

Ecological Assessment of Siswan Reserve, Punjab



Project Report

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Foreword

India has a comprehensive network of 764 Protected Areas (PA) covering 4.93 % of its geographic area. However, significant extent of ecologically important area lies outside the traditional boundaries of PAs, spreading across the managed forests or other government and private lands. Taking cognizance of this fact, in 2006, two new categories of PAs i.e. Conservation Reserves and Community Reserves were included in Wildlife (Protection) Act 1972 to bring in more areas of ecological importance for effective biodiversity conservation as well as to provide a *de jure* role to the local communities in biodiversity conservation. These two categories have a significant role in strengthening of biodiversity conservation initiatives in areas outside of traditional PAs, including private lands. Moreover, the scope of creating more National Parks and Wildlife Sanctuaries is also becoming limited. In fact, States have already started efforts for covering more and more areas under Conservation Reserve and Community Reserve categories.

Many wetlands and water bodies outside forest areas are important for maintaining the ecological integrity of landscapes, while contributing to the needs of the local communities. These areas could be managed effectively by declaring them as Community Reserves and Conservation Reserves. While bringing more and more areas under protection is crucial for enhancing conservation initiatives, generation of baseline information and supporting community institutions for their management is also important even though challenging. Punjab Forest and Wildlife Protection Department has taken this important step of building ecological baseline for Siswan Reserve through this short-term project. The Siswan Reserve was proposed to be declared as a Community Reserve. It is also envisaged to develop this area as an important wildlife habitat and an ecotourism destination. Such studies will strengthen the department's proposal to declare this area as a Community Reserve and also serve as a model for other areas of the State.

Dr. V.B. Mathur
Director, WII

26th July 2017

Dehradun



Preface

Punjab has a large expanse of its area under agriculture and consequently the PA network of the state is small, extending over only 0.7% of its total geographical area. However, there are many patches of forested and wetland wild habitats outside traditional PA network which play an important role not only for biodiversity and ecosystem conservation but also support agriculture landscapes.

The Punjab Forest and Wildlife Protection Department, hopes to bring more areas under the Protected Area network along with ensuring local community participation in biodiversity conservation. In this quest, it has identified Siswan reserve located in Majri Tehsil of Mohali district (in the western Shiwalik hill range) as a prospective area to create a Community Reserve and an important wildlife habitat and ecotourism destination. This report is a first step towards building baseline information for this reserve to help promote scientific planning and management of this area.

This is a preliminary report, prepared in a limited time that exhibits the potential of this area to emerge as a model for inclusive biodiversity conservation in the state of Punjab, wherein biodiversity conservation can complement development of livelihood options for the local people. It can be a useful document for establishment of baseline information for future conservation planning of the proposed Community Reserve as well as strengthen the case of the department for declaring it as such.



Acknowledgements

This piece of work could be possible because of the support and contributions of a large number of individuals from Punjab Forest & Wildlife Protection Department and Wildlife Institute of India (WII). Idea of this task evolved through a series of meetings with Sh. Kuldip Lomis, Principal Chief Conservator of Forests and Head of Forest Force, Government of Punjab. We would like to convey our sincere thanks to him for his ideas and encouragement throughout this assignment. Sh. Dhirendra Singh, Principal Chief Conservator of Forests and Chief Wildlife Warden, Punjