOVT. PUNJAB

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Wildlife Institute of India (2022). Management Plan for Siswan Community Reserve 2022-23 to 2027-28, Wildlife Institute of India, Dehradun.

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**Wildlife Institute of India, Dehradun:**

Dr. S.P. Yadav, Director; Dr. Dhananjay Mohan, Former Director; Dr. V.B. Mathur, Former Director and now Chairman, Biodiversity Authority of India; Dr. Y.V. Jhala, Dean; Dr. G.S. Rawat, Former Dean; Sh. P.C. Tyagi, Senior Professional Fellow; Dr. Pratap Singh, Scientist-G; Dr. B. S. Adhikari, Scientist-G; Dr. Ruchi Badola, Scientist-G; Dr. Bitapi C. Sinha, Scientist-G; Dr. V.P. Uniyal, Scientist-G; Dr. Bivash Pandav, Scientist-F; Dr. J. A. Johnson, Scientist-E; Dr. Gautam Talukdar, Scientist-E; Dr. Abhijit Das, Scientist-D; Sh. Bidyut Bikash

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**Siswan Village:**

Panchayat Pradhan; Panchayat Members; members of Self-Help Groups and residents of village.

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**-Team Leader**

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| | |
|---|---|
| APO | Annual Plan of Operation |
| CDH | Conservation Development and Harvest |
| CR | Community Reserve |
| CWLW | Chief Wildlife Warden |
| DFO | Divisional Forest Officer |
| EDC | Eco-Development Committee |
| FCC | False Colour Composition |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| KADP | Kandi Area Development Project |
| LULC | Land Use Land Cover |
| NGI | Non-Governmental Individual |
| NGO | Non-Governmental Organization |
| NTFP | Non-Timber Forest Product |
| OBC | Other Backward Caste |
| PA | Protected Area |
| PSC | Planning Sub Committee |
| SSCT | Siswan Shivalik Conservation Trust |
| SAS Nagar | Sahibzada Ajit Singh Nagar |
| SC | Scheduled Caste |
| SCR | Siswan Community Reserve |
| SCRMC | Siswan Community Reserve Management Committee |
| SHG | Self Help Group |
| SWOT | Strengths Weaknesses Opportunities and Threats |
| TESSA | Toolkit for Ecosystem Service Site-based Assessment |

# ***Preface***

Conservation Reserves and Community Reserves became the legal categories of Protected Areas in India in 2006 through the amendment of Wildlife (Protection) Act, 1972. Responding to the emerging challenges of integrating local socio-economic needs and ecological integrity of important ecosystems, these categories try to further the cause of inclusive conservation. India, as on date, has 163 Community Reserves and 86 Conservation Reserves (WII Database, 2020). Punjab has the pride of establishing the first Community Reserve of the country. Subsequently, the state is proactively taking steps for initiating scientific management for these areas. The biggest challenge in preparation of scientific management plans for these reserves is to build the ownership of the local communities and empower them for taking up an active role in the management of these areas.

The current management plan for Siswan Community Reserve is the outcome of field investigation, stakeholder engagement and expert consultations. This plan has tried to strengthen the baseline information of the area. Additionally, it attempts to document the various challenges pertaining to the sustainable management of the Siswan ecosystem in the light of its economic, social, cultural, ecological and historical values. Building on the long-drawn process of consultation and engagement with key stakeholders, the plan provides the necessary and feasible strategies for better management of this area. With a futuristic vision, this plan aspires to develop Siswan Community Reserve as a model of conservation and development, which can help extend similar initiatives to the adjoining landscape of Punjab Shivaliks.

# *Chapter 1*

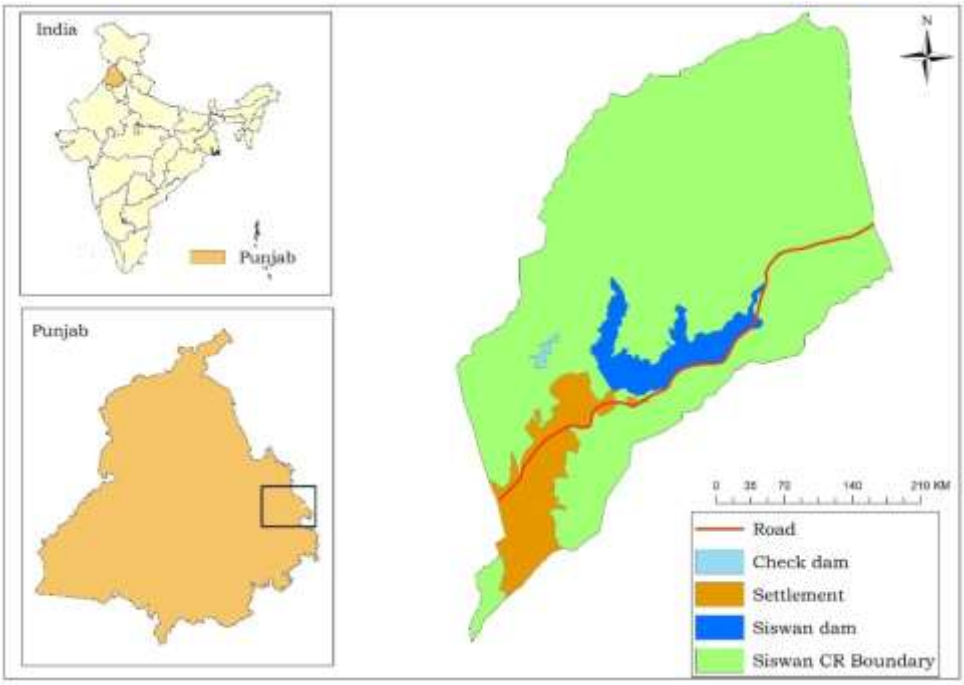
# Introduction to Siswan Community Reserve

*Anil Kumar Bhardwaj, Bidyut Barman, Amrita Laha*

## 1.1. Name, Location, Constitution and Extent

Siswan Community Reserve (SCR) is located in Majri Tehsil of Sahibzada Ajit Singh Nagar (Mohali), district of Punjab. It extends between 30°52′ North and 76°45′ East and is spread over an area of ~ 13km$^2$. Of the four community reserves of Punjab, two of which were the first ever notified in India, SCR is the latest and declared so in December 2017. SCR is named after Siswan village, which is located towards the south-western part of the community reserve.

**Figure 1.1 Map of Siswan Community Reserve**




SCR is composed of mostly community land and some government land. The Siswan reservoir (30°52'8.71"N, 76°45'0.66"E), which is enclosed in the reserve, is under the ownership of the irrigation department. There are eleven villages within 5 km radius of the community reserve. The source of water in Siswan reservoir is from the seasonal stream

of *Siswan* River. SCR is governed in accordance to the Punjab Land Preservation Act, 1900, for the conservation of sub-soil water and prevention of erosion. The area is managed through Department of Forest and Wildlife Preservation. SCR has been notified under Section 36C of Wildlife Protection Act, 1972 (amended in 2006) as Community Reserve vide Government of Punjab Notification No: 34/12/2017-Ft.-5/1052786/1 Dated29th August 2017 (Annexure Ia).

## 1.2. Approach and Access

SCR is approachable by air, rail and road. By road, SCR is 17 km from Chandigarh and 29km from Mohali. Chandigarh and Mohali railway stations are about 27 km and 29 km respectively from this area. Chandigarh Airport is ~38 km from the reserve. Buses enroute to Himachal Pradesh from Chandigarh ISBT also go via Siswan. The Siswan-Baddi highway connects the industrial hub of Himachal Pradesh with Chandigarh.

## 1.3. State of Significance

SCR is largely located in the undulated and sub mountainous region of the western Shivalik hill range. Part of the reserve lay in the piedmont area that is the transition zone between the Shivalik hills and the alluvial terraces. Though the region itself is not part of the Kandi region of Punjab, it acts as an important watershed for villages in the Kandi region. Siswan Khad is one of the numerous *choes* or seasonal rivulets that originate in the Shivalik hills. Thus, Siswan reservoir and dam is an outcome of the Kandi Area Development Project (KADP) that commenced in the 1970s to attenuate floods and provide assured irrigation in the otherwise irrigation starved *Kandi* region, and in turn facilitated socio-economic upliftment of the inhabitants of the region. The predominant idea was construction of contour canals beyond the command of the dams for development of irrigation wherein there would be gravity flow on the lower side and lift irrigation on the higher side. Presently, the Siswan reservoir has a catchment area of 15.6 $km^2$ and a culturable command area of 950 Ha. Close to Siswan, on the slope facing the nearby village of Mirzapur is the low earthen dam of Mirzapur reservoir with a culturable command area of 970 Ha. These water bodies along with the contiguous forests surrounding them have thus emerged as a unique habitat blend of forest and wetland ecosystems with significant biodiversity values. Evidently, not only has agriculture benefitted in these areas but also enhanced the biodiversity.

The contiguous forest alongside the water-bodies comprises of 58.78% of acacia mixed forest and covers nearly 10.51 km². Mixed forest covers 17.80 % of total area of the reserve, which is 3.18 km². The undulating terrain, dense forest habitat along with patches of savannah grassland holds potential habitat for diverse mammalian fauna such as Leopard, Sambar, barking deer, jackal, jungle cat, civet and wild pig. SCR has nearly 116 species of birds, many of which are of rare distribution status. Insect biodiversity of the reserve is represented by 169 species (Bhardwaj et al., 2017; Singh et al., 2018). This is both due to rich plant diversity of the area as well as long interface with the agriculture landscape.

Another fundamental attribute of the SCR, whose quantum cannot be easily measured, is in form of the innumerable ecosystem services it provides. These include access to fuelwood, fodder, thatch grass and other Non-Timber Forest Produce (NTFP). As the area has been notified under Punjab Land Preservation Act 1900, there are community rights in the form of grazing, firewood collection, and timber as per the provision of current Management Plan of SAS Nagar, Mohali. Additionally, the reservoir forms an important source of water for irrigation and ground water recharge, with these benefits extending beyond the SCR. This area also serves as a sink for carbon sequestration, which in turn has impact on the local climate.

The SCR also entails several socio-cultural values, which add to its significance. The interlinkages between the nature and culture are most evident through the dependence of local communities of the forests for their livelihoods and associated cultural practices. In addition, interactions with field experts reveal the historical significance of this area. Traditionally, Siswan region lay on an ancient trade route connecting Himachal Pradesh and Punjab. It is due to its topographical suitability and geographic connectivity that Siswan also formed an important *mandi* (market) for all trades, making it a vibrant economic centre in earlier times. In all, SCR houses innumerable ecological, social, economic and cultural assets, which add to the dynamism of the area. It is, therefore, important to appreciate and understand these from a holistic perspective to be able to chart out a meaningful strategy for management of SCR. This plan is a step in that direction.

# *Chapter 2*

# Background Information and Attributes

*Anil Kumar Bhardwaj, B.S. Adhikari, Bivash Pandav, V.P. Uniyal, J.A. Johnson, Ruchi Badola, Abhijit Das, Pratap Singh, Gautam Talukdar, Bidyut Barman, Uday Raj, Sakshi Rana, Priti Kumari*

## 2.1. Boundaries

The Community Reserve is located in the Shivalik Hills adjacent to state boundaries of Punjab, Haryana and Himachal Pradesh. The main road from Chandigarh towards Baddi Town of Himachal Pradesh cuts through the Community Reserve. The major landmark of the reserve is the Siswan Reservoir, which was constructed in 1997. Outer boundaries of the reserve are comprised of following:

**North**- Himachal Pradesh state boundary and Mirzapur Forest area.

**West**- Dulwan-Pallanpur village forest area and Majra village boundary.

**South** - Village Chhoti Badi Nangal.

**East** - Interstate border of Haryana and Naggal forest area.

## 2.2. Altitude/Terrain

The area is undulating and sub-mountainous with an average altitude of 246 m above mean sea level. The reserve is highly undulating with both steep and gentle slopes. Siswan reservoir (30°52'8.71"N, 76°45'0.66"E) is located on the slope facing Siswan village and was previously a slightly undulating plain. The ridges running over the hill tops are more or less sharp due to excessive erosion.

## 2.3. Geology, Rock and Soil

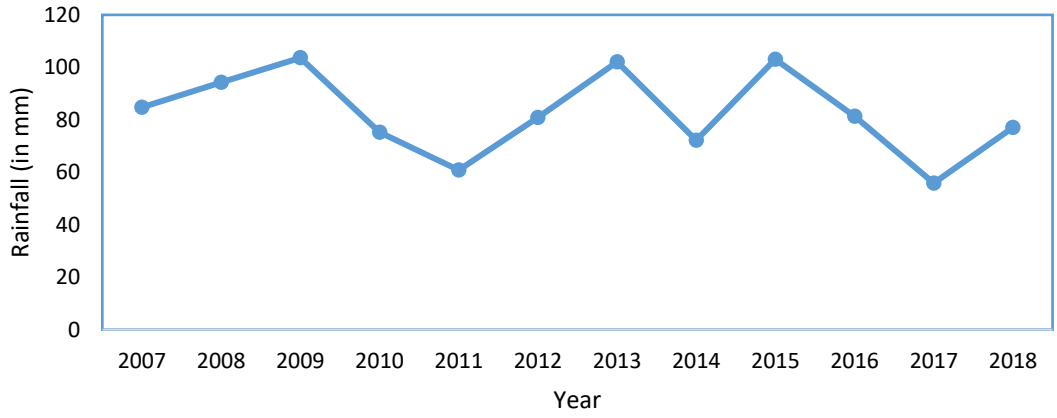
Being part of Shivaliks, the area comprises of unconsolidated alluvial sediments of Pleistocene to recent age deposited in the Sutlej River basin, which forms a part of the Indo-Gangetic plains. The soil is olive brown to reddish brown in colour with loamy texture, predominately mixed with sand. The loose texture of soil undergoes erosion during

rains. The pebbles mix with soil flow heavily during monsoon and get piled into the reservoir leading to heavy siltation.

## 2.4. Climate, Temperature and Rainfall

The Punjab Shivaliks fall under the sub-moist to humid and less hot region. The south-west monsoon arrives in late June and continues upto about middle of September. The average rainfall observed is about 617mm. The normal annual rainfall of SAS Nagar district is 1061mm, which gets distributed unevenly over the area during a period of about 49 days (Saigal, 2013). The period from mid-September to the middle of November constitutes the post monsoon or transition season. The district also receives occasional rainfall in winter from the west. The average annual rainfall of SAS Nagar district is as follows:

**Figure 2.1 Average Annual Rainfall (in mm) of SAS Nagar District, Punjab**




*Source*: S.A.S Nagar Management Plan, 2017 and Indian Meteorological Department, 2018

The temperature ranges from 4ºC in winter and upto 45ºC in summer. May and June are generally hottest months and January and February are the coldest months. Relative humidity is high, averaging about 70 percent during monsoon.

## 2.5. Hydrological Features

The CR, located adjoining the Punjab part of vast Indo-Gangetic alluvial plains, forms the main aquifer system. The ground water level ranges between 150 feet and 250 feet. Seasonal fluctuation shows that, in general, there is an overall decline in the water level.

SCR has a reservoir, which has a storage capacity of 384.50 cubic meter (Refer to Annexure IIa). The major source of water is rainfall and run-offs from the surrounding areas. Earlier, the area was a grassland and due to the surrounding hill range, the check-dam was built which supports different varieties of fishes. The CR has many hairline streams, which collect seasonal rainwater to the reservoir.

## 2.6. Forest Cover in Siswan Community Reserve

The Shivalik forests of Punjab in and around Siswan dam area can be categorized into Acacia-Dalbergia-mixed dry deciduous forest and dry deciduous scrub based on physiognomy (qualitatively). Lantana scrub is distributed throughout the region along with *Ziziphus* sp. On hilltops and slopes, Baggar or Bhabbar grass grows widely.

## 2.7. Terrain and Topographic Features

### 2.7.1. Slope:

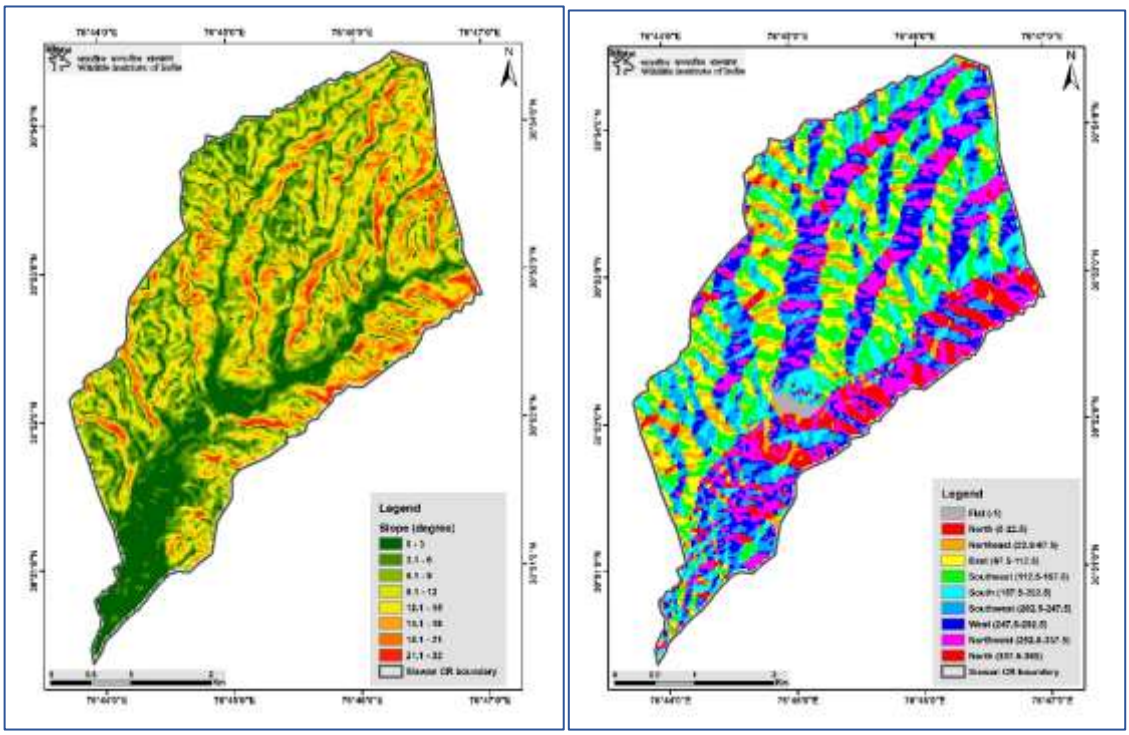
Cartosat 30 m DEM was used for the generation of a Slope and Aspect information for Siswan landscape. Slope and Aspect are important triggering factors that determine the hazardousness of an area (Chandel et al., 2011). Higher slope values represent steeper terrain while lower slope values represent flatter terrain. The range of elevation of the Siswan Community Reserve is 350m to 559m. In majority of the study area, the slope varies between 0-15 degrees.

**Table 2.1 Slope Variation of Siswan Community Reserve**

| S. No | Class (degree) | Area (Sq. km) | Percentage Area (%) |
|---|---|---|---|
| 1 | 0-3 | 2.82 | 15.75 |
| 2 | 3.1-6 | 2.91 | 16.28 |
| 3 | 6.1-9 | 3.22 | 18.03 |
| 4 | 9.1-12 | 2.94 | 16.45 |
| 5 | 12.1-15 | 2.80 | 15.66 |
| 6 | 15.1-18 | 1.71 | 9.58 |
| 7 | 18.1-21 | 1.04 | 5.83 |
| 8 | 21.1-32 | 0.43 | 2.42 |
| **Total** | | **17.88** | **100** |

**Figure 2.2 (A) Slope and (B) Aspect of Siswan Community Reserve**

**A** **B**



### 2.7.2. Aspect:

The aspect has significance in understanding the slope stability (Chandel et al., 2011). In addition, aspect identifies the downslope direction of the maximum rate of change in value from each cell to its neighbour. The slopes facing southeast (SE) to south (S) and southwest (SW) are more prone to slope failure and sliding activities. However, in the study area South-west, West and North-west facing slopes were comparatively more stable than the remaining aspects (Refer Table 2.2).

## 2.8. Land Use and Land Cover (LULC)/Habitats

The final classification of land-use and land-cover types was done based on the ability to interpret spectral reflectance differences and ground observation data. The vegetation type map generated indicates Acacia mixed forest dominating the Community Reserve with total area of 10.51 km², while mixed forest and savannah woody forests together occupy approximately 5 km² of the area out of total 17.88 km² area of the Siswan CR. For reference, a visual representation of the classification scheme of LULC along with the map

statistics is also provided (Figure 2.3 and Table 2.3). Forest diverted land (0.97 Sq. km) has been demarcated on the basis of field data provided by the department.

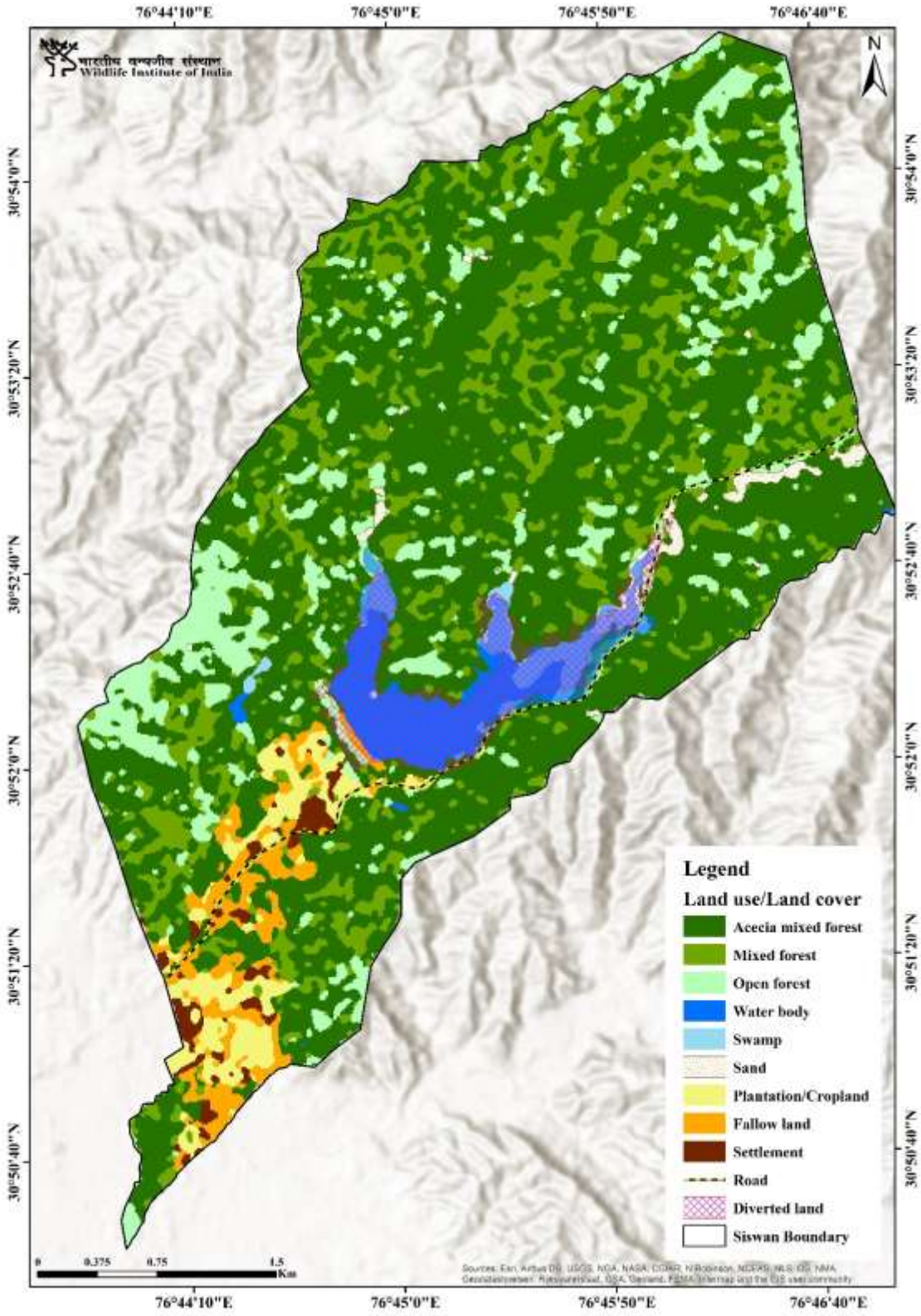
**Table 2.2 Aspect Details of Siswan Community Reserve**

| S.No. | Class (direction) | Area (Sq.km) | Percentage Area |
|---|---|---|---|
| 1 | Flat (-1) | 0.14 | 0.76 |
| 2 | North (0-22.5) | 0.59 | 3.31 |
| 3 | Northeast (22.5-67.5) | 1.64 | 9.18 |
| 4 | East (67.5-112.5) | 2.02 | 11.32 |
| 5 | Southwest (112.5-157.5) | 2.75 | 15.39 |
| 6 | South (157.5-202.5) | 2.41 | 13.45 |
| 7 | Southwest (202.5-247.5) | 2.33 | 13.05 |
| 8 | West (247.5-292.5) | 2.64 | 14.76 |
| 9 | Northwest (292.5-337.5) | 2.56 | 14.33 |
| 10 | North (337.5-360) | 0.79 | 4.41 |
| **Total** | | **17.88** | **100** |

**2.8.1 Acacia Mixed Forests:** The acacia mixed forest is the most dominating forest type in the reserve. It represents 58.78% of the total area of the reserve covering 10.51 km². The forest type comprises of *Acacia catechu*, *A. modesta*, *A. nilotica* mixed with *Dalbargia sissoo*, *Anogeissus latifolia*, *Bombax ceiba*, *Diospyros* sp., *Ehretia laevis*, *Flacourtia indica*, *Grewia glabra*, *Lannea coromandelica* and *Oogenia oojenensis*. These forest patches are characterized by *Acacia* sp. dominance.

**2.8.2. Mixed Forest:** Mixed Forest constitutes of *Acacia catechu*, *A. modesta*, *A. nilotica* and mixed with *Dalbargia sissoo*, *Anogeissus latifolia*, *Bombax ceiba*, *Diospyros* sp., *Ehretia laevis*, *Flacourtia indica*, *Grewia glabra*, *Lannea coromandelica*, *Laucaena leucocephala*, *Nyctanthes arbor-tristis* and *Phoenix humilis*. The mixed forest patch covers 17.80 % of total area of the reserve, which is 3.18 km² in area.

**Figure 2.3 Land use land cover map of Siswan Community Reserve**



**2.8.3. Savannah Woody Forests:** This is the third category of vegetation cover found inside the reserve. It represents 10.34% of the total area which is 1.85 km². The area is invaded by *Lantana camara* and *Cassia tora* weeds which was earlier dominated by grass. *Acacia* species sporadically present.

**2.8.4. Plantation/ Cropland:** This category comprises of various farmland and agricultural activity in the study area. They appear as a well-defined land parcels with smooth dotted texture and dark tone where it is mostly associated with the settlements.

**2.8.5. Fallow land:** It is the farming land, which is left with no agricultural activities for a season in order to regain the fertility**.** They appear as well-defined land parcel with smooth texture and light brown tone. It is mostly associated with the Settlement and agricultural land.

**2.8.6. Swamp:** It occurs in the transitional zone between land and water body, which is permanently saturated due to water. Mostly dominated by woody vegetation. It shows a dark cyan colour most commonly associated with the water bodies in the satellite imagery.

**2.8.7. Water Body:** The Community Reserve has two major water bodies. One is the Siswan Dam under the jurisdiction of Irrigation department and another water body which was constructed by the Soil Conservation Department. A small check dam is also present inside the reserve adjacent to the Siswan Dam. The water bodies together constitute 0.57 km² area.

**2.8.8. Sand:** The Community Reserve has a small portion of area covered by sand, which is on a hill streambed namely, "*Lambi Nadi"*. It flows from the hills of Haryana and Himachal Pradesh and end up into the Siswan Dam.

**2.8.9. Settlement:** The Settlement areas are identified by its greyish tone in the False Colour Composition (FCC) image shows a light, rough and defined shape, which are mostly associated with the fallow land and agricultural field.

**Table 2.3 Land Use and Land Cover Classes by Area of Siswan Community Reserve**

| Land use/Land cover Classes | Area (Sq.Km) | Percentage Area |
|---|---|---|
| Acacia mixed forest | 10.51 | 58.78 |
| Mixed forest | 3.18 | 17.79 |
| Savannah Woody Forest | 1.85 | 10.35 |
| Swamp | 0.25 | 1.40 |
| Water body | 0.57 | 3.19 |
| Sand | 0.23 | 1.29 |
| Farmland | 0.54 | 3.02 |
| Fallow land | 0.54 | 3.02 |
| Settlement | 0.21 | 1.17 |
| **Total Area** | **17.88** | **100** |
| **Forest Diverted Land** | **0.97** | |

## 2.9. Different Ecological Features - Flora and Fauna

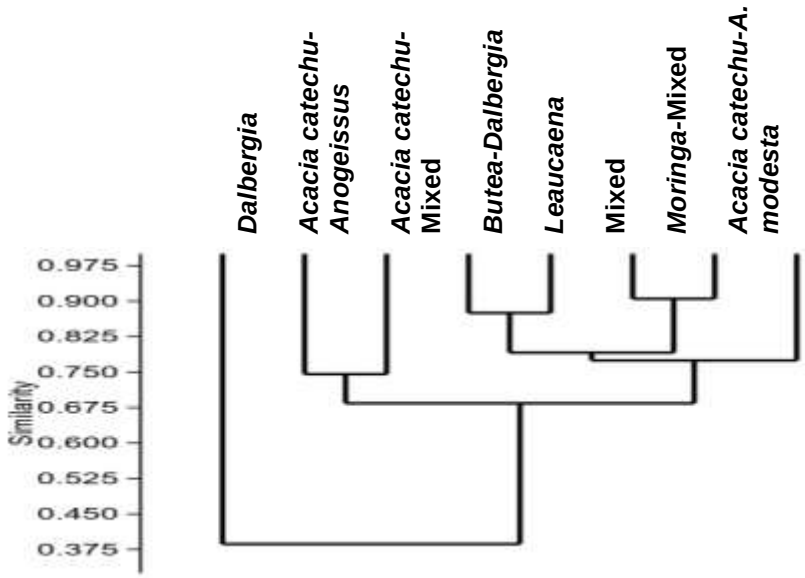
### 2.9.1. Flora:

Siswan Community Reserve represents a total of 160 species of vascular plants (Annexure IIb) as recorded during the survey. Of these, herbs (45.6%) contributed the most followed by trees (21.3%), shrubs (12.5%), grasses (10%), climbers (8.8%) and sedges (1.9%). Fabaceae with 29 species was the most dominant family followed by Poaceae (29 species), Asteraceae (16 species) and Malvaceae (10 species) (Adhikari et al., 2020).

The vegetation of Siswan area is primarily dominated by early successional species with several associations, governed by topographic features. The forest is mainly dominated by *Acacia* species, viz. *Acacia catechu, A. nilotica* and *A. modesta*, while other species of mid-seral stage also occur in the forest, such as *Butea monosperma*, *Diospyros cordifolia*, *Leucanea leucocephala*, *Lannea coromendelica* etc. Among Acacias, the contribution of *A. catechu* is highest as compared to other Acacias in terms of density and total basal cover. In few pockets, *Leucaena* forms the forest along with several deciduous species such as

*Dalbergia sissoo*, *Acacia modesta*, *A. catechu*, *Butea monosperma* and *Bombax ceiba*. A total of eight forest communities were discernible through cluster analysis based on Bray-Curtis similarity (Fig. 2.4).

**Figure 2.4 Dendrogram based on Cluster Analysis for Community Identification in SCR**




The overall status of different forest communities in the study area showed that the total species richness was highest for mixed community (17) followed by *Acacia* (14), *Acacia* mixed (13), and *Leaucaena* (10) and lowest for *Butea-Dalbergia* and *Anogeissus* (7 each), *Dalbergia* (6) and *Moringa*-Mixed (4) communities. A very important climber, i.e. *Tinospora sinensis*, which is used for the treatment of various ailments, such as urinary troubles, general debility, malaria, leprosy and fever is gregariously growing on *Acacia* trees in hilltops as one of the best habitats. Therefore, we propose the development of nursery of medicinal plants found in Siswan CR, especially the *Tinospora* (Giloy) by involving the local community. We may envisage the CDH plan (conservation, development and harvest) for *Tinospora* within the SCR. A model of CDH plan can be developed by identifying the following: **(a) Conservation**: The area is intact and having a good population of *Tinospora*; **(b) Development**: The area suitable for planting the *Tinospora* cuttings; and **(c) Harvest**: The area having good population of *Tinospora*, and can sustainably be harvested by involving local community. This model will act as an

exhibitor and enhance the knowledge of visitors as well as improve the livelihood of locals as a nature guide and on the other hand by selling the cuttings of the plant to the visitors.

**Figure 2.5 Different Forest patches of Siswan Community Reserve**

***Acacia catechu* forest on hill top** ***Acacia catechu-Anogeissus* forest**

### 2.9.2. Fauna:

The Shivalik hills are the youngest east west mountain of the Indian subcontinent with unique faunal assemblage. The habitat type of Siswan Community Reserve represents the typical Shivalik character of forests and watershed which could support several lifeforms. The present study has revealed diversity in mammalian fauna along with avian, insects and reptilian fauna. Following is a brief description on the findings of different faunal groups.

#### 2.9.2.1. Mammalian Fauna:

The undulating terrain and dense forest habitat along with patches of savannah grassland holds potential habitat for diverse mammalian fauna. To support the population of large mammals, the community reserve has water reservoirs which makes the habitat suitable for both herbivores and carnivores throughout the year. Although the area of the Community Reserve is small, i.e., 12.9 $Km^2$ but the contiguous forest patch covers more than 200 $km^2$ area of Shivalik hills in Punjab and this provides a free ranging area for large mammals like leopard and sambar.

**Figure 2.6 Mammal species photographed using camera trap in SCR**


It is evident that SCR has the presence of minimum three different leopards (*Panthera pardus fusca*). Sambar deer (*Rusa unicolor*) was found to be the most frequently captured wild ungulate species in Siswan. The undulating terrain of Siswan with abundance of palatable grass species such as *Chrysopogon fulvus*, *Nerodia arundinaria* and *Apluda mutica* provide conducive habitat for sambar to thrive in Siswan. Barking deer (*Muntiacus muntjak*) and wild pig (*Sus scrofa cristatus*) were the other common ungulates. A detailed species list (Table 2.4) is presented below:

**Table 2.4 List of Mammalian Species in SCR**

| S. No. | Species | Common name | IUCN Status | Schedule |
|---|---|---|---|---|
| 1 | *Panthera pardus fusca* | Leopard | VU | I |
| 2 | *Rusa unicolor* | Sambar | VU | III |
| 3 | *Boselaphus tragocamelus* | Nilgai | LC | III |
| 4 | *Muntiacus muntjac* | Barking Deer | LC | III |
| 5 | *Sus scrofa cristatus* | Indian Wild Boar | LC | III |
| 6 | *Canis aureus* | Golden Jackal | LC | II |
| 7 | *Lepus nigricollis* | Indian Hare | LC | IV |
| 8 | *Hystrix indica* | Indian Crested Porcupine | LC | IV |
| 9 | *Semnopithecus entellus* | Northern Plains Langur | LC | II |
| 10 | *Macaca mulatta* | Rhesus Macaque | LC | II |
| 11 | *Felis chaus* | Jungle Cat | LC | II |
| 12 | *Paradoxurus hermaphroditus* | Common Palm Civet | LC | II |
| 13 | *Viverricula indica* | Small Indian Civet | LC | II |
| 14 | *Herpestesauro punctatus* | Small Indian Mongoose | LC | II |
| 15 | *Vulpes bengalensis* | Bengal Fox | LC | II |

The understanding on occupancy of major species in the area of Siswan Community Reserve is important from protection point of view. The species wise occupancy map was generated and is presented as follows.

**Figure 2.7.1 Occupancy map of Sambar in SCR**

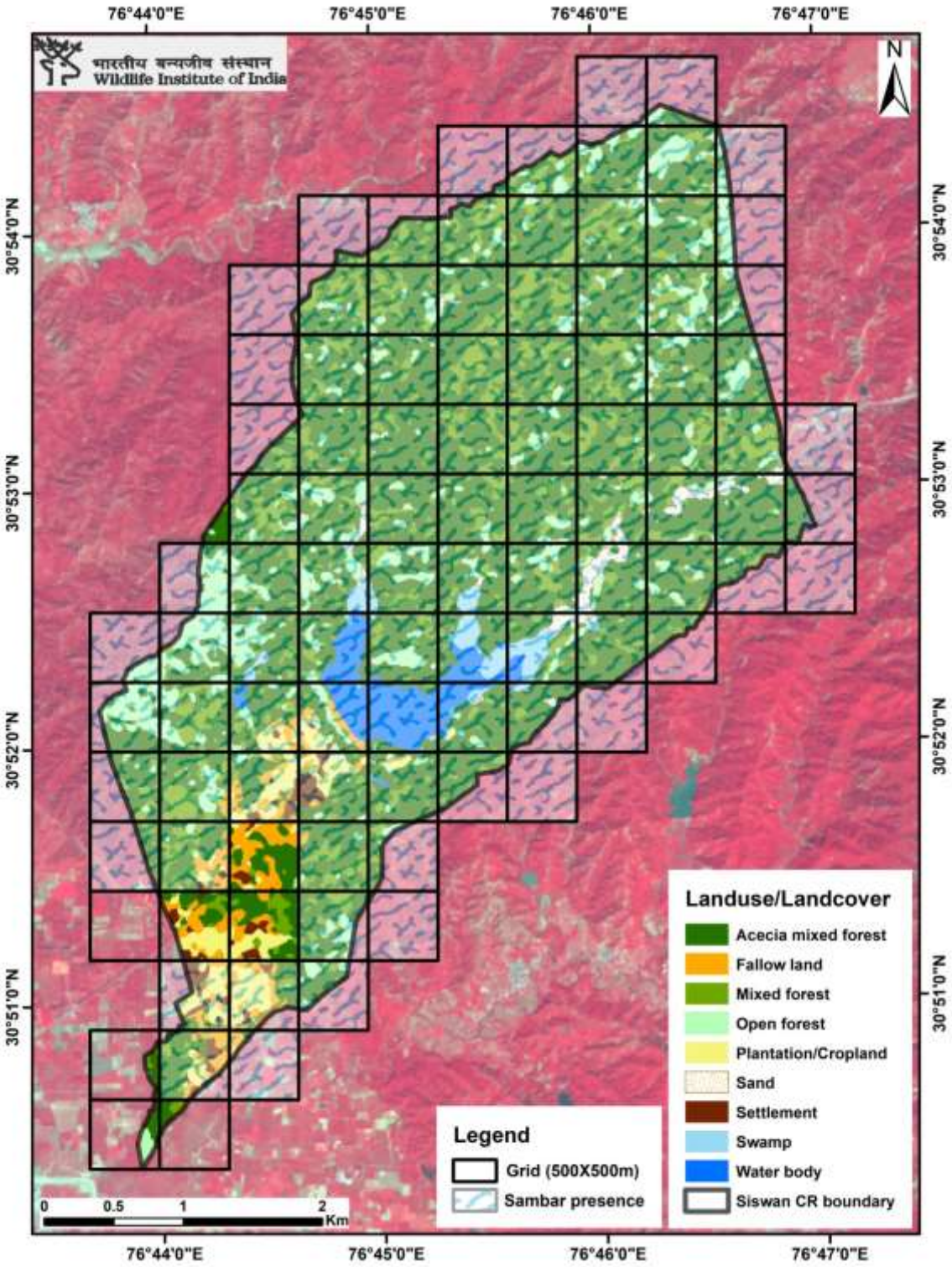


**Figure 2.7.2 Occupancy map of Nilgai in SCR**

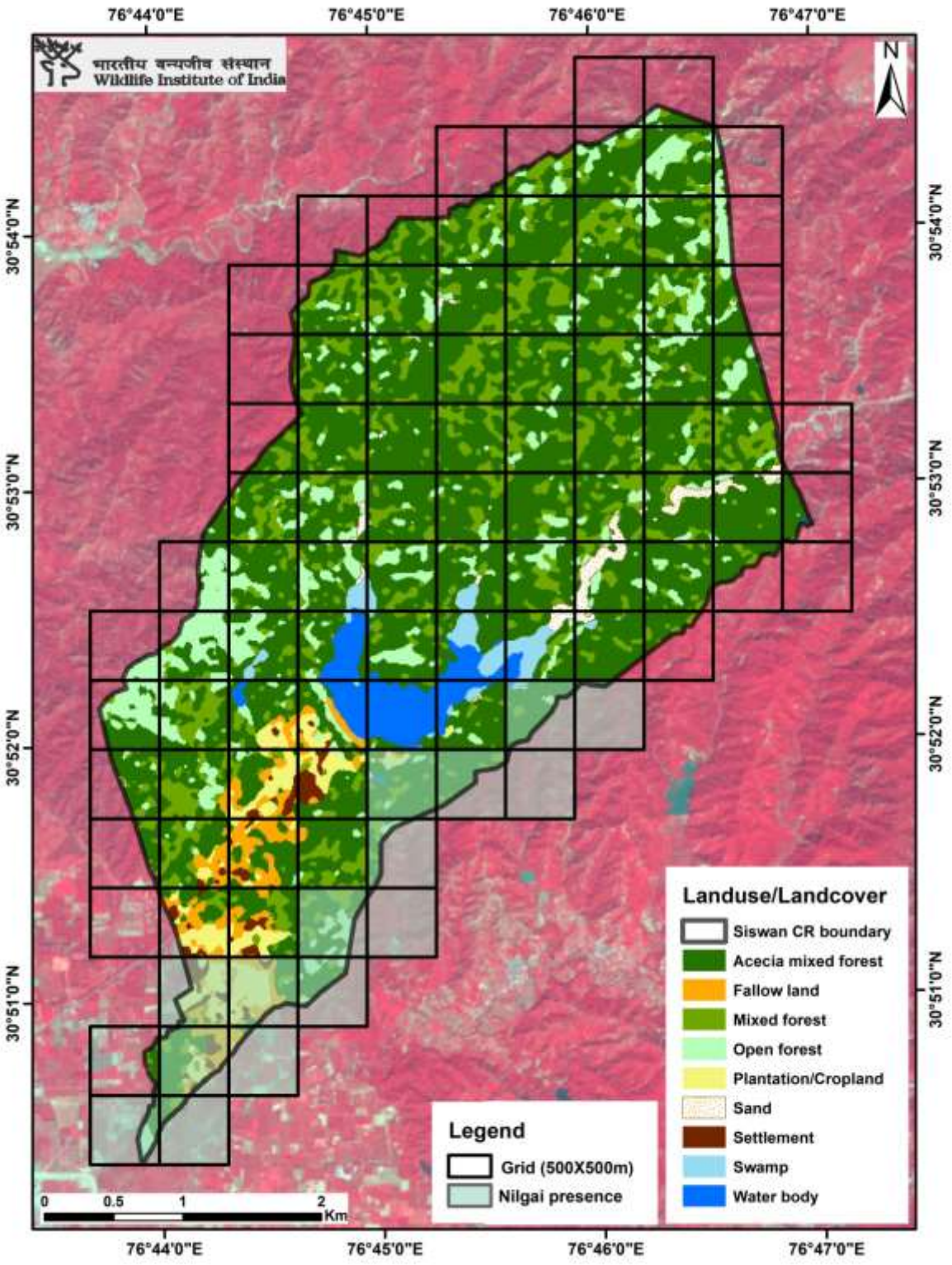


**Figure 2.7.3 Occupancy map of Barking Deer in SCR**

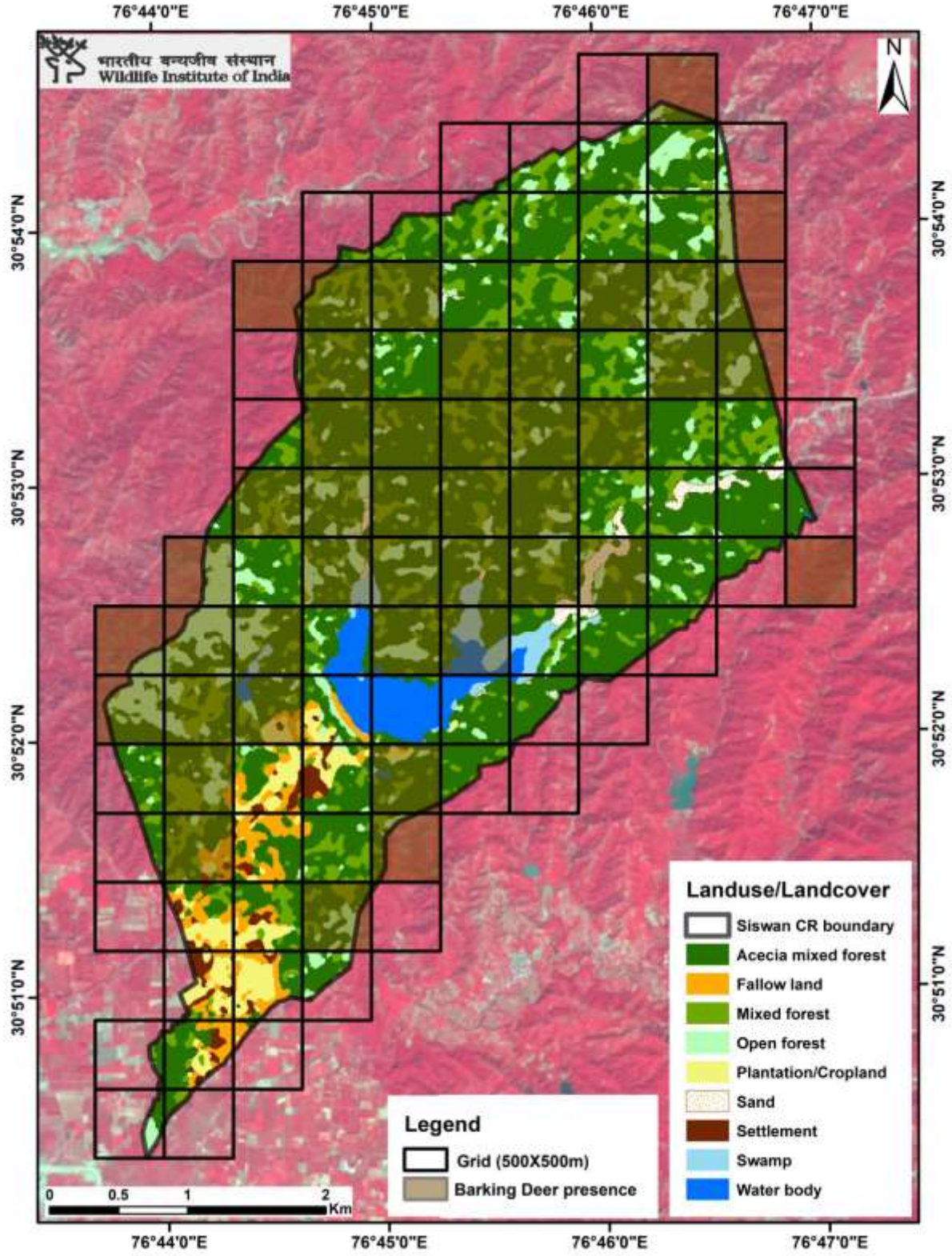


**Figure 2.7.4 Occupancy map of Wild Pig in SCR**

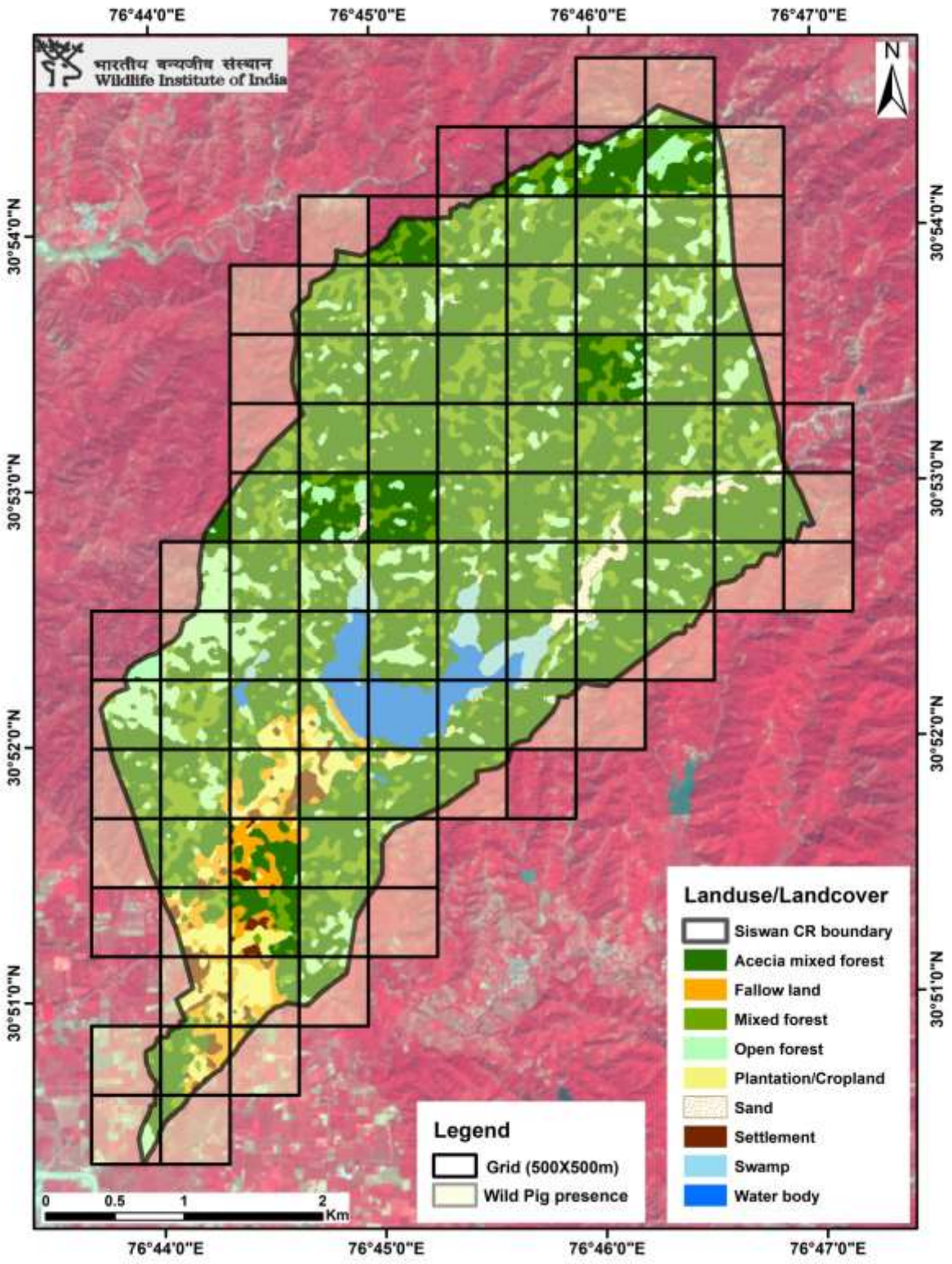


**Figure 2.7.5 Occupancy map of Porcupine in SCR**

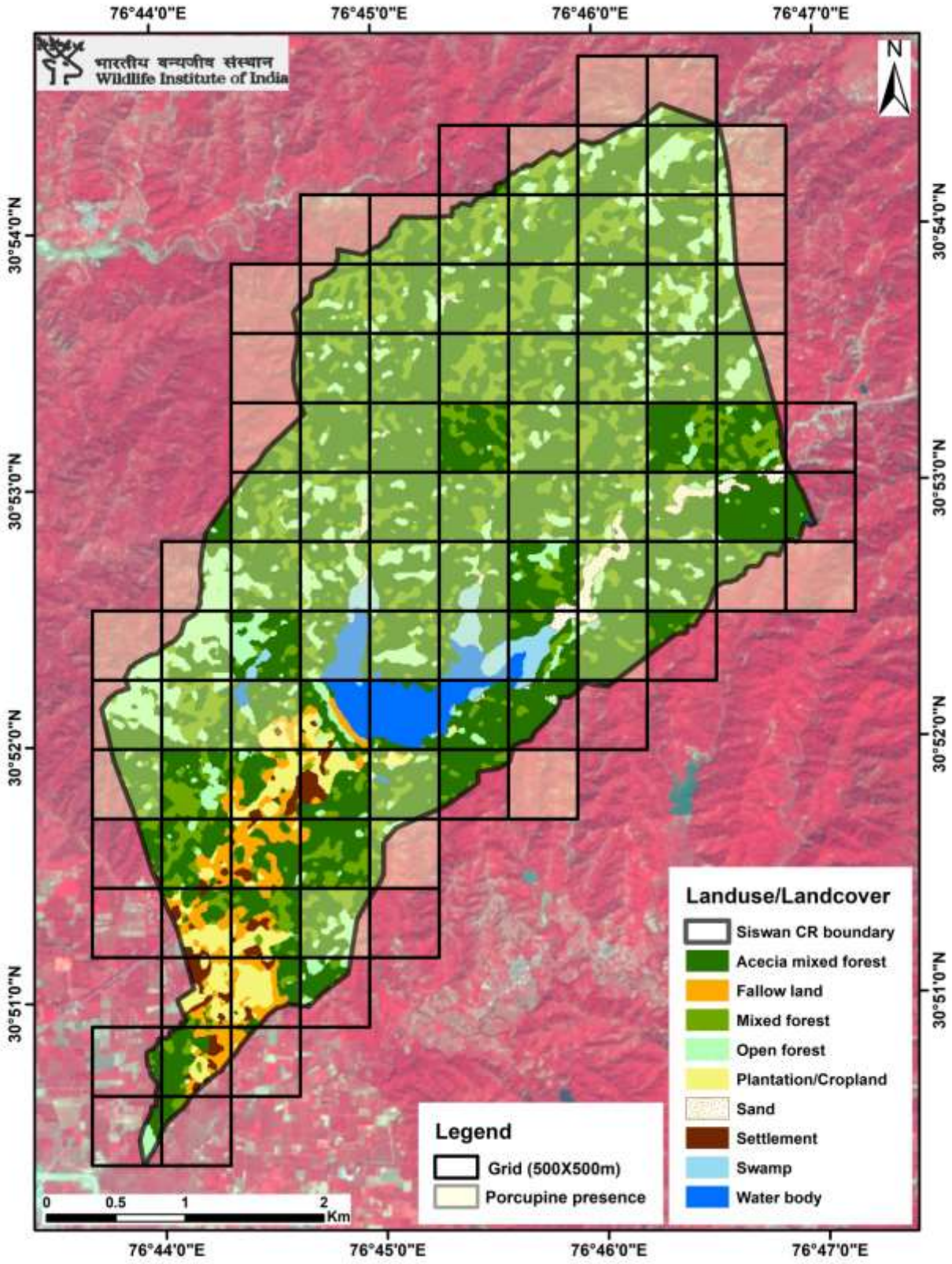


**Figure 2.7.6 Occupancy map of Leopard, Jackal and Fox in SCR**

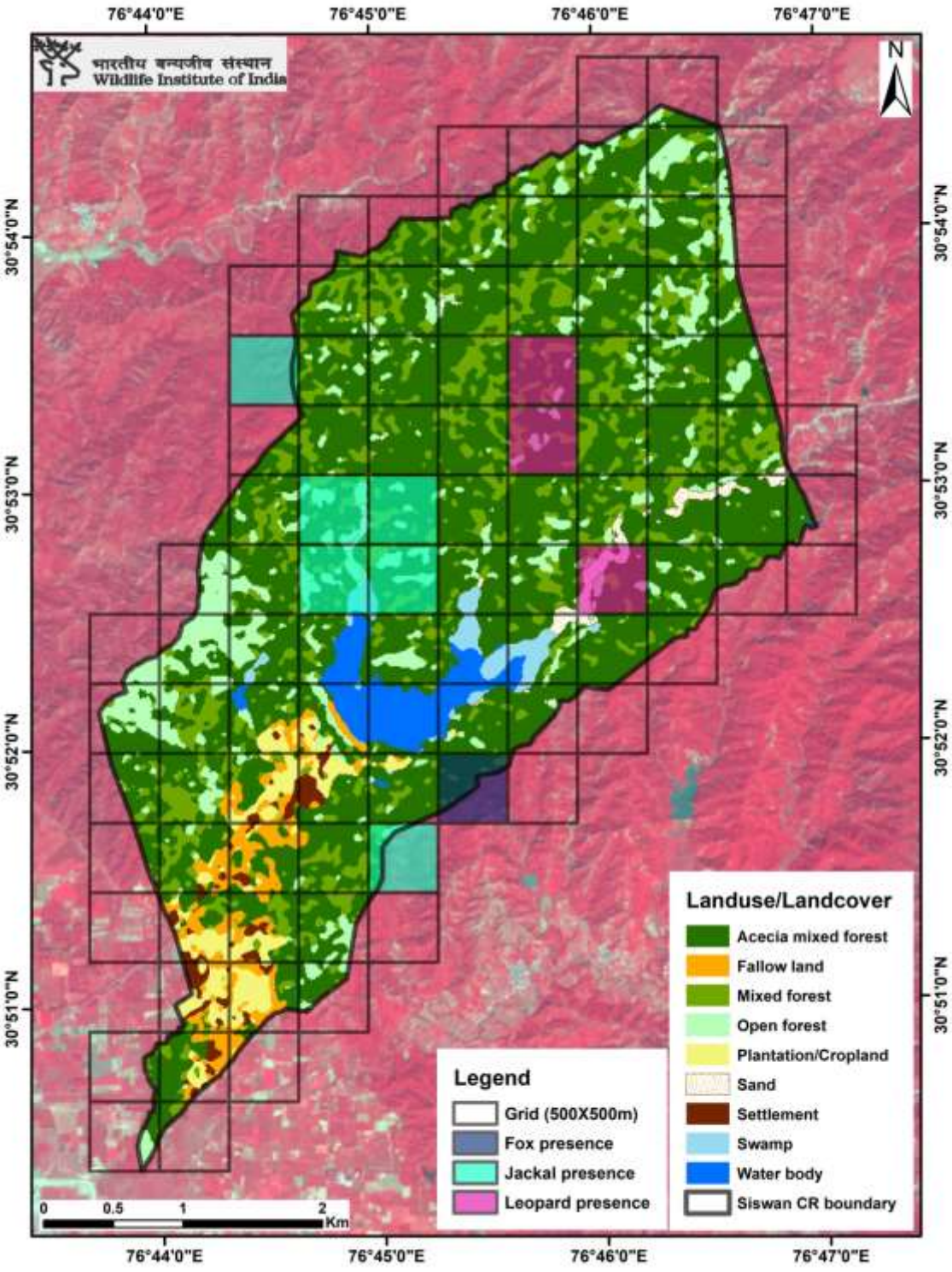
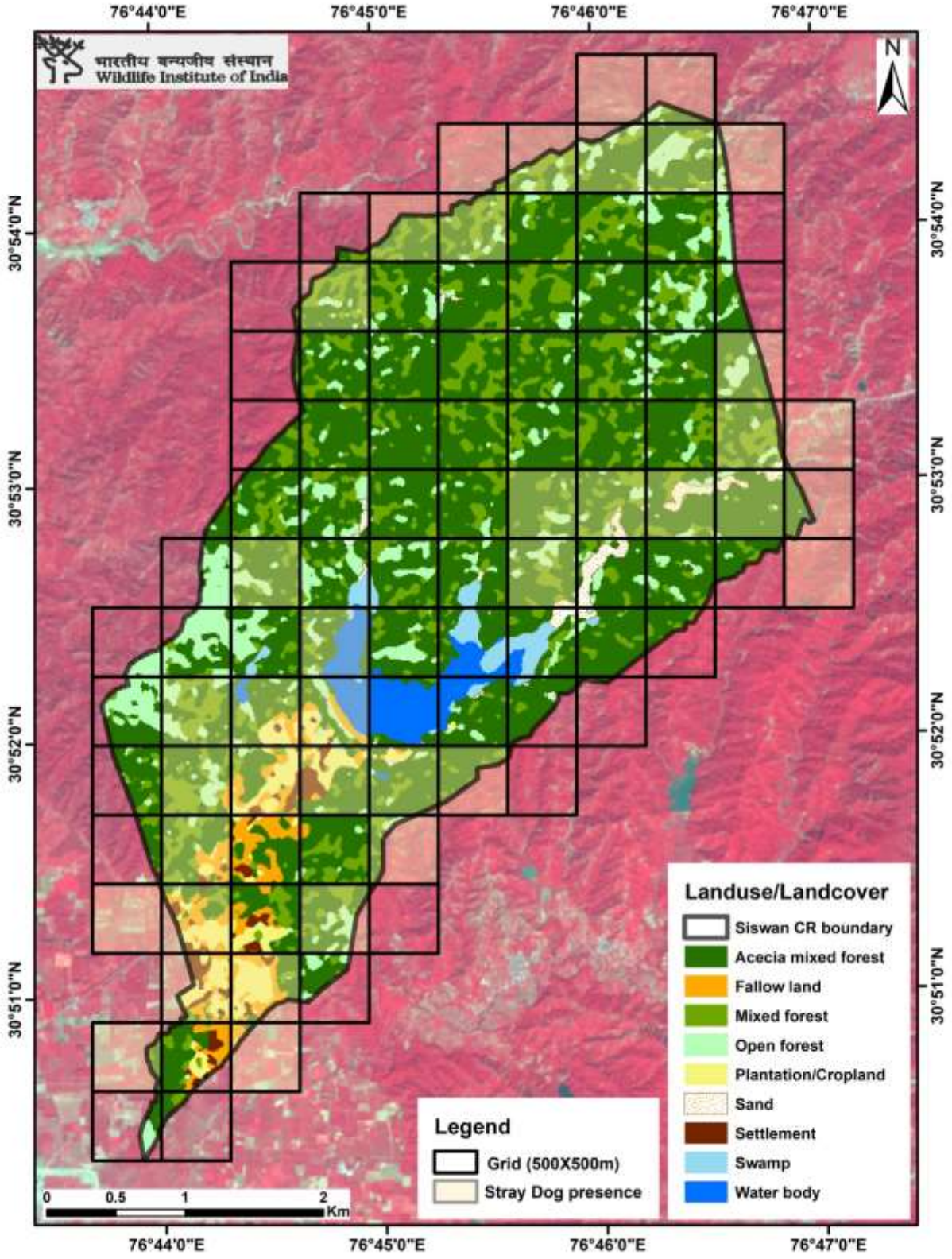


**Figure 2.7.7 Occupancy map of Stray Dog presence in SCR**



### 2.9.2.2. Avifauna:

Siswan has diverse bird habitats comprising of hilly terrain with scrub and tree growth, water bodies and grasslands near water bodies and outskirts of human habitations. This habitat diversity makes Siswan very rich in bird species. Its contiguity with nearby forest are as in Punjab, which extends to Himachal Pradesh, adds to bird richness and is important for long term conservation of avifauna of Siwalik foothills. The detailed list of bird is presented in Annexure IIc.

**Figure2.8 Some birds of Siswan Community Reserve**


### 2.9.2.3 Herpetofauna:

Amphibians and reptiles are key component of any natural ecosystem surrounding us. Amphibians contribute to regulating services by reducing mosquito recruitment from ephemeral wetlands. Amphibians and reptiles are effective biological pest controller. As bio-indicators of environmental health, many amphibian species are used to detect high nutrient load in waterbodies. Tadpoles pick up metals from the surface of sediments, making them potential indicators of contaminated environments. In Siswan Community Reserve, a total of nine species of amphibians (all anurans) and five species of Reptiles were recorded. These are *Hoplobatrachus tigerinus, Minervarya* ch*. pierrei, Minervarya teraiensis, Euphlyctis cyanophlyctis, Sphaerotheca breviceps, Microhyla nilphamariensis, Polypedates maculatus, Duttaphrynus melanostictus, Duttaphrynus stomaticus,* belonging to four families. Among Reptiles, representatives of lizards and snakes were recorded from the area. Species details (Figure 2.9 and Table 2.5) are given below:

**Figure 2.9 Recorded Herpetofaunal species. A. *Polypedates maculatus,* B.*Microhyla nilphamariensis,* C. *Euphlyctis cyanophlyctis,* D. *Sphaerotheca breviceps,* E.*Duttaphrynus stomaticus,* F. *Ptyas mucosa,* G. *Lycodon aulicus,* H. *Hemidactylus cf.brookii.***

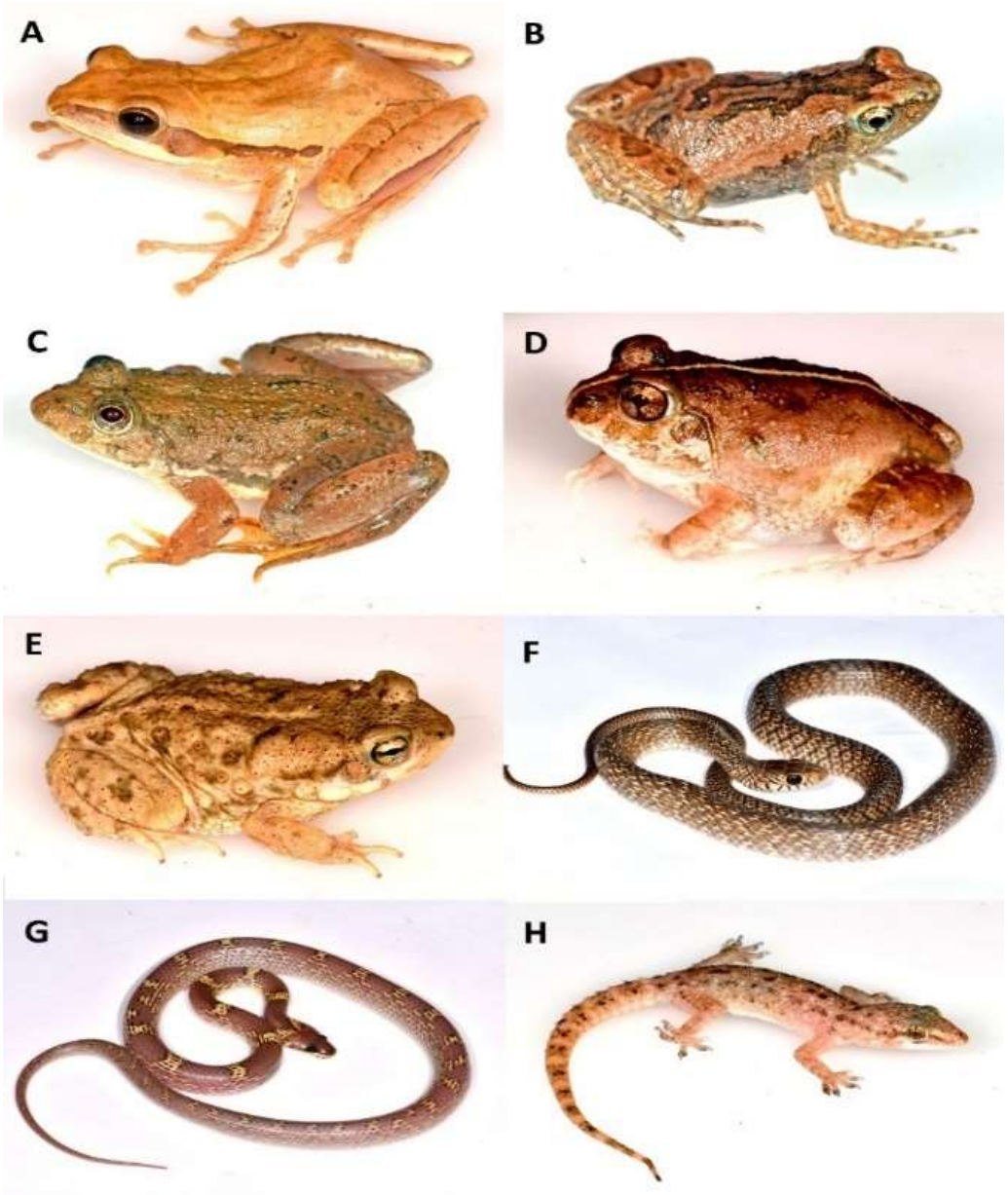


**Table 2.5 Herpetofauna Species of SCR**

| Order | Family | Species | Common Name |
|---|---|---|---|
| AMPHIBIA | Bufonidae | *Duttaphrynus melanostictus* | Common Asian toad |
| | | *Duttaphrynus stomaticus* | Marbled toad |
| | Dicroglossidae | *Minervarya* cf. *pierrei* | Pierre's cricket frog |
| | | *Minervar yateraiensis* | Terrai cricket frog |
| | | *Hoplobatrachus tigerinus* | Indian bull frog |
| | | *Euphlyctis cyanophlyctis* | Indian skipping frog |
| | | *Sphaerotheca breviceps* | Indian burrowing frog |
| | Microhylidae | *Microhyla nilphamariensis* | |
| | Rhacophoridae | *Polypedates Maculatus* | Common Indian tree frog |
| REPTILE | Agamidae | *Calotes versicolor* | Indian garden lizard |
| | Gekkonidae | *Hemidactylus* cf. *brookii* | Brook's house gecko |
| | Natricidae | *Fowlea piscator* | Checkeredkeelback |
| | Colubridae | *Ptyas mucosa* | Indian rat snake |
| | | *Lycodon aulicus* | Common wolf snake |

**2.9.2.4. Fish fauna:**

Fishes are the best group of aquatic organisms, which exist near the top of aquatic food chain. Taxonomic and balanced guild structure diversity of fish assemblages in an aquatic habitat indicates good health of the system. Twenty-eight species of fishes belonging to 21 genera and 8 families were recorded from the Siswan Community Reserve and the list of fish species recorded during the sampling period is presented in Annexure IId. Out of 28 species recorded, 21 species are native to this landscape and remaining seven species are Exotic/ Genetic carps, which were introduced as part of Reservoir Fisheries.

Among the fishes, members of Cyprindae family (carp) are dominant in the fish assemblage structure (50%), followed by Danionidae (small minnows), which constituted 18% in the fish assemblages. The percentage composition of family wise fish recorded from the Siswan Community Reserve is given in Figure 2.10. The common Cyprinidea/ Danionidae fishes recorded from the Siswan Community Reserve are:*Amblypharyngodon mola, Cirrhinus reba, Devario devario, Opsarius bendalisis, Puntius chola, Pethia conchonius, Puntius sphore* and *Rasbora danicorius* (Figure 2.11).

Apart from carps and minnows, the predatory carnivorous fishes such as *Channa gachua, Channa striatus, Mystus cavasius, Mastacem belusarmatus* and *Sperata seenghala* also recorded from the Siswan Community Reserve. The native species recorded from the Siswan Community Reserve are neither Rare nor Threatened species, all the species are listed as Least Concern categories in the IUCN Redlist data, except *Wallago attu,* which is listed as Near Threatened categories. Based on the information on feeding guilds of fishes, revelled that the Siswan reservoir has balanced trophic structure and all feeding guilds are represented with equal proportion.

Apart from these native fish species, seven species of culture carps, namely *Cirrhinus mirgala, Cyprinus carpio, Ctenopharyngodon idella, Gibelion catla, Hypothalmichthys molitrix, Hypothalmichthys nobilis* and *Labeo rohita* were recorded from the daily fish landings (Figure 2.12). In fact, the PWD Department/ Irrigation Department of Punjab leased the fishing rights to private fisheries professional.

The fisher contractors, regularly stock fish seeds of *Cirrhinus mirgala, Cyprinus carpio, Ctenopharyngodon idella, Gibelion catla, Hypothalmichthys molitrix, Hypothalmichthy snobilis* and *Labeo rohita* for achieving fisheries production. The average daily fish catch Siswan Community Reserve is minimal (10 to 15 Kg/ day), which include culture carps, catfishes and other minor carps. One of the daily catch recorded from the reservoir is shown in the Figure 2.13.

**Figure 2.10 Family wise percentage composition of fish species recorded from SCR**

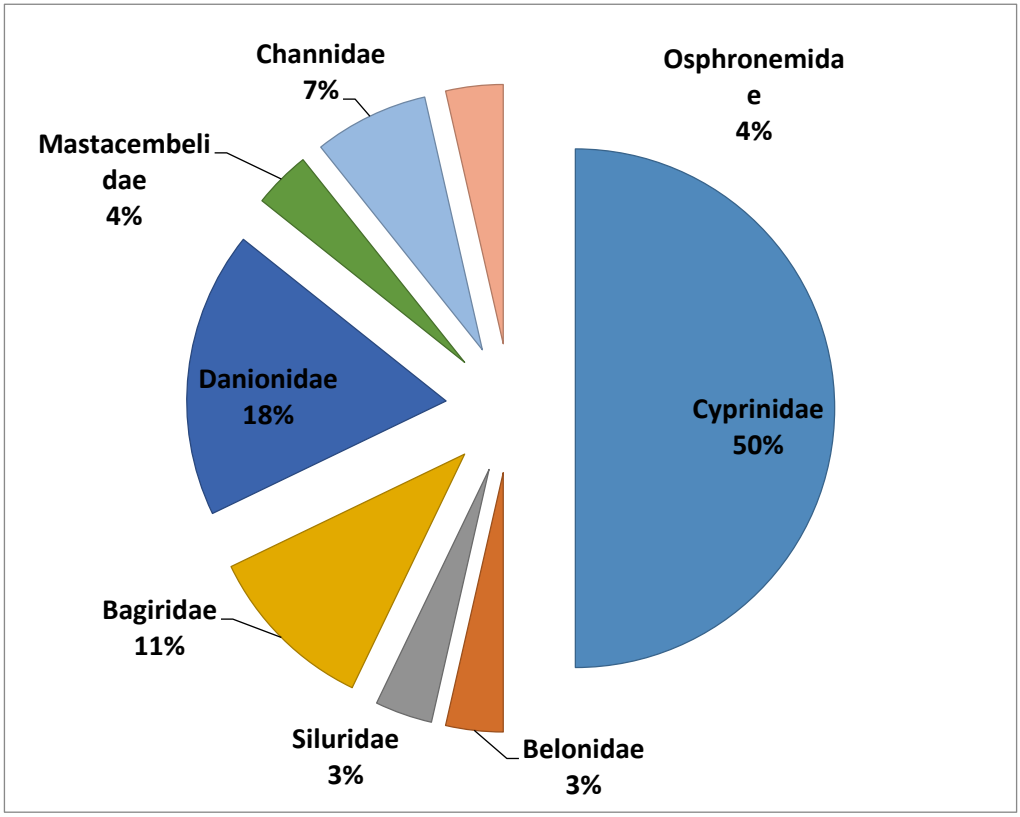
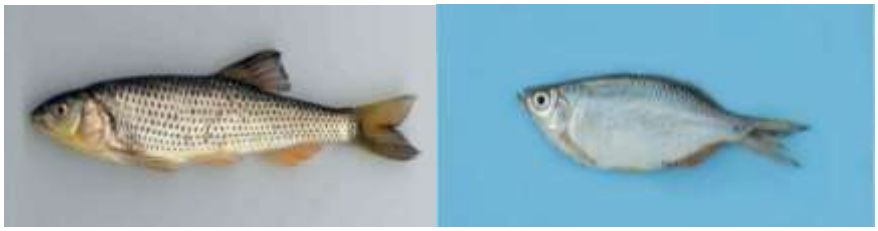



**Figure 2.11 The common minnows and barbs recorded in SCR**

***Cabdio morar*** ***Cirrhinus reba***



***Opsarius bendalisis*** ***Devario devario***

**Figure 2.12 Some of the cultured carps recorded from in SCR**

***Giabelian catla***

***Labeo rohita***

***Ctenopharyngodon idella***

**Figure2.13 Fish catch from the Siswan Community Reserve**

### 2.9.2.5. Entomofauna:

Insects comprise the most diverse and successful group of multicellular organisms on the planet, and they contribute significantly to vital ecological functions such as pollination, pest control, decomposition, and maintenance of wildlife species (Losey & Vaughan 2006). Provisioning and supporting are the basic ecosystem services provided by the insect community. A total of 146 species of insect fauna was reported from Siswan Forest reserve,

comprises of 10 orders (Singh et al., 2018). Order Coleoptera and Lepidoptera were found dominant with overall percentage of 37% and 34 % respectively followed by order Orthoptera 6%, Odonata 5%, Hymenoptera 4%, Hemiptera 3%, Blattodea 1%, Dermaptera 1%, Diptera 1% and Ephemeroptera 1% (Fig. 2.14). Blattoida comprises of 2 families and 2 species, Coleoptera 11 families 58 species, Dermaptera 1 families 1 species, Diptera 2 families 2 species, Hemiptera 4 families 4 species, Hymenoptera 3 families 7 species, Lepidoptera 12 families 53 species, Odonata 3 families 8 species and Orthoptera 3 families 10 species. The details of sampled species list are presented in Annexure IIe.

**Figure 2.14 Some Insects of Siswan Community Reserve**

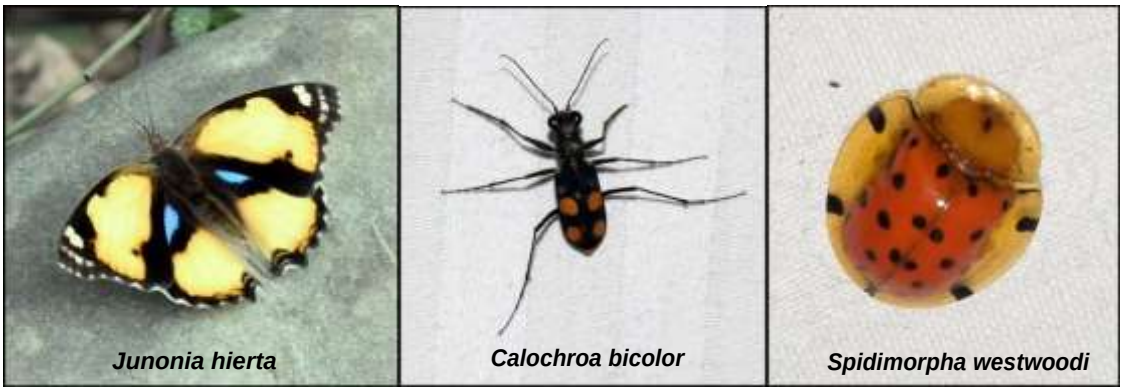



**Figure 2.15 Relative Insect Species count per order in SCR**

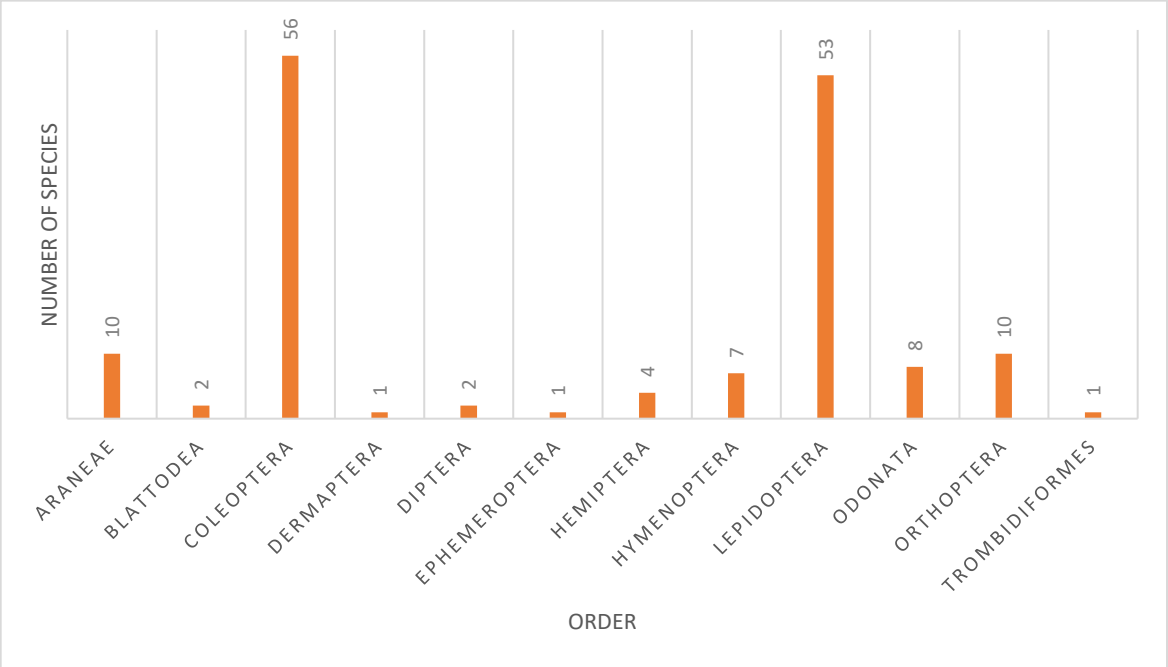
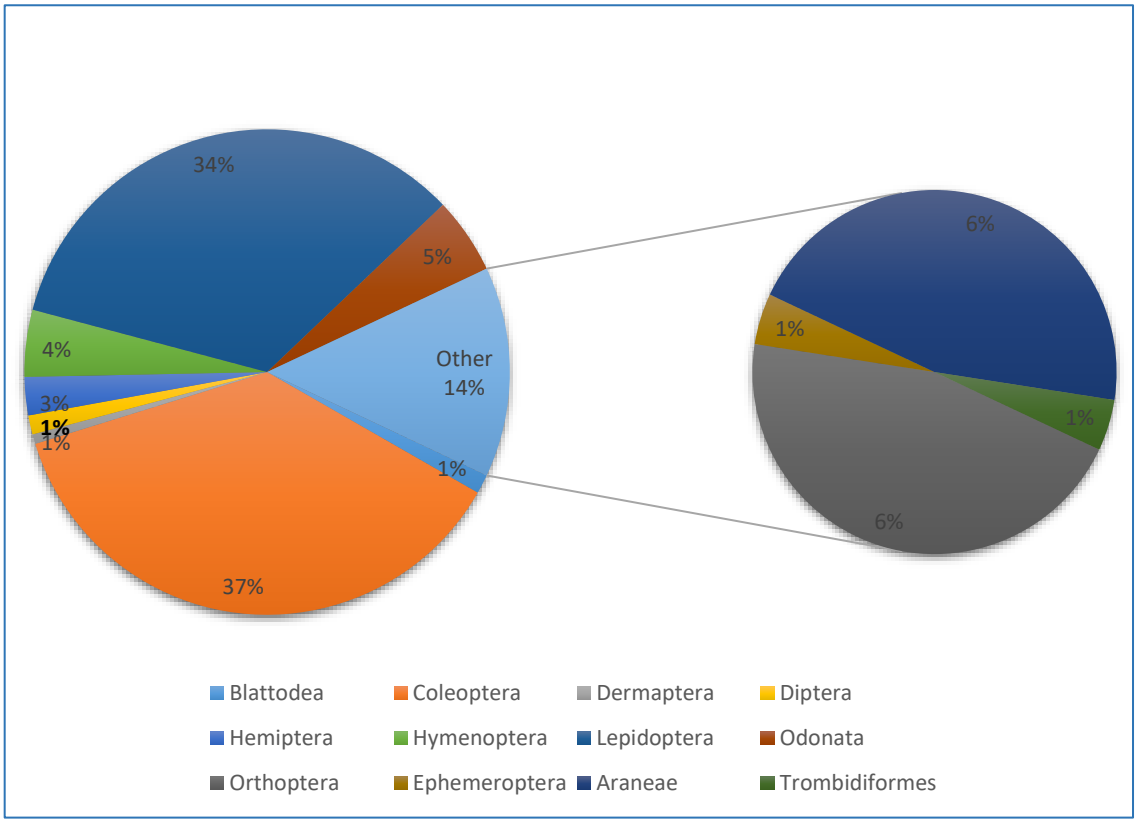


**Figure2.16 Overall percentage of insect species found in SCR**




## 2.10. Ecosystem Services

Siswan Community Reserve (SCR) provides a range of ecosystem services to the local communities including water, fuelwood, thatch grass and has a good potential as an ecotourism destination (Annexure IIf). It is also an important carbon sink, contributing to global climate regulation. Some of these benefits, like ground water, are enjoyed by the surrounding urban landscapes of Chandigarh and Mohali at regional scale. Being one of the few forested patches in this area, it is also an important wildlife habitat providing connectivity in the highly fragmented Shivalik landscape.

In this report, we made a first attempt at assessing ecosystem services of SCR following rapid and simple methods from TESSA (Toolkit for Ecosystem Service Site-based Assessment) developed by Peh et al. (2017). We used data provided by Punjab Irrigation Department, Siswan Community Reserve Microplan (2016-2022) and a previous study by Bhardwaj et al. (2017). Any additional necessary information was collected from interviews of key persons in the area. We selected water for irrigation from Siswan Dam,

climate regulation taking carbon stock as indicator and fuelwood extracted from the reserve for economic valuation.

The total benefit generated from the three selected ecosystem services by SCR is estimated to be **INR 69,02,19,854.6 (USD 98, 05, 094.96) or INR 6.902 billion.** We estimated the economic value of the irrigation water from Siswan Dam, which mostly benefits the downstream villages, to be **INR 3,79,703.577 (USD 5393.9764) per year.** The benefit of the fuelwood extracted from the Community Reserve was valued at **INR 1,47,000 (USD 208.82)** per year or **INR 402.73 (USD 5.72) per day**. We valued the carbon stock stored in both above and below ground biomass of Siswan forest at **INR 68,96,93,151** (**USD 97,97,613) or INR 6304.77 (USD 89.56) per hectare**.

This forest patch is especially important for its watershed services in the light of rising water crisis in the region. Though we could not establish any direct link from our study, from personal interviews with local villagers we found that the ground water quality was perceived to be good as far as 10 km from SCR and especially near the forest. Ground water from Siswan and nearby villages is sourced by private tanker owners to residents of Mohali and Chandigarh during summer season when they face acute water shortage. It is also a catchment for Siswan Dam, which as mentioned above. This dam is an important source of irrigation water for many downstream farmers, especially small landholders, which could help to reduce the demand on the fast-depleting groundwater in the region. Hence, there is a need to conduct a more detailed empirical study on groundwater recharge potential of SCR and dependency of the nearby cities on its groundwater and other watershed services.

Given the rapid nature of the study, these are very conservative estimates as a limited set of ecosystem services were valued using secondary data and hence should be interpreted with caution. We aim at providing these values to highlight the ‘hidden’ benefits of the area and as a starting point for more detailed studies on assessment of its ecosystem services which should be incorporated in future decision-making and management of SCR, and urban planning and development in the region. These values can be used for advocating for incentive mechanisms for the local communities to participate actively in the conservation of the community reserve for a sustained supply of water and other important services.

# *Chapter 3*

# History of Management and Present Practices

*Anil Kumar Bhardwaj, Aditi Bhardwaj and G.S. Benipal*[1]

## 3.1. General History

Siswan Community Reserve (SCR) falls in Siswan Forest Range of S.A.S. Nagar Forest Division. It forms part of Punjab Shivalik Hills. The Shivaliks belong to the tertiary deposits of outer Himalayas, chiefly composed of sandstone and conglomerate rock formations, which are solidified detritus of Himalayas forming poorly consolidated formations. These hills are located outer to Himalayas and stretch over a length of about 2,400 km, starting from Indus River in the west to Brahmaputra River towards the east.

This ecosystem evolved during Miocene to early Pleistocene period, is intimately connected with the uplifts, folding, faulting and erosion associated with the collision of the Indian sub-continent plate to Asian plate. The Shivaliks of north-west, of which this area forms a part, presents a highly dissected topography created by ephemeral streams of various genetic types. Due to withering and denudation, variety of erosional landforms such as rills, gullies, scraps, ridges and amphitheatrical basins form the prominent features of this landscape. Drainage channels of these hills carry huge amount of detritus and bed load, leading to siltation of reservoirs, sand deposition in agricultural fields and disruption of transport and communication. Area is characterized by tropical dry deciduous forest and abundance of thorny species. Agriculture continues to be of primarily of subsistence nature in the entire range due to limited irrigation facilities.

Earliest records of civilization in Shivaliks can be traced back to lower Paleolithic period. This area inhabited the Soanian civilization. Shivalik hills are also among the richest fossil sites for large number of animal species, anywhere in Asia. This indicates extent of biodiversity richness in this area during the ancient times. Some of the large animals found as fossil records in this area, are the ancestors of present day species like sloth bear, giraffe, elephant, etc.

[1]District Revenue Officer, S.A.S. Nagar, Mohali, Punjab

## 3.2. Past Conservation Efforts

### 3.2.1. Pre-British Period:

Earliest records of Shivaliksare depicted in Mauryan empire literature. However, no specific details about conservation initiatives could be traced. There are some records which give idea about the state of interference in this area around 1000 B.C. During this period, prior to the establishment of Mughal Empire in India, a number of Turkish and other invaders had plundered the areas on their way to Delhi. Shivaliks offered suitable routes for movement of these invaders as the plains used to be marshy due to presence of rivers. This process continued even during the Mughal period. Sirhind was established as an important strategic gateway for movement of armies from Lahore to Delhi. There were many instances when the armies had to take shelter in the Shivalik hills, which might have led to destruction of these areas.

### 3.2.2. British Period:

Prior to the coming of British, the ownership of these forests was under local chieftains. These areas were primarily used for game hunting. After coming of the British, the local chieftains surrendered most of the land to the local Zamindars. With this, the process of clearing of forests for agriculture gained momentum. Rich wildlife habitats of Shivaliks were lost. Carnivores fell prey to the bullets. In this process, the herbivore populations grew, causing overuse of vegetation and further degradation. This led to massive soil erosion and hill torrents, turning the cultivable lands barren. To control this situation, government brought legislation in the name of Punjab Land (Preservation) Act, 1900.

Under this Act, the power of overseeing the felling of trees in these areas was vested with the Deputy Commissioner. The lands were classified and demarcated into section 4 and 5. Under Section 4, lands with gentle or slightly undulating slopes were included. In this zone, trees could be felled for bonafide domestic agriculture use. Grazing was normally allowed in the area, except by camels, goat and sheep. In addition, trees could only be sold with the permission of civil authorities. Restrictions under Section 5 were far more rigorous. No grazing or felling of trees was allowed in these areas even for bonafide use. Trees were made available to local population by permit from civil authorities. Therefore, during British time, lot of steps were taken for preserving these fragile lands, including soil and

moisture conservation initiatives. From 1934 onwards, these areas were gradually put under the control of forest department. After 1939, entire area was transferred to forest department (Punjab Forest and Wildlife Preservation Department, 2017).

### 3.2.3. Post- Independence Period:

In 1947, after independence, there was partition of the country. A large number of Muslim landowners of this area left for Pakistan. In independent India, the process of development had started in different spheres. From 1950s to 1970s, government policies continued to control and preserve these areas. Important project named Kandi Watershed and Area Development Project was undertaken in this area from 1980 onwards. This was an integrated programme of World Bank, implemented in five watersheds as a pilot initiative for rehabilitating the vegetation of Shivaliks as well as increasing the productivity of agriculture lands. Afforestation and soil conservation works were major activities undertaken as part of this project. Similar initiatives were also undertaken through centrally sponsored and state sponsored schemes. Subsequent to this, externally aided projects such as Integrated Watershed Development Programme-Phase 1 and Phase 2 (1991-92 to 2003-04) and Japan Bank of International Cooperation Project (1997-98 to 2005-06) have been implemented in the area.

The major activities under these projects included raising plantations, soil conservation works, dry stone missionary check dams, crate-bar structures, live hedges, slip control measures, land slide control measures, etc. Forest Protection Committees (FPCs) and Joint Forest Management Committees (JFMCs)were also constituted in all the villages where the forest has been closed under section 4 of Punjab Land (Preservation) Act, 1900. Self-help groups were also formed in almost all the villages. This was basically to involve the local communities in conservation and protection of forests.

The first management plan of the area was implemented from 2007-2008 to 2016-2017. During this period, extensive planting work was undertaken. Also, lot of initiatives for soil and moisture conservation were undertaken. This management plan covered 10052.12 ha private/panchayat area covering 30 villages closed under section 4 and 5 of Punjab Land (Preservation) Act, 1900. The current management plan has been prepared for the period 2017-2018 to 2026-2027. This plan also prescribes for same strategies for forest conservation as proposed in last plan. For the bonafide needs of the local communities,

regular extraction of trees is allowed as per the provision of the management plan and associated rules. Previously, the forests were being opened for felling after every 10 years but now this period has been reduced to 5 years. This area was declared as a Community Reserve in 2017.

## 3.3. Resource Dependency and Rights of Local People

There are two villages adjoining to the reserve i.e. Siswan and Mirzapur. However, the forest of this reserve is under the ownership of Siswan village. As per the provisions of Management Plan of SAS Nagar Mohali Division, the villagers have the rights of grazing, fuelwood collection and timber extraction. However, the major resource use of this area is in the form of extraction of trees. The forests are opened periodically, for selection felling and major part of the revenue from these extractions go to the Panchayat. Other resource dependence of the local communities has come down drastically, particularly, after the construction of the Siswan reservoir. However, there are some poor households, who collect firewood for their personal use. Some opportunistic use of fodder and NTFP was also evident during the fieldwork. After the construction of the dam, fishing is not allowed in the reservoir by local communities. Adjoining areas of the reserve, towards Mirzapur side, have comparatively more resource use in terms of firewood collection, grazing and other NTFP removal as compared to Siswan village.

## 3.4. Status of Protection

This area is small. Nonetheless, due to poor ownership of communities, shortage of staff and limited resources, there are occasional cases of illegal felling. The area is also very close to the main road and the possibilities of small-scale poaching cannot be ruled out. There is serious problem of stray dogs in this area, which are a threat to the herbivores, particularly, the young population of Sambar.

## 3.5. Development Programmes in the Surrounds

The landscape around SCR is mostly under agriculture. Simultaneously, the pressures of development are growing. There is one existing resort within the 3 km radius of the reserve and few new ones are proposed to be constructed in the adjoining landscape. With the

coming up of New Chandigarh city, these pressures are expected to increase. However, with proper long-term engagement with resort converted into opportunities.

## 3.6. Tourism

The visitation of the people in the area is very informal, sporadic and opportunistic. As such, there is no systematic tourism programme for the reserve. However, there is a good potential to develop the area as a viable eco-friendly tourism destination. In fact, few land owners in this area do bring outside groups periodically using their tented accommodations.

## 3.7. Communication and Infrastructure

The forest staff are not stationed in the reserve and therefore, there is neither any infrastructure in the form of guard station nor any system of communication such as telephone or wireless in the reserve. There is only one vehicle available in the range, which is used by range officer as well as his staff.

## 3.8. Existing Situation in the Zone of Influence

### 3.8.1. Villages around SCR and their economy

Village Siswan is located very close to the reserve on eastern side and Village Mirzapur is close to the forest adjoining to SCR on western side. In addition, there are 11 villages within 5 km radius of the reserve (Table 3.1). Total population of these villages is 7670. About 34% of the households belong to Schedule caste category. Major occupation of families in these villages is agriculture. However, nearly 46% of the population belong to worker class. There is problem of unemployment among the youth. Interestingly, the level of literacy is about 80%.

### 3.8.2. Relationship of Local Communities with the Reserve

The ownership of SCR lies with Siswan village. As has been already stated above, the members of Siswan village have very less resource dependency on the reserve, except for extraction of trees as per the management plan. Due to this, the stake of the community in conservation of the area remains very poor. Consequently, the area is likely to be prone to illegal poaching as well as encroachment by the outsiders. Even though some employment is provided by the forest department for management activities of the reserve, the mutual

relationship is weak. The relationship of local panchayat with the forests as well as the department is limited to the material incentives.

**Table 3.1 Demographic Details of Villages within 5 km of SCR**

| S. No | Villages | No. of HHs | Village Area (ha) | Population | SC Population | Literate | Total Workers | Main Workers |
|---|---|---|---|---|---|---|---|---|
| 1 | Gochar | 91 | 419.6 | 623 | 0 | 352 | 266 | 175 |
| 2 | Mirzapur | 84 | 1541 | 481 | 116 | 276 | 175 | 173 |
| 3 | Burana | 7 | 318 | 7 | 30 | 16 | 9 | 9 |
| 4 | Siswan | 104 | 1678 | 104 | 157 | 376 | 183 | 178 |
| 5 | Palhanpur | 120 | 257 | 120 | 244 | 483 | 298 | 271 |
| 6 | Choti Bari Nangal | 97 | 1178 | 97 | 19 | 278 | 286 | 128 |
| 7 | Paraul | 489 | 103 | 2632 | 882 | 1753 | 1118 | 1014 |
| 8 | Hoshiarpur | 311 | 304 | 1482 | 423 | 1131 | 555 | 488 |
| 9 | Majra | 222 | 471 | 1310 | 623 | 959 | 392 | 367 |
| 10 | Khadri | 36 | 76 | 225 | 0 | 118 | 84 | 83 |
| 11 | Takipur | 120 | 138 | 589 | 112 | 444 | 186 | 183 |
| **Total** | | **1681** | **6483.6** | **7670** | **2606** | **6186** | **3552** | **3069** |

*Source:* Census of India, 2011

### 3.8.3. Land Use and its Impacts

With respect to SCR, the existing practice of extraction of trees from the reserve is not compatible with the long-term ecological integrity of area. Due to the fragile nature of the landscape, extractions are likely to increase the soil erosion and deplete the catchment value of the area. This area has to be seen as part of the larger Shivalik landscape. Areas adjoining to the reserve are fragmented and under various stages of degradation. For the long-term integrity of this area, the initiatives of conservation need to be expanded to the adjoining forests. Entire stretch of land on the eastern side of the reserve is under agriculture. The boundaries of the reserve ae not consolidated. Due to expanding agriculture as well as urbanization, there are chances of encroachment.

### 3.8.4. Reserve and its Implications for the People

As far as Siswan village is concerned, establishment of the reserve and construction of the reservoir has put some restrictions in terms of resource use. In order to preserve the integrity of this fragile ecosystem, rationalization of the current land use will lead to some restrictions on consumptive use of some area, which is required to be compensated through alternatives. Therefore, alternative livelihoods are going to be crucial for compensating these losses and for maintaining the linkages of the community with the reserve.

This reserve also has a very important role in terms of ecosystem services, particularly carbon sequestration and water. Reservoir was created for providing irrigation water to the farmers. Also, this area plays critical role for ground water recharge. In all, the implications for conservation of this area are manifold and go beyond the immediate local communities.

### 3.8.5. Development Programmes and its Implications

Forest and irrigation departments are the only government agencies, which provide some employment opportunities to the local communities of Siswan. Local panchayat also takes steps for the development activities of the area. A large number of people go out for employment. Therefore, there is a need to create additional livelihood opportunities for the communities within the reserve. The irrigation department as well as the fisheries department should also play a role in this endeavor.

## 3.9. Summary of Threats

One of the major challenges for the management of this area is poor ownership of the local communities. Currently, the four major stakeholders i.e. forest department, irrigation department, fisheries department and local panchayat do not have any coordination for the better management of this area. The boundaries of the reserve are not clearly demarcated, which increases the risk of encroachment. Being part of Shivaliks, the ecosystem is very fragile and prone to soil erosion. The current practice of extraction of trees is not ecologically compatible for the long-term sustenance of this area and therefore, further adds to the denudation of area and siltation of the reservoir. In addition, pressures of development, including urbanization of the adjoining landscape are also credible threats for SCR.

# *Chapter 4*

# Vision, Objectives and Problems

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## 4.1. Conservation Values of Siswan Community Reserve

The Siswan Community Reserve (SCR), despite its high ecological potential, has not received adequate attention both by managers and researchers in the past. However, as per the request of Punjab Forest and Wildlife Preservation Department, a study was carried out by the Wildlife Institute of India, Dehradun in 2017 on the ecological assessment this Reserve. Based on this study and subsequent fieldwork for the current Management Planning, the conservation values for the Reserve are being formulated as follows:

1. The SCR forms a small but comparatively intact forest patch of Punjab Shivaliks, with significant ecosystem values and associated wildlife habitats.
2. Constructed for providing irrigation to the local farmers, the Siswan Reservoir, located in SCR, has its hydrological values and also forms the lifeline for the wildlife of the area.
3. The ownership of the forest of Siswan is with the local communities and therefore, it has diverse socio-economic linkages with the people in terms of resource use.
4. The area has rich historical and cultural values, being located on the ancient trade route from Himachal Pradesh to Punjab.
5. Due to its strategic location on Chandigarh-Baddi Road and proximity to the cities of Chandigarh and Mohali, SCR has a good potential to be developed as a site for recreation and nature education.

## 4.2. Vision

The vision for this Management Plan is to develop SCR and adjoining landscapes as an outstanding example of community managed area, ensuring its ecological integrity providing economic benefits to the local communities and maximizing ecosystem services to the adjoining rural and urban areas.

## 4.3. Goal

Given, the dynamic and complex socio-cultural, economic and ecological values that this landscape entails, the opportunities and challenges that SCR brings to the front are unique. In the light of the above issues, the overarching goals of this integrated Management Plan are as follows:

1. The immediate goal of the current plan is to develop SCR as a model Community Reserve through the process of ecosystem conservation, community empowerment and effective stakeholder engagement.
2. The long-term goal of the plan is to initiate the processes for expanding participatory conservation initiatives to the larger landscape, of which SCR forms an important part.

## 4.4. Objectives

Two stakeholder workshops were conducted as a part of the Management Planning exercise. The first workshop (See annexure IVa) was conducted during February 2019 with major stakeholders to understand the issues of the Reserve and capture the suggestions of the participants for the effective management of the area. Subsequently, the second stakeholder workshop (See annexure IVb) was organized in October 2019 for objective setting and strategy formulation. Based on the outcomes of these workshops, subsequent meetings and logical framework analysis, the specific objectives of this Plan are as follows:

1. To protect and improve the Siswan ecosystem, with a specific focus on the catchment area and associated wildlife habitats.
2. To strengthen the ownership of local communities through sustainable resource use and alternative livelihoods.
3. To develop SCR as a site for recreation and nature education for visitors through participation of local communities.
4. To foster a system of key stakeholder engagement for effective management of SCR and adjoining landscape.

## 4.5. Problems

To achieve the set objectives, a number of challenges are visualized. A brief account of various problems against each objective are documented as follows:

***Objective 1: To protect and improve the Siswan ecosystem, with a specific focus on the catchment area and associated wildlife habitats.***

**Problems:**

a. Unscientific management of the area
b. Poor protection
c. Encroachment
d. Unregulated resource use in the form of fuelwood, fodder and other NTFP
e. Soil erosion due to fragile nature of soil
f. Silting of reservoir and lack of maintenance of the dam
g. Illegal sand mining
h. Inadequate staff
i. Limited staff capacity and low motivation
j. Insufficient resources
k. Threat to ungulates due to stray dogs

***Objective 2: To strengthen the ownership of local communities through sustainable resource use and alternative livelihoods.***

**Problems:**

a. Lack of socio-economic incentives to local communities
b. Inadequate institutional capacity
c. Poor community engagement
d. Vested interest groups
e. Loss of traditional connect with the nature

***Objective 3: To develop SCR as a site for recreation and nature education for visitors through participation of local communities.***

**Problems:**

a. Lack of long-term vision and plan
b. Inadequate infrastructure and other resources
c. Inadequate skill specific human resource
d. Lack of supportive programmes

e. Low visitation and poor visitor management

***Objective 4: To foster a system of key stakeholder engagement for effective management of SCR and adjoining landscape.***

**Problems:**

a. Lack of trust among key stakeholders
b. Lack of awareness
c. No coordination mechanism between key stakeholders
d. Lack of integrated vision and plan
e. Poor baseline information for the adjoining landscape

## 4.6. Strengths-Weaknesses-Opportunities-Threats (SWOT) Analysis

In order to manage this dynamic area, the management will have to make use of strengths while minimizing the problems. Similarly, they will have to keep in mind, both the threats and opportunities of the area. Accordingly, the SWOT Analysis of SCR is detailed below:

**Figure 4.1. SWOT Analysis of Siswan Community Reserve**

# *Chapter 5*

# Management Strategies

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## 5.1. Management Philosophy

A good Management Plan derives its strength from appropriate philosophy or approach. The management strategies prescribed in this Management Plan of SCR are based on the philosophy outlined in this section.

### 5.1.1. Geographic Scope of Management Plan

The area of Siswan Community Reserve (SCR) is small. However, the ecological boundaries of the reserve transcend beyond the administrative boundaries to the adjoining landscape. Therefore, it is imperative to envision Siswan and its management as part of the larger landscape. Most of the current interventions will be focused on the Community Reserve to develop this area as a model. Concurrently, the processes will be initiated to extend the community-based conservation programmes to the adjoining landscape. The ecological surveys carried out during 2017 reveal that the larger landscape is being utilized as habitat both by large herbivores as well as by carnivores. In addition, the forest tract in of this landscape has its significant contribution in terms of ecosystem services like water and ground recharge. Conservation of this human-dominated and fragmented landscape will require support of the public for its effective management. For this, the role of extension as well as limited ecodevelopment programmes in the adjoining villages will also be crucial. Lessons learnt from implementation of this plan in SCR will help to expand the boundaries of the reserve and associated ecodevelopment programmes in other selected pockets of the landscape.

### 5.1.2. Building Ownership of the Local Communities

Traditionally, local communities of Siswan were dependent upon the natural resources of the area in terms of firewood collection, fodder, grazing and NTFP. However, communities perceive that the construction of the Siswan dam has restricted their free access to the area and forest resources. Even though removal of Kher and other species is being allowed

periodically as per the provisions of the Forest Management Plan of S.A.S Nagar, Mohali, this activity is mainly undertaken through Panchayat. Therefore, with limited benefits percolating down of the larger community, their interest and ownership for conservation of this area has also eroded over the years. In this context, maintaining the ecological integrity of SCR will first require restoring the relationship between the community and the area. While socio-cultural linkages form an integral part of this process, it requires continuous engagement. The obvious and most feasible starting point of this long-drawn process is, therefore, to ensure economic empowerment of the communities through a combination of alternate livelihoods and sustainable use of some resources.

Unlike National Parks and Wildlife Sanctuaries, the management of Community Reserves, by definition, (Refer to Section 36D of Wildlife Protection Act, 1972) has to be steered by the Community Reserve Management Committee, which will comprise representatives nominated by the village panchayat and one representative of the state forest department. It is important to understand that the forest department has the role of an advisor and a facilitator. Therefore, the empowerment of the communities and the Management Committee will be critical for effective implementation of the plan.

### 5.1.3. Rationalization of Land Use

SCR forms an integral part of the Punjab Shivaliks, which has evolved over centuries through natural processes of change and adaptation. However, in the current times, the anthropogenic pressures on this ecosystem have led to unsustainable land use. It is important to note that the role of Siswan in terms of providing tangible and intangible ecosystem services is much more critical than the extractive resource use. For instance, the catchment values for both the reservoir water as well as underground recharge are intrinsic to the health of the surrounding agriculture landscapes. Therefore, the rationalization of the current land use is important for maintaining the long-term ecological integrity of the area. In light of this, the plan is attempting to continue to provide some consumptive resource use by the local communities. Simultaneously, this will be supplemented with alternate livelihoods through ecodevelopment and ecotourism programmes to compensate for economic losses, if any.

### 5.1.4. Effective Stakeholder Engagement

The SCR forms an interesting example in context the multiplicity of stakeholders and values. While the Reserve land belongs to the communities, the management of the area is being guided by the forest department. The reservoir falls under the jurisdiction of the irrigation department. Further, the fisheries department is managing the pisciculture activities in the reservoir. All these key stakeholders generally work in isolation, which is detrimental for the long-term health of this ecosystem. Therefore, the plan is trying to bring convergence in working of the key stakeholders.

## 5.2. Major Management Strategies

The broad strategies of this plan are based on the outcome of the two major workshops organized with stakeholders. While the first workshop helped in understanding the major issues confronting communities and other actors, the second workshop aimed at understanding the problems of the management, possible solutions and monitoring protocols. Based on the learnings from these workshops, a participatory problem analysis and strategy formulation (logical framework method) exercise was carried out during May 2020. The strategies evolved through this exercise were discussed and refined with the planning team at Wildlife Institute of India. The details about this analysis are provided as figure 5.1 and 5.2.

The CR, as per the current management rules, is open for selection felling at a five-year time interval. However, looking at the current requirements of the area to maintain its ecological integrity, this management may not be appropriate. The protection level of catchment as well as associated wildlife is considerably weak. Therefore, the broad strategies of the Management Plan have to focus on rationalizing the resource use of the area, both for protection of catchment and wildlife. At the same time, it is important to facilitate sustainable resource use for the communities. Strategies also need to explore alternative livelihoods for the communities for any loss due to restriction on felling and other extractions.

### 5.2.1. Boundary Demarcation

The notification of the CR mentions about different *Khasra* numbers (See Aneexure Ia), which have been included in the reserve. While carrying out the field surveys, boundaries

**Figure 5.1 Problem Tree for Siswan Community Reserve**

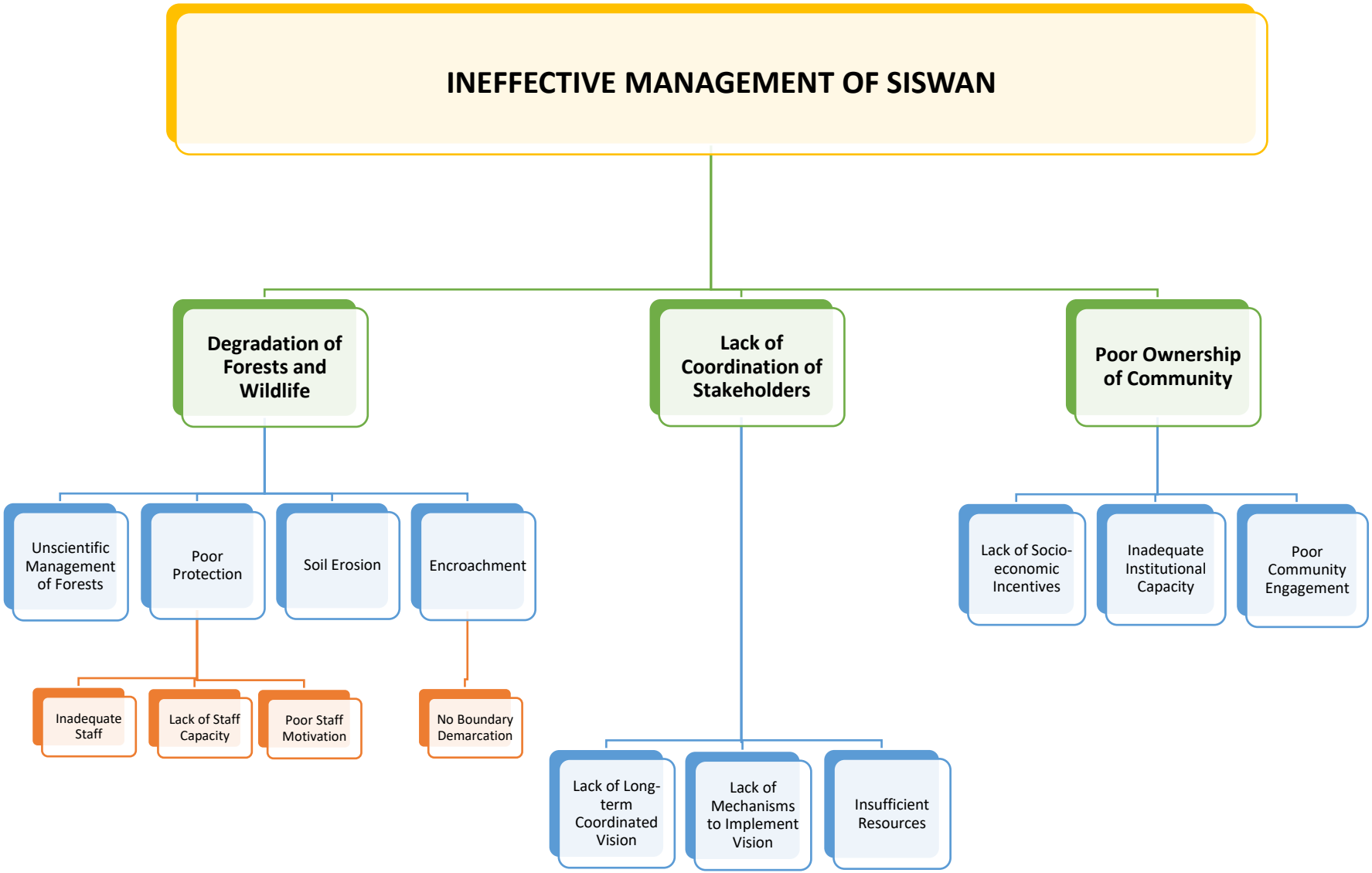
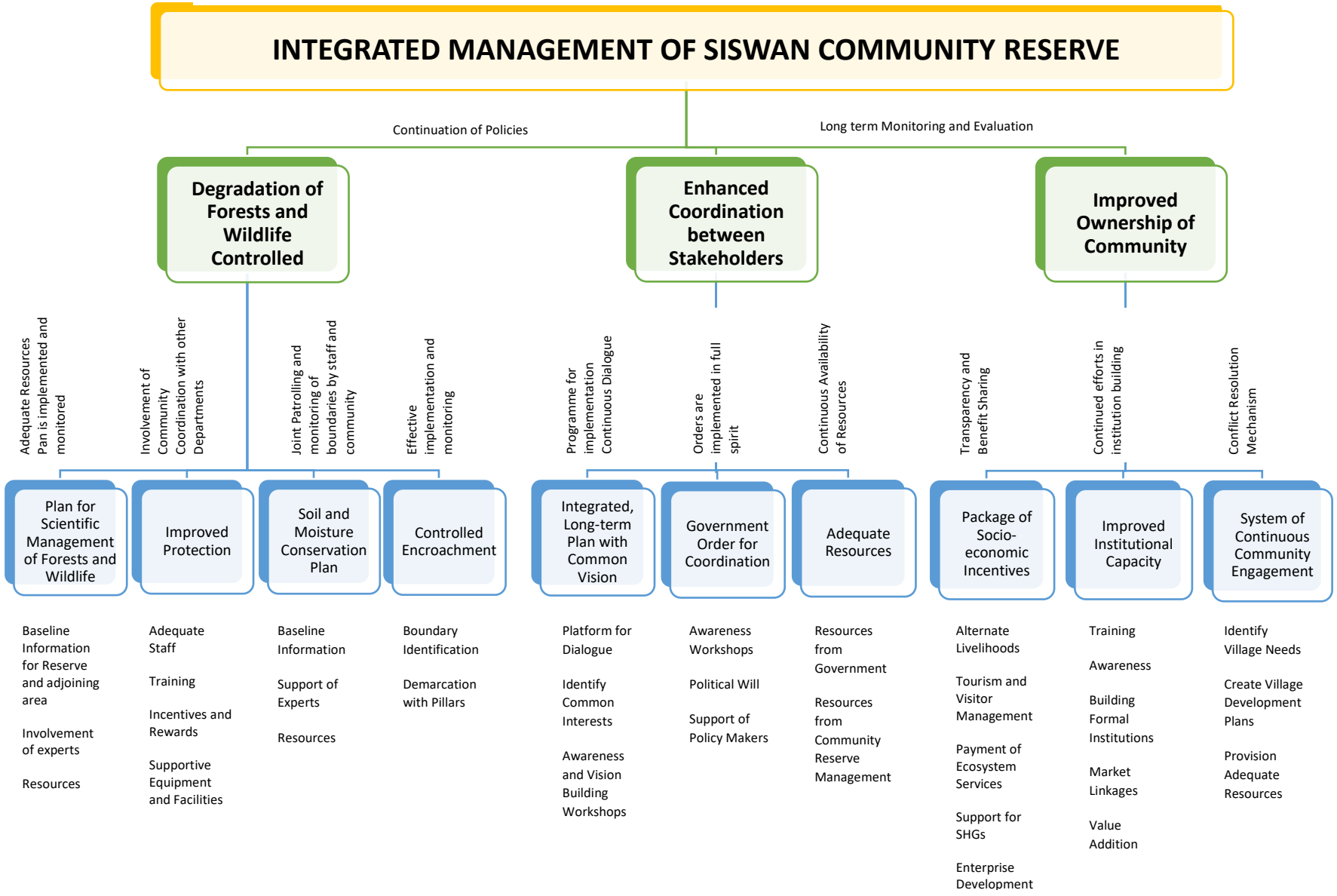


**Figure 5.2 Solution Tree for Siswan Community Reserve**



were roughly defined by looking at these *Khasra* numbers. However, the exact boundary of the Reserve is not clear, both on paper and on ground. Moreover, there are some incidences of encroachment. Therefore, for defining the exact boundaries, a joint ground verification by the Revenue Department and Forest Department has to be urgently carried out. The plan, therefore, proposes to clearly define these boundaries after joint verification and then carry out the boundary demarcation by putting pillars. This activity has to be carried out on priority basis.

### 5.2.2. Zonation

To meet the twin objectives of protection of catchment and socio-economic needs of the community, the area is divided into three zones (Refer Figure 5.3 for map) as follows:

#### *5.2.2.1. Watershed Conservation Zone*

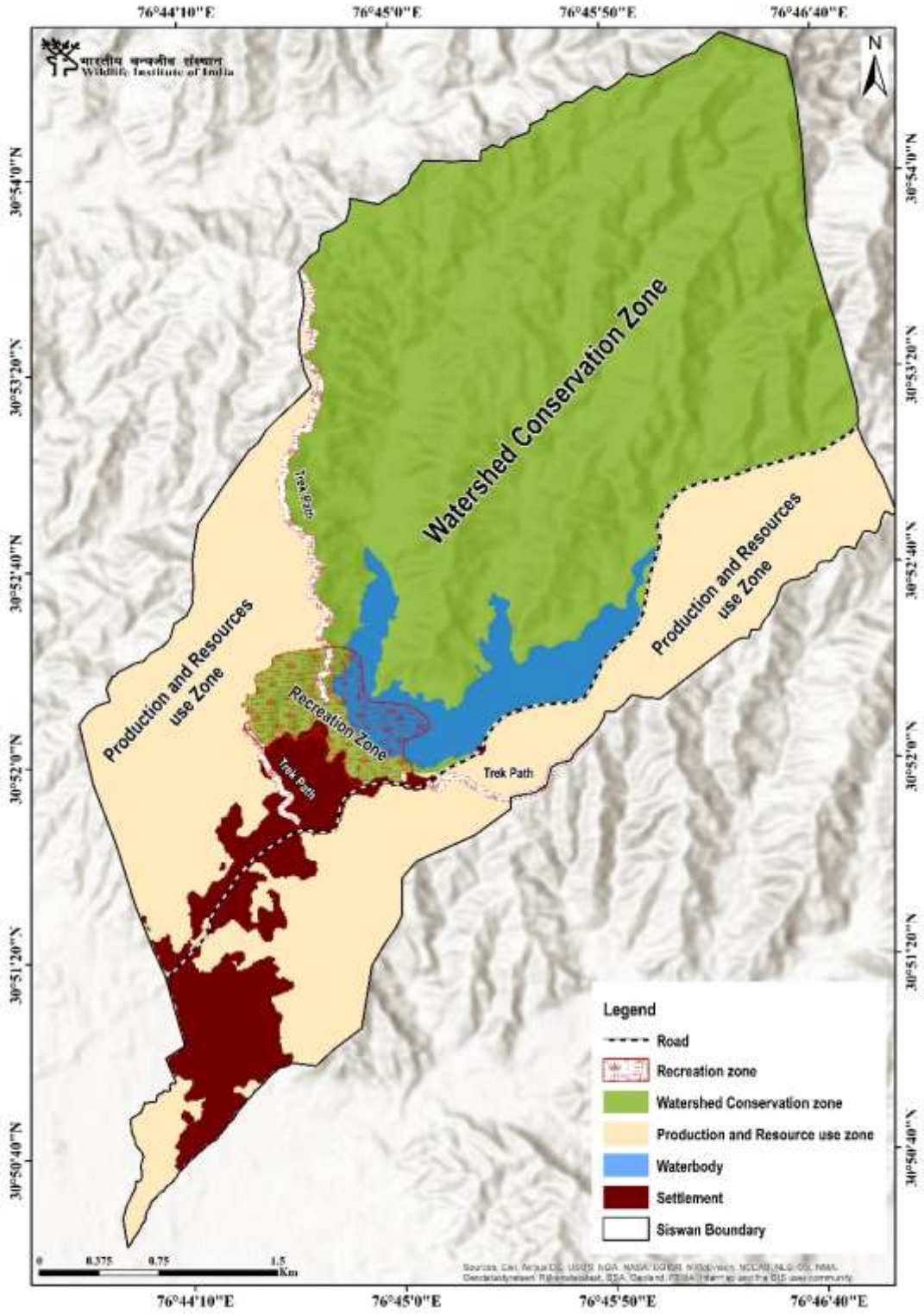
This zone covers the entire forest patch, which forms the watershed of the reservoir. The boundary of this zone starts from the point from where the proposed health trail originates in the recreation zone and then moves along the boundary of the health trail till the point heath trails takes a turn towards Mirzapur. Beyond this, the zone boundary continues along the along the ridge of the forest until it meets the inter-state border. Thereafter, it moves along the inter-state boundary of the reserve until it joins the Chandigarh-Baddi road. It then moves parallel this road and joins the edge of the Siswan dam, near the recreation zone. This zone extends over about 57.55% of area. Objective of this zone is to give maximum protection to the watershed and wildlife habitats.

#### *5.2.2.2. Recreation Zone*

Recreation zone starts from the main gate of the dam, moves along it until it reaches the starting point of the health trail. It then crosses over the health trail and moves towards the western side of the reserve until it reaches the jamun trail. Thereafter, it moves along the boundary of the Siswan village and again joins the dam gate. In addition to this, the entire area of the health trail, jamun trail and lake view trail with a width of 20 m on each side of the trails also forms the part of the recreation zone. Nearly, half of the water spread of the reservoir is also included in this zone. The objective of this zone is to provide visitor facilities, interpretation centre and space for other tourism related activities. This zone is

about 4.47% of the total area. Currently, the reservoir area is under the control of irrigation department and not part of the CR. Efforts should be made to convert the reservoir area as conservation reserve.

**Figure 5.3 Zonation Map of Siswan Community Reserve**



#### *5.2.2.3. Production and Resource Use Zone*

Remaining area of the reserve excluding Watershed Conservation Zone and Recreation Zone are included in Production and Resource Use Zone. This zone will extend over about 30.87% of the total area. Objective of this zone is to meet the forest resource requirements of community. The existing rights of communities as per the provisions of current Management Plan of SAS Nagar, Mohali will continue in this zone. This zone will also be managed for regenerating the extracted resources in an intensive manner and gradually current level of entire resource use of SCR can be met from this zone itself.

### 5.2.3. Zone Plans

The three main zones of the CR i.e. Watershed Conservation Zone, Production and Resource Use Zone and Recreation Zone will have different set of prescriptions. While the Watershed Conservation Zone will be subjected to complete protection and no resource use, the Production and Resource Use Zone will be managed through sustainable extraction and intensive regeneration practices. Interventions related to ecotourism, interpretation, visitor management and nature education will be limited to Recreation Zone. Ecodevelopment, research and monitoring cannot be associated with a particular zone and hence will be discussed as theme plans. The protection, as an integral part of the management, is also being discussed separately as theme plan as it will spread across all the zones. Based on the different zones, the specific zone plans are discussed below:

**Watershed Conservation Zone**

1. *Soil and Moisture Conservation Plan:*

The geology of Shivalik ecosystem is very fragile and prone to soil erosion. Excessive biotic pressures had led to degradation of the vegetation in these areas. Heavy rains accelerate the rate of the soil erosion leading to further degradation of the area. In SCR, this is quite evident from the fact that heavy siltation in this area has led to reduction in the water holding capacity of the reservoir. Soil erosion also leads to the degradation of the habitats and downstream farms. Therefore, for effective conservation, a well-planned soil and moisture conservation programme will have to be implemented.

During field survey in few areas of the catchment, small gullies have been observed. Therefore, the soil and moisture conservation initiatives have to be systematically planned

and carried out after proper mapping of the area. While undertaking these initiatives it should be ensured that each gully is treated from its start to the end. In Sukhna Wildlife Sanctuary of Chandigarh, some of the field staff of the forest department has originally shifted from soil conservation department. Therefore, already the expertise of planning and implementing soil moisture conservation initiative is available. SCR could also follow the model of Sukhna Wildlife Sanctuary for soil and moisture conservation initiative of this area.

2. *Habitat Management Plan:*

Due to past exploitation of the area, some patches of this zone have been degraded. Because of very fragile nature of Shiwalik ecosystem, interventions need to be very carefully planned and implemented. Therefore, it is proposed that some augmentation of degraded patches should be done with fast growing and native species like *Terminalia bellerica* (Beheda), *Terminalia chebula* (Harad), *Emblica officinalis* (Amla), *Sygzium cuminii* (Jamun), *Cordia dichotoma* (Lasoda), local varieties of Zizyphus, etc. In drier areas even Bamboo can also be tried. These areas need to be continuously monitored to ensure that the exotic and invasive species do not encroach these areas. Reservoir has a good potential for attracting water birds. Therefore, wetland habitat of the reservoir also needs interventions for creation of shallow water areas, small pools and mud flats. Some local trees could also be planted near the shallow ends of reservoir so as to provide nesting spaces for the water birds.

*3. Resource use Plan:*

Areas included in this zone are steep and hence subjected to minimum felling of trees. However, the existing rights of the communities as per the provisions of current management plan of SAS Nagar Mohali can be continued in this zone till these are gradually compensated through alternatives generated through ecotourism and ecodevelopment. Communities have to be kept involved in this entire process of change.

**Production and Resource Use Zone**

*1. Production and Resource Use Plan:*

As per the existing management plan of SAS Nagar, Mohali, extraction of Khair and Sisoo is being allowed in a regulated manner in these forests. Different forests are opened up for

extraction at five years interval. However, after extraction, the replanting of areas is poor and opportunistic depending upon the availability of resources and initiative of individual officers. As per the existing rules for extraction, each felled tree has to be compensated by planting of five trees. In practice these norms are rarely followed. Therefore, it is proposed that this zone should be intensively managed. Extraction of trees may be continued to be allowed as per the provision of existing Forest Management Plan of SAS Nagar, Mohali. But these areas will have to be replanted with the extracted species regularly. This will ensure regular and sustained supply of timber to this Panchayat without affecting the health of these forests.

Keeping in mind the health of the habitats, the local fast-growing species as suggested in the watershed conservation zone should also be planted regularly in the area.

2. *Soil and Moisture Conservation Plan:*

The need of soil and moisture conservation initiative is more in this zone because of regular extractions and resource use. Same principles as provided in catchment conservation zone, maybe followed for soil and moisture conservation initiatives in this area.

**Recreation Zone**

*1. Ecotourism Development Plan:*

One of the objectives of management of SCR is to develop this area as an ecotourism destination to provide constructive visitor engagement and socioeconomic incentives to the local communities. Details of this plan are provided in Chapter 7.

### 5.2.4. Theme Plans

The following theme plans are proposed for SCR management:

1) Protection Plan
2) Species Augmentation Plan
3) Community Empowerment and Ecodevelopment Plan
4) Ecotourism, Interpretation and Nature Education Plan
5) Research and Monitoring Plan

6) Extended Landscape Management Plan

While the theme plans for protection, species augmentation and extended management zone are being provided here, the remaining three plans are discussed separately in chapter 6, 7 and 8.

### 5.2.4.1. Protection Plan

SCR has a long interface with agriculture landscape. There are about 11 villages within the 5 km radius of the reserve. Therefore, protection is one of the important concerns for this area. There are several issues, which need to be addressed for protection. Poor community ownership is one of the major challenges, which is being addressed through ecodevelopment programmes. The awareness of the local communities, particularly farmers, about the long-term importance of this area is critical for protection. Simultaneously there are issues related to the staff. As on today, the staff strength, their capacities to support participatory initiatives, level of motivation, and the basic facilities are inadequate. There is one Block Officer and one Forest Guard for a large area of one Tehsil and two sub-Tehsils. The current forest guard is in additional charge of two other forest beats. There is only one vehicle of the Range Officer, which is being used by all the staff. For protection of this reserve and adjoining landscape, the staff must have good understanding about flora and fauna of the area, existing legal provisions for wildlife protection, intelligence gathering, booking of offence, writing of offence reports and pursuing court cases. In this community- driven initiative, staff also require additional competence and attitude in community participation, stakeholder networking, conflict resolution, motivation and conservation-development programmes. Therefore, the protection requires a multi-pronged strategy as described below:

**a) Boundary demarcation, maintenance and monitoring**

After the notification of this area no demarcation of boundaries has not been done so far in SCR. Lack of clarity about the boundaries may lead to intentional or unintentional encroachments. SCR, therefore, needs to be demarcated on the ground immediately as suggested earlier. In addition, it will be necessary to monitor the boundaries and periodically invest in maintenance of boundary pillars.

It is also proposed that the maps of the area need to be prepared after proper survey and these maps should be made available to the management committee, protection squad of local EDC members, staff/officials of forest department, irrigation and fisheries department. One GPS instrument is also needed to be procured for purpose of effective protection and monitoring.

**b) Patrolling of area**

The responsibility of patrolling of the area will be with the Management Committee of SCR, forest department staff and local communities. Management Committee will decide the modalities of patrolling, composition of patrolling squad from among the local EDC members and schedules of patrolling. Basic patrolling gears and material required for protection will be procured both for the patrolling squad as well as staff.

**c) Daily patrolling**

There will be a daily patrolling schedule for SCR and the timing and responsibility for this patrolling will be assigned by Management Committee of SCR. The forest staff will also join and facilitate the daily patrolling.

**d) Weekly Patrolling**

Weekly patrolling schedule will be covering both SCR and adjoining landscape of the reserve. This patrolling schedule will be done jointly by the forest staff and local communities as per the decisions of Management Committee.

**e) Reporting Systems**

Management Committee will design its own reporting systems and record keeping mechanisms. These mechanisms have to be kept very simple and transparent. Department will help the Management Committee to design these systems. The Management Committee will devise norms for giving responsibility of reporting to the daily patrolling squad and the records will be maintained by the Management Committee. Management Committee can decide the modalities of sharing this information and record with the local staff. Management committee will review the progress of patrolling during its monthly meetings.

Simultaneously the reporting and record keeping of weekly patrolling will be done by the local staff as per existing norms of the department and modalities of sharing of this information with Management Committee of SCR should be worked. In nut shell, SCR management will have to be empowered to take all decisions regarding the protection of this area and the department will provide necessary support and help to the Management Committee.

**f) Creating protection infrastructure**

Following infrastructure will be created for the staff and Management Committee of SCR. These buildings have to be small and their design has to be compatible with the natural settings of the area. Location of these buildings should be decided in a manner that these do not spoil the natural view of the reservoir and forest.

i. One Guard Station cum camp office (For SCR Management Committee and staff).

ii. One watch tower/shelter for observation at a suitable high location with a real-time monitoring electronic eye.

**g) Communication facilities**

Following communication facilities will be created/procured

i. One Gypsy Jeep

ii. One motor bike

**h) Capacity building**

Staff and local communities involved in protection will be required to be trained in various issues. This aspect will be covered in the next chapter under trainings.

**5.2.4.2. Species Augmentation Plan**

**a) Strengthening Population of Barking Deer and Indian Hare**

During the field survey, it was seen that due to the problem of predation by stray dogs, the population of small herbivores like Barking Deer and Indian Hare is very low. To strengthen the populations of these two species in-situ habitat improvements initiatives

should be carried out in selected areas of Water Conservation zone. Indian Hare is basically a herbivore and it prefers short grasses like *Cynodon dactylon, Digitaria abludens, Setaria pumila, imperata cylindrica, Poa annua, etc.* and small herbs like *Tridax procumbens, Ziziphus jujuba, Sonchus asper, Medicago polymorpha, Sida cordifolia, etc.* Barking Deer on the other hand is a browser and it prefers humid habitats. As per available literature its major food species are *Indigofera tinctoria, Ziziphus jujuba, Rubus paniculate, Flemingia, etc.* Majority of these species are locally available in the area. Few plots of these plant species should be created in the zone and these should be monitored over time. However, for success of this augmentation, removal of stray dogs from this reserve will be very critical.

**b) Reintroduction of Chital**

During stakeholder workshops, there was a proposal for re-introduction of Chital in SCR, as this species was historically reported to be available in this landscape. As majority of the area of the reserve is steep and rugged, limited suitable habitat in the lower valleys of SCR is available for Chital re-introduction. Therefore, it is proposed that reintroduction facility for Chital can be created towards Mirzapur side by developing comparatively plain grassland area as the reintroduction site. The stock of Chital can be bred here in the beginning, following necessary IUCN and CZA guidelines (Annexure Va). These animals can then be released in suitable areas of the SCR and adjoining landscape of the reserve as per existing rules and guidelines.

*i. About the Species:*

The chital deer (Axis axis) are commonly found in dense deciduous or semi evergreen jungles and open grassland. Their coats are reddish brown, marked with white spots and the belly is white. Only Adult or sexually mature males have antlers which are shed annually. Their life span is between 20 to 30 years. Chital occur mostly in herds of ten to fifty individuals, with hierarchy of stags and a number of females and young ones. They are often fairly habituated to humans and vehicles, especially where they are accustomed to human disturbance. The chital forages primarily on shrubs, grasses and foliage of trees. The chital has a protracted breeding season and births can occur throughout the year. For this reason, males do not have their antler cycles in synchrony and there are some fertile females at all times of the year. Males with hard antlers are dominant over those in velvet or those

without antlers, irrespective of their size and other factors. The species is well represented in open forest and grassland tracts and also occurs in large population in zoos of the country as they are prolific breeders. The zoos in India have a huge population of Chital in their collection.

*ii. Conservation status and legal requirements*

Chital is listed in schedule III of the Wildlife (Protection) Act, 1972. The Chief Wild Life Warden (CWLW) of the state can permit, with prior permission of the state government, translocation of Chital for the purpose of "scientific management" (section 12). This provision can be utilized for translocation of wild population to Siswan Community Reserve.

The Chief wildlife warden can permit release of the surplus Zoo bred stock to Community Reserve on application by the Reserve Management Committee for restocking/ reintroduction following IUCN and CZA protocol for capture and release. Prior approval of CZA for Schedule III species is not necessary as the process and protocol for release of surplus animal has been approved by CZA.

The area of the Siswan Community Reserve is about 13 sq. km and suitable area away from the human settlements and villages are to be selected and delineated for release of Chital. However, due to absence of predators their number is likely to rise steadily and the surplus population may wander out into human dominated landscape and may cause human-deer conflict. If the Reserve Management constructs fences to contain the population into a large enclosed space 4-5 sq km in extent without any predator than the animals will be deemed to be confined and treated as captive animals for which permission of CZA may be necessary. However, if the enclosed space is large and the animals can naturally sustain themselves as free ranging natural population with few predators the wilderness and habitat will not qualify as a captive population.

*iii. Causes of local extinction and current challenges*

Old working plans and discussion with elders has revealed that species was widely distributes in this landscape. Due to expansion of agriculture, fragmentation of habitat and local hunting, species was wiped out in this area long back. Major

justification for reintroduction species will be restoration of habitats and overall ecological health of the landscape as well as enhancing the tourism potential of the area.

SCR has feeble connectivity to adjoining forest patches and is surrounded by vast agriculture landscape. Therefore, the major challenges of reintroduction will be how to contain the animals within the wilderness patches of the landscape and to avoid any possible human wildlife conflict in the form of depredation of crops. Reintroduction in this landscape will require a strong support of local farmers, village communities and other stakeholders. Another limiting factor requiring immediate attention will be the removal of stray dogs.

Chital is a prolific breeder and population is likely to grow very fast and this agriculture dominated landscape will have limiting carrying capacity. Therefore, active management of species will be critical. Population will have to be monitored closely and surplus animals will have to be periodically relocated to other suitable sites in the state. Such active management will need the support of trained teams of staff and comprehensive baseline information.

*iv.* *Preparation for reintroduction*

The programme to re-introduce Chital into Siswan will be in conformity with the 'reintroduction' guideline of IUCN/SSC. These guidelines define a 're-introduction' as 'an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct'. The prerequisites for re-introduction are adoption of the following measures.

Preparatory Pre-project activities:

The pre-project activities for re-introduction consists of the following:

- ✓ feasibility study and background research;
- ✓ identification of suitable release stock;
- ✓ an evaluation of the re-introduction site (Ecological restoration of habitats with a variety of foraging species needed by Chital and availability of food and shelter, etc);

- ✓ identification of factors that led to decline and ultimately local extinction of species and measures for elimination, or reduction to a sufficient level, of causes of decline; (human disturbances, interaction with domestic livestock, predation by domestic dogs and poaching, etc.) and
- ✓ assessing the socio-economic and legal requirements

The planning, preparation and release stages, have been documented well in the CZA Guidelines and are based on the IUCN/SSC document prepared by the Re-introduction Specialist Group of the IUCN's Species Survival Commission. The salient features are:

- ✓ Approval by the local stakeholders, Government and coordination with national conservation organizations.
- ✓ Setting a multi-disciplinary team with experts from the research organisation (WII, WWF, etc) and veterinary staff for capture transport and release.
- ✓ Availability of funding for all phases including monitoring the pre and post release phase.
- ✓ Monitoring the health of individuals, as intervention may be necessary if the situation becomes unfavourable and alarming.
- ✓ Appropriate health and genetic screening of release stock.
- ✓ Health screening of species in the re-introduction area. If release stock is ZOO bred, care must be taken to ensure that (a) the stock is free from infectious or contagious pathogens and parasites before transport and (b) the stock will be able to withstand and have immunity of disease agents which may be present at the release site
- ✓ Development of transport plans for delivery of stock to the site of reintroduction, with special emphasis on ways to minimize stress on the individuals during transport.
- ✓ Determination of release strategy (acclimatization of release stock to release area; group composition, number, release patterns and techniques; timing).
- ✓ Development of conservation education for long-term support; professional training of individuals involved in the long-term programme; public relations activities using the mass media and in the local community; and involvement where possible of local people in the programme. The welfare of the animals to be released is of paramount concern through all these stages.

v. *Feasibility study and identification of Stock for reintroduction:*

The feasibility study includes ensuring that the ecological requirements for re-introduction of Chital in Siswan Community Reserve will be established after habitat amelioration works in the habitat delineated for reintroduction.

Generally wild stock of chital is more suitable for re-introduction as the natural attribute of defence against predators like Jackal and domestic dogs and immunity from disease will be more in wild stock. However, as the area of the suitable habitat for the Chital is limited and the Siswan Community Reserve is in proximity to human dominated landscape the Zoo bred stock will be comparatively easy to acquire and after health screening can be released first in holding facility for acclimatisation and rewilding in large closed enclosures till they develop natural attributes and then released in the habitat.

vi. *Design of enclosure at Siswan*

A survey for a suitable site for a soft release of the Chital in Siswan need to be carried out by the WII (or any technical body) and FD officials. A site with good vegetation, cover and water will be selected for holding the stock. A small enclosure within the 200-300 ha large release enclosure will be fenced.

vii. *Veterinary protocols for translocation*

A Protocol for the veterinary care and safety of wild animals during transportation with special reference to deer species has been developed by CZA and it includes details on:

*Capture, transport and release:* This protocol can be adopted to translocate the Chital from the selected site to Siswan,

*Selection of animal and site:* The recommendation is for selecting a herd of Zoo bred surplus Chital from the Chhatbir Zoo and if need be, from the adjoining Zoos (National Zoological park, Delhi; Lucknow Zoo; Jaipur Zoo; etc). Several north India Zoos have surplus Chital deer and will volunteer to supply the animals. The herd size should be of 15-20 animals of varied sex and age classification.

In case it is felt that for biological and logistic reasons wild Chital are to be translocated for reintroduction from the nearest forest in Shiwaliks with abundant population a feasibility study will conducted for the most appropriate site for capture and translocation. A wild herd from 15-20 animals with natural grouping and optimum sex ratio can be selected by an advance reconnaissance team. The capture of Chital will be done by using the Boma technique

*Method for capture of free ranging wild Chital-Use of boma for capture:* This is a most safe and successful technique used for mass capture of Chital deer. In this method the animals are driven into a large funnel shaped enclosure called "boma' which has a loading chute leading into the back of a truck on the other side. The boma is about 20-30 metres wide and 75 metres long. The animals were driven in with the help of beaters, moving the animals towards the entry of the funnel. A nearby herd can also be baited inside the enclosure if there is adequate time to get them used to visit the boma interior. When a sizable number of animals is inside, the enclosure is closed behind them, squeezing them further and further into a narrow passage by closing several gates behind them. The animals finally run straight into the back of the truck which is closed as soon as the requisite number is inside. The animals can be sorted into various combinations, based on age and sex, in the 3-4 truck compartments. The transportation truck should have interconnected compartments so that different ages and sexes can be separated. Mixing young ones with adult males should be avoided for smaller animals being crushed. Similarly, more than one male in a single compartment should not be transported together.

If the number of animals inside the boma is more than the capacity of truck, another truck is reloaded by prodding the animals into the truck until the truck capacity is reached. The truck is driven straight to the translocation site and off-loaded on a ramp that fits the back of the truck. The department has to customise the designing of truck and arrange the compartments before the capture operation. If one truck is available, the first round of transportation the chital can be held in Boma for the arrival of truck for second round of transportation

*Method for Capture of Zoo bred chital:* This method is the passive form of capture without stress to animals. This is done in the chital deer enclosures in Zoo where a funnel shaped kraal is constructed at the rear end of the enclosure using the boundary barrier and the chain link for constructing the funnel for a length of 10-20 metres and the animal are provided food and water inside the boma for few days till they get habituated and then are driven into the transportation cages through the narrower portion of the chute. Normally one animal is accommodated in one cage so several such cages are required. These are loaded into trucks and taken to the translocation site. The design developed by WII for transportation cages will be adopted for use during this operation.

*Post capture Health examination:* One of the major complications that may arise during capture is mortality or morbidity due to capture myopathy which may appear within hours, days and months after the operation. This is a result of the stress and struggle experienced by them during capture. Capture myopathy can be reduced with the help of suitable sedatives immediately after capture or by minimizing unnecessary physical handling during mass capture operations. During the period the animals are kept in the holding facility before being released in an in their habitat, a regular watch must be kept on their numbers and health condition. The fence of the enclosure should be made clearly visible to animals by putting shade net or thatch matting etc. so that the animals do not hit it while running.

The health screening of the Chital kept in the holding facility should be done by qualified Veterinarian as per the protocol developed by Central Zoo Authority.

*Release of animals:* After the mandatory quarantine of animals before release and ensuring the chital are not carriers of any disease they can be released in the wild one full herd at a time. Since the number of animals translocated and released are individuals of same herd 15-20 in number they need not be marked for identification and subsequent monitoring.

*viii. Re-introduction action plan*

The reintroduction programme shall involve following stages:

- ✓ Capture of Chital using the boma technique and chemical immobilization method from capture site, loading and transport to recovery enclosures for few days for acclimatization and observation for any veterinary treatment.
- ✓ Transportation in specially modified vehicles.
- ✓ Release into a large enclosure of 200- 300 ha for about 6 months, till the habitat is ready for release.
- ✓ Final release into the reserve.
- ✓ Monitoring of the reintroduced population is a must to analyse the factors associated with success or failure of its survival. The health, behaviour, movements, interaction with and bonding shall be continuously monitored through a team of wildlife biologists. The Wildlife Institute of India will provide scientific inputs for both planning and implementation of Chital reintroduction, as well as for monitoring and establishment of reintroduced animals. Latest equipment and techniques shall be used for monitoring. Based on results of monitoring, corrective measures can be taken for the welfare of the reintroduced stock.

**c) Re-introduction of Hog Deer and Swamp Deer**

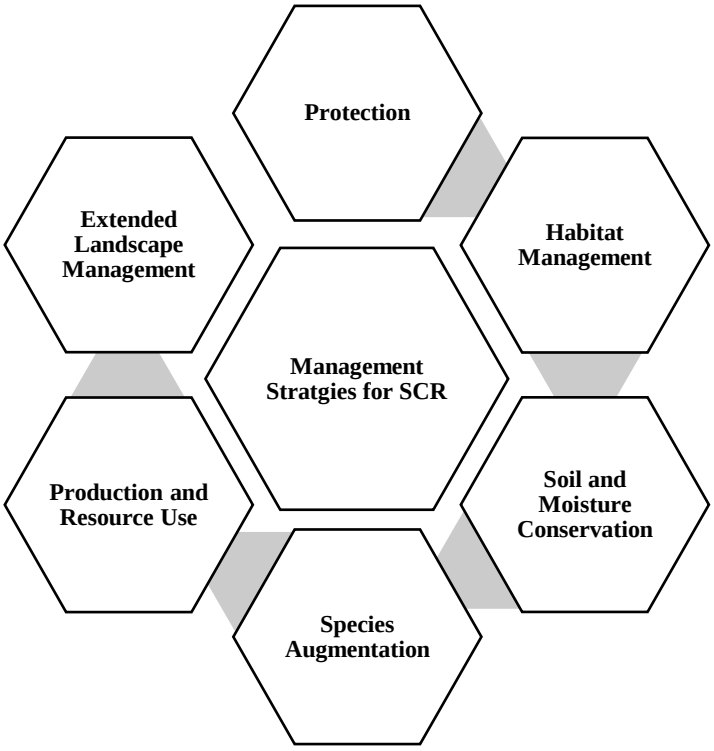
During stakeholder workshop, some of the participants were of the view that there are few marshy patches around the reservoir and therefore, re-introduction of Hog Deer and Swamp Deer should be tried in the CR. Studies conducted during management plan preparation indicate that the marshy habitat required for these two species is very limited in CR. Moreover, the water in the reservoir is highly fluctuating. During summer season, the water level becomes very low, thereby reducing the available wet areas further. Therefore, the possibilities of *in-situ* conservation of these species are very limited. However, if required, e*x-situ* methods for introduction of these two species in enclosed areas can be tried for the purpose of recreation and education.

### 5.2.4.3. Extended Landscape Management Plan

SCR has to be seen in association with the adjoining Shivalik landscape. The long-term objective of this plan is to ultimately expand the conservation initiatives to the larger landscape in the light of learnings from SCR. During the plan period, the processes for this expansion should be initiated through generation of baseline information, creation of

awareness in surrounding villages, some trust building activities and building resources for the proposed Trust. Additionally, networking with major institutions and department will be required for this expansion.

**Figure 5.4 Major Management Strategies for Siswan Community Reserve**




## 5.3. Budget

The budget for undertaking the proposed management strategies is as follows:

**Table 5.1 Budget for undertaking management strategies for SCR**

| S. No. | ITEM OF WORK | Unit cost | Cost (In Lakhs) | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|
| | | | Year I | Year II | Year III | Year IV | Year V | |
| 1. | Protection | LS | 30.00 | 40.00 | 10.00 | 10.00 | 10.00 | 100.00 |
| 2. | Habitat Management | LS | 10.00 | 10.00 | 5.00 | 5.00 | 5.00 | 35.00 |
| 3. | Soil and Moisture Conservation | LS | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 100.00 |
| 4. | Species Augmentation | LS | 10.00 | 20.00 | 10.00 | 5.00 | 5.00 | 50.00 |
| 5. | Production and Resource Use | LS | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 75.00 |
| 6. | Extended Landscape Management | LS | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 25.00 |
| | **Total** | | **90.00** | **110.00** | **65.00** | **60.00** | **60.00** | **385.00** |

# *Chapter 6*

# Community Empowerment and Ecodevelopment

*Anil Kumar Bhardwaj, Ruchi Badola and Aditi Bhardwaj*

## 6.1. Rationale

SCR is a small patch of Shivalik ecosystem and the Siswan village is located on south-western boundary of the reserve. The ownership of the land of the reserve lies with this village. It is, therefore, obvious that the involvement of Siswan village is crucial for the long-term conservation of this habitat. There are 104 households in this village with a total population of 510. Some of the members, who have private property in the area, have settled outside. During our survey of the village, it was revealed that about 40% of the population belongs to Scheduled Caste (SC) and about 28% to Other Backward Class (OBC). About 27% of the total households have marginal land holding with less than 2.5 acre while 40% are landless. Mostly the villagers are involved in the informal sector to earn their living. Few of the families in Siswan also go out to the adjoining cities for employment. Sizable number of people are involved in temporary works of forest and irrigation department. The poverty is dictated by being unemployed or a wage labourer. Additionally, this community also has limited livestock. Despite the problems of livelihood, the dependence of the community on the forest resources is not very alarming, except for some firewood collection, fodder and removal of NTFP. Because of low dependence of the communities on the reserve, their stake in the conservation is also poor.

Another village, Mirzapur, which is on the north-western side of the reserve but beyond the boundary of SCR, is also important in the long-term conservation of this area. Mirzapur is, comparatively, of same size with total population of 481and total households of 84. The structure of the village in terms of caste and religion is more or less similar to Siswan. Even though Mirzapur does not have any ownership of land in the community reserve, they have demonstrated active interest in the conservation of the area, primarily due to their dependence on the forest resource from forest areas adjoining the community reserve as well as strong local leadership.

The ecological boundaries of SCR extend beyond the administrative boundaries as many of the large herbivores use habitats both inside and outside the reserve. There are 11 villages within 5 km radius from the boundary of the SCR. The predominant land use in the adjoining area is agriculture with major crops grown being Wheat, Paddy and Sugarcane, of which the later two are water intensive crops. Over time, there are major land use changes happening in terms of urbanization, resorts and other related urban developments. In light of the above, the proposed Ecodevelopment program will have to take into account the diversity of issues and will have to focus on addressing poor stake of the communities in the conservation initiatives, increasing pressures of urbanization and lack of coordination among different stakeholders.

## 6.2. Objectives

The main objectives of ecodevelopment will be as under:

1. To establish a system of continuous community engagement.
2. To strengthen the socio-economic incentives to the local communities through sustainable resource harvest and alternative livelihoods.
3. To improve the institutional capacity of the communities in context of the ecodevelopment programme.

## 6.3. Broad Strategies

Outcomes of the two stakeholder workshops and series of discussions with the community revealed that the major challenge of the management of this area is how to rationalize the existing land use of the reserve and strengthen the livelihood opportunities of the local communities. Linking of the benefits of the management of SCR to the local communities will be another important issue for planning the ecodevelopment initiatives. Ecotourism with good visitor experience can be another important activity, which could provide alternate livelihoods to the local people. To achieve this, the process of ecodevelopment will have to be spread over a reasonable timeframe. The broad strategies (Refer to Figure 6.1) for ecodevelopment are provided as follows:

### 6.3.1. Constitution and Training of Spearhead Team

At present, the staff strength of the reserve and their managerial capacity for ecodevelopment are low. Ecodevelopment program requires the involvement of communities, right from the stage of planning, implementation and then monitoring. To bring the focus on community empowerment through ecodevelopment initiatives, it is proposed to constitute a 5-member spearhead team, consisting of one forest staff, 3 representative of village and 1 NGO/NGI representative. This team will work under the leadership of local Range Officer and overall guidance of Siswan Community Reserve Management Committee (SCRMC). The responsibility of the spearhead team will be initiating a process of dialogue with the communities, facilitate the preparation of microplan, its subsequent implementation and institution building process.

The process of constituting spearhead team will required to be backed by adequate capacity building efforts for its members. Training the members of spearhead team in building skills and attitudes required for decentralized planning and participatory management will be an integral part of the capacity building process.

### 6.3.2. Dialogue, Awareness and Trust Building

Spearhead team will initiate an active engagement with the communities through periodic discussions to understand the problems of the people and build a rapport with the community. This process will be complemented with a series of awareness programmes about the conservation needs of the area and various other dimensions of community well-being. Such activities will establish a platform for communities and forest department for continuous communication. Facilitating field visits of community members to some of the PAs with a strong focus on ecodevelopment programmes can play a vital role for awareness generation.

Very often, the process of dialogue is not translated into meaningful outcomes for the community. Given, the support and participation of local communities is critical in ecodevelopment programmes, any dialogue must lead to some trust building activities. Therefore, the spearhead team will have to identify few such activities for the welfare of the village. Normally, activities related to health care, education, drinking water supply, skill development, etc. do fit well in such trust building initiatives. The purpose of these activities is not only to give a message that the management is really concerned

for the welfare of the people but also this is an opportunity of bringing in the elements of community participation, transparency, and leadership in the area.

### 6.3.3. Microplanning

The process of community engagement requires to be taken to the next level after the initial trust building activities. In order to achieve this, it is important to prepare village microplans with active involvement of community. This activity serves twin purposes. First, it ensures that communities do not perceive the initial trust building activities as opportunistic. Secondly, it provides a framework for prioritizing the development needs to the village. Lastly, it initiates the process of empowering the communities in terms of better decision making and team work.

In case of SCR, a microplan has already been prepared under the Green India Mission. This plan has the limited objective of afforestation. Therefore, the proposed microplan needs to be much more holistic, keeping in mind the agenda of conservation and community development. The livelihood component of the microplans will have to be prepared in consultation with the communities with very clear agreements regarding mutual roles and responsibilities of forests departments and the EDC members. Linking of the community benefits from SCR to the protection/management of the CR should be the fundamental principle of any livelihood option provided in the microplan. While the final inputs for this will emerge from the microplan, some of the important areas of livelihoods requiring focus in microplans are detailed in Table 6.1

**Table 6.1 Broad areas of focus for livelihoods for communities**

**Direct**

- Protection of reserve and adjoining habitats
- Ecotourism guides for the reserve
- Activities related to tourism management in the area
- Monitoring and research of reserve
- Employment generated through management activities of the reserve

**Indirect**

- Support for local SHGs
- Facilitating other community welfare through other development agencies

### 6.3.4. Strengthening Livelihoods

As part of the reserve is being brought under watershed conservation zone, alternate livelihoods will have to be planned to compensate for the losses to the communities due to restriction on extraction of trees from this zone. The production zone of the reserve is exclusively focused on regeneration and harvest of trees as per the existing rules of the working plan. As on today, the income from this harvest is mainly accruing to the Panchayat. Therefore, concerted effort will be taken to ensure that the production initiatives provide maximum livelihood opportunities and economic incentives to the communities. Moreover, the survey of the area reveals that there are some possibilities of sustainable extraction and use of NTFP like *Gilloy* (Tinaspora species) as an additional source of income.

In addition to rationalizing the existing consumptive resource use, there is a need to develop alternate options for livelihoods. One such promising area is ecotourism. The existing tourism programmes are not well strategized, providing very low visitor experience and benefit to the local community. Therefore, a comprehensive ecotourism programme should be planned with the involvement of local communities and other experts. Details of the proposals for ecotourism programme are provided in chapter 7. The programme will aim at providing maximum livelihood opportunities to the local communities.

Another area of intervention will be skill development and training of the members of the community for alternate livelihood opportunities. However, it is important to understand that these programmes will need to be tailor made to suit the needs of diverse groups such as youth and women. The spearhead teams should take up this initiative in consultation with the SCRMC and community members.

### 6.3.5. Building Institutional Capacity

The success of any community ecodevelopment programme is dependent on a strong foundation in form of robust institutions. While SCRMC will act as an umbrella organization, community involvement will have to be at a further decentralized level of Ecodevelopment Committees (EDCs). This plan proposes two EDCs. One, at the village level, which will also oversee the activities of user groups, if any. The other EDC will be a professional group EDC of tourist guides and people employed in

tourism related activities. These EDCs will play a pivotal role in steering the engine of ecodevelopment initiatives. Therefore, participatory planning, awareness and capacity building programmes will have to be steered at not just at the level of SCRMC but also the EDCs in such a way that this facilitates institution building process.

Additionally, participation of local communities and conflict resolution will be an ongoing process of institution building programme. The communities as well as the forest staff will have to be acquainted with good practices of conservation and development work elsewhere in the country so that these lessons can be internalized in the ecodevelopment programme of the reserve. Another important aspect will be putting in place mechanisms of equitable benefit sharing of the profits from ecodevelopment initiatives.

At this stage, it is important to understand that the process of decentralization of decision making and benefit sharing will have to be supported by appropriate administrative framework and necessary orders of the government/department. This will include the roles and responsibilities of the Management Committee and the departmental officers, delegation of powers, roles and responsibilities of village EDCs, etc.

### 6.3.6. Ecodevelopment and Protection

Ecodevelopment programme will always keep the protection of SCR in focus. In fact, the EDC members should ultimately, become the main string of protection for SCR in association with forest staff. The ecotourism guides and other EDC members will have to play a very important role in protection, even when there are no tourists. Such arrangements will have to be chalked out by the department and these can be gradually, anchored by the SCRMC. In this monitoring, involvement of other stakeholders will be necessary so as to make the process transparent.

**Figure 6.1. Broad Strategies for Community Empowerment and Ecodevelopment in Siswan Community Reserve**


## 6.4. Budget for Community Empowerment and Ecodevelopment

The budget for the proposed strategies for ecodevelopment programme are summarized in the Table 6.2 below:

**Table 6.2 Budget for Ecodevelopment Activities in Siswan Community Reserve**

| S. No. | ITEM OF WORK | Unit cost | Cost (In Lakhs) | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|
| | | | Year I | Year II | Year III | Year IV | Year V | |
| 1. | Training of Spear Head Team | LS | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 | 6.00 |
| 2. | Trust Building Activities | LS | 10.00 | 10.00 | - | - | - | 20.00 |
| 2. | Participatory Surveys and Microplanning | LS | 2.00 | 1.00 | 1.00 | 0.50 | 0.50 | 5.00 |
| 3. | Capacity Building of EDC Members | LS | 4.00 | 4.00 | 3.00 | 3.00 | 3.00 | 17.00 |
| 4. | Livelihood Support Activities and Protection | LS | 20.00 | 30.00 | 25.00 | 15.00 | 10.00 | 100.00 |
| | **Total** | | **38.00** | **46.00** | **30.00** | **19.50** | **14.50** | **148.00** |

**The part of the budget will also be used for expansion of the programme to the adjoining landscape.*

# *Chapter 7*

# Ecotourism, Interpretation and Conservation Education

*Bitapi Sinha, Sajeev T.K., Anil Kumar Bhardwaj, Priya Prajapati and Aditi Bhardwaj*

## 7.1. Ecotourism

### 7.1.1. Background

Relations among conservationists, communities and tourism practitioners have not always been smooth and collaborative. For years, PAs have been managed through minimal collaboration with the people living in and around these areas. However, the concept and practice of ecotourism brings these different actors together. Ecotourism has emerged as a platform to establish partnerships and to jointly guide the path of tourists seeking to experience and learn from natural areas. The term ecotourism is defined as "r*esponsible travel to natural areas that conserves the environment and improves the well-being of local people"* (International Ecotourism Society, 1990). The International Union for Conservation of Nature and Natural Resources (IUCN) in 1996 described ecotourism as:

> *"Environmentally responsible travel and visitation to natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features, both past and present) that promote conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of local peoples".*

Punjab has traditionally been famous for its religious and spiritual tourism. However, the potential of nature-based tourism in Punjab has been, comparatively, less explored. Places like Harike Wildlife Sanctuary attracts large number of nature tourists every year. Other naturally conserved areas, emerging as tourism destinations, are Kanjili, Ropar and Keshopur-Chhumb Community Reserve.

SCR is visited occasionally by local tourists. However, the area has not been developed and managed effectively as a tourism destination. Due to its strategic location, adjoining to Chandigarh and Mohali as well as good connectivity, it has tremendous potential of transforming into a tourism site. The area provides advantages of both terrestrial as well as wetland habitats, which could be used for providing good visitor experience. In the

current management plan, due to proposed restrictions of the watershed conservation zone, developing this reserve as a tourism site is also a necessity. Expected revenues from the tourism will help compensate the local communities and Panchayat for the loss of consumptive use incomes from proposed Watershed Conservation Zone. This will also be important for strengthening the involvement and ownership of these communities in SCR through improved livelihood opportunities.

### 7.1.2. Objectives

The main objective of ecotourism in SCR is to ensure ecologically responsible tourism, through adequate livelihood support and empowerment of local communities. In the light of above, the specific objectives of ecotourism for SCR will be as follows:

1. To generate alternate livelihood opportunities for local community and help them to rationalize the existing landuse in SCR.

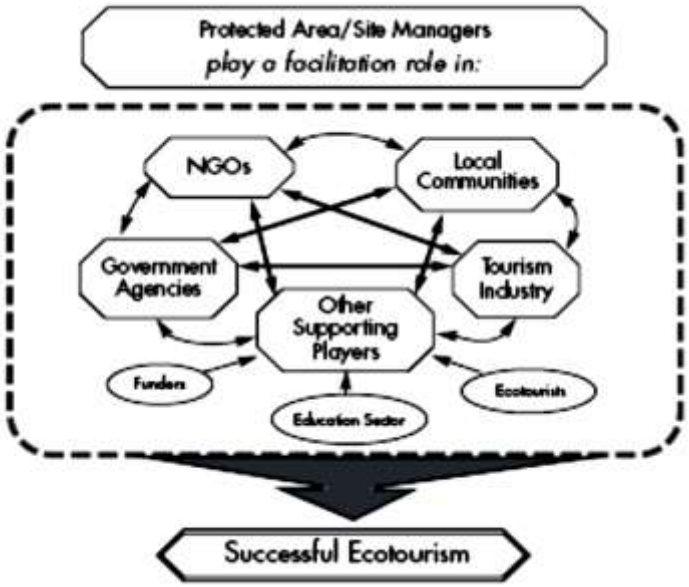
2. To promote conservation awareness amongst the visitors and local people through conservation education and interpretation.

3. To establish harmonious relationship between the CR, visitors and the host communities.

### 7.1.3. Stakeholders in Ecotourism

A key to the success of ecotourism is the formation of strong partnerships as depicted in Fig. 7.1 so that the multiple goals of conservation and equitable development can be met. Given, the diversity of visitor experiences that SCR can offer, the ecotourism activities in this area will have to cater to the interest of different stakeholders. Although, the lead role will be played by the local communities and the Management Committee of SCR, the involvement of forest department will also be crucial. Simultaneously, irrigation department, which has control over the reservoir will also need to be taken on board in different ecotourism activities. Eventually, with growth of the area, it will be in interest of the SCR to partner with other outside groups such as tour operators, hoteliers, education institutions in and around the area, research organizations, etc.

**Figure 7.1: Ecotourism Partnerships needed for success**




*Source:* Adapted from Drumm A and Moore A., 2005

### 7.1.4. Target Groups for Ecotourism

The major target groups among the visitors in SCR will be:

1. General public, who visit for leisure and recreation.
2. Nature Enthusiasts, including international visitors, who are interested in different ecological and socio-economic attributes of the CR.
3. Bird Watchers, with specific focus on the avian fauna of the area.
4. Students, who may visit as part of their school/institute's nature education programmes.
5. Youth and other enthusiasts, who are interested in trekking the area.
6. Senior citizens and young children, who wish to have treks that are more comfortable.

In light of the above different categories, the broad activities of the ecotourism programme will have to be designed keeping in mind the group specific requirements.

### 7.1.5. Strategies

During the planning process, it is important to think about the various objectives of SCR. There will always be the need to strike a balance between good visitor experience and ecological integrity of the area.

Disturbance caused by visitors can be concentrated and then zoned across the rest of the site. One model is to ensure that with greater distance from the main entry, the activities become quieter, allowing visitors a chance to observe wildlife in relatively low levels of disturbance. This approach also provides for the needs of wildlife.

To a large extent, this can be self-regulating due to the fact that families with young children may not venture as far from the hub of the centre and its facilities and those seeking a wilder experience will expect and be happy to go on the nature trails. Not only can this be good practice in terms of wildlife but the zoning of activities also reinforces the different audience segments, which often prefer to have some separation.

Understanding which types of visitors will be moving around different parts of the centre is crucial. Access routes, paths, trails and the overall flow of visitors need to be considered when integrating disturbance zones.

In Siswan two sub-zones are identified for tourism within the main recreation zone. These are:

(i) Nature Watch Sub-Zone

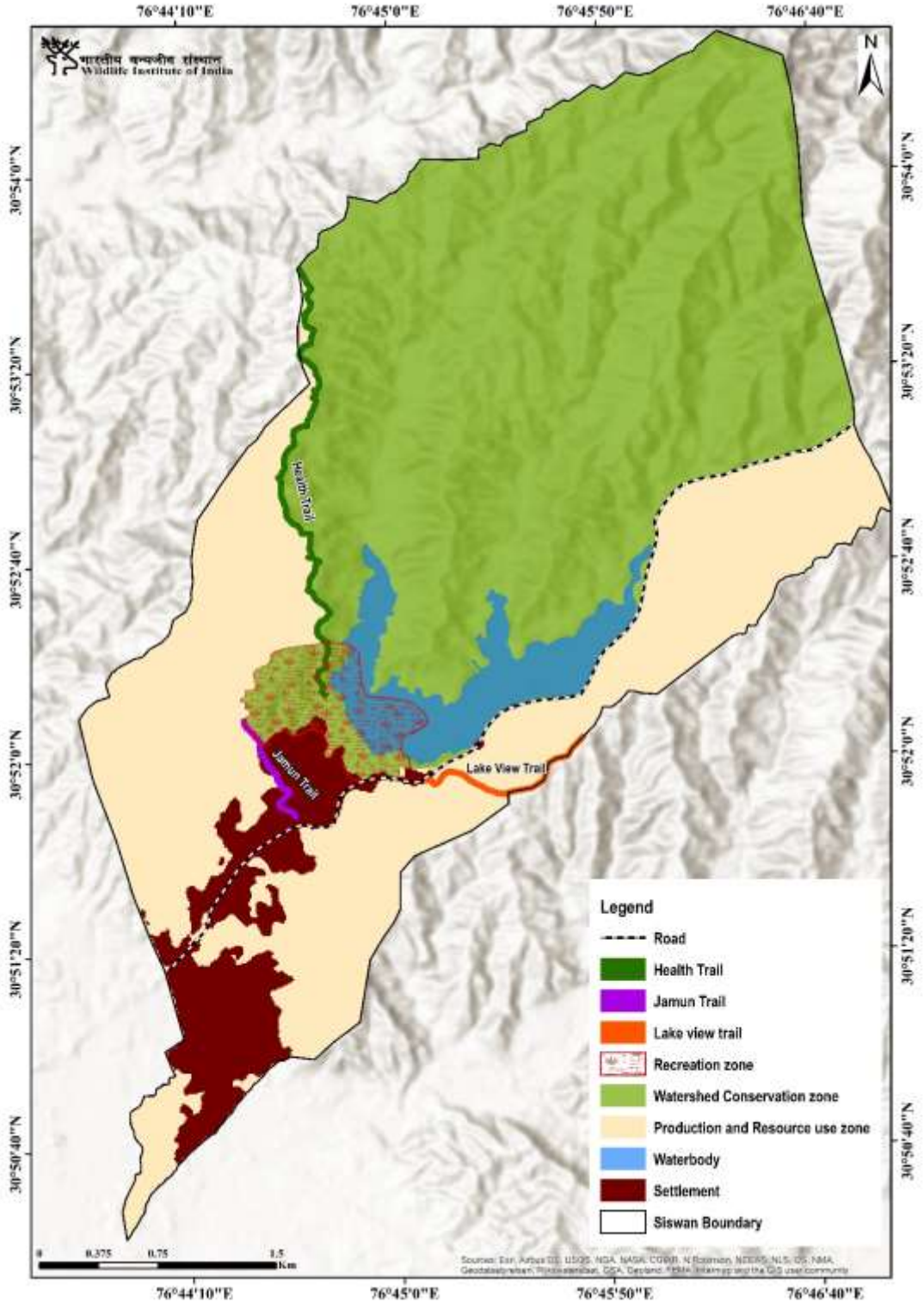
(ii) Conservation Education Sub-Zone

**Nature Watch Sub-Zone**

The objective of this zone is to protect the natural environment and offer recreational opportunities characterized by a minimum of environmental impact and very few group encounters.

The zone will allow movement of visitors interested in observing nature, particularly bird watching and animal sighting. This zone would be restricted to two nature trails already laid in the reserve i.e. Health Trail and Lake View Trail. All along these trails, efforts will have to be made to plant trees, which will form a good habitat for birds. This will also deter tourists from diverting away from designated paths. Suitable signage without disturbing the aesthetic of the area will have to be fixed to provide information to the visitors.

**Figure 7.2: Map showing the location of Trails**



**Objectives of Nature Trails:**

Three nature trails have been proposed for SCR with each designed in such a manner so as to cater to a different interest group.

1. **Health trail:** This trail will start from end of the dam and will move along Siswan-Mirzapur trek path. The purpose of this trail is to provide visitors a blend of nature education and adventure. This trail would be the prime attraction for SCR with only limited groups of people who are interested in learning while in nature should be allowed. It is recommended that the trail be developed in a manner to support a range of activities, including bird watching, animal sighting and vegetation identification. All along the trail, viewpoints can also be developed to better facilitate this process. The role of the guides would be to provide scientific information and effective interpretation for the visitors. Over time, nature based sports such as cycling and fish angling could also be experimented with.

2. **Lake View Trail:** This trail will start from the entry point of the reserve and then move up to the waterhole area and culminate at the lake viewpoint. It would revolve more around the idea of recreation for a far more diverse group of people with different interests. A basic community-run (under supervision of SCRMC) snack outlet can also be put in place in an appropriate location along the trail. The purpose is not to establish a business but provide some facilities (packed eatables, water and washroom) for visitors. The only condition would be to ensure no garbage is left over in the area. The end point of the trail could also develop innovative ideas such as photos booths which immediately print photographs for a fee. The guides will continue to provide relevant information to the groups about the area, its flora and fauna as well as importance of this reserve for the larger landscape.

**Rules and regulations:**

1. Public use will be limited to special groups accompanied by guides in two trails i.e. Health Trail and Lake View Trail.

2. Visitor groups for guided trails will be limited to a maximum of five people per trip. Additionally, schedule for these treks will have to be planned in such a way that solitude of the trail is maintained and it does not get crowded.

3. The entire CR will be plastic free zone. The role of the guides is also to ensure people follow all the rules, including no littering, walking only on designated paths, maintaining decorum, etc. Additionally, cameras could be installed to ensure better surveillance. Any offender could be penalised for violation of rules.

4. Payment for these treks will be over and above the entry fees to the reserve. In addition, an attractive component of bamboo rafting can be included starting from the reservoir.

**Conservation Education Sub-Zone**

The objective of this zone is to offer educational and recreational opportunities within a relatively natural environment, with medium concentration of visitors. The zone consists of Interpretation Centre, Jamun Nature Trail, limited non-mechanized boating (1 or 2 small paddled/foldable boats for extra payment) and self-guided walks using signages.

**Jamun Trail:** This trail starts from one of the ends of the recreation zone and moves down along the boundary of the zone and gradually enters the settlement area upto seepage channels of the dam (area close to Baddi Road). This trail will be open to all, particularly focusing on children and elderly people. The trail could also house a photo booth similar to the Lake View Trail.

**Rules and regulations:**

1. Site will provide all basic amenities like washrooms, drinking water and refreshment outlet.

2. Picnicking by visitors will not be allowed. Refreshments and food facilities will be provided on payment basis at site through the EDCs. Therefore, no outside food will be allowed.

3. While planning development infrastructure, the needs of differently abled visitors will have to be kept in mind.

3. Only entry fees will be levied for activities limited to this sub-zone unless some special facilities are created by SCRMC.

**Entry point**

Car parking should be created just outside the gate of the reserve and the entrance to SCR must act as a magnet, encouraging people towards the path to the Conservation Education Subzone. This area should also have a small souvenir shop being run by the SCRMC.

### 7.1.6. Proposed Activities

Following activities are proposed for ecotourism in the plan period:

1. Existing two guided trails need to be further developed as good bird watching and animal sighting trails, with minimum intrusion or disturbance to the habitat.
2. Along the trail routes, locations for watch towers, hides and observation points (Bare minimum number) need to be identified and installed. At present, there are already two watchtowers located on strategic points of health trail. On the lake view trail, two new watchtowers/hides at appropriate locations may be designed. These should be compatible with the natural surrounds of the area and should not be concrete buildings.
3. Selected local youth, preferably from Siswan village and forest department staff should be trained in ecotourism. The local youth should act as nature guides for running the ecotourism programme in nature watch sub-zone. These guides will have a dual responsibility of visitor management and protection of SCR while taking visitors on trails.
4. Infrastructure development such as setting up of an interpretation cum information centre and hall for participants attending an educational activity. Location and structure of these facilities has to be carefully planned, so that these are compatible with the natural surroundings of the area and these do not hamper with the tranquillity of the landscape.
5. Interpretation centre can be designed around the important themes of the area i.e. Geological history and significance of Shivaliks, history of Punjab Shivaliks, its cultural and religious values, Biodiversity of SCR and our role in conservation of this landscape, etc.
6. Siswan village falls on the traditional trade route and has a rich history. Therefore, the village can be developed as a heritage village.
7. A ticketing counter near the entrance gate and stall for eateries and refreshments near the information center need to be put in place.
8. Extension and education material such as signages, wayside exhibits, banners, posters and brochures, films highlighting the SCR may be developed.

## 7.2. Interpretation

Interpretation is an educational activity, which aims to reveal meanings and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simply communicating factual information (Tilden, 1977). This is used as a visitor management tool to affect visitor's behaviour and in order to do this, motivate through an appeal to human needs and emotions. SCR, although, small in size, hosts a range of ecological, social, economic and cultural values. Therefore, interpretation becomes a very important instrument for educating tourists while simultaneously enhancing their visitor experience.

Once people get into the reserve, they will want to know about the resources and facilities available, what activities are permitted or forbidden and about safety and security. As their understanding of the area grows, visitors show more curiosity about its natural environment. This is the demand to which interpretation has to respond. The result of well-planned interpretation should be a more fulfilling visitor experience.

### 7.2.1. Objectives

Main objectives of interpretation for SCR will be:

1. To educate the visitors and other stakeholders about the importance of this area and ongoing management initiatives.
2. To provide good visitor experience.
3. To enhance livelihood opportunities for EDCs.
4. To reach out to the public at large in and around this landscape and link them with SCR.

### 7.2.2. Interpretation Zone

An area at the lower side of the Siswan Dam is marked for the interpretation zone. Here one can walk around and learn about the whole place without actually going deep in to the trails. A self-guided trail marked with signages and other interpretative materials will help the person to learn and enjoy. This will also have access to the edge of the water body.

A mobile cafeteria is proposed adjacent to the interpretation zone to cater to the visitors. In addition, the facilities of one Butterfly Restaurant and a Medicinal Plant Area are also proposed in this zone:

**Figure 7.3. Interpretation Zone in SCR**


**Butterfly Restaurant**

There are reports, which mentions more than 80 species of butterflies from the Punjab Shivaliks (Singh et.al 2016). This rich biodiversity can be represented in the butterfly restaurant area. An area adjoining to the interpretation zone can be converted in to a butterfly restaurant. All kinds of food plants for butterflies frequenting the reserve will have to be planted here to cater to butterflies. This will ensure visibility of butterflies and thereby help in interpretation. It will also help students to see the life cycle of butterflies, interaction of plants and butterflies and so on.

**Medicinal plants area**

Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts, Egyptian papyrus and Chinese writings described the use of herbs. Evidence exist that Unani Hakims, Indian Vaids and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Indigenous cultures such as Rome, Egypt, Iran, Africa and America used herbs in their healing rituals, while other developed traditional medical systems such as Unani, Ayurveda and Chinese Medicine in which herbal therapies were used systematically. A medicinal plant area is designed to create awareness among public about the importance of the area in conserving rich tradition of

India in ayurvedic life style. The medicinal plants in the reserve, which are not visible in the trails and otherwise, will be planted here with signages explaining their use.

### 7.2.3. Interpretation Centre

The interpretation zone will have to have comprise of an interpretation centre. This centre will help disseminate information, generate awareness and enhance visitor experience. As already hinted, the interpretation centre will provide written and audio-visual information on the evolution of the Shivalik ranges, the array of ecological, social and cultural values of the large landscape as well as weave a story around the development of Siswan as a Community Reserve.

While constructing the centre, it will be essential to ensure that the structure does not impinge the natural beauty of the reserve and gels well with the surrounds.

### 7.2.4 Interpretation techniques

Broad interpretation techniques for SCR are being provided as Table 7.1.

**Rules and regulations**

1. Entry charges to the interpretation complex will be included in the entry ticket itself. Separate charges for Butterfly Restaurant can be considered by SCRMC depending upon its demand with the visitors.

2. All trash must be removed by the visitors themselves.

**Table 7.1 Interpretation techniques for SCR**

| Technique | Components | Comments |
|---|---|---|
| Personal services | • Information desk at the entry, a kiosk at the Interpretation centre<br>• Guided tours<br>• Lectures and demonstrations | Provide information directly to visitors by nature guides and staff |
| Non-personal services | • Interpretation centre<br>• Signages (Directional & Interpretive)<br>• Publications<br>• Audio Visuals and films | Non-personal services can make information widely available at a relatively low expense per visitor contact. |

### 7.2.5. Signs and Visitor Circulation

A minimum number of signs are needed to welcome, direct or control visitors at Siswan. These signs are described below:

#### 7.2.5.1. Pathway Directional Signs

In order to regulate the flow of visitor's pathway directional signs should be placed at regular intervals so that the visitors are aware which way to go. The signs should lead them to all the major facilities that are available for the visitors such as toilets, drinking water and conservation education centre.

Since the area is open for visitors and minimum park management personnel are visualized in this complex, steel reinforced concrete footing with granite sign panel is recommended.

This should also include the “Things to remember” signage near the entry kiosk and in the Conservation education Zone.

#### 7.2.5.2. Interpretive Signages

Interpretive signage about the importance of forests as well as wetland, geophysical setting of OBS and birds can be placed on the viewing platform. These signage should be low lying and non-obtrusive. The signage can either be made on steel panels or in ceramic, both of which are vandal proof and are outdoor material.

#### 7.2.5.3. Temporary Signs

As wetland habitat of the area develops, it may start receiving few migratory bird species for a limited period. Therefore, some signs can be made temporary which can be removed.

#### 7.2.5.4. Other signages that can be put up at the interpretation zone

A short study was carried out in the area and it proposes a number of signages in the interpretation zone (Annexure VII a). However, following signages are proposed to begin with:

1. **Rocks**

   Different kinds of rocks colour variations.

2. **Fossil Models**

   Importance of fossils, the area, evolution can be explained using fossil models.

3. **3D Elevation model of the place**

   Ideally, it should be at the entrance showing the place, roads infrastructures, trails and other important elements.

### 7.2.6. Publications

All publications should have a masthead so that the viewer can know which department has produced it. This would also act as a means of publicity for the area and the department. Following publications for the area are proposed:

- SCR Brochure
- Checklist of wild animals, birds and fishes
- Plant identification guide
- Posters
- Outreach Material

Publications can be priced and the money generated can be ploughed back for improvement of the interpretation facility through SCRMC. The revenue can be used for replenishing the stock of publications and maintaining the conservation education centre.

#### 7.2.6.1 SCR Brochure

The brochure would consist of all the information that would be required by a visitor for planning the visit and what one can expect to see in the area. The brochure would also have the 'Things to remember' i.e. what one is allowed to do on the trip within the reserve and what is prohibited. It would also give information on the timings and the period when the reserve would be open for visitation.

#### 7.2.6.2 Checklist of animals and birds

SCR has important large mammalian species. There are large number of birds also recorded in the area. The area can be promoted as a birding site for bird lovers and students.

In order to assist the students, a checklist of birds needs to be prepared. This checklist can be regularly updated with the help of birdwatchers and new records mentioned.

The checklist can be produced both in Punjabi and English so that the students from the neighboring schools and colleges can also be benefited. Services of some retired officers of the department or other experts can be taken to design these materials.

#### 7.2.6.3 Plant Identification Guide

Since most of the facilities in the SCR would be self-guided, it is important that the visitors have some aid to assist them in knowing about the area. The plant identification guide would be a source of information for local flora. Visitors can use the guide to know about the plants in the reserve wetland and on the islands.

The guide would be pictorial with line drawing depiction of the plants. It will have the Botanical name, common name, flowering and fruiting period, importance to the habitat and to the fauna, and economic importance to human being.

#### 7.2.6.4 Posters

A series of 5 pictorial posters is recommended namely:

- Fishes, Amphibians and Reptiles
- Mammals,
- Flowering Plants
- Avifauna
- Importance SCR, including role of community and their socio-cultural history

These posters can be sold as souvenirs for the visitors and can also be used as outreach material for the visitors, including school children. The posters can be produced in two languages i.e. Punjabi and English.

#### 7.2.6.5 Outreach Material

Since students, local public and youth will also be potential visitors to the area, it will be important to reach out to them through publications and other means.

These materials can be used during special events day such as World Environment Day (5th June), Wildlife Week (2-8th October) and Wetland Day (2nd February). Such events increase public awareness of an environmental issue and motivate people to participate by focusing their attention on a particular environmental issue.

The materials can be activity booklets like draw and color, sheets or cards. The material produced has to be in easy to understand language. The activity booklets can be used by school children and on successful completion of the activity they can be given a Certificate which would motivate the children to learn more about their surrounds.

Environment clubs too can be formed in schools and colleges located around SCR and environmental awareness activities can be undertaken in these clubs.

#### 7.2.6.6 Website

Gradually a website for SCR should also be developed with the help of professionals.

### 7.2.7. Nature Guides

Local educated youths from Siswan or other adjoining villages should be trained as nature guides. This will be an important effort to involve the community in tourism initiatives. A sensitization programme has already been organized for the local youth of Siswan by inviting a resource person from Kerala during the planning period. Such capacity building initiatives need to be continued periodically. At present, there are not many visitors and therefore the youth may not see any advantage of pursuing their career as nature guides. Once the facilities are developed and visitors start flowing then there would be an opportunity for the youth. The youth can take groups of students/visitors on the journey around the reserve and other areas of the landscape. They can also be deployed to take care of the entry kiosk and the conservation education area.

Training of guides and staff should be a routine process. During non-visitation period, the guides can undergo refresher course training at the site. This would update their knowledge and sharpen their skills required for guiding visitors. During the refresher course, the performance of the guides may be evaluated and based on their knowledge and communication skill, they may be categorized by A, B, C type. Accordingly, their fee for one trip with the visitor can be fixed. The group size should not be more than 10 persons.

Once tourism picks up, then the guides will have to be persuaded to contribute a small amount of the fee to SCR for guide and staff welfare. The SCRMC may also contribute a share to this kitty for the welfare of staff and guides. This fund would not only provide financial support in times of need to the guides, but would also provide uniform and books for the guides.

### 7.2.8. Audio Visual

Films are an important media of mass communication and it works well in rural settings. Series of 20 minutes film on SCR & Shivaliks, its ecological & socio-cultural importance, threats and its mitigation can be prepared with strong visual content. The commentary can be in Punjabi for use in the villages but English commentary can be superscripted for use in the Conservation Education Centre. The film should be professionally done.

### 7.2.9. Differential Pricing

Management Committee of SCR could decide differential rates of entry fee for Indian and foreigner visitors. The entry fee suggested are as below:

**Table 7.2: Suggested entry fee for SCR**

| S. No. | Visitors | Fee (Rs.) per person per day |
|---|---|---|
| 1 | Indians- Adults<br>- Child between 5 -18yrs | 100<br>50 |
| 2 | Foreigners | 500 |
| 3 | School/College Groups of minimum 10 people (on production of institution's ID card) | 35 per person |
| 4 | Guide Charges for Nature Trail | 100 per person subject to a group of five people. If there are less than five people, fixed charge of 500 will be levied. |

Increases in fees, or the introduction of new fees, are best done with the clear intent of improving services to visitors. Visitors will be much more willing to pay when they see

that the services provided are improved. Experience indicates that modest fees generally do not have a significant effect on park visitation. Nevertheless, the impact on visitors of raising charges should be monitored and changes introduced, if necessary, by the Management Committee. Guide fee will be in addition to the entry fee.

## 7.3. Conservation Education Programme

SCR will have regular nature education programme. Nature camps could be organized for surrounding school children free of cost. Similarly, these programmes could be designed and organized for other schools and target groups as paid programme. Based on the results of a study conducted on the potential of conservation education programme for Siswan, it has been revealed that there are 186 schools and 93 colleges/institutes in Chandigarh and 104 schools and 110 colleges/institutes in Mohali. In addition, 120 NGOs are working in these two cities on different aspects of conservation. More than 200 eco-clubs are also established in different schools and colleges of these cities. This provides tremendous potential of nature education in Siswan. It is, therefore, proposed that Siswan should be developed as a centre for nature education for different target groups.

### 7.3.1. Nature Camps

Tomorrow's leaders must be equipped for tomorrow's challenges, and we must adequately prepare our children for the future they will inherit. That requires a commitment to providing children with environmental education that helps them become the educated think tanks of tomorrow. Therefore, it is essential to create awareness among the masses to conserve the environment. Nature Camps are one of the apt tools for this purpose and has been successfully carried out in various parts of the country. Such camps could be one of the important activities of the reserve for disseminating awareness about nature conservation and also for building a local constituency for the conservation of this area.

This will require infrastructure in terms of meeting hall facility for interactive sessions, audio-visual equipment, reference material, binoculars, spotting scopes, educational documentaries, brochures and pamphlets. Panel of resource person could be short-listed, who could be invited to add value to these programmes. Necessary technical and non-technical staff could be engaged for running these programmes and the cost of the same

could be borne through the incomes of SCRMC. Gradually these staff could be supported by the proposed Punjab Shivalik Trust.

### 7.3.2. Target groups

1. KG to 3rd std.
2. 4th to 7th std.
3. High School
4. Higher secondary and College
5. In-service staff at government and Semi Govt.
6. Media people
7. NGOs
8. Other Nondescript organisations

### 7.3.3. Duration

Based on the results of the survey with the target audience, several expectations and concerns were documented for the conservation education programme in Siswan. These included demands such as adventure activities, guided tours and adequate infrastructure facilities. Security concerns were also registered for night stay programmes for young children. Therefore, it is proposed that two types of nature camps may be organized at Siswan:

1. Half day for the KG to 7th standard students
2. Full Day for all others

### 7.3.4. Venue

Venue will be the facilities at Siswan Community Reserve or anywhere as decided by the authorities.

### 7.3.5. Eligibility

Willingness to participate in conservation activities is the criteria.

### 7.3.6. Number of participants

The number of participants in a class room is decided by the reach of the teacher. Here it can be decided by the available facilities. Still a group of 30 to 40 is a viable group at a time. In case of students there should be one teacher for every ten students.

### 7.3.7. Syllabus

The typical syllabus of a camp should be covering:

1. biodiversity local to global
2. need for conservation of biodiversity
3. basics of biogeography
4. elements of biogeography, forest types
5. deforestation and its impact
6. pollution, types of pollution and its impact
7. Need and greed differentiation

All session however small it is should talk about the actions possible by the target group. It should give what they can do as an individual and as a group. Further topics can be added based on the requirements of the participating group.

### 7.3.8. Infrastructure requirements

1. Accommodation facilities
2. Conference hall/Meeting space for lectures and interactive sessions
3. Audio-visual equipment
4. Reference materials
5. Binoculars
6. Spotting-scopes
7. Handheld lenses
8. Laptop
9. CDs of wildlife films / Educational documentaries
10. Transport facilities
11. Brochures, pamphlets
12. White board/Marker pens
13. Printer/Copier/Scanner
14. Power Back up

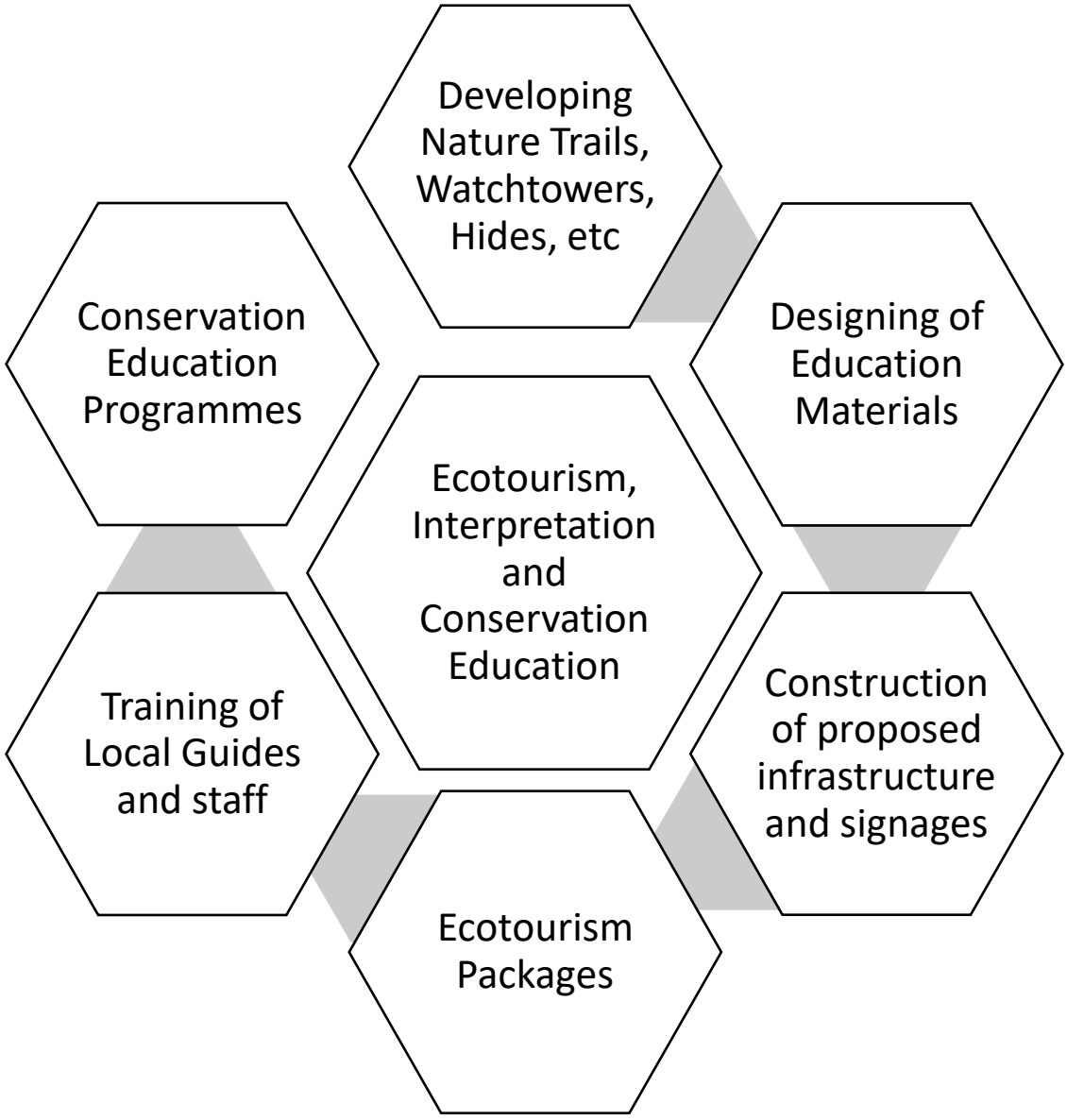
### 7.3.9. Panel of Resource Persons

There should be a panel of locally available resource persons who can add value to the programme.

### 7.3.10. Advertisements and other promotion work

Government should put up ads in print and other media to invite people from all around for the programme.

**Figure 7.4 Major Action Points for Ecotourism, Interpretation & Conservation Education**



## 7.4. Budget

**Table 7.3: Budget provisions for Ecotourism, Extension and conservation Education**

| S. no. | ITEM OF WORK | Unit cost | Cost (in Lakhs) | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|
| | | | Year I | Year II | Year III | Year IV | Year V | |
| 1. | Construction of interpretation centre and other visitor facilities | LS | 100.00 | 50.00 | 50.00 | 50.00 | -- | 250.00 |
| 2. | Construction of conservation education centre and a dormitory | LS | 50.00 | 25.00 | -- | -- | --- | 75.00 |
| 3. | Purchase of audio visual and other equipment | LS | 10.00 | 10.00 | 2.00 | 2.00 | 2.00 | 26.00 |
| 4. | Designing education materials | LS | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 50.00 |
| 5. | Strengthening nature trails, watch towers and hides | LS | 25.00 | 15.00 | 10.00 | -- | -- | 50.00 |
| 6. | Developing ecotourism packages | LS | 2.00 | 2.00 | 2.00 | 1.00 | 1.00 | 8.00 |
| 7. | Training of local guides and staff | LS | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 10.00 |
| 8. | Maintenance of infrastructure | LS | -- | 5.00 | 5.00 | 10.00 | 10.00 | 30.00 |
| 9. | Conducting nature education programmes | LS | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 15.00 |
| | **Total** | | **202.00** | **122.00** | **84.00** | **78.00** | **28.00** | **514.00** |

# *Chapter 8*

# Monitoring, Research and Training

*Anil Kumar Bhardwaj, B.S. Adhikari, Bivash Pandav, V.P. Uniyal, Ruchi Badola, J.A. Johnson, Abhijit Das, Gautam Talukdar and Sakshi Rana*

## 8.1. Introduction

The aim of establishing Siswan Community Reserve is to conserve the ecological integrity of this important area while strengthening the stakes of the local communities through enhancement of livelihoods. For this it is fundamental to improve our understanding about this ecosystem and resolve the management problems through a science-based approach. This requires an active networking with the stakeholders and flow of scientific information to the Management Committee of SCR and local staff. It is in this context that the research and monitoring become very important for the management of SCR. The outcomes of the research and monitoring will not only help in taking scientific decisions but will also help in designing of ecotourism and nature education programmes for visitors and other interest groups.

SCR is part of the large Punjab Shivalik landscape and therefore, it has lot of potential of conducting integrated research on various aspects of ecosystem conservation, wildlife management, ecosystem services and human dimensions of nature conservation. For successful implementation of this plan, basic applied research and biodiversity monitoring programs are a must. The success of the implementation of this plan will also depend upon participation of local community, NGOs and government agencies. Hence, SCR Management Committee may consider:

a) Prioritization of research activities for the area.

b) Follow the recommended protocol for biodiversity monitoring

c) Capacity building toward formulation and conducting basic research, and monitoring of biodiversity

Important areas for immediate research are given as follows:

a) Strengthening existing baseline information on various taxa of the reserve and adjoining landscape with their conservation status
b) Preparation of comprehensive checklist and photo-documentation of birds in all seasons from the reserve and adjoining landscape
c) Preparation of GIS Maps for the reserve and adjoining landscape
d) Status of different habitats in CR and the adjoining landscape
e) Socio-economic status and dependencies of local communities in the CR and the adjoining landscape
f) Perception and attitudes of local communities and various stakeholders towards conservation and management of CR and the adjoining landscape
g) Human-wildlife conflict in CR and the adjoining landscape
h) Documentation of cultural and historical values of the landscape
i) Ecotourism potentials and community livelihood.
j) Detailed assessment of ecosystem services of the reserve and the adjoining landscape

## 8.2. Monitoring

As far as monitoring is concerned, it is proposed that the Management Committee of SCR and Departmental staff should monitor the landuse/ different habitats; quality of water and soil; the status of forest vegetation and major wildlife species at regular intervals. This monitoring should be extended to the adjoining landscape; of course, the frequency of monitoring in the landscape could be longer. Initially, these monitoring activities can be anchored by the Management Committee and gradually, Punjab Shivalik Conservation Trust can take over them. Broad protocols for monitoring of SCR are given in Table 8.1

### 8.2.1. Main considerations in design of monitoring program

The main target of the monitoring program will be the ecological values of the reserve, associated habitats and major wildlife species. However, the monitoring has to be extended to the other socio-economic parameters of the program, level of conflict and support of local people and other stakeholders for conservation. It is proposed to have permanent protocols for the monitoring of the habitat and key faunal species.

### 8.2.2. Biodiversity monitoring

Information on population trends of a species/community is essential for understanding the long-term conservation status of that species/community. Hence, a long-term monitoring of major wildlife species, birds, aquatic vegetation, and fishes is prescribed. Professional institutions/NGOs can be engaged for this purpose and the work can be coordinated by local NGOs, or State Forest Department. SCR is known for its ecosystem services and wildlife, which may be considered as the bio-indicators to assess the health of SCR ecosystem. Therefore, long term monitoring of these parameters is important.

#### 8.2.2.1 Avifaunal monitoring

Our initial surveys revealed that there are a large number of terrestrial bird species in the area. However, the reserve has to be seen as a part of large landscape, which is a mosaic of fragmented habitats and also some water bodies. Therefore, it is proposed to carry out the bird surveys once in a year using standard protocols for the entire landscape. To capture the seasonality of the birds, the survey could also be attempted twice in a year.

#### 8.2.2.2. Habitat monitoring

Habitat monitoring is essential to understand the efficacy of this Conservation Plan. Any changes in the habitat are expected to affect the associated wildlife. Therefore, monitoring of wildlife habitat is inevitable. Permanent monitoring plots need to be established to monitor the changes in the vegetation structure both in the watershed conservation and resource use zone. Land use and land cover mapping and monitoring may also be carried out using remote sensing and GIS tools in very five year intervals.

#### 8.2.2.3. Wildlife health monitoring

Every year a joint monitoring team along with the Veterinary Departments, should conduct a systematic health monitoring of the wild animals inside the reserve and livestock in the adjoining area. This is important to keep a check on the spread of any disease from livestock to wildlife or vice versa.

## Table 8.1 Protocols for monitoring in Siswan Community Reserve

| Broad Parameter | Protocols for monitoring | Frequency of monitoring | Means of Verification | Agencies to be involved |
|---|---|---|---|---|
| Ecological | Land use and land cover mapping of the reserve | Once in a year during the month of December | Baseline data collected in the beginning of plan | State Remote Sensing Deptt. &GIS unit of State Forest Deptt. |
| | Water and air quality of the reserve | Three times in a year during summer, monsoon and winter | Limits prescribed by Bureau of Indian Standards (BIS) | State Pollution Control Board, Irrigation Department |
| Biodiversity | Habitat quality (using standard vegetation analysis techniques ) of each habitat types | Once in each season in the reserve, (sampling for 3 seasons during peak period of the respective season), and once every year in the adjoining landscape | Baseline data in the beginning, camera trap techniques | State Forest Department, Punjab University, and local Colleges, Science and Technology, NGOs, WII, BNHS etc. |
| | Major wildlife i.e. amphibians, reptiles, mammals and invertebrates (using camera traps and standard field methods) | Once in year (amphibian-monsoon, reptiles-summer, mammals-winter) | Baseline data collected and in the beginning | Punjab University, and local Colleges, SCT, State Forest Department, NGOs, WII, BNHS |
| | Resident, breeding and wintering birds population (using Point count and Total count method) | Two times in a year | Baseline data collected in the beginning of plan implementation. | Punjab University, and local Colleges, SCT, State Forest Department, NGOs, WII, BNHS |
| | Fish diversity (using Catch Per Unit Effort (CPUE) method) | Once in each season of the year | From the baseline data in the beginning | Punjab University, and local Colleges, SCT, State Forest Department and Fisheries Deptt. |
| Socio economic | Dependency of local people | Twice in a year (Summer and Winter) | Baseline data | Management Committee and State Forest Department staff, SCT |
| | Socio-economic conditions of EDC village | Once in every year | Baseline data | CR Management Committee and State Forest Department staff, SCT |
| Ecosystem Services | Groundwater Recharge, Water Flow, Surface water | Once in every year | Baseline data | Irrigation Department, State Forest Department |

### 8.2.3. Environmental monitoring

Forest contributes to maintenance of water and air quality. From our interaction with local people, water was perceived to be good for consumption as far as 10 km from SCR and air quality near SCR was perceived to be better than nearby urban centres. Hence, it becomes important to monitor both water and air quality near SCR to check if the ecosystem is functioning well or not. Therefore, water and air quality of SCR may be monitored once in a year continuously using prescribed protocol with the help the State Pollution Control Board.

### 8.2.4. Regular collection of meteorological data

At present there is no proper infrastructure and instruments available at SCR. It is therefore necessary to establish a small weather station to collect regularly data on weather conditions. The local forester/village representative should be assigned the responsibility to collect data on a prescribed format and report to divisional headquarters through Range Forest Officer on monthly basis. This data can be collected with the help of patrolling squads proposed to be designated by Management Committee of SCR, Irrigation Department and Meteorological Department. In the initial stage, following instruments may be procured to establish a meteorological station:

(i) Rain gauge for recording rainfall: 1

(ii) Thermometer for recording temperature: 2

(iii) Aneroid Barometer for pressure and general weather condition: 1

(iv) Dry and wet bulb thermometer for recording relative humidity: 1

(v) Anemometer for recording wind velocity: 1

### 8.2.5. Socio economic monitoring

Socio-economic conditions and dependency of local people on the reserve and the quantity of biomass extracted needs to be monitored periodically to know the extent of biomass including fish biomass extracted from the reserve, especially the resource use zone. This data would also help in assessing the impact of extraction on the reserve.

### 8.2.6. Tourism monitoring

Tourism monitoring should become a regular feature of the monitoring programmes at SCR. The records of the tourist coming to SCR has to be meticulously maintained and stored in a computerized database. Tourist feedback surveys also need to be taken periodically to know about visitor satisfaction levels and also to seek suggestions from them.

## 8.3. Research

Following potential areas for research in SCR is being identified and recommended to be taken up in future:

1. Ecology of migratory water birds in SCR and adjoining landscape
2. Ecology of breeding birds in SCR and adjoining landscape
3. Study of impact and management of invasive alien species in SCR
4. Restoration of identified critical habitats of SCR
5. Landscape connectivity

## 8.4. Training

Training is a very important tool for capacity building and improving the professionalism of the staff. The conservation reserve staff, while carrying on their normal duties, also needs to develop an understanding of various issues related to management at a professional level. Capacity building in this regard can best be achieved through trainings designed for this purpose.

Improving the knowledge and capacity of staff has several benefits. It helps them to carry out their duty with an increased understanding and awareness and hence with increased dedication. It gives them more confidence in their work. This helps them to deal with various stakeholder groups, such as local people and tourists, with more confidence. Improved skills and knowledge will improve their productivity and quality of output.

Some areas where training will benefit the staff are as follows:

i. Knowledge and identification of wild animals and birds species found in the SCR and adjoining landscape, habits of species, biology and ecology of important species
ii. Basic knowledge of reptile, amphibians, Lepidoptera and Odonata species found in the reserve
iii. Knowledge and identification of plants, including medicinal plants found in the area
iv. Interdependence of plant and animal species
v. Monitoring methods, population estimation methods
vi. Anti-poaching skills and documentation of offence cases
vii. Conflict resolution skills for dealing with local people
viii. Use of instruments such as compass, binoculars, digital camera, GPS, etc.
ix. Computer literacy

Competent EDC members and Field staff could be given small projects on which they should collect information from the field such as information on animal, bird or plant species. They should make write-ups and give presentations on their project.

Training should also be imparted to local people, particularly guides and tour operators with the intention of upgrading their skills for tourism. Such trainings have already been conducted for the nature guides, primarily with help from the Wildlife Institute of India and regular refresher courses need to be conducted. Some important training subjects for the local people are:

i. Wildlife (Protection) Act, 1972 particularly in reference to community reserve rules
ii. Skills of dealing with tourists
iii. Interpretational skills
iv. Skills on identification of animal and bird species
v. Basic forest and wetland ecology
vi. Microplanning
vii. Management of self-help groups
viii. Conflict resolution, team building and leadership
ix. Community Livelihoods

x. Natural Resources and value additions

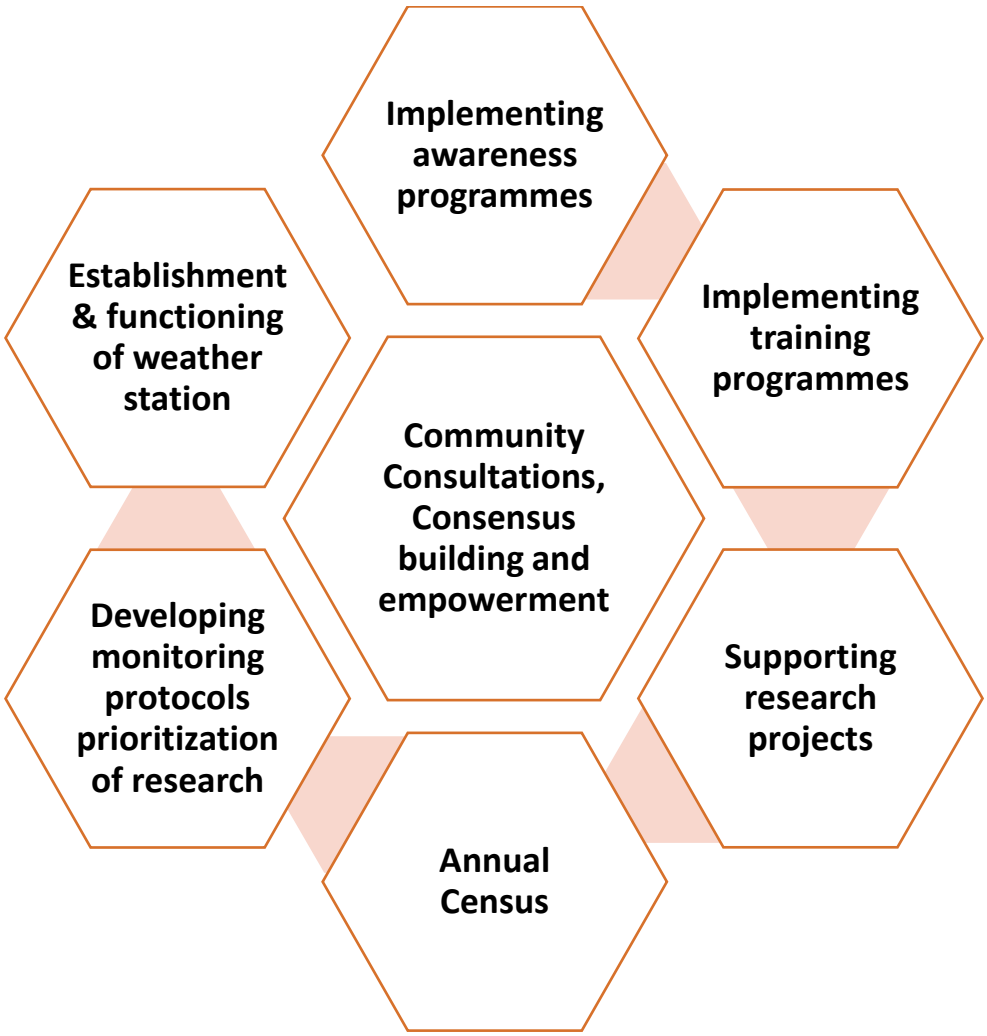
xi. Marketing and networking

Professional organizations should be involved in developing and conducting training programmes. Officers of the department should also be involved in training programmes.

## 8.5. Establishing a Learning Centre

SCR should ultimately be evolved as a learning centre for staff and different stakeholders. This should also maintain the data generated through long-term monitoring and research. Learning centre should also anchor a series of awareness programme (both paid and free) for school and collage children and other target groups.

**Figure 8.1 Major Action Points for Research Monitoring & Training**



## 8.6. Budget

The budget for monitoring, research and training in SCR is provided below:

**Table 8.2 Budget Provisions for Research Monitoring and Training**

| S.No. | ITEM OF WORK | Unit Cost | Cost (in Lakhs) | | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|
| | | | Year I | Year II | Year III | Year IV | Year V | |
| 1. | Establishment and upkeep of a weather station-1 | LS | 10.00 | 5.00 | 1.00 | 1.00 | 1.00 | 18.00 |
| 2. | Annual Wildlife Census | LS | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 10.00 |
| 3. | Other Monitoring Protocols | LS | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 5.00 |
| 4. | Research Prioritization and monitoring Protocols workshop -1 | LS | 2.00 | - | - | - | - | 2.00 |
| 5. | Research Projects (Part support) – 10 | LS | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 20.00 |
| 6. | Training Programmes – 20 | LS | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 10.00 |
| 7. | Awareness Programmes – 25 | LS | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 10.00 |
| | **Total** | | **23.00** | **16.00** | **12.00** | **12.00** | **12.00** | **75.00** |

# *Chapter 9*

# Organisation and Administration

*Anil Kumar Bhardwaj, Bivash Pandav and B.S. Adhikari*

## 9.1. Structure and Responsibilities

Being a community reserve, SCR will have different organization and structure. The main responsibility of management of SCR will be with the management committee of this area. However, the department will play a role of facilitation and support to the Management Committee. Chief Wildlife Warden will have important role to approve the APOs and periodic review of functioning of CR in the light of main management objectives of CR. While Range Officer is the part of management committee as member secretary, DFO (Wildlife) will be the Chief Executive of the programme and a representative of CWLW in the field for frequent guidance and support to the management committee. Currently, part of the area is under territorial division of S.A.S. Nagar, Mohali. It is recommended that the entire reserve be put under the charge of the wildlife division of the area.

### 9.1.1. Different Committees and Institutions

Following will be the main committees for functioning of SCR (See Figure 9.1):

#### 9.1.1.1. Siswan Community Reserve Management Committee (SCRMC)

This is the main institution to look after the day-to-day management of CR. The committee will consist of eleven members with following structure:

| | |
|---|---|
| Panchayat Pradhan or any other elected member of the village Panchayat or any other member nominated by the panchayat | Chairman |
| Five elected village representatives | Member |
| Concerned Range Officer of SCR | Member Secretary |
| Engineer of Irrigation Department looking after Siswan Dam | Member |
| Representative of Fisheries Department | Member |
| Two representatives from Reputed NGOs | Members |

Main responsibilities of this committee will be preparation of APOs in consultation with EDCs/other stakeholders, approval of APOs, getting approvals of CWLW, oversee the implementation of approved programme, monitor the progress of implementation, Human resource development, coordination and networking, timely procurement of funds, management of the revenue and expenditures, record keeping, timely auditing of accounts, preparation and submission of periodic/annual reports.

#### 9.1.1.2. Planning Sub Committee (PSC)

The structure of this committee will be as follows:

| | | |
|---|---|---|
| One of the EDC chairperson (On rotation) | - | Chairman |
| Chairperson of other EDC | - | Member |
| One NGO representative | - | Member |
| Forest Guard concerned | - | Member Secretary |

Major responsibility of this committer will be the preparation of APO in consultation of EDCs and other stakeholders.

#### 9.1.1.3. Ecodevelopment Committees

It is proposed to have two Ecodevelopment Committees (EDCs) for SCR. One of these committees will be the village ecodevelopment committee and the other will be professional group ecodevelopment committee for ecotourism. For village ecodevelopment committee, from each household of Siswan there will be two members - one male and one female who are heading the family (However one house hold will have only one vote). This will constitute the general committee of the EDC. Similarly, for professional group EDC, all the ecotourism guides and other persons involved in running of ecotourism programs will be the members of this general committee of EDC. Each EDC will have an executive committee with the following structure:

| | |
|---|---|
| Chairman EDC | 1 elected member from General Committee |
| Members | 6 members elected from General committee (At least three members from among SCs, STs and OBCs and overall 30% as women members) |
| Member | 1 representative from local NGOs/NGI |
| Member Secretary | 1 Local Forester/ Forest Guard |

Village EDC will also facilitate the establishment of Self-Help Groups and Nature Clubs among the communities and their functioning.

#### 9.1.1.3. Siswan Shivalik Conservation Trust (SSCT)

The immediate objective of this management plan is to develop Siswan Community Reserve as a model of integrated conservation and development of this area. However, the long-term sustainability of this area is contingent upon the conservation of adjoining areas. Therefore, lessons from Siswan need to be used to extend these initiatives to the adjoining landscape of Shivaliks. The purpose of expanding the program to the adjoining landscape is to gradually facilitate the ecological integrity of these areas, which have very critical values in terms of ecosystem services, biodiversity and socio-economics. To facilitate and anchor this program, we propose the establishment of a trust named as Siswan Shivalik Conservation Trust (SSCT). Department should take steps during the plan period to establish this trust.

The major objectives of this trust will be:

1. To provide a conducive platform for networking with different stakeholders like government departments, NGOs, research institutions, private entities and local communities to integrate conservation and development initiatives in the area.
2. To generate financial and human resources for conservation related activities of the landscape adjoining to Siswan.
3. To create awareness about ecological significance of the area and its conservation.
4. To support the ecodevelopment programs for the villages associated with this landscape.
5. To support research, monitoring, training and capacity building programs of the area.

National Tiger Conservation Authority has already given guidelines for constitution of Tiger conservation foundations in each Tiger Reserve. These guidelines can provide the framework and principles for constitution of SSCT.

As far as the composition of this trust is concerned, it should provide representation to the management of SCRMC, representatives of various panchayats in the landscape, local communities (EDCs), forest department officials, district development authorities and

other stakeholders at the governing body and executive committee level. At governing body level, District Collector could be the chairman of SSCT and the DFO (Wildlife), Ropar could be the member secretary. At executive committee level, one of the panchayat presidents of the landscape could be the president and the Forest Range Officer (Wildlife), SAS Nagar, Mohali could be the member secretary.

SSCT will have its own financial resources for its functioning. There could be different sources of income for this Trust. These could be funding support from the government, income from research, training and conservation awareness program, donations from different sources and part of revenue for the proposed future tourism programs. Necessary government order for such a Trust and appropriate decisions of Management Committee of Siswan for revenue generation and sharing will have to be pursued by the Forest Department. Necessary rules for the functioning of the Trust as well as the management of the finances will have to be framed by the Department.

**Figure 9.1 Structure and Organization for Management of SCR**

### 9.1.2. Administrative Structure

#### 9.1.2.1. Role of Departmental Staff

As already explained, the staff in field will be responsible for facilitating the functioning of EDCs. They will also be helping the communities and SCRMC in the management of SCR. Range Officer as a Member Secretary of Management Committee will have the role of facilitating the management of SCR. DFO (Wildlife) will be the Chief Executive of SCR for guiding the Management Committee. He will also be the representative of CWLW in the field for overseeing the functioning of SCR. CWLW is the final authority for approvals of APOs and other supporting administrative arrangements. Representatives of the department have to work with the mind set of empowering the communities. Gradually SCR should be managed by communities themselves and role of department will be supportive and guidance.

#### 9.1.2.2. Infrastructure Development

Vehicles as provided in the theme plan of Protection need to be procured immediately. Similarly, other infrastructure development for protection and ecotourism also has to taken up on a priority basis.

#### 9.1.2.3. Staff Amenities

**Housing**: House for staff is a must at the site. For initiating the programme staff has to stay in SCR area. A guard station cum residential quarter must be constructed urgently before the entrance of SCR.

**Staff Welfare**: Welfare activities for the staff in terms of medical support, incentives and rewards should be decided at the level of management committee and the department.

# *Chapter 10*

# Budget

*Anil Kumar Bhardwaj, Bivash Pandav and B.S. Adhikari*

## 10.1. The Plan Budget

The plan budget under broad categories of activities is provided as follows:

**Table 10.1 Budget for Management of Siswan Community Reserve**

| S. No. | Major Activity | Year-wise financial outlay (Rs. In Lakhs) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1st year | 2nd year | 3rd year | 4th year | 5th year | Total |
| 1 | Habitat/Watershed Conservation and Species Augmentation | 40.00 | 50.00 | 35.00 | 30.00 | 30.00 | **185.00** |
| 2 | Production, Resource Use and Extended Landscape Management | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | **100.00** |
| 2 | Protection | 30.00 | 40.00 | 10.00 | 10.00 | 10.00 | **100.00** |
| 3. | Community Empowerment and Ecodevelopment | 38.00 | 46.00 | 30.00 | 19.50 | 14.50 | **148.00** |
| 4. | Ecotourism, Interpretation and Nature Education | 202.00 | 122.00 | 84.00 | 78.00 | 28.00 | **514.00** |
| 5. | Research monitoring and Training | 23.00 | 16.00 | 12.00 | 12.00 | 12.00 | **75.00** |
| | **Total** | **353.00** | **294.00** | **191.00** | **169.50** | **114.50** | **1122.00** |

## 10.2 Sources of Funding

The management committee of SCR will have to strive for different sources of money. The role of the department will be to help the management committee in exploring all possible sources of funding from different agencies. Ultimately, the management committee should try to become self-sufficient. Different possible sources of funds could be as follows:

**Forest Department**

The regular budget of the division could provide funds both under state share and support from Government of India coming for protected areas.

**SCR Management Committee**

Management Committee will be able to generate some resources through ecotourism and conservation education programme.

**District Development Authorities**

Different agencies involved in the development programmes could provide support in terms of funds or expertise or activities.

**Other Government Departments**

We expect this area will become an attraction for eco-tourists and therefore there are enough possibilities of financial support from Tourism Department. Additionally, contributions from the Irrigation Department and Fisheries Department will form an important source of revenue for the development of SCR.

**Non- Governmental Organizations (NGOs)**

The NGOs could also be contacted for providing support in terms of expertise, resources or activities.

**Donors**

There are many individual and corporate donors, who will be coming forward to support such initiatives. Along Shivalik, there are some important private education institutions and industrial hubs. They could be prominent donors for this initiative.

**Panchayats**

Local panchayat could also contribute in terms of part funding.

**Punjab Shivalik Conservation Trust (SSCT)**

This proposed trust will be one important source of financial support in the time to come.

# *Chapter 11*

# Schedule of Operations and Other Regulations

*Anil Kumar Bhardwaj, Bivash Pandav and B.S. Adhikari*

## 11.1. The Schedule

The annual plan of operation (APO) shall be prepared by a Planning Sub Committee (PSC) on the basis of various prescriptions of Management Plan and inputs provided by the EDCs. This APO will be presented to Management Planning Committee of SCR. It will be deliberated in a meeting of Management Committee in which DFO will also be a special invitee. Management Committee will pass the APO after deliberations and then it will be sent to Chief Wildlife Warden (CWLW) through DFO (WL) for final approval. CWLW will approve the APO in consultation with concerned DFO (WL). After Chief Wildlife Warden's approval, various works will be implemented as per the schedule. DFO and his team will help and guide the Management Committee to implement the APO, help in getting necessary funds from department and other agencies. He or She will also communicate to CWLW periodic progress of implementation of the APO.

## 11.2. The Record of Employment Potential

It is very important to know as to how much man-day has been generated in a financial year through different works. Record of the same would be maintained by the Management Committee and these could be inspected by DFO periodically.

**Table 11.1 Performa for Employment Generation**

| S.No. | Name of the Village/ EDC | Month | Nature of work and locations | No. of man days generated | Approximate Expenditure | Remarks if any |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | | | |

Date: Signatures Chairman, Management Committee:

## 11.3. Maintenance of Community Reserve History and Other Records

It is one of the very important documents, which have to be maintained properly. It is important in many ways to record the observations and will be helpful at the time of monitoring of several activities.

### 11.3.1. Community Reserve Note Book

All kinds of annual activities like census report, periodic bird and animal sightings, bird counts, observations on habitat condition, fire damage, regeneration status, information on floods and droughts, phonological observations, wildlife health surveillance records, etc. need to be maintained in the note book. Note Book will be prepared by Management Committee with the help of Range Officer. This will be verified by the DFO and Chairman of management committee at least once in a month. This will also be inspected by senior officers whenever they visit the area. All the inspecting officers should provide their suggestions and records.

### 11.3.2. Plantation Journal

The sustainable resource zone of the reserve will have considerable amount of planting activities. Whenever such activities take place these will be properly documented in the standard prescribed forest department's format as per the extant orders of the state. Management Committee will prepare this record with the support of Range Officer and it will be subjected to periodic inspections of DFO (WL) and other senior officers as provided for Community Reserve Note-Book

### 11.3.3. Fire and Disease incidence Record

There is always a possibility of fire and sometimes diseases. Therefore, a proper record must be kept of all such incidences. The entries of incidences of fire or disease should be made in appropriate registers which could be subject to periodic inspections.

### 11.3.4. Boundary Register

A Boundary Register should be initiated for SCR. Periodic verifications can be carried out by Management Committee and recorded. This register should also be maintained by

Management Committee and subjected to inspections by senior officers as provided for Community Reserve Note-Book.

### 11.3.5. Other Records

Management Committee will also maintain following records:

a. Revenue and expenditure.

b. Records related to monitoring.

c. Copies of research reports.

d. Records of visitor and visitor feedback.

e. Records of periodic meetings of Management Committees and minutes of meeting.

f. Records of nature education programmes.

g. Any other records prescribed by Government from time to time or decided by Management Committee

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## Notification for Siswan Community Reserve

ਪੰਜਾਬ ਸਰਕਾਰ
ਵਣ ਅਤੇ ਜੰਗਲੀ ਜੀਵ ਸੁਰੱਖਿਆ ਵਿਭਾਗ, ਪੰਜਾਬ
ਦਫ਼ਤਰ ਪ੍ਰਧਾਨ ਮੁੱਖ ਵਣ ਪਾਲ,
ਵਣ ਭਵਨ, ਸੈਕਟਰ-68, ਸਾਹਿਬਜ਼ਾਦਾ ਅਜੀਤ ਸਿੰਘ ਨਗਰ (ਮੋਹਾਲੀ)
(ਵਣ-2 ਸ਼ਾਖਾ)

ਸੇਵਾ ਵਿਖੇ

1. ਪ੍ਰਧਾਨ ਮੁੱਖ ਵਣ ਪਾਲ (ਜੰਗਲੀ ਜੀਵ) ਪੰਜਾਬ।
2. ਸਮੂਹ ਵਣ ਪਾਲ।
3. ਸਮੂਹ ਵਣ ਮੰਡਲ ਅਫਸਰ।

ਮੀਮੋ ਨੰ: ਵਣ-2/ਨੋਟੀਫਿਕੇਸ਼ਨ/_____
ਮਿਤੀ _____

ਵਿਸ਼ਾ: ਪਿੰਡ ਸਿਸਵਾਂ (ਹੱਦਬਸਤ ਨੰ: 338) ਦੇ ਪੰਚਾਇਤੀ ਰਕਬੇ ਨੂੰ ਸਿਸਵਾਂ ਕਮਿਊਨਿਟੀ ਰਿਜਰਵ ਘੋਸ਼ਿਤ ਕਰਨ ਬਾਰੇ।

* * * * * * * *

ਉਪਰੋਕਤ ਵਿਸ਼ੇ ਸਬੰਧੀ ਆਪ ਨੂੰ ਪੰਜਾਬ ਸਰਕਾਰ ਵੱਲੋਂ ਜਾਰੀ ਕੀਤੇ ਨੋਟੀਫਿਕੇਸ਼ਨ ਨੰ: 34/12/2●17-Ft-5/1●52786/1 ਮਿਤੀ 29.●8.2●17 ਦੀ ਕਾਪੀ ਸੂਚਨਾ ਅਤੇ ਅਗਲੀ ਲੋੜੀਂਦੀ ਕਾਰਵਾਈ ਲਈ ਭੇਜੀ ਜਾਂਦੀ ਹੈ। ਇਸ ਸਬੰਧੀ ਸਮੂਹ ਵਣ ਮੰਡਲ ਅਫਸਰਾਂ ਨੂੰ ਹਦਾਇਤ ਕੀਤੀ ਜਾਂਦੀ ਹੈ ਕਿ ਇਹ ਨੋਟੀਫਿਕੇਸ਼ਨ ਜਿਲ੍ਹਾ ਪ੍ਰਸ਼ਾਸਨ ਨੂੰ ਆਪਣੇ ਪੱਧਰ ਤੇ ਮੁਹੱਈਆ ਕਰਵਾਈ ਜਾਵੇ।

ਸਹਿਪੱਤਰ/ਉਪਰੋਕਤਵਾਂਗ

ਜਿਤੇਂਦਰਾ ਸ਼ਰਮਾ, ਆਈ.ਐਫ.ਐਸ
ਪ੍ਰਧਾਨ ਮੁੱਖ ਵਣ ਪਾਲ **(HoFF)**, ਪੰਜਾਬ।

ਪਿਠ ਅੰਕਣ ਨੰ: ਵਣ-2/ਨੋਟੀਫਿਕੇਸ਼ਨ/ 14172 ਮਿਤੀ 08-09-2017

ਪੱਤਰ ਦੀ ਇਕ ਨਕਲ (ਸਮੇਤ ਸਹਿਪੱਤਰ) ਸਿਸਟਮ ਮੈਨੇਜਰ ਦਫ਼ਤਰ ਪ੍ਰਧਾਨ ਮੁੱਖ ਵਣ ਪਾਲ (HoFF), ਪੰਜਾਬ ਨੂੰ ਭੇਜ ਕੇ ਹਦਾਇਤ ਕੀਤੀ ਜਾਂਦੀ ਹੈ ਕਿ ਇਹ ਨੋਟੀਫਿਕੇਸ਼ਨ ਵਿਭਾਗ ਦੀ ਵੈੱਬਸਾਈਟ ਤੇ ਅਪਲੋਡ ਕੀਤੀ ਜਾਵੇ।

ਸਹਿਪੱਤਰ/ਉਪਰੋਕਤਵਾਂਗ

ਜਿਤੇਂਦਰਾ ਸ਼ਰਮਾ, ਆਈ.ਐਫ.ਐਸ
ਪ੍ਰਧਾਨ ਮੁੱਖ ਵਣ ਪਾਲ **(HoFF)**, ਪੰਜਾਬ।

**Government of Punjab**
**Department of Forests and Wildlife Preservation**
**(Forest Branch)**

## NOTIFICATION

No 34/12/2017-Ft-5/1052786/1 Chandigarh, dated the 29/8/2017

Whereas the Government of Punjab is of the opinion that due to its ecological, floral and faunal significance for the purpose of protecting, propagating and developing wild life and associated ecosystems, the area mentioned in the following schedule shall be declared as **Siswan Community Reserve** in district S.A.S. Nagar (Mohali), Punjab. The concerned Panchayat of village Siswan has given its consent in the form of resolution.

Now, therefore, in exercise of the powers conferred under section 36-C of the Wildlife (Protection) Act, 1972 as amended by Wildlife (Protection) Act, 2006, the Governor of Punjab is pleased to declare the area of Panchayat Land of Village Siswan, Tehsil & District S.A.S. Nagar (Mohali) totalling to 3199.448 acres as "**Siswan Community Reserve**" from the date of notification. The provisions of sub section (2) of Sector 18, Sub Section (2), (3) and (4) of section 27, Section 30,32 and clauses (b) and (c) of Section 33 of the Wildlife (Protection) Act, 1972 as amended from time to time shall also apply to the Community Reserve being notified. Detail of Area and boundaries are as under: -

**Panchayat Land area of village Siswan and Siswan Dam area In the North Village Mirzapur and Interstate boundary of Himachal Pradesh. In the East Interstate Boundary of Himachal Pradesh and Village Chhoti Bari Nangal in the South and In the West Dulwan, Pallanpur and Majra village boundary.**

**SCHEDULE**

**Detail of Khasra Nos of Village Siswan (Had Bast No. 338) Tehsil & Distt. SAS Nagar**

| S. No | Khasra No. | Area (Bigha - Biswa) | S. No. | Khasra No. | Area (Bigha - Biswa) | S. No. | Khasra No. | Area (Bigha - Biswa) |
|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 26-6 | 19 | 237 | 72-0 | 37 | 414 | 0-5 |
| 2 | 23 | 1-11 | 20 | 244 | 2-0 | 38 | 415 | 0-13 |
| 3 | 24 | 1-10 | 21 | 295 | 93-16 | 39 | 454 | 112-10 |
| 4 | 48 | 1-17 | 22 | 302 | 4-16 | 40 | 455 | 69-0 |
| 5 | 65 | 3-16 | 23 | 303 | 0-17 | 41 | 456 | 100-0 |
| 6 | 98 | 32-11 | 24 | 305 | 1-11 | 42 | 457 | 59-10 |
| 7 | 117 | 2-2 | 25 | 361 | 0-18 | 43 | 458 | 100-0 |
| 8 | 178 | 115-18 | 26 | 362 | 1-5 | 44 | 459 | 100-0 |
| 9 | 179 | 75-5 | 27 | 367 | 23-3 | 45 | 462 | 2-4 |
| 10 | 180 | 1-18 | 28 | 368 | 2-7 | 46 | 469 | 0-11 |
| 11 | 181 | 5-12 | 29 | 370 | 93-13 | 47 | 471 | 1-3 |
| 12 | 189 | 0-7 | 30 | 371 | 20-16 | 48 | 476 | 0-7 |
| 13 | 229 | 23-13 | 31 | 372 | 60-10 | 49 | 481 | 0-8 |
| 14 | 231 | 5-8 | 32 | 373 | 101-0 | 50 | 482 | 0-8 |
| 15 | 233 | 0-4 | 33 | 409 | 1-13 | 51 | 488 | 3-0 |
| 16 | 234 | 0-13 | 34 | 410 | 3-7 | 52 | 489 | 4-6 |
| 17 | 235 | 96-17 | 35 | 412 | 1-0 | 53 | 490 | 1-6 |
| 18 | 236 | 45-0 | 36 | 413 | 0-9 | 54 | 491 | 5-0 |
| S. No. | Khasra No. | Area (Bigha - Biswa) | S. No. | Khasra No. | Area (Bigha - Biswa) | S. No. | Khasra No. | Area (Bigha - Biswa) |
| 55 | 492 | 35-0 | 108 | 551 | 0-8 | 161 | 829 | 1-4 |
| 56 | 493 | 34-19 | 109 | 552 | 11-4 | 162 | 831 | 2-10 |

| 57 | 498 | 19-0 | 110 | 553 | 23-19 | 163 | 832 | 3-13 |
|---|---|---|---|---|---|---|---|---|
| 58 | 499 | 16-0 | 111 | 554 | 23-19 | 164 | 834 | 0-11 |
| 59 | 500 | 35-0 | 112 | 555 | 69-0 | 165 | 836 | 4-12 |
| 60 | 501 | 35-0 | 113 | 556 | 16-0 | 166 | 837 | 0-3 |
| 61 | 502 | 14-0 | 114 | 557 | 100-0 | 167 | 838 | 1-6 |
| 62 | 503 | 21-0 | 115 | 560 | 0-14 | 168 | 841 | 1-12 |
| 63 | 504 | 35-0 | 116 | 580 | 2-13 | 169 | 843 | 0-3 |
| 64 | 505 | 32-0 | 117 | 581 | 3-0 | 170 | 865 | 21-12 |
| 65 | 506 | 2-19 | 118 | 589 | 2-2 | 171 | 874 | 0-19 |
| 66 | 507 | 34-19 | 119 | 590 | 0-14 | 172 | 883 | 10-11 |
| 67 | 508 | 35-0 | 120 | 614 | 1-12 | 173 | 885 | 93-14 |
| 68 | 509 | 35-0 | 121 | 615 | 33-0 | 174 | 886 | 100-0 |
| 69 | 510 | 11-3 | 122 | 625 | 0-11 | 175 | 887 | 100-0 |
| 70 | 511 | 24-5 | 123 | 626 | 0-5 | 176 | 888 | 100-0 |
| 71 | 512 | 35-1 | 124 | 631 | 0-7 | 177 | 889 | 105-0 |
| 72 | 513 | 35-1 | 125 | 632 | 0-11 | 178 | 890 | 102-0 |
| 73 | 516 | 35-0 | 126 | 633 | 0-3 | 179 | 891 | 135-0 |
| 74 | 517 | 11-0 | 127 | 662 | 0-6 | 180 | 892 | 100-0 |
| 75 | 518 | 36-18 | 128 | 674 | 1-8 | 181 | 893 | 67-12 |
| 76 | 519 | 24-2 | 129 | 676 | 0-11 | 182 | 894 | 132-0 |
| 77 | 520 | 23-17 | 130 | 678 | 1-0 | 183 | 895 | 53-1 |
| 78 | 521 | 23-18 | 131 | 679 | 0-3 | 184 | 896 | 113-10 |
| 79 | 522 | 9-18 | 132 | 683 | 0-11 | 185 | 897 | 100-0 |
| 80 | 523 | 14-1 | 133 | 684 | 0-10 | 186 | 898 | 100-0 |
| 81 | 524 | 24-0 | 134 | 685 | 0-3 | 187 | 899 | 100-0 |
| 82 | 525 | 24-2 | 135 | 686 | 0-2 | 188 | 900 | 100-0 |
| 83 | 526 | 100-0 | 136 | 688 | 0-2 | 189 | 901 | 100-0 |
| 84 | 527 | 9-0 | 137 | 689 | 0-2 | 190 | 902 | 100-0 |
| 85 | 528 | 24-0 | 138 | 690 | 0-6 | 191 | 903 | 100-0 |
| 86 | 529 | 24-0 | 139 | 695 | 0-3 | 192 | 904 | 100-0 |
| 87 | 530 | 24-0 | 140 | 696 | 0-2 | 193 | 905 | 100-0 |
| 88 | 531 | 19-0 | 141 | 697 | 0-11 | 194 | 906 | 100-0 |
| 89 | 532 | 5-0 | 142 | 699 | 0-6 | 195 | 907 | 100-0 |
| 90 | 533 | 24-2 | 143 | 702 | 0-6 | 196 | 908 | 100-0 |
| 91 | 534 | 24-2 | 144 | 703 | 0-4 | 197 | 913 | 95-18 |
| 92 | 535 | 23-17 | 145 | 704 | 0-6 | 198 | 914 | 100-0 |
| 93 | 536 | 23-0 | 146 | 707 | 0-4 | 199 | 915 | 100-0 |
| 94 | 537 | 2-0 | 147 | 708 | 0-6 | 200 | 916 | 100-0 |
| 95 | 538 | 24-0 | 148 | 709 | 0-6 | 201 | 917 | 66-0 |
| 96 | 539 | 24-0 | 149 | 710 | 0-10 | 202 | 918 | 98-10 |
| 97 | 540 | 25-0 | 150 | 711 | 0-2 | 203 | 919 | 95-7 |
| 98 | 541 | 25-0 | 151 | 712 | 0-2 | 204 | 924 | 90-8 |
| 99 | 542 | 24-0 | 152 | 721 | 2-19 | 205 | 926 | 1-2 |
| 100 | 543 | 23-19 | 153 | 729 | 0-4 | 206 | 927 | 91-19 |
| 101 | 544 | 23-19 | 154 | 742 | 0-8 | 207 | 928 | 100-0 |
| 102 | 545 | 23-19 | 155 | 761 | 0-18 | 208 | 929 | 100-0 |
| 103 | 546 | 4-4 | 156 | 767 | 0-9 | 209 | 930 | 100-0 |
| 104 | 547 | 20-5 | 157 | 786 | 0-5 | 210 | 931 | 100-0 |
| 105 | 548 | 23-18 | 158 | 795 | 1-13 | 211 | 932 | 100-0 |
| 106 | 549 | 23-18 | 159 | 810 | 1-8 | 212 | 933 | 100-0 |
| 107 | 550 | 23-18 | 160 | 811 | 0-12 | 213 | 934 | 100-0 |
| **S. No.** | **Khasra No.** | **Area (Bigha - Biswa)** | **S. No.** | **Khasra No.** | **Area (Bigha - Biswa)** | **S. No.** | **Khasra No.** | **Area (Bigha - Biswa)** |
| 214 | 935 | 100-0 | 257 | 1102 | 71-14 | 300 | 1209 | 242-0 |
| 215 | 936 | 100-0 | 258 | 1102 | 7-7 | 301 | 1210 | 30-0 |
| 216 | 937 | 100-0 | 259 | 1103 | 2-18 | 302 | 1210 | 123-15 |

| 217 | 938 | 100-0 | 260 | 1103 | 86-2 | 303 | 1039min | 71-11 |
|---|---|---|---|---|---|---|---|---|
| 218 | 939 | 0-8 | 261 | 1106 | 5-0 | 304 | 1039min | 6-6 |
| 219 | 941 | 97-2 | 262 | 1106 | 18-0 | 305 | 1149min | 13-18 |
| 220 | 942 | 100-0 | 263 | 1106 | 7-0 | 306 | 1201/1 | 76-0 |
| 221 | 945 | 98-6 | 264 | 1107 | 146-10 | 307 | 176-177 | 168-4 |
| 222 | 946 | 158-10 | 265 | 1108 | 113-10 | 308 | 25min | 97-10 |
| 223 | 947 | 25-8 | 266 | 1109 | 105-10 | 309 | 25min | 50-0 |
| 224 | 948 | 91-10 | 267 | 1110 | 73-10 | 310 | 25min | 12-9 |
| 225 | 949 | 100-0 | 268 | 1111 | 46-2 | 311 | 296min | 1-10 |
| 226 | 950 | 52-0 | 269 | 1111 | 4-8 | 312 | 296min | 50-0 |
| 227 | 951 | 88-19 | 270 | 1112 | 106-16 | 313 | 296min | 48-10 |
| 228 | 952 | 60-10 | 271 | 1112 | 7-14 | 314 | 392/70 | 4-2 |
| 229 | 953 | 100-0 | 272 | 1116 | 71-17 | 315 | 392/71 | 71-0 |
| 230 | 954 | 100-0 | 273 | 1124 | 28-7 | 316 | 392/71 | 8-0 |
| 231 | 955 | 100-0 | 274 | 1128 | 39-6 | 317 | 392/71 | 12-0 |
| 232 | 956 | 98-0 | 275 | 1130 | 2-3 | 318 | 392/71 | 20-0 |
| 233 | 957 | 141-0 | 276 | 1132 | 82-8 | 319 | 452/1 | 2-10 |
| 234 | 958 | 100-0 | 277 | 1132 | 7-7 | 320 | 453min | 442-0 |
| 235 | 959 | 98-13 | 278 | 1140 | 109-1 | 321 | 453min | 1-0 |
| 236 | 965 | 96-17 | 279 | 1141 | 92-0 | 322 | 453min | 15-0 |
| 237 | 966 | 100-0 | 280 | 1142 | 50-0 | 323 | 453min | 10-0 |
| 238 | 970 | 84-0 | 281 | 1144 | 55-7 | 324 | 453min | 10-0 |
| 239 | 971 | 100-0 | 282 | 1149 | 1-16 | 325 | 453min | 8-0 |
| 240 | 972 | 125-10 | 283 | 1169 | 87-4 | 326 | 460min | 50-0 |
| 241 | 973 | 71-10 | 284 | 1169 | 0-16 | 327 | 460min | 20-0 |
| 242 | 984 | 100-0 | 285 | 1178 | 0-17 | 328 | 460min | 30-0 |
| 243 | 991 | 88-0 | 286 | 1179 | 0-9 | 329 | 497/2 | 11-0 |
| 244 | 993 | 92-18 | 287 | 1180 | 170-13 | 330 | 591/1 | 4-0 |
| 245 | 994 | 100-0 | 288 | 1183 | 1-11 | 331 | 591/1 | 6-9 |
| 246 | 995 | 100-0 | 289 | 1193 | 95-15 | 332 | 591/1 | 4-0 |
| 247 | 998 | 82-0 | 290 | 1199 | 23-9 | 333 | 591min | 12-0 |
| 248 | 1009 | 105-1 | 291 | 1199 | 7-14 | 334 | 628/22 | 0-5 |
| 249 | 1010 | 149-8 | 292 | 1200 | 4-0 | 335 | 628/23/1 | 40-5 |
| 250 | 1012 | 132-16 | 293 | 1203 | 148-15 | 336 | 716/14 | 4-0 |
| 251 | 1013 | 100-0 | 294 | 1203 | 7-7 | 337 | 826min | 31-1 |
| 252 | 1017 | 59-17 | 295 | 1204 | 99-6 | 338 | 826min | 9-12 |
| 253 | 1057 | 0-8 | 296 | 1205 | 96-16 | 339 | 857/1 | 171-4 |
| 254 | 1072 | 1-17 | 297 | 1206 | 112-6 | 340 | 974/1 | 36-0 |
| 255 | 1101 | 64-18 | 298 | 1207 | 106-0 | 341 | 99/1 | 0-16 |
| 256 | 1101 | 7-14 | 299 | 1208 | 154-0 | 342 | 99/2 | 7-9 |

**Himmat Singh**
Special Chief Secretary, Government of Punjab
Department of Forests and Wildlife Preservation.

Endst. No.34/12/2017-Ft-5/10527 86/2-8 Chandigarh, dated the 29/8/2017

A copy is forwarded to the following for information and further necessary action: -

1. Principal Chief Conservator of Forests (HoFF), Punjab.
2. Principal Chief Conservator of Forests (HAG+) and Chief Wildlife Warden, Punjab.
3. All Chief Conservator of Forests/Conservator of Forests, Punjab.
4. Divisional Forests Officer (Territorial and Wildlife), Ropar.
5. Deputy Commissioner, Ropar.

6. Senior Superintendent of Police, Ropar.
7. A copy with a spare copy of the notification is forwarded to the Controller, Printing & Stationery, Punjab for publication the same in Government gazette **(through Nodal Officer, o/o Principal Chief Conservator of Forests, Punjab, Mohali.)**

Additional Secretary, Government of Punjab
Department of Forests and Wildlife Preservation.

**Annexure IIa**

**Information About Siswan Irrigation Project**

| S. No. | Year | Area of water supplied | Amount of area irrigated (Hector) | Name of villages under irrigation | Water stored in the Siswan Dam (Cubic Meter) |
|---|---|---|---|---|---|
| **1** | 2004 | 38.5 | 308.5 | Siswan | 384.500 |
| **2** | 2005 | 271 | 309 | Sultanpur | |
| **3** | 2006 | 513 | 209.03 | Majra | |
| **4** | 2007 | 591 | 178.51 | Hoshiyarpur | |
| **5** | 2008 | 327 | 101.25 | Kartarpur | |
| **6** | 2009 | 669 | 150.95 | Kansala | |
| **7** | 2010 | 561 | 150.71 | Takipur | |
| **8** | 2011 | 778 | 164.40 | | |
| **9** | 2012 | 510 | 98.91 | | |
| **10** | 2013 | 532 | 96.18 | | |
| **11** | 2014 | 419 | 97.35 | | |
| **12** | 2015 | 289 | 72.35 | | |
| **13** | 2016 | 378 | 111.94 | | |
| **14** | 2017 | 268 | 103.60 | | |
| **15** | 2018 | 254 | 107.69 | | |
| **16** | 2019 | 371 | 44.53 | | |

**Annexure IIb**

**List of plant species observed in Siswan Community Reserve**

| S. No. | Botanical Name | Family | Habit |
|---|---|---|---|
| **1** | *Abrus precatorius* L. | Fabaceae | C |
| **2** | *Abutilon indicum* (L.) Sweet | Malvaceae | H |
| **3** | *Acacia catechu* (L.f.) Willd. | Fabaceae | T |
| **4** | *Acacia modesta* Wall. | Fabaceae | T |
| **5** | *Acacia nilotica* ssp. *indica* (Benth.) A.F.Hill | Fabaceae | T |
| **6** | *Achyranthes aspera* L. | Amaranthaceae | H |
| **7** | *Adhatoda vasica* Nees | Acanthaceae | S |
| **8** | *Aegle marmelos* (L.) Corrêa | Rutaceae | T |
| **9** | *Agave americana* L. | Agavaceae | H |
| **10** | *Ageratum conyzoides* (L.) L. | Asteraceae | H |
| **11** | *Ajuga integrifolia* Buch.-Ham. | Lamiaceae | H |
| **12** | *Albizia lebbeck* (L.) Benth. | Fabaceae | T |
| **13** | *Alternanthera philoxeroides* (Mart.) Griseb. | Amaranthaceae | H |
| **14** | *Alternanthera sessilis* (L.) R.Br. ex DC. | Amaranthaceae | H |
| **15** | *Alysicarpus vaginalis* (L.) DC. | Fabaceae | H |
| **16** | *Amaranthus spinosus* L. | Amaranthaceae | H |
| **17** | *Amaranthus viridis*L. | Amaranthaceae | H |
| **18** | *Anagallis arvensis* L. | Primulaceae | H |
| **19** | *Anisomeles indica* (L.) Kuntze | Lamiaceae | H |
| **20** | *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guillem. & Perr. | Combretaceae | T |
| **21** | *Argemone mexicana* L. | Papaveraceae | H |
| **22** | *Arundo donax* L. | Poaceae | G |
| **23** | *Asparagus adscendens* Roxb. | Liliaceae | S |
| **24** | *Azadirachta indica* A.Juss. | Meliaceae | T |
| **25** | *Barleria cristata* L. | Acanthaceae | H |
| **26** | *Bauhinia variegata* L. | Fabaceae | T |
| **27** | *Bidens pilosa* L. | Asteraceae | H |
| **28** | *Blumea lacinata* (Wall. ex Roxb.) DC. | Asteraceae | H |
| **29** | *Boerhavia diffusa* L. | Nyctaginaceae | H |
| **30** | *Bombax ceiba* L. | Bombacaceae | T |
| **31** | *Brassica campestris* L. | Brassicaceae | H |
| **32** | *Butea monosperma* (Lam.) Taub. | Fabaceae | T |

| S. No. | Botanical Name | Family | Habit |
|---|---|---|---|
| **33** | *Caesalpinia decapetala* (Roth) Alston | Fabaceae | C |
| **34** | *Calotropis procera* (Aiton) Dryand. | Asclepiadaceae | H |
| **35** | *Cannabis sativa* L. | Cannabaceae | H |
| **36** | *Capparis decidua* (Forssk.) Edgew. | Capparaceae | S |
| **37** | *Capparis zeylanica* L. | Capparaceae | S |
| **38** | *Cardamine impatiens* L. | Brassicaceae | H |
| **39** | *Carex sp.* | Cyperaceae | Sd |
| **40** | *Carissa spinarum L.* | Apocynaceae | S |
| **41** | *Cassia fistula* L. | Fabaceae | T |
| **42** | *Cassia occidentalis* L. | Fabaceae | H |
| **43** | *Cassia tora* L. | Fabaceae | H |
| **44** | *Celastrus paniculatus* Willd. | Celastraceae | C |
| **45** | *Chenopodium album* L. | Chenopodiaceae | H |
| **46** | *Chenopodium ambrosioides* L. | Chenopodiaceae | H |
| **47** | *Chrysopogon aciculatus* (Retz.) Trin. | Poaceae | G |
| **48** | *Chrysopogon fulvus* (Spreng.) Chiov. | Poaceae | G |
| **49** | *Cissampelos pareira* L. | Menispermaceae | C |
| **50** | *Colebrookia oppositifolia* Sm. | Lamiaceae | S |
| **51** | *Commelina benghalensis* L. | Commelinaceae | H |
| **52** | *Convolvulus arvensis* L. | Convolvulaceae | H |
| **53** | *Cordia dichotoma* G.Forst. | Boraginaceae | T |
| **54** | *Croton bonplandianus* Baill. | Euphorbiaceae | H |
| **55** | *Cryptolepis dubia* (Burm.f.) M.R.Almeida | Asclepiadaceae | C |
| **56** | *Cuscuta reflexa* Roxb. | Cuscutaceae | C |
| **57** | *Cynodon dactylon* (L.) Pers. | Poaceae | G |
| **58** | *Cyperus compressus* L. | Cyperaceae | Sd |
| **59** | *Cyperus rotundus* L. | Cyperaceae | Sd |
| **60** | *Dalbergia sissoo* DC. | Fabaceae | T |
| **61** | *Datura metel* L. | Solanaceae | H |
| **62** | *Dendrocalamus strictus* (Roxb.) Nees | Poaceae | G |
| **63** | *Desmodium microphyllum* (Thunb.) DC. | Fabaceae | H |
| **64** | *Desmodium oojeinense* (Roxb.) H.Ohashi. | Fabaceae | T |
| **65** | *Desmodium triflorum* (L.) DC. | Fabaceae | H |
| **66** | *Dicliptera roxburghiana* Nees | Acanthaceae | H |
| **67** | *Digitaria abludens* (Roem. & Schult.) Veldkamp | Poaceae | G |
| **68** | *Dioscorea bulbifera* L. | Dioscoreaceae | C |
| **69** | *Diospyros cordifolia* Roxb. | Ebenaceae | T |

| S. No. | Botanical Name | Family | Habit |
|---|---|---|---|
| **70** | *Dodonea angustifolia* L.f. | Sapinaceae | S |
| **71** | *Ehretia laevis* Roxb. | Ehretiaceae | T |
| **72** | *Eleusine indica* (L.) Gaertn. | Poaceae | G |
| **73** | *Eragrostis amabilis* (L.) Wight & Arn. | Poaceae | G |
| **74** | *Erythrina suberosa* Roxb. | Fabaceae | T |
| **75** | *Euohorbia hirta* L. | Euphorbiaceae | H |
| **76** | *Euphorbia royleana* Boiss. | Euphorbiaceae | S |
| **77** | *Ficus racemosa* L. | Moraceae | T |
| **78** | *Ficus religiosa* L. | Moraceae | T |
| **79** | *Flacourtia indica* (Burm.f.) Merr. | Flacourtiaceae | S |
| **80** | *Fumaria indica* (Hausskn.) Pugsley | Fumariaceae | H |
| **81** | *Gnaphalium pensylvanicum* (Willd.) Cabrera | Asteraceae | H |
| **82** | *Grewia serrulata* DC. | Tiliaceae | T |
| **83** | *Ichnocarpus frutescens* (L.) W.T.Aiton | Apocynaceae | C |
| **84** | *Imperata cylindrica* (L.) Raeusch. | Poaceae | G |
| **85** | *Indigofera heterantha* Brandis | Fabaceae | S |
| **86** | *Iopomea pes-tigridis* L. | Convolvulaceae | C |
| **87** | *Ipomoea carnea* Jacq. | Convolvulaceae | S |
| **88** | *Ipomoea quamoclit* L. | Convolvulaceae | C |
| **89** | *Justicia procumbens* L. | Acanthaceae | H |
| **90** | *Lannea coromandelica* (Houtt.) Merr. | Anacardiaceae | T |
| **91** | *Lantana camara* L. | Verbenaceae | S |
| **92** | *Lathyrus aphaca* L. | Fabaceae | H |
| **93** | *Lespedeza juncea* (L.f.) Pers. | Fabaceae | H |
| **94** | *Leucaena leucocephala* (Lam.) de Wit | Fabaceae | T |
| **95** | *Leucas aspera* (Willd.) Link | Lamiaceae | H |
| **96** | *Leucas cephalotes* (Roth) Spreng. | Lamiaceae | H |
| **97** | *Majus pumilus* (Burm. f.) Steenis | Scrophulariaceae | H |
| **98** | *Malva parviflora* L. | Malvaceae | H |
| **99** | *Malvastrum coromandelianum* (L.) Garcke | Malvaceae | H |
| **100** | *Medicago polymorpha* L. | Fabaceae | H |
| **101** | *Melia azedarach* L. | Meliaceae | T |
| **102** | *Melilotus alba* Ledeb. | Fabaceae | H |
| **103** | *Millettia extensa* (Benth.) Baker | Fabaceae | T |
| **104** | *Mimosa pudica* L. | Fabaceae | H |
| **105** | *Moringa oliefera* Lam. | Moringaceae | T |
| **106** | *Morus alba* Bur. | Moraceae | T |

| S. No. | Botanical Name | Family | Habit |
|---|---|---|---|
| **107** | *Mucuna pruriens* (L.) DC. | Fabaceae | C |
| **108** | *Murraya koenigii* (Linn.) Spreng. | Rutaceae | S |
| **109** | *Neyraudia arundinacea* (L.) Henrard | Poaceae | G |
| **110** | *Nicotiana plumbaginifolia* Viv | Solanaceae | H |
| **111** | *Nyctanthus arbor-tristis* L. | Oleaceae | T |
| **112** | *Oxalis corniculata* L. | Oxalidaceae | H |
| **113** | *Parthenium hysterophorus* L. | Asteraceae | H |
| **114** | *Paspalum distichum* L. | Poaceae | G |
| **115** | *Persicaria barbata* (L.) H.Hara | Polygonaceae | H |
| **116** | *Persicaria hydropiper* (L.) Delarbre | Polygonaceae | H |
| **117** | *Phoenix sylvestris* (L.) Roxb. | Arecaceae | T |
| **118** | *Phyllanthus amarus* Schumach. & Thonn. | Euphorbiaceae | H |
| **119** | *Phyllanthus emblica* L. | Euphorbiaceae | T |
| **120** | *Phyllanthus urinaria* L. | Euphorbiaceae | H |
| **121** | *Plantago lanceolata* L. | Plantaginaceae | H |
| **122** | *Plumbago zeylanica* L. | Plumbaginaceae | S |
| **123** | *Poa annua* L. | Poaceae | G |
| **124** | *Portulaca pilosa* L. | Portulaceae | H |
| **125** | *Prosopis juliflora* (Sw.) DC. | Fabaceae | T |
| **126** | *Pueraria tuberosa* (Willd.) DC. | Fabaceae | C |
| **127** | *Ricinus communis* L. | Euphorbiaceae | S |
| **128** | *Rungia pectinata* (L.) Nees | Acanthaceae | H |
| **129** | *Saccharum bengalense* Retz. | Poaceae | G |
| **130** | *Saccharum spontaneum* L. | Poaceae | G |
| **131** | *Setaria pumila* (Poir.) Roem. & Schult. | Poaceae | G |
| **132** | *Sida acuta* Burm.f. | Malvaceae | H |
| **133** | *Sida cordata* (Burm.f.) Borss.Waalk. | Malvaceae | H |
| **134** | *Sida cordifolia* L. | Malvaceae | H |
| **135** | *Sida rhombifolia* | Malvaceae | H |
| **136** | *Solanum nigrum* L. | Solanaceae | H |
| **137** | *Solanum viarum* Dunal | Solanaceae | H |
| **138** | *Sonchus asper* (L.) Hill | Asteraceae | H |
| **139** | *Sporobolus diandrus* (Retz.) P.Beauv. | Poaceae | G |
| **140** | *Stellaria media* (L.) Vill. | Caryophyllaceae | H |
| **141** | *Syzygium cumini* (L.) Skeels | Myrtaceae | T |
| **142** | *Tectona grandis* L.f. | Verbenaceae | T |
| **143** | *Tinospora cordifolia* (Willd.) Hook. f. and Thoms. | Menispermaceae | C |

| S. No. | Botanical Name | Family | Habit |
|---|---|---|---|
| **144** | *Toona ciliata* M. Roem. | Meliaceae | T |
| **145** | *Trichodesma indicum* (L.) R. Br. | Boraginaceae | H |
| **146** | *Tridax procumbens* L. | Asteraceae | H |
| **147** | *Triumfetta rhomboidea* Jacq. | Tiliaceae | H |
| **148** | *Typha angustata* Bory & Chaub. | Typhaceae | H |
| **149** | *Urena lobata* L. | Malvaceae | H |
| **150** | *Vallaris solanacea* (Roth) Kuntze | Apocynaceae | C |
| **151** | *Veronica wyomingensis* (A.Nelson) M.M.Mart.Ort. & Albach | Asteraceae | H |
| **152** | *Vicia sativa* L. | Fabaceae | H |
| **153** | *Vitex negundo* L. | Verbenaceae | S |
| **154** | *Xanthium indicum* J. Koenig | Asteraceae | H |
| **155** | *Youngia japonica* (L.) DC.) | Asteraceae | H |
| **156** | *Ziziphus jujuba* Mill. | Rhamnaceae | T |
| **157** | *Ziziphus mauritiana* Lam. | Rhamnaceae | T |
| **158** | *Ziziphus nummularia* (Burm. f.) Wight & Arn. | Rhamnaceae | S |
| **159** | *Ziziphus oenoplia* (L.) Mill. | Rhamnaceae | S |
| **160** | *Ziziphus xylopyrus* (Retz.) Willd. | Rhamnaceae | S |

**Annexure IIc**

**List of bird species observed in Siswan Community Reserve, Punjab**

| S.No. | Bird name | Status | S.No. | Bird name | Status |
|---|---|---|---|---|---|
| 1 | Little Grebe | R | 59 | Plum.headed Parakeet | R |
| 2 | Great Cormorant | R | 60 | Rose.ringed Parakeet | R |
| 3 | Little Cormorant | R | 61 | Alexandrine Parakeet | R |
| 4 | Cattle Egret | R | 62 | Greater Coucal | R |
| 5 | Little Egret | R | 63 | Indian Scops Owl | R |
| 6 | Great Egret | R | 64 | Large.tailed Nightjar | R |
| 7 | Grey He`ron | M | 65 | Spotted Owlet | R |
| 8 | Indian Pond Heron | R | 66 | Common Hoopoe | R |
| 9 | Painted Stork | R | 67 | White.throated Kingfisher | R |
| 10 | Ruddy Shelduck | M | 68 | Common Kingfisher | R |
| 11 | Shoveller | M | 69 | Stork.billed Kingfisher | R |
| 12 | Pintail | M | 70 | Little Green Bee.eater | R |
| 13 | Indian Spotbil Duck | R | 71 | Blue.tailed Bee.eater | M |
| 14 | Common Pochard | M | 72 | Grey Hornbill | R |
| 15 | White.eyed Pochard | M | 73 | Coppersmith Barbet | R |
| 16 | Black Kite | R | 74 | Brown.headed barbet | R |
| 17 | Accipiter spp | ? | 75 | Great Barbet | R |
| 18 | Oriental Honey.buzzard | R | 76 | Jacobine Cuckoo | M |
| 19 | White.eyed Buzzard | R | 77 | Asian Koel | R |
| 20 | Short.toed Eagle | R | 78 | Grey.bellied Cuckoo | M |
| 21 | Crested Serpent Eagle | R | 79 | Eurasian Cuckoo | M |
| 22 | Aquila app | ? | 80 | Indian cuckoo | M |
| 23 | Egyptian Vulture | R | 81 | Common hawk Cuckoo | R |
| 24 | Peregrine Falcon | R | 82 | Common Hoopoe | R |
| 25 | Barred Buttonquail | R | 83 | Yellow.fronted Pied Woodpecker | R |
| 26 | Black Francolin | R | 84 | Black.rumped Flameback | R |
| 27 | Red Junglefowl | R | 85 | White Wagtail | M |
| 28 | Peafowl | R | 86 | Grey.throated Martin | R |

| S.No. | Bird name | Status | S.No. | Bird name | Status |
|---|---|---|---|---|---|
| **29** | Common Moorhen | R | **87** | Common Woodshrike | R |
| **30** | Eurasian Coot | M | **88** | Common Iora | R |
| **31** | White.breasted Waterhen | R | **89** | Large Cuckooshrike | R |
| **32** | Black.winged Stilt | R/M | **90** | Black.headed Cuckooshrike | M |
| **33** | Red.wattled Lapwing | R | **91** | Scarlet Minivet | R |
| **34** | Little Ringed Plover | M | **92** | Red.rumped swallow | M |
| **35** | Green Sandpiper | M | **93** | Red.vented Bulbul | R |
| **36** | Brown.headed Gull | M | **94** | Himalayan Bulbul | R |
| **37** | Rock Pigeon | R | **95** | Black Bulbul | M |
| **38** | Eurasian Collared Dove | R | **96** | Red.whiskered Bulbul | R |
| **39** | Laughing Dove | R | **97** | Indian Robin | R |
| **40** | Red.collared Dove | R | **98** | Oriental Magpie Robin | R |
| **41** | Yellow footed Green Pigeon | R | **99** | Black Redstart | M |
| **42** | Pied Bushchat | R | **100** | Olivaceous Leaf warbler | M |
| **43** | Orange.headed thrush | M | **101** | Lesser White.throat | M |
| **44** | Redbreated flycatcher | M | **102** | Blue.whistlingthrush | M |
| **45** | Verditer Flycatcher | M | **103** | Oriental White.eye | R |
| **46** | Paradise Flycatcher | M | **104** | Purple Sunbird | R |
| **47** | Yellow.eyed Babbler | R | **105** | Thickbilled Flowerpecker | R |
| **48** | Tickell's Flycatcher | R | **106** | Ortolon Bunting | M |
| **49** | Black.chinned Babbler | R | **107** | White.capped bunting | M |
| **50** | Tawny.bellied Babbler | R | **108** | Chestnut.shouldered Patronia | R |
| **51** | Jungle Babbler | R | **109** | Black drongo | R |
| **52** | Jungle Prinia | R | **110** | Spangled Drongo | R |
| **53** | Grey.breasted prinia | R | **111** | Pied Myna | R |
| **54** | Graceful Prinia | R | **112** | Grey.headed Myna | R |
| **55** | Plain Prinia | R | **113** | Indian Golden Oriole | M |
| **56** | Ashy Prinia | R | **114** | Jungle Crow | R |
| **57** | Common Tailorbird | R | **115** | House Crow | R |
| **58** | Hume’s Warbler | M | **116** | Rufous Treepie | R |

**Annexure IId**

**List of Fish fauna found in Siswan Community Reserve, Punjab**

| S. No. | Species | Common name | Family | IUCN status | Trophic guild |
|---|---|---|---|---|---|
| | **Native fish species** | | | | |
| **1** | *Amblypharyngodon mola* | Mola Carplet | Danionidae | Least Concern | Planktonivroe |
| **2** | *Cabdio morar* | Morari | Danionidae | Least Concern | Planktonivroe |
| **3** | *Cirrhinus reba* | Reba Barb | Cyprinidae | Least Concern | Detritivore |
| **4** | *Channa gachua* | Dwarf Sankehead | Channidae | Least Concern | Carnivore |
| **5** | *Channa striatus* | Striped Sankehead | Channidae | Least Concern | Carnivore |
| **6** | *Devario devario* | Sind Danio | Danionidae | Least Concern | Insectivore |
| **7** | *Mastacembelus armatus* | Zig-zag eel | Mastacembelidae | Least Concern | Carnivore |
| **8** | *Mystus cavasius* | Gangetic mystus | Bagiridae | Least concern | Carnivore |
| **9** | *Mystus vittatus* | Striped Catfish | Bagiridae | Least concern | Carnivore |
| **10** | *Osteobrama cotia* | Cotia | Cyprinidae | Least Concern | |
| **11** | *Opsarius bendalisis* | Baril | Danionidae | Least Concern | Insectivore |
| **12** | *Pethia conchonius* | Rosy Barb | Cyprinidae | Least Concern | Omnivore |
| **13** | *Pethia ticto* | Ticto Barb | Cyprinidae | Least Concern | Detritivore |

| S. No. | Species | Common name | Family | IUCN status | Trophic guild |
|---|---|---|---|---|---|
| **14** | *Puntius chola* | Swamp Barb | Cyprinidae | Least Concern | Omnivore |
| **15** | *Puntius sophore* | Pool Barb | Cyprinidae | Least Concern | Detritivore |
| **16** | *Rasbora danicorius* | Slender Rasbora | Danionidae | Least Concern | Insectivore |
| **17** | *Sperata seenghala* | Giant River Catfis | Bagiridae | Least Concern | Carnivore |
| **18** | *Systomus sarana* | Olive Barb | Cyprinidae | Least Concern | Omnivore |
| **19** | *Trichogaster lalius* | Dwarf Gourami | Osphronemidae | Least Concern | Insectivore |
| **20** | *Wallago attu* | Wallago | Siluridae | Near Threatened | Carnivore |
| **21** | *Xenentodon cancila* | Freshwater Garfish | Belonidae | Least Concern | Insectivore |
| | **Culture Carps** | | | | |
| **22** | *Cirrhinus mirgala* | Mirgal | Cyprinidae | Gangetic carp | Detritivore |
| **23** | *Cyprinus carpio* | Common carp | Cyprinidae | Exotic | Omnivore |
| **24** | *Ctenopharyngodon idella* | Grass carp | Cyprinidae | Exotic | Herbivore |
| **25** | *Gibelion catla* | Catla | Cyprinidae | Gangetic carp | Planktonivore |
| **26** | *Hypophthalmichthys molitrix* | Silver Carp | Cyprinidae | Exotic | Planktonivore |
| **27** | *Hypophthalmichthys nobilis* | Bighead Carp | Cyprinidae | Exotic | Planktonivore |
| **28** | *Labeo rohita* | Rohu | Cyprinidae | Gangetic carp | Herbivore |

**Annexure IIe**

**Diversity of Entomofauna in Siswan Community Reserve, Punjab**

| S. No. | Order | Families | Species |
|---|---|---|---|
| **1** | Blattodea | Blattidae | *Periplanata amaricana* (Linnaeus, 1758) |
| **2** | | Ectobiidae | *Blatella germanica* (Linnaeus, 1767) |
| **3** | Coleoptera | Carabidae | *Calochroa bicolor* (Fabracius, 1781) |
| **4** | | | *Scarites subterraneus* (Fabricius, 1775) |
| **5** | | Cerambycidae | *Acanthophorus serraticornis* (Olivier, 1795) |
| **6** | | | *Elaphidion* sp. |
| **7** | | | *Cerambycidae* sp. |
| **8** | | | *Cetoniidae* sp. |
| **9** | | | *Spidimorpha westwoodi* (Boheman, 1854) |
| **10** | | | *Aspidimorpha westwoodi* (Boheman,1854) |
| **11** | | | *Aspidimorpha* sp.1 |
| **12** | | | *Chiridopsis bipunctata* (Linnaeus, 1767) |
| **13** | | | *Zygogramma bicolorata* (Pallister, 1953) |
| **14** | | | *Chrysomelidae* sp. |
| **15** | | | *Spidimorpha* sp. |
| **16** | | | *Agelastica* sp. |
| **17** | | Coccinellidae | *Epilachna vigintioctopunctata* (Fabricius,1775) |
| **18** | | | *Coccinella septumpunctata* (Linnaeus, 1758) |
| **19** | | | *Henosepilachna elaterii* (Rossi, 1794) |
| **20** | | | *Curculionidae* sp. |
| **21** | | Elateridae | *Athous* sp. |
| **22** | | | *Orthostethus* sp |
| **23** | | | *Elateridae* sp. |
| **24** | | Histeridae | *Carcinops pumilio* (Erichson,1834) |
| **25** | | | *Spilodiscus biplagiatus* (J. E. LeConte, 1845) |
| **26** | | | *Margarinotus brunneus* (Fabricius, 1775) |
| **27** | | Hybosoridae | *Hybosorus orientalis* (Westwood,1845) |
| **28** | | Hydrophilidae | *Hydrophilus triangularis* (Geoffroy, 1762) |
| **29** | | Meloidae | *Epicauta hirticornis* (Haag-Rutenberg, 1880) |
| **30** | | | *Epicauta conferta* (Say, 1824) |
| **31** | | | *Hycleus* sp. |
| **32** | | Rutelidae | *Anomala varicolor* (Gyllenhal, 1817) |
| **33** | | | *Anomala dimidiate* (Hope, 1839) |
| **34** | | Tenebrionidae | *Tenebrio molitor* (Linnaeus, 1758) |
| **35** | | | *Aphodius moestus* (Fabricius, 1775) |
| **36** | | Scarabaeidae | *Aphodius* sp.1 |
| **37** | | | *Aphodius* sp.2 |

| | | | |
|---|---|---|---|
| **38** | | | *Catharsius capucinus* (Fabracius, 1781) |
| **39** | | | *Catharsius molossus* (Linnaeus, 1758) |
| **40** | | | *Copris surdus* (Arrow, 1931) |
| **41** | | | *Euoniticellus pallipes* (Fabricius,1781) |
| **42** | | | *Digitonthophagus bonasus* (Fabricius,1775) |
| **43** | | | *Oniticellus cinctus* (Fabricius, 1775) |
| **44** | | | *Onitis philemon* (Fabricius,1801) |
| **45** | | | *Gymnopleurus cyaneus* (Fabricius,1798) |
| **46** | | | *Onthophagus dama* (Fabricius, 1798) |
| **47** | | | *Onthophagus mopsus* (Fabricius,1792) |
| **48** | | | *Onthophagus hindu* (Arrow, 1931) |
| **49** | | | *Onthophagus pactolus* (Fabricius, 1787) |
| **50** | | | *Onthophagus ramocellus* (Bates,1891) |
| **51** | | | *Onthophagus* sp. |
| **52** | | | *Sisyphus longipes* (Olivier,1789) |
| **53** | | | *Tiniocellus spinipes* (Roth, 1851) |
| **54** | | | *Garreta degeani* (Castelnau,1840) |
| **55** | | | *Scarabaeidae* sp. |
| **56** | | | *Protaetia alboguttata* (Vigors, 1826) |
| **57** | | | *Alphitobius* sp. |
| **58** | | | *Eleodes* sp. |
| **59** | Dermaptera | Forficulidae | *Doru* sp. |
| **60** | Diptera | Calliphoridae | *Lucilia sericata* (Meigen, 1826) |
| **61** | | Muscidae | *Musca domestica* Linnaeus, 1758 |
| **62** | Hemiptera | Belostomatidae | *Belostomatidae* sp. |
| **63** | | Pseudococcidae | *Sternorrhyncha* sp. |
| **64** | | | *Pyrrhocoris* sp. |
| **65** | | Reduviidae | *Acanthaspis* sp. |
| **66** | Hymenoptera | Apidae | *Apis mellifera* (Linnaeus,1758) |
| **67** | | | *Bombus* sp. |
| **68** | | | *Xylocopa latipes* (Drury, 1773) |
| **69** | | | *Xylocopa* sp. |
| **70** | | Megachilidae | *Megachile* sp. |
| **71** | | Vespidae | *Polistes* sp. |
| **72** | | | *Ropalidia variegata* (Smith, 1852) |
| **73** | Lepidoptera | Hesperiidae | *Pelopidas* sp. |
| **74** | | | *Pseudocoladenia dan* (Fabricius, 1787) |
| **75** | | Lycaenidae | *Tarucus nara* (Kollar 1848) |
| **76** | | | *Cheritra freja* (Fabricius, 1793) |
| **77** | | | *Lycaena phlaeas* (Linnaeus, 1761) |
| **78** | | | *Lampides boeticus* (Linnaeus, 1767) |

| | | | |
|---|---|---|---|
| **79** | | | *Pseudozizeeria maha* (Kollar, 1844) |
| **80** | | | *Zizina otis* (Fabricius, 1787) |
| **81** | | | *Zizeeria karsandra* (Moore, 1865) |
| **82** | | Nymphalidae | *Acraea terpsicore* (Linnaeus, 1758) |
| **83** | | | *Danaus chrysippus* (Linnaeus, 1758) |
| **84** | | | *Ariadne ariadne* (Moore, 1884) |
| **85** | | | *Junonia hierta* (Fabricius, 1798) |
| **86** | | | *Junonia atlites* (Linnaeus, 1763) |
| **87** | | | *Junonia orithya* (Linnaeus, 1758) |
| **88** | | | *Junonia lemonias* (Linnaeus, 1758) |
| **89** | | | *Junonia almana* (Linnaeus, 1758) |
| **90** | | | *Junonia iphita* (Cramer, 1779) |
| **91** | | | *Melanitis* sp. |
| **92** | | | *Melanitis phedima* (Cramer, 1780) |
| **93** | | | *Melanitis leda* (Linnaeus, 1758) |
| **94** | | | *Mycalesis mineus* (Linnaeus, 1758) |
| **95** | | | *Cyrestis thyodamas* (Boisduval, 1836) |
| **96** | | | *Ypthima baldus* (Fabricius, 1775) |
| **97** | | | *Ypthima nareda* (Kollar, [1844]) |
| **98** | | Pieridae | *Thaumantis diores* (Doubleday, 1845) |
| **99** | | | *Belnois aurota* (Fabricius (1793) |
| **100** | | | *Catopsilia pomona* (Fabricius, 1775) |
| **101** | | | *Cepora nerissa* (Fabricius, 1775) |
| **102** | | | *Ixias pyrene* (Linnaeus 1764) |
| **103** | | | *Colias croceus* (Geoffroy, 1785) |
| **104** | | Papilionidae | *Graphium doson* (C. & R. Felder, 1864) |
| **105** | | | *Papilio polytes* (Linnaeus, 1758) |
| **106** | | Crambidae | *Spoladera recurvalis* (Fabricius, 1775) |
| **107** | | | *Diaphania indica* (Saunders, 1851) |
| **108** | | Erebidae | *Areas galactina* (Jan van der Hoeven, 1840) |
| **109** | | | *Asota caricae* (Fabricius, 1775) |
| **110** | | | *Creatonotos transiens* (Walker, 1855) |
| **111** | | | *Eressa confinis* (Walker, 1854) |
| **112** | | | *Syntomoides imaon* Cramer, 1779 |
| **113** | | | *Oruza divisa* (Walker, 1862) |
| **114** | | Geometridae | *Thalassodes* sp. |
| **115** | | | *Hyposidra talaca* Walker, 1860 |
| **116** | | | *Timandra comae* (Hampson, 1895) |
| **117** | | | *Timandra* sp. |
| **118** | | | *Scopula* sp. |
| **119** | | | *Parapholodes fuliginea* (Hampson, 1891) |

| | | | |
|---|---|---|---|
| **120** | | Eupterotidae | *Eupterote* sp. |
| **121** | | Limacodidae | *Thosea* sp. |
| **122** | | Noctuidae | *Aegocera venulia* (Cramer, 1777) |
| **123** | | | *Spodoptera litura* (Fabricius, 1775) |
| **124** | | | *Thysanoplusia* sp. |
| **125** | | Sphingidae | *Macroglossum pyrrhosticta* (Butler, 1875) |
| **126** | Odonata | Coenagrionidae | *Ischnura senegalensis* (Rambur, 1842) |
| **127** | | Gomphidae | *Ictinogomphus rapax* (Rambur, 1842) |
| **128** | | Libellulidae | *Brachythemis contaminate* (Fabricius, 1793) |
| **129** | | | *Orthetrum luzonicum* (Brauer, 1868) |
| **130** | | | *Neurothemis tullia* (Drury, 1773) |
| **131** | | | *Orthetrum glaucum* (Brauer, 1865) |
| **132** | | | *Rhyothemis variega* (Linnaeus, 1763) |
| **133** | | | *Trithemis pallidinervis* (Kirby, 1889) |
| **134** | Orthoptera | Acrididae | *Acrida gigantea* (Herbst, 1786) |
| **135** | | | *Acrida exaltata* (Walker, 1859) |
| **136** | | | *Diabolocatantops innotabilis* (Walker, 1870) |
| **137** | | | *Eucoptacra praemorsa* (Walker, 1870) |
| **138** | | | *Trilophidia annulata* (Thunberg, 1815) |
| **139** | | | Schistocerca gregaria Forsskål, 1775 |
| **140** | | | *Ceracris nigricornis nigricornis* Walker, 1870 |
| **141** | | Tetrigidae | *Criotettix bispinosus* (Dalman, 1818) |
| **142** | | Gryllidae | *Modicogryllus (Modicogryllus) confirmatus* (Walker, 1859) |
| **143** | | | *Gryllus (Gryllus) bimaculatus* De Geer,1773 |
| **144** | Ephemeroptera | Ephemeridae | *Ephemera* sp. |
| **145** | Araneae | Araneidae | *Neoscona theisi* (Walckenaer, 1841) |
| **146** | | | *Araneus* sp. |
| **147** | | Hersiliidae | *Hersilia savignyi* (Lucas, 1836) |
| **148** | | Lycosidae | *Lycosa* sp. |
| **149** | | Oxyopidae | *Peucetia* sp. |
| **150** | | | *Oxyopes* sp. |
| **151** | | Pisauridae | *Pisauridae* sp. |
| **152** | | Salticidae | *Hyllus* sp. |
| **153** | | | *Salticidae* sp. |
| **154** | | Tetragnathidae | *Leucauge decorate* (Walckenaer, 1842) |
| **155** | Trombidiformes | Trombidiidae | *Trombidium grandissimum* (Koch, 1867) |

## A Preliminary Assessment of Ecosystem Services of Siswan Community Reserve

A healthy well-functioning ecosystem has a high capacity to provide a range of benefits or ecosystem services to not just the communities residing nearby it but beyond at regional and global level (Costanza et al. 1997, MEA 2005, Bagstad et al. 2014). Especially for the local communities who have long lived beside these natural ecosystems, these ecosystems act like safety nets in difficult times by providing basic necessities for survival (Shackleton et al. 2008).

However, the exclusionary approach of traditional models of protected areas like National Park to keep natural ecosystems pristine and intact has ended up alienating the local communities by restricting their access to many of these services, without providing an adequate alternative or compensation. In recent years India has made efforts by introducing policies like JFM and Community Reserve to encourage participatory community conservation. Being a less restricting and collaborative model of protected area, community reserves give an opportunity of engaging communities in conservation activities together with the forest department and other important stakeholders to co-manage natural resources. This model has the potential to reconcile conservation and communities by giving people a voice and also a restrained but continued access to the services of the ecosystem they are protecting. This in turn gives a reason for the communities to conserve the natural resources.

However, often there is inequitable ecosystem services delivery exacerbated by weak institutions and passive participation of communities in decision-making and conservation activities. Hence, it is important to assess ecosystem services and who are getting benefitted from them (Kettunen et al. 2009). These beneficiaries are not just restricted at the local scale i.e. the communities who live within or near the site, but can be present at regional or even global scale (Tomich et al. 2004, Hein et al. 2006, Law et al. 2014). How these benefits are delivered and distributed depends on factors like land use management decisions, socio-economic conditions, governance, markets, culture (Fisher et al. 2008).

Nestled in the western Shivalik hill range of Punjab, Siswan Community Reserve (SCR) provides a range of ecosystem services to the local communities including water, fuelwood, thatch grass and has a good potential as an ecotourism destination. It is also an important carbon sink,

contributing to global climate regulation. Some of these benefits, like ground water, are enjoyed by the surrounding urban centres like Chandigarh and Mohali at regional scale. Being one of the few forested patches in Punjab, it is also an important wildlife habitat providing connectivity in the highly fragmented Shivalik landscape. In this report, we make a first attempt of assessing ecosystem services of SCR following a rapid approach. First we identify the ecosystem services provided by the area and then economically value three select ecosystem services.

## 2. Methods

Due to limited resources and time for fieldwork, we used available data for identification and valuation of select ecosystem services. We used data provided by Punjab Irrigation Department, Siswan Community Reserve Microplan (2016-2022) and a previous study by Bhardwaj et al. (2017). Any additional necessary information was collected from interviews of key persons in the area. We selected water for irrigation from Siswan Dam, climate regulation taking carbon stock as indicator and fuelwood extracted from the reserve for economic valuation.

### 2.1. Identification of ES from SCR

Ecosystem services provided by SCR were compiled from peer-reviewed publications, grey literature, MEA and IPBES assessments and a list was created with consensus of some experts from the Institute before we went to field for a rapid assessment. From the land use land cover map of SCR prepared by GIS cell of Wildlife Institute of India, different land cover types were identified. Following Burkhard et al. (2009), capacity of each land cover type within SCR was scored on a scale of 0 to 5 where: 0 = no relevant capacity, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. Their spatial extent and beneficiaries were identified through existing data and discussions with local key persons and experts.

### 2.2. Valuation of ES

We took a rapid approach for valuation of select ecosystem services by adapting methods from TESSA (Toolkit for Ecosystem Service Site-based Assessment) (Peh et al. 2017). We selected three ecosystem services for economic valuation: Water for irrigation from Siswan Dam, climate regulation taking carbon stock as indicator, and fuelwood extracted from the reserve.

### 2.2.1. Irrigation water - Provisioning service

Data from Irrigation Department was collected on the beneficiary villages, area irrigated by dam water, and amount of water released by the dam from 2004 to 2019. Taking Paddy as the crop of interest as it is a water intensive crop; we calculated the value of irrigation water by calculating the cost of extracting the same amount of groundwater for irrigation following TESSA and IWMI (2012).

Average area of land irrigated annually by the Siswan dam is 145.12 ha.

We used the rate of diesel in December 2019 which was 64.72 rupees per litre. Taking the amount of diesel needed to run a pump for 1 hour from IWMI (2012) as 3 litre. Then the cost of diesel used per hour would be 194.16 rupees / hour.

Per ha cost of irrigation using diesel = 21 * 194.16 = 4077.36 rupees.

Per ha cost of irrigation using both diesel and electricity = 21*194.16 + 79*0 = 4077.36 rupees

For 2019, PSERC determined tariff of agriculture at 5.28 rupees / KWh

Total cost of energy required for irrigating 1 ha of paddy = 1422*5.28 =7508.16 rupees

**Per unit cost of energy required for pumping groundwater** = 7508.16/4077.36 = **1.84 rupees per unit (C)**

Economic value of water released from the dam for irrigation = (A) x ((B) x (C))

(A) Area irrigated by the dam water (ha) = 145.12

(B) Energy required for irrigation per hectare for paddy (kwh/ha) = 1422

(C) Unit cost of electricity for pumping groundwater (e.g. Rs/unit) = 1.84

Assumptions:

1. We have used the same value taken by the IWMI (2012) as energy required for irrigating Paddy which was 1422 kwh/ha

2. We assume proportion of electricity and diesel used for irrigating paddy for small farm size classes is same as calculated in IWMI (2012), which is 79% and 21% respectively, as from our data the area is dominated by small land holdings.

### 2.2.2. Fuelwood from SCR – Provisioning service

Percentage of dependent households and their annual consumption were taken from previous reports. Price at which firewood is bought locally was taken from a local key person and used to calculate the value of firewood extracted from forest.

Economic value of fuelwood = (A) x (B)

(A) Total amount of fuelwood extracted from site (quintal)

(B) Unit price of the fuelwood in market (Rupees/quintal)

Assuming that the opportunity cost of collecting firewood for each household was rupees 0.

### 2.2.3. Carbon Stock (Climate regulation) – Regulating service

Vegetation data for different forest types collected for a previous study by Bhardwaj et al. (2017) was used to calculate the above ground biomass through allometric equation (Chave et al. 2005). This above ground biomass was then converted into below ground biomass taking 0.5 as the conversion factor. Both above and below ground biomass were converted into carbon stock in tonnes C. In order to value the carbon stock, we used the social cost of carbon for India i.e. loss of USD 86 incurred by Indian economy for every tonne of carbon emitted in atmosphere (Ricke et al., 2018).

Economic value of Carbon stock= (A) x (B)

(A) Total amount of carbon stored in the site (tonne)

(B) Social price of the carbon (USD/tonne)

## 3. Results

### 3.1. Identification of ES from SCR

16 ecosystem services from four categories according to MEA framework were identified from Siswan Community Reserve (Table 1). Provisioning services are the tangible ones i.e. directly used by the users while the rest are intangible or indirectly used. Regulating services result from complex interactions among the elements of ecosystems and are important for regulation of ecosystem processes. Cultural services result due to aesthetic properties of the area or some cultural importance attached by people. Supporting services support all the other three services as they are the basic ecological processes that are needed to maintain the ecosystem and hence, might not benefit people directly.

Some important ecosystem services of Siswan CR are discussed below:

**Freshwater** – This forest patch is especially important for its watershed services in the light of rising water crisis in the region. It is important to ensure water table recharge and maintenance of the water level and quality in the region. Though we could not establish any direct link from our study, from personal interviews with local villagers we found that the ground water quality was perceived to be good as far as 10 km from SCR and especially near the forest. Agriculture is a major occupation in this area and Paddy is the main Kharif (winter) crop which requires huge amount of water for irrigation, which comes from groundwater through tubewells. Groundwater from Siswan and nearby villages is also sourced by private tanker owners to residents of Mohali and Chandigarh during peak season when they face acute water shortage. With no formal markets or institutional arrangements for water, exploitation of groundwater resources is rampant with the very same villages from where the water is sourced being left high and dry during peak season. In Siswan village, water pumped by community borewell is supplied through pipes to every household but for a limited time in a day. Water shortage is quite common in summers and demand is met through water tankers by those who can afford or communal taps of local temples and other institutions by the poor. It is also a catchment for Siswan Dam in which water from seasonal streams originating from the forest like siswan nadi gets collected. As mentioned above, Siswan dam is an important source of irrigation water for many downstream farmers, especially small land holders, which could help to reduce the demand on the fast depleting groundwater in the region.

Hence, there is a need to conduct a more detailed and empirical study on groundwater recharge potential of SCR and dependency of the nearby cities on its groundwater and other watershed services.

**Forest Resources –** The forest is home to *Acacia catechu* or Khair, a timber species famous for its heartwood. Khair is commercially extracted from this forest and auctioned, the profits from which are given to the Panchayat for development of the village. There are also medicinal plants, especially *Tinospora sinensis* or Giloy, but due to declining traditional knowledge many are not known any more. A previous study by Bhardwaj et al. (2017) estimated that 25 % of the households in Siswan are dependent on the fuelwood extracted from the forests. Some also use fuelwood for cooking along with LPG.

**Climate regulation-** These forests help in climate regulation not just at local scale but at regional and global scale as well. Locally, these forests provide moisture to farmers and stabilize local temperature to control the microclimate. At regional scale, any large scale modification in the land cover can change the albedo or the amount of solar radiation reflected back, which in turn can influence the energy and water budgets. Hence, the presence of the forest can be considered essential for climate regulation. At global scale, conversion or degradation of forest causes release of the stored carbon in atmosphere and hence, it can become a major source of carbon dioxide emissions instead of sink and contribute to global warming.

We estimate that Siswan has around **113925.7 tonnes of carbon** or **73.31 tonnes of carbon per hectare** as total above and below ground carbon stock. Our estimate is about 2% of the total above and below ground carbon stock in Punjab's forest as reported by FSI (2019).

**Tourism**- In recent years, the Siswam Dam has become a popular tourism spot for people from Chandigarh, Mohali and nearby areas. Many like to stop here while traveling to and from Himachal Pradesh as it situated on Chandigarh-Baddi highway. With the rugged Shiwalik hills and the SCR in the background, it provides a scenic setting for the local villagers and outsiders alike.

**Table 1: Potential ecosystem services delivered by SCR along with their spatial characteristics**

| Ecosystem Services categories | Ecosystem Services | Spatial extent | Beneficiaries |
|---|---|---|---|
| Provisioning services | Timber (Khair wood) | Regional | Panchayat, External users (Paper industry, Timber industry, Katha industry) |
| | Fire wood | Local | Local communities |
| | Medicinal Plants | Local | Local communities |
| | Freshwater | Local | Local communities, External users (City residents) |
| Regulating Services | Climate regulation | National | Local communities, External users (City residents), Global community |
| | Ground water recharge | Regional | Local communities, City residents |
| | Agriculture productivity | Regional | Local communities, External users |
| | Wildlife habitat | Local | Local communities, Forest Department |
| | Flood regulation | Local | Local communities (especially downstream ones) |
| | Soil Fertility | Local | Local communities (Especially farmers) |
| Supporting services | Nutrient cycling | Local | Local communities (Especially farmers) |
| | Water cycle | Regional | Local communities, Regional community |
| | Pollination | Local | Local communities |
| | Soil erosion control | Local | Local communities |
| Cultural Services | Tourism | Regional | Tourists, Local communities, Forest Department, Tourism industry |
| | Aesthetic value | Regional | Local communities, Tourists |

**Table 2: Capacity of each land use land cover to provide ES in SCR**

| LULC | Khair Timber | Fire wood | Fodder | Thatching | Medicinal Plants | Irrigation water | Climate regulation | Water flow regulation | Ground water recharge | Agriculture productivity | Wildlife habitat | Tourism | Aesthetic value | Nutrient cycling | Pollination | Soil erosion control |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acacia mixed forest | 5 | 5 | 5 | 5 | 5 | 0 | 5 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 |
| Mixed forest | 5 | 5 | 5 | 5 | 4 | 0 | 5 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 5 |
| Open forest | 4 | 5 | 5 | 5 | 4 | 0 | 5 | 5 | 5 | 0 | 5 | 5 | 5 | 4 | 5 | 5 |
| Dam | 0 | 0 | 4 | 4 | 0 | 5 | 3 | 0 | 0 | 0 | 5 | 5 | 4 | 1 | 0 | 0 |
| Agricultural fields | 0 | 2 | 3 | 3 | 0 | 0 | 2 | 0 | 1 | 5 | 2 | 3 | 1 | 1 | 1 | 1 |
| Settlement | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0 = no relevant capacity, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity

### 3.2. Valuation of ES

Starting from 2004 till 2019, an average area of **145.12 ha** land is annually irrigated from the water released by dam which is used by downstream farmers from 7 villages including Siswan. Based on per unit cost of extracting this same amount of ground water through pumps, we estimated the economic value of the irrigation water from Siswan Dam, which mostly benefits the downstream villages to be **INR 3, 79, 703.577 (USD 5393.9764) per year.**

The sum total of above and below ground carbon stock in the forest area of SCR was estimated to be **113925.7 tonnes of carbon** or **73.31 tonnes of carbon per hectare**. Our estimate is about 2% of the total above and below ground carbon stock in Punjab's forest as reported by FSI (2019). We valued the carbon stock stored in both above and below ground biomass of Siswan forest at **INR 68, 96, 93, 151** (**USD 97, 97,613) or INR 6304.77 ( USD 89.56) per hectare**.

The benefit of the fuelwood extracted from the Community Reserve was valued at **INR 1, 47, 000 (USD 208.82)**per year or **INR 402.73 (USD 5.72) per day**.

The total benefit generated by the three selected ecosystem services of SCR is estimated to be **INR 69, 02, 19, 854.6 (USD 98, 05, 094.96) or INR 69.02 billion.**

### 4. Limitations

Given the rapid nature of the study, these are very conservative estimates as a limited set of ecosystem services were valued using secondary data and hence, should be interpreted with caution. We aim at providing these values to highlight the 'hidden' benefits of the area and as a starting point for more detailed studies on assessment of its ecosystem services which should be incorporated in future decision-making and management of SCR and wider landscape.

### 5. Recommendations

1. More detailed study on ES and its linkages with the local human well-being.
2. Effectively communicate the significance of the ecosystem services of the natural protected areas to raise general awareness for the protection of biodiversity and its value

3. More power to local communities in decision making and management of the reserve (making them aware of their rights and restrictions) and strengthening of local institutions

4. PES arrangement to provide incentives to local communities and other primary beneficiaries for protecting the forest or actively participating in management and conservation activities to ensure continued supply for important ecosystem services like groundwater recharge, freshwater supply and climate mitigation.

5. Emphasis should be on increasing water recharge capacity of the forest as it is a watershed for Siswan Dam. More plantations should be done to improve the quality of the forest.

6. Identify stakeholders who are absolutely dependent on the SCR's resources whether upstream or downstream and ensure their resource needs are met through alternatives to provide incentive for their continued support

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A Report On

# Stakeholder inception workshop for management planning of Siswan Community Reserve, Punjab

7th February, 2019
Forest Headquarters, S.A.S. Nagar, Mohali

**Organised by**

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Throughout this exercise there had been guidance and support of Dr. V.B. Mathur, Director, Wildlife Institute of India (WII) and Dr. G.S. Rawat, Dean, WII. We express our gratitude to both of them for their continuous support.

We would also like to thank Shri Basanta Rajkumar, the Chief Conservator of Forests (Wildlife) for his contributions, not only for this workshop but for the entire exercise of planning. Thanks are also due to Shri Harjeender Singh, Divisional Forest Officer (Wildlife), Ropar, Shri Neeraj Gupta, Deputy Conservator of Forests (Wildlife), Mohali and Shri Randhir Singh Chakkal, Range Forest Officer, Mohali and all his team members for their warm hearted support towards successfully organising the workshop.

We would like to particularly thank Shri Sandeep Kumar, the President, Siswan Village Panchayat and other Panchayat members for participating in this workshop and sharing their views with us. Thanks are also due to community representatives of Siswan for participating in this consultation and enriching with their ideas.

Thanks are also due to Irrigation, Revenue and Tourism department for sending their representatives and share with us their valuable understanding on stakeholder networking and their role towards the collective initiatives for the betterment of the area and the community.

We are also indebted to the members of State Wildlife Board, Punjab and Chandigarh Bird Club for their participation. We particularly acknowledge their willingness to support the future initiatives of management planning exercise and effective implementation of the plan in Siswan.

Last but not the least, we wish to acknowledge the active involvement and inputs of faculty members who are part of the team in this project. Thanks are also due to all the WII faculty and staff for their direct and indirect support.

**Background:**

Siswan Reserve located in Majri tehsil of Sahibzada Ajit Singh Nagar, Mohali, Punjab was declared as a Community Reserve on 29th August, 2017. Total area of the reserve is 3199.448 acre (about 12.95 square kilometre). Punjab Forest and Protection Department has requested Wildlife Institute of India, Dehradun to help them in preparation of a management plan for this reserve. Any sound Protected Area (PA) planning in a human dominated landscape must take into account the concerns and knowledge of different stakeholders of the area, which could be useful for making the management more effective and sustainable. Involvement of stakeholders is critical during not only planning but also in plan implementation as well as monitoring. This is particularly true with respect to community reserves where the local communities and other stakeholders have critical role in carrying out the management of these areas. Keeping this process in mind a stakeholder inception workshop was organised in Forest Headquarters, Mohali on 07th February, 2019.

**Aim and Objectives of the workshop:**

The aim of this workshop was to have a two-way interaction with the stakeholders to understand their concerns and initiate a long-term engagement with them for the process of planning and subsequent implementation. Under this main aim, the major objectives of this workshop were as follows:

- To apprise the stakeholders about how WII proposes to go ahead with the management plan preparation
- To initiate a process of active engagement with the stakeholders for the planning process
- To understand various concerns about this area which could be addressed in the management plan.

A range of stakeholders participated in this workshop. These include village communities from Siswan; Panchayat Pradhan/Members; Tourism Department; Irrigation Department; Revenue Department; members of State Wildlife Board; Chandigarh Bird Club; Forest Department and Wildlife Institute of India (WII). A list of participants is provided as Annexure I.

**Methodology and process of workshop:**

The preparations for the workshop started about a month before, when active discussions were held with Chief Wildlife Warden (CWLW), Punjab and his other officers. As proposed by WII, Shri Harjinder Singh, Divisional Forest Officer (Wildlife), Roper was designated as the Management Planning Officer (MPO) for Siswan. It was also agreed that MPO would undertake the actual process of fieldwork along with his team of staff members working in this area. Another senior officer, Shri Basanta Rajkumar, Chief Conservator of Forests (Wildlife) anchored this workshop from the side of the department.

In another discussion with CWLW, CCF (WL), DCF (WL) and MPO a list of major stakeholders for Siswan Community Reserve was prepared. Invitation were sent to all the stakeholders for their participation. At WII the team of faculty members and technical assistant involved in this project, did the advance planning for the workshop. Making use of the existing information a presentation was prepared for exposing the stakeholders to the conservation values of this area as well as the processes proposed to be used during planning.

On 7th February, 2019 the entire team of WII moved to Mohali for conducting this workshop. The workshop started at 11:00 am in which about 30 members representing different stakeholder groups participated. The programme of the workshop is provided as box-2. The entire deliberations of the workshop were carried out following principles of Andragogy (box-1).

**Box-1**
**Principles of Andragogy**

- The learning in Andragogy is self-directed,
- This learning is of immediate application,
- The learning is experiential (based on work experience),
- It provides self-respect to participants, as each one of them is a contributor for this learning,
- It provides a safe and convenient atmosphere for learning.

**Box-2**
**Workshop Programme**

| | |
|---|---|
| 1100-1105 hrs. | Setting the stage –Shri Bidyut B. Barman, Wildlife Institute of India (WII) |
| 1105-1110 hrs. | Welcome to the participants-Shri Harjinder Singh, DFO (WL), Ropar |
| 1110-1120 hrs. | Introductory Remarks - Shri Kuldip Lomis, Chief Wildlife Warden, Punjab |
| 1120-1125 hrs. | About the workshop- Dr. A. K. Bhardwaj, Senior Professional fallow, WII, Dehradun |
| 1125-1140 hrs. | Managing Community Reserves- Experience from Keshopur Chhamb Community Reserve- Shri Basanta Rajkumar, CCF (WL) |
| 1140-1210 hrs. | About Siswan Community Reserve - Wildlife Institute of India team |
| 1210-1310 hrs. | Discussion with Stakeholders |
| 1310-1325 hrs. | Firming up decisions of the workshop |
| 1325-1330 hrs. | Vote of thanks-Shri Neeraj Gupta, DCF (WL) |
| 1330 hrs onwards | Workshop Lunch |

The workshop proceedings were initiated with welcome remarks of CCF (WL). The Chief Wildlife Warden, Punjab inaugurated the workshop and delivered his keynote address. He explained the purpose of this workshop to the participants and explained different initiatives of the department being undertaken for the management of this reserve. Dr. A K Bhardwaj, team leader of WII explained the objectives of this workshop. Already a project has been completed for Siswan to generate baseline information for this reserve. Faculty members from WII made a joint presentation explaining the ecological significance of this area with respect to different taxonomic groups. Shri Basanta Rajkumar, CCF (WL), shared his experiences about initiatives undertaken by Forest & Wildlife Department and Tourism Department in Keshopur Chhamb Community Reserve (CR), which happens to be the first CR in the country.

With these initial inputs, the workshop was opened for discussion with the stakeholders. After intensive interactions, a number of issues and recommendations evolved from this workshop.

**Major issues and recommendations:**

1. **Communication and engagement:**

   It was pointed out by few of the Panchayat members and community representatives that there has been no communication with them for this planning exercise before. Further the communities do not know how new initiatives proposed for this reserve are going to be beneficial to them. It was explained that during the previous project "Ecological Assesment of Siswan Reserve, Punjab", discussions were held with the communities while carrying out the fieldwork. In fact, Participatory Rural Appraisal (PRA) was carried out to understand the socioeconomic dimensions of this area during this project.

   It was agreed that focused discussions would be held with different stakeholders, particularly the Panchayat and the communities, during the process of management planning. The purpose of these discussions will be to understand the linkages of the communities with this area and what could be their role in the management of the reserve. Through these discussions more clarity will be brought among the communities regarding the proposed management planning process and how this could be useful to them. It was also told that this workshop is primarily the beginning of stakeholder engagement and this process will be continued throughout the planning process and subsequent implementation.

2. **Unemployment:**

   Representatives of Panchayat and local communities informed that some people of Siswan village are still dependent on forest resources of this area. Also, there are significant number of youth who were unemployed.

   It was agreed that the management plan will focus on facilitating alternatives to the communities dependent upon forest resources of this area. Department does not have any programme to provide jobs to all the youth in the village as such. However, there is a possibility of creating additional livelihood opportunities through the management of this community

reserve. Management plan will provide for giving maximum available livelihood opportunities through various programmes of this reserve to the local youth of this area.

CCF (wildlife) also informed that in the light of existing policy of the government, necessary provisions will be made in the plan for use revenue generated by this reserve for improvement of this area itself and for empowerment of communities.

3. **Silvicultural operations:**

The communities and Panchayat express their fear that after declaration of this area as a CR, all the existing silvicultural operations will be stopped which will badly impact the livelihoods and local incomes. At present, after prescribed silvicultural fellings, nearly 80% of the revenue goes to the communities.

It was explained that the sole purpose of declaring this area as CR is to protect the biodiversity values of this reserve. Therefore, the management plan is not aimed at halting the silvicultural operations. The ongoing system of sharing of revenue will be continued. The attempt of the management will be to continue such operations in a sustainable way and ongoing revenue sharing mechanism for the produce generated through silvicultural felling.

In fact, more livelihood opportunities can be available to the local youth through activities like eco-tourism.

4. **Human-wildlife conflict:**

The community representatives expressed that crop-raiding incidents are quite common in the area due to which the farmers suffer crop loss. Wildlife species mainly macaque, common langur and sambar are causing this damage. Monkey menace has become a big issue in Siswan village.

It was explained by the CCF (wildlife) that there are existing programmes of the government to deal with the issue of human-wildlife conflict. This includes payment of compensations, subsidies for installation of fences and issue of permits for elimination of problematic animals. Recently, department is also creating a new “mobile application” for quick disposal of such cases. Communities are advised to avail the opportunities of using these programmes.

Regarding the issue of monkeys, there are various methods being tried in different states but with partial success. It was further agreed that the issues of human-wildlife conflict including monkey menace will be kept in mind while preparing the management plan.

5. **Feral dog control:**

It was expressed by different stakeholders that feral dogs are becoming a big problem not only in this area but all across the state. These dogs are chasing and killing the smaller mammals and the young population of sambar in this area. These dogs have become so ferocious that they even sometime chase the human beings. Presence of feral dogs has become a big issue for the healthy population of sambar and other species in the area. It was stressed that some immediate steps need to be taken for removing these dogs.

It was agreed that the management plan would include provisions for removal of feral dogs from the area.

6. **Issues of legal boundary:**

It was pointed out by community representatives that so far there is no clarity regarding the exact boundary of the community Reserve. Also, there are issues regarding the ownership of some of the areas of the reserve.

It was agreed that steps would be taken to prepare the maps for the reserve as per the notification. Subsequently, these maps will form the part of the proposed management plan. Actual boundary demarcation work would be carried out during the planning period jointly by the Forest and the Revenue Departments. The copies of these maps would also be provided to the local staff as well as management committee of the conservation reserve. This will help in clarifying most of the issues of boundary and ownership.

7. **Understanding role of fisheries and irrigation departments:**

The representative of the Irrigation Department informed that Fisheries Department has got a 5 years contract for fishing in Siswan reservoir. The details about other associated activities were not readily available. It was agreed that separate discussions will be held with Irrigation

and Fisheries Departments to understand their existing roles and how they could be involved in the future management of the area.

8. **Education and awareness:**

Representatives from Chandigarh Bird Club (CBC) informed that they are undertaking a series of awareness and training programmes for the local communities, particularly youth, regarding avian fauna. They are also involved in many of the initiatives of long term monitoring in the form of exercises like bird counts, census of water birds, etc. They expressed their willingness to help in organising some of the training programmes on birds to the local youth who could be engaged as eco-guides in the reserve.

The proposal of CBC was welcomed and it was agreed that they would be actively involved in the planning process as well as the associated awareness and training programmes.

## ਵਰਕਸ਼ਾਪ ਦੇ ਮੁੱਦੇ ਅਤੇ ਮੁਖ ਫੈਸਲੇ

| ਮੁੱਦੇ | ਮੁਖ ਫੈਸਲੇ |
|---|---|
| 1. ਯੋਜਨਾ ਦੇ ਬਾਰੇ ਵਿਛ ਸਥਾਨਿਯ ਲੋਕਾਂ ਨੂੰ ਜਾਣਕਾਰੀ ਨਹੀਂ \| | 1. ਇਸ ਯੋਜਨਾ ਦੇ ਤਹਤ ਏ ਪਹਲੀ ਵਰਕਸ਼ਾਪ ਹੈ\| ਅੱਗੇ ਭੀ ਇਸ ਤਰਾਂ ਦੀਆਂ ਬੈਠਕਾਂ ਕਿੱਤਿਆਂ ਜਾਨ ਗਿਆਂ \| |
| 2. ਪਿੰਡ ਵਿਚ ਕਾਫੀ ਬੇਰੋਜਗਾਰੀ ਹੈ ਅਤੇ ਅੱਜ ਭੀ ਕੁਛ ਲੋਗ ਜੰਗਲ ਤੇ ਨਿਰਭਰ ਹਨ \| | 2. ਸਿਸਵਾਂ ਵਿਚ ਪੈਦਾ ਹੋਣ ਵਾਲੇ ਜ਼ਿਆਦਾ ਤੋਂ ਜ਼ਿਆਦਾ ਰੋਜਗਾਰ ਸਥਾਨੀਆਂ ਲੋਕਾਂ ਨੂੰ ਪ੍ਰਦਾਨ ਕਰਨ ਦੀ ਕੋਸ਼ਿਸ਼ ਕਿੱਤੀ ਜਾਵੇਗੀ \| |
| 3. ਕਮਿਊਨਟੀ ਰਿਜ਼ਰਵ ਬਨਨ ਤੋਂ ਬਾਦ ਜੰਗਲ ਕਟਾਈ ਤੇ ਪੂਰੀ ਤਰਾਹ ਰੋਕ ਲੱਗ ਜਾਏਗੀ \| | 3. ਜੰਗਲ ਕਟਾਈ ਦੀ ਸੁਵਿਧਾ ਮੈਨਜਮੈਂਟ ਪਲੈਨ ਦੇ ਅਨੁਸਾਰ ਜਾਰੀ ਰਹੇਗੀ \| ਐਸੀ ਕੋਈ ਰੋਕ ਨਹੀਂ ਲਗੇਗੀ \| ਇਸਦੇ ਨਾਲ ਨਾਲ ਹੋਰ ਭੀ ਰੋਜਗਾਰ ਅਵਸਰ ਪੈਦਾ ਹੋਣ ਦੀ ਸੰਭਾਵਨਾ ਹੈ \| |
| 4. ਜੰਗਲੀ ਜੀਵ ਖੇਤੀ ਦਾ ਬਹੁਤ ਨੁਕਸਾਨ ਕਰ ਰਹੇ ਹਨ \| ਇਸ ਦੇ ਬਾਰੇ ਕਦਮ ਲੈਣ ਦੀ ਸਖਤ ਜਰੂਰਤ ਹੈ \| | 4. ਮੈਨਜਮੈਂਟ ਪਲਾਨ ਤੈਯਾਰ ਕਰਨ ਵੇਲੇ ਇਸ ਮੁੱਦੇ ਨੂੰ ਧਯਾਨ ਵਿਚ ਰੱਖਿਆ ਜਾਏਗਾ \| |
| 5. ਸਿਸਵਾਂ ਵਿਚ ਅਵਾਰਾ ਕੁੱਤੇ ਜੰਗਲੀ ਜੀਵਾਂ ਦਾ ਸ਼ਿਕਾਰ ਕਰਕੇ ਬਹੁਤ ਨੁਕਸਾਨ ਕਰ ਰਹੇ ਹਨ \| ਇਸਲਈ ਜਰੂਰੀ ਕਦਮ ਉਥਾਨ ਦੀ ਬਹੁਤ ਲੋੜ ਹੈ \| | 5. ਮੈਨਜਮੈਂਟ ਪਲਾਨ ਤੈਯਾਰ ਕਰਨ ਵੇਲੇ ਇਸ ਮੁੱਦੇ ਨੂੰ ਧਯਾਨ ਵਿਚ ਰੱਖਿਆ ਜਾਏਗਾ \| |
| 6. ਸਿਸਵਾਂ ਦੀ ਸੀਮਾ ਸ੍ਪਸ਼ਠ ਨਹੀਂ ਹੈ \| ਏਸ ਦੇ ਨਾਲ ਨਾਲ ਹੱਕ ਹਕੂਕ ਦੇ ਬਾਰੇ ਭੀ ਪੂਰੀ ਜਾਣਕਾਰੀ ਨਹੀਂ ਹੈ \| | 6. ਸਿਸਵਾਂ ਦੀ ਸੀਮਾ ਨਿਰਧਾਰਣ ਦਾ ਜਮੀਨੀ ਕਮ ਜਲਦ ਕਿੱਤਾ ਜਾਏਗਾ \| |
| 7. ਫਿਸ਼ਰੀ ਅਤੇ ਸਿੰਚਾਈ ਵਿਭਾਗ ਦੇ ਕੰਮ ਦੇ ਬਾਰੇ ਪੂਰੀ ਜਾਨਕਾਰੀ ਉਪਲਬਧ ਨਹੀਂ ਹੈ \| | 7. ਦੋਨੋ ਵਿਭਾਗਾਂ ਦੇ ਨਾਲ ਇਸ ਬਾਰੇ ਅਲੱਗ ਅਲੱਗ ਬੈਠਕਾਂ ਕਿੱਤਿਆਂ ਜਾਵਨਗੀਆਂ \| |
| 8. ਸਥਾਨੀਆਂ ਲੋੱਕਾਂ ਨੂੰ ਸਿਸਵਾਂ ਦੇ ਬਾਰੇ ਅਤੇ ਇਸ ਯੋਜਨਾ ਦੇ ਬਾਰੇ ਹੋਰ ਜਾਨਕਾਰੀ ਦੀ ਜਰੂਰਤ ਹੈ \| ਇਸਦੇ ਨਾਲ ਨਾਲ ਯੁਵਾ ਵਰਗ ਦੀ ਟ੍ਰੇਨਿੰਗ ਦੀ ਭੀ ਜਰੂਰਤ ਹੈ \| | 8. ਸਥਾਨੀਆਂ ਲੋੱਕਾਂ ਦੇ ਲਈ ਗਯਾਨ ਵਰਧਨ ਦਾ ਵਿਸ਼ੇਸ਼ ਪ੍ਰੋਗਰਾਮ ਚਲਾਯਾ ਜਾਏਗਾ \| ਐਸ ਦੇ ਨਾਲ ਕਈ ਟ੍ਰੇਨਿੰਗ ਭੀ ਕਰਵਾਨ ਦੀ ਕੋਸ਼ਿਸ਼ ਕਿੱਤੀ ਜਾਵੇਗੀ \| ਇਸ ਲਇ ਚੰਡੀਗੜ੍ਹ ਬਰਡ ਕਲੱਬ ਦੀ ਮਦਦ ਭੀ ਲਿੱਤੀ ਜਾਵੇਗੀ \| |

**Future proposed action:**

The CCF (Wildlife), who chaired the concluding session of the workshop and the WII team headed by Dr. A K Bhardwaj had expressed their gratitude to the participants for raising and discussing various issues of the area.

In the future, different stakeholders would be involved in the planning process. Departments like Fisheries, Irrigation and Revenue will be approached and their role in the Siswan management planning process would be discussed.

The village stakeholders will be involved in all major discussions regarding the management planning of the community reserve. The role of other relevant stakeholders will be conveyed to the community and efforts will be made to build a common understanding between all the stakeholders of the area.

Name of the participants of the stakeholder workshop

| S.No. | Name | Designation | Mobile Number |
|---|---|---|---|
| 1. | Sh. Rajesh Kumar | Assistant Engineer | 8054506391 |
| **2.** | Sh. Manmohan Singh | Patwari | 9417573642 |
| 3. | Sh. Baljinder Singh | Forest Range Officer, Siswan | 9877288421 |
| 4. | Sh. Guramanpreet Singh | DFO, S.A.S. Nagar | 8968155669 |
| 5. | Dr. Gautam Talukdar | Scientist, WII | 9456178697 |
| 6. | Dr. J.A. Johnson | Scientist, WII | 9410992211 |
| 7. | Dr. B.S. Adhikari | Scientist, WII | 9412056031 |
| 8. | Dr. Bivash Pandav | Scientist, WII | 9412056031 |
| 9. | Sh. Ajay Srivastav | Scientist, WII | 8057981755 |
| 10. | Sh. Harjinder Singh | D.F.O (WL), Ropar | 9915594164 |
| 11. | Smt. M.Geethanjali | CF (WL), PPA Circle | 8130930838 |
| 12. | Sh. Basanta Raj Kumar | CCF (Wildlife) | 9988421399 |

| | | | |
|---|---|---|---|
| 13. | Dr. Kuldip Kumar | PCCF (Wildlife) | 9814462074 |
| 14. | Dr. Anil Kumar Bhardwaj | Senior Scientist (WII) | 9412056376 |
| 15. | Smt. Ridhi Bhatia | M (CV), PHTPB | 9815380188 |
| 16. | Smt. Vidushi Sharma | Env. Safeguard Specialist, IDIPT-PHTPB | 8427852111 |
| 17. | Sh. Gurdeep Singh | Wildlife Range, S.A.S. Nagar | 9855048424 |
| 18. | Sh. Narinder Kumar | Forest Guard, Wildlife Range Mohali | 9592717799 |
| 19. | Sh. Randhir Singh | Range Officer, Mohali | 9876046641 |
| 20. | Sh. San | Committee Member | 9041342296 |
| 21. | Sh. Akhil Kumar | Committee Member | 9592881428 |
| 22. | | | 9988424674 |
| 23. | Sh. Mukesh Gupta | Committee Member | 7973118017 |
| 24. | Sh. Surinderpal singh | Panchayat Secretary | 8699760026 |
| 25. | Sh. Sandeep Kumar | Sarpanch Siswan | 9569696963 |
| 26. | Sh. Hiten Kapila | BDPO, Majri | 9780780000 |
| 27. | Sh. Raj Mohinder Singh | Member, Punjab Wildlife Board | 9818575847 |
| 28. | Sh. Jeet Mohinder Singh | Member, Punjab Wildlife Board | 9810038050 |
| 29. | Smt. Rima Dhillon | Member, Punjab Wildlife Board, Secretary, CBC | 9876151090 |
| 30. | Smt. Kalpana. K | D.F.O (Wildlife), Ferozepur | 9412927001 |

**Annexure IVb**

A Report on

# Stakeholders workshop on objective setting and strategy formulation for Management Plan of Siswan Community Reserve

24th October, 2019
Forest Headquarters, Mohali

Organized by
Department of Forests and Wildlife Preservation
Government of Punjab
&
Wildlife Institute of India, Dehradun

***Published by***

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**Acknowledgement**

We would like to convey our gratitude to Dr. Kuldip Kumarb Lomis, Principal Chief Conservator of Forests and Chief Wildlife Warden and, Government of Punjab for his ideas and support for organizing this workshop and during the entire process of management planning. Thanks are also due to Shri Basanta Rajkumar, Chief Conservator of Forest (Wildlife), Smt. M. Geetanjali, Sh. Manish Kumar, Conservator of Forests, Sh. Ganan Prakash, Conservator of Forests, Dr. Monika Yadav, Divisional Forest Officer, Sh. Randhir Singh, Forest Range officer and all the staff of the department for their active participation and valuable inputs.

Throughout this exercise, there had been guidance and support of Dr. V.B. Mathur, Director, Wildlife Institute of India (WII) and Dr. G.S. Rawat, Dean, WII. We express our gratitude to both of them for their continuous support.

Outcomes of this workshop formed the backbone of the strategies of the proposed. Contributions of officers from various departments were extremely crucial. We would like to sincerely acknowledge the inputs from Major Benipal, Ditrict Revenue Officer, Mohali; Sh. J.S. Gill, Senior Fisheries officer, Mohali; Sh. Kulwant Singh, Ass. Engineer, PWD, Mohali; Sh. Ashok Kumar, Asst. Engineer, PWD, Mohali; Sh. Jaskaranbir Singh, Surveyer, Revenue Department, Mohali and Dr. Nitin Gautam, Veterinary officer, Mohali.

Last but not the least, we wish to acknowledge the active involvement and inputs of faculty members who are part of the team in this project. Thanks are also due to all the WII faculty and staff for their direct and indirect support.

**Management Planning Team**

**Background:**

Wildlife Institute of India and Punjab Forest Department jointly conducted a workshop on 7th February, 2019 which was a participatory workshop to understand the issues of Siswan Community Reserve and its stakeholders. The workshop had informed the stakeholders about the plan behind preparing a management plan for Siswan Community Reserve. The process of initiation of active participation and involvement of different stakeholders including the Siswan village community was discussed in the workshop. The concerns of the village community and other stakeholders were discussed in the platform. The active participation of stakeholders like Irrigation, Fisheries, Revenue, Tourism, Education, etc. departments and the village community could only ensure the successful implementation of the management planning. In continuation of the process, a series of rapid surveys were conducted in the village as well as in the forest patch. Regarding biodiversity, species occupancy maps were generated. Landscape level map of the study area depicting important features like digital elevation map, slope map, aspect map and a baseline map of the Siswan Community Reserve were generated. To discuss all the major findings including information on Ecosystem Services like Provisioning, Regulating and Cultural services being availed by the community. The workshop on 24th October, 2019 was organized to discuss the major issues of the community based on the understanding developed so far in continuation with the previous workshop with Siswan Community Reserve stakeholders.

Department of Forests and Wildlife Preservation, Punjab has given Wildlife Institute of India the task of preparing the management plan for Siswan Community Reserve. The field work was started from the month of November, 2018. To assess the biodiversity of the reserve, intensive surveys had been conducted there after. The first workshop for understanding the concerns of the community of the Siswan CR was organized on 7th February, 2019. After that a series of discussions was organized with the community. Simultaneously field surveys for enriching the ecological information of the reserve was carried out. In continuation to this, the second workshop was organized jointly by Wildlife Institute of India, Dehradun and Department of Forests and Wildlife Preservation, Punjab at Mohali on 24th October, 2019 to decide the objectives and strategies for the proposed plan.

**Objectives of the workshop:**

The aim of the workshop was to draw out the major issues and understanding of the stakeholders on the possible strategies to resolve the issues. Under this main aim, the major objectives of the workshop were as follows,

I. To apprise the participants about values and current planning activities of Siswan Community Reserve.
II. To undertake participatory problem analysis for the reserve.
III. To set vision, objectives and broad strategies for the plan.

In this workshop, different stakeholders from PWD- Irrigation, Fisheries, Revenue, Animal Health Forests, participated. A list of participants is presented at the end of this report.

**Methodology and process of workshop:**

The preparation of the workshop started about 2-3 months before, when active discussions were held with Chief Wildlife Warden (CWLW), Punjab and his other officers. A series of meetings with the officials of Fisheries and Irrigation departments were conducted. The Divisional Forest Officer (DFO) of Ropar, Dr. Monika Yadav was given the responsibility to look into necessary arrangements to conduct the workshop.

Participatory tools were followed to organize the workshop. Among the participants from different stakeholders, focused group discussions were conducted to identify various issues, vision and possible strategies. In doing that, three groups were made namely, Community as group-I, Departments as group-II and Biodiversity Conservation as group-III. Each group had discussed on major issues, vision, possible strategies and indicators of monitoring. Later the discussed points were submitted among the larger groups and a small discussion to summarise the finding was conducted.

The details of outcome from the different groups were included in Annexure-II.

**The Workshop Programme:**

| | |
|---|---|
| 1030-1045 hrs. | Welcome, mutual introductions<br>*Sh. Basanta Rajkumar, CCF (Wildlife) and Dr. Monika Yadav, DFO (WL), Ropar* |
| 1045-1050 hrs. | Inaugural remarks<br>*Dr. Kuldip Lomis, PCCF and CWLW, Punjab* |
| 1050-1105 hrs. | About the workshop- Introduction to Siswan and planning process<br>*Dr. A.K. Bhardwaj, Senior Professional Fellow and WII team* |
| 1105-1115 hrs. | Knowing activities of Irrigation and Fisheries Department<br>*Representative officers* |
| 1115-1130 hrs. | Tea |
| 1130 -1200 hrs. | Understanding issues and possible solutions |

| | |
|---|---|
| | *Small group work (WII Team)* |
| 1200- 1225 hrs. | Designing Vision for the area<br>*Small group work (WII Team)* |
| 1225-1255 hrs. | Setting objectives<br>*Small group work (WII Team)* |
| 1255 -1330 hrs. | Framing Strategies<br>*Small group work (WII Team)* |
| 1330-1430 hrs. | Lunch |
| 1430-1445 hrs. | Summing up the major outcomes of workshop and future agreements<br>*Dr. A. K. Bhardwaj, Senior Fellow, WII* |
| 1445-1500 hrs. | Vote of Thanks<br>*Representative of Punjab Forest Department* |
| 1500 hrs. | Tea |

**Outputs of Focused Group Discussions:**

**Group – 1 (Community group)**

**Vision-**

Gram Panchayat should get maximum sources of revenue and at the same time people of the Siswan village should get priority in employment.

**Major problems-**

- Problem of water, Fire wood, fodder for cattle, garbage and stray animals.
- Problem of moral values in new generations.
- Lack of employment in village and coordination among the village's people.

**Possible strategies-**

- Re-commissioning of the water tank
- Regular plantation
- Stray animal prevention
- Skill developing technical training system and employment generation in the village

**Monitoring Indicators-**

- There should be a regular meeting of the Gram Sabha and it should also include the forest department and other linked stakeholder representatives.
- Employment training should be provided to village youths on time to time.
- The tree plantation program should regularly be organized by the Forest Department.

**Group-2 (Biodiversity Conservation group)**

**Vision-**

- Should be a top Eco-tourism spot
- Conserve rare species.
- By adding or adjoining increase the existing area.

**Major problems-**

- Felling of trees.
- Felling trees affecting the biodiversity life of dam.
- Lack of efficient field staff.
- Resource crunch (Less funds for wildlife conservation plan).

**Possible strategies-**

- Training to field staff.
- Inter department coordination between gram panchayat, municipal corporation, NGOs, fisheries and revenue department.
- Completely ban on felling of trees and any kind of mining.
- No lifting of dead-decaying trees.
- Human fencing.
- Local youth should be included as they are enthusiastic (as income generation option for them).

**Monitoring Indicators-**

- Monitor air and water quality
- Monitor water discharge (especially during mansoon)
- Monitoring Biodiversity (terrestrial and aquatic)
- Monitoring revenue generated (by Siswan Community Reserve) by forest/ wildlife department.

**Group- 3 (Departments)**

**Vision-**

To ensure long term functions of urban biodiversity by securing ecosystem services, nature education and heritage conservation.

**Major problems-**

- Encroachment, majorly land mafia.
- Illegal wood cutting.
- Sedimentation issues
- Mining (sand)
- Funding issues.
- Escalating land cost.
- Community people are under influence and they work as facilitator for outsiders because their economic situation is not good.

**Possible strategies-**

- Boundary demarcation by constructing pillars and wiring it.
- Appraising the CM for the current situation.
- Regular patrolling for encroachment, poaching, etc.
- De-siltation of land, some levels of plantations and soil erosion control measures should be taken.
- Increase transparency so that people who are doing all these could be checked and punishable measures or fine can be kept.

**Monitoring indicators-**

- Local people for patrolling
- Water table measurement (Adequate water availability)
- Water level in Dam
- Biodiversity Index.

**Summarized outputs of focused group discussion:**

**Major Issues:**

a. Unscientific management of the area
b. Poor protection
c. Encroachment
d. Unregulated resource use in the form of fuelwood, fodder and other NTFP
e. Soil erosion due to fragile nature of soil
f. Silting of reservoir and lack of maintenance of the dam
g. Illegal sand mining
h. Inadequate staff
i. Limited staff capacity and low motivation
j. Insufficient resources
k. Threat to ungulates due to stray dogs
l. Lack of socio-economic incentives to local communities

m. Inadequate institutional capacity
n. Poor community engagement
o. Vested interest groups
p. Loss of traditional connect with the nature
q. Lack of long-term vision and plan
r. Inadequate infrastructure and other resources
s. Inadequate skill specific human resource
t. Lack of supportive programmes
u. Low visitation and poor visitor management
v. Lack of trust among key stakeholders
w. Lack of awareness
x. No coordination mechanism between key stakeholders
y. Lack of integrated vision and plan
z. Poor baseline information for the adjoining landscape

**Consolidated vision:**

The vision for this Management Plan is to develop SCR and adjoining landscapes as an outstanding example of community managed area, ensuring its ecological integrity providing economic benefits to the local communities and maximizing ecosystem services to the adjoining rural and urban areas.

**Proposed major strategies:**

1. Boundary demarcation and rationalization
2. Protection of catchment and habitat improvement
3. Community participation and livelihoods (Sustainable existing ones and alternatives)
4. Stakeholders engagement, networking and coordination
5. Ecotourism, recreation and education
6. Infrastructure and capacity building
7. Expansion of conservation initiatives to adjoining landscape
8. Research and monitoring

**Additional recommendations of the workshop:**

1. Separate discussions with community should be organized at the village during planning phase and greater participation from the village community should be ensured even during plan implementation.
2. An all stakeholder meeting should be organized at Siswan

**List of Participants**

| Sr. No. | Name | Designation | Email | Phone No. |
|---|---|---|---|---|
| 1 | Narinder Kumar | Forest Guard | kumarnarinder019@gmail.com | 9592717799 |
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| 3 | Randhir Singh | RFO (WL), Mohali | | 9876046641 |
| 4 | Prem Singh Solu | Dy.RFO(WL), Mohali | | 9417565734 |
| 5 | Gautam Talukdar | Scientist-WII | gautam@wii.gov.in | 9456178697 |
| 6 | Jatinder S. Gill | Senior Fisheries Officer | dwjpunjab@gmail.com | 9256304117 |
| 7 | Ashok Kumar | Asst. Engineer | | 9417186889 |
| 8 | Kulwant Singh | Asst. Engineer | | 8847334538 |
| 9 | Dr. B.S. Adhikari | Scientist-G | adhikaribs@wii.gov.in | 9412056031 |
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**Annexure VIIa**

## Report on Nature Education and Interpretation in Siswan Community Reserve by Sajeev TK

### Background

Almost 80% of the land in Punjab is under cultivation and only a little area is left for wildlife. The Shivalik hill area of Punjab, the Siswan Community Reserve where the proposed Nature Trail lies, is spread over geographical area of 9448.97 $km^2$ and lies in the north-eastern part of the state extending from north-west to south-east along the Himachal Pradesh border. It is very important s to conserve this area. With increasing requirement of more and more land for developmental activities it is important that we create awareness and a feeling of ownership among the public towards these nature reserves. The area has also been identified as one of the micro-endemic zones of the country and is also one of the most degraded rain-fed agro-ecosystem of Punjab. It is one of the unique ecosystems of Punjab and is the only major area of the state harbouring natural vegetation.

The formal education today is not giving necessary exposure for the challenges that is anticipated in future. Moreover the kind of gadgets as well as mind-sets has made our children lead more and indoor life than outdoor. This movement indoors is not benign; there are costs to the health of our children: attention difficulties, hyperactivity, childhood obesity, diminished use of senses, disconnect from things that are real. Additionally, if children are detached from nature, how will they learn about, understand, and value nature? How will the next generation care about the land and be stewards of its resources?

Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and aquire the skills to make informed and responsible decisions. Environment education can take place at its best in nature and in hands on programmes. The nature trails and nature interpretation gives an opportunity to the otherwise deprived city dwellers a chance to interact with and understand in depth the interactions in nature which ultimately keeps the life on earth going.

An understanding of life around makes it possible for them to develop a love for the nature and willingness to strive for conservation.

Siswan community reserve is in Majri Tehsil of Sahibzada Ajit Singh Nagar, Mohali district of Punjab in the western Shiwalik hill range. Name of the reserve is derived from village Siswan located south-west of the forest. With easy access from neighbouring cities like Chandigarh and SAS Nagar Mohali this area has a great potential to cater to the educational needs. The city of Chandigarh and Mohali have more than 500 educational institutions and that in it can be tapped for the purpose.

Wildlife Institute of India has been asked to prepare a management plan for the Siswan Community Reserve. The Department wanted to make use of the potential of the area for nature education to create awareness among the people. This will also generate livelihood opportunities for the Siswan community who are traditionally dependent on this landscape for their daily needs.

**Objectives**

1. To design nature trails (with interpretation content) to be used by nature guides/ staff for taking visitors and participants of nature education programmes.
2. To suggest improvements in the proposed active interpretation zone of the reserve. on lower side of Siswan Dam
3. To design a plan for nature education programme of the reserve for different target groups
4. To design a training programme for eco guides/ staff who will be responsible for visitor management

**Methodology**

1. Literature review

Available reports and papers about the wildlife in the area and books like Pictorial guide to the birds of Indian Subcontinent, Butterflies of India, Common wildflowers, Trees of Delhi etc. were looked in to for information on the flora and fauna of the region.

2. Visit to the proposed area and walking the proposed trail

The area was visited during the last week of March 2019. The proposed landscape was surveyed looking for points for interpretation, taking notes and making lists. The paths to lay Nature trails were marked and interpretation points identified.

3. Interactions with the officials concerned

   The possibilities were discussed with all the department officials right from PCCF to the frontline staff

4. Meeting the local community members

   The Sarpanch and other eminent people from the community were involved in the discussions and separate meetings were held with them to find out the pulse of the community.

**Output**

The whole proposed area was surveyed with the help of the staff. Three trails are marked with the help of GPS and possible points for interpretation noted. The trails are designed in such a way to make it possible for all categories or age groups can make use of the facility and get benefits from it.

**Small trail:** for children below 10years and visitors who cannot afford to do hard trek and is circular in nature covering major vegetation types and water body in a short span.


**Self Guided trail:** This is proposed inside the Interpretation Zone and will be guided using signages

**Long trail**: This one starts from the interpretation Zone and goes right up to the Forest Guest House, Mirzapur. This has stopover huts watch tower, resting area and others facilities en-route. It takes more than three hours to complete and is recommended for high school, college students and serious wildlife enthusiasts and trekkers


**Interpretation Zone**

An area at the lower side of the Siswan Dam is marked for the interpretation zone. Here one can walk around and learn about the whole place without actually going deep in to the trails. A self guided trail marked with signages and other interpretative materials will help the person to learn and enjoy. This will also have access to the edge of the water body.


A mobile cafeteria is proposed adjacent to the interpretation zone to cater to the visitors.

**Butterfly Restaurant**

There are reports from the state which mentions more than 80 species of butterflies from the Punjab Shivaliks (Mehra et.al 2016). This rich biodiversity can be represented in the butterfly restaurant area. An area adjoining to the interpretation zone can be converted in to a butterfly restaurant where butterflies can come and feed to their hearts content. All kinds of food plants for butterflies frequenting the reserve will have to be planted and nurtured here to cater to

butterflies. This will ensure visibility of butterflies and thereby help in interpretation. It will also help students to see the life cycle of butterflies, interaction of plants and butterflies and so on.

**Medicinal plants area**

Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts Egyptian papyrus and Chinese writings described the use of herbs. Evidence exist that Unani Hakims, Indian Vaids and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Indigenous cultures such as Rome, Egypt, Iran, Africa and America used herbs in their healing rituals, while other developed traditional medical systems such as Unani, Ayurveda and Chinese Medicine in which herbal therapies were used systematically. A medicinal plant area is designed to create awareness among public about the importance of the area in conserving rich tradition of India in ayurvedic life style.

An area adjacent to the interpretation zone can also be converted in to a medicinal plants area. The medicinal plants in the reserve which are not visible in the trails and otherwise will be planted here with signages explaining use of the plant.

**Nature Camp**

Tomorrow's leaders must be equipped for tomorrow's challenges, and we must adequately prepare our children for the future they will inherit. That requires a commitment to providing children with environmental education that helps them become the educated think tanks of tomorrow. Therefore it is essential to create awareness among the masses to conserve the environment. Nature Camps are one of the apt tools for this purpose and has been successfully carried out in various parts of the country.

There is a high potential to develop this site for nature camp. Nature camps can be provided for schools, colleges, NGOs, and other institutions and there by create awareness. The camps here can typically of and half day and full day.24hour long. The activities can be planned to keep participants occupied and educated.

Nature Education and interpretation activities will help to create a constituency of aware people to support conservation activities in and around. It is very essential support needed in the modern context.

**The target groups**

1. KG to 3rd std.
2. 4th to 7th std.
3. High School
4. Higher secondary and College
5. In-service staff at government and Semi Govt.
6. Media people
7. NGOs
8. Other Nondescript organisations

**Duration**

Looking in to the local carrying capacity and the target group we can have only two types of camps at Siswan

1. Half day for the KG to 7th standard students
2. Full Day for all others

**Venue**

Venue will be the facilities at Siswan Community Reserve or anywhere as decided by the authorities.

**Eligibility**

Willingness to participate in conservation activities is the criteria.

**Number of participants**

The number of participants in a class room is decided by the reach of the teacher. Here it can be decided by the available facilities. Still a group of 30 to 40 is a viable group at a time. In case of students there should be a teacher per ten students.

**Syllabus**

The typical syllabus of a camp should be covering

1. biodiversity local to global
2. need for conservation of biodiversity

3. basics of biogeography
4. elements of biogeography, forest types
5. deforestation and its impact
6. pollution, types of pollution and its impact
7. Need and greed differentiation

All session however small it is should talk about the actions possible by the target group. It should give what they can do as an individual and as a group. Further topics can be added based on the requirements of the participating group

**Infrastructure requirements**

1. Accommodation facilities
2. Conference hall/Meeting space for lectures and interactive sessions
3. LCD projectors
4. Sound system
5. Reference materials
6. Binoculars
7. Spotting-scopes
8. Handheld lenses
9. Laptop
10. CDs of wildlife films / Educational documentaries
11. Transport facilities
12. Brochures, pamphlets
13. White board/Marker pens
14. Printer/Copier/Scanner
15. Power Back up

**Panel of Resource Persons**

There should be a panel of locally available resource persons who can add value to the programme.

**Ads and other promotion work**

Government should put up ads in print and other media to invite people from all around for the progamme

**List of Signages that can be put up at the interpretation area**

1. Skeleton of animals (like Camel. Horse, Cow, Goat & Dog)
   These help in interpreting differences and for children it will be a great experience to have a hands on experience on these.
2. **Rocks**

   Different kinds of rocks, colour variations all can be explained

3. **Fossil Models**
   Importance of fossils, the area, evolution… all can be explained using fossil models
4. **3D Elevation model of the place**
   Ideally it should be at the entrance showing the place, roads infrastructures, trails and other important elements
5. **Mammals**
   Representative mammals from the region both historical and the present can be included in the signage of diorama
6. **Birds**
   Photographs of all major birds seen in the place should be there
7. **Reptiles**
   The pictures should be depicting common and dreaded ones. Breaking false myths and giving correct information.
8. **Amphibians**
   Either photographs or models can be used
9. **Fish**
   Being water dominated landscape fish fauna should be represented in its glory
10. **Invertebrates**
    Dragon flies, bees, damsel flies, butterflies, moths should be well narrated in the trails and depicted in signages

11. **Plants**

    Dominant tree and other plant species should be included in the signages. Invasive species should be treated separately to increase awareness

**Other Environments enhancement Display materials for the trails**

1. **Nest boxes for birds and bees**

   Nest boxes catering to different species of birds should be built in to landscape.

**Capacity Building for the staff**

In depth training progammes with hands on training should be given to the staff and participating community members. Recurring sessions of trainings and in-service classes along with practical demonstrations in the field are absolutely necessary.

A well-equipped library containing necessary literature on flora fauna and geology of the region should be made available for reference. Small brochures and booklets on the region should be prepared and made available.

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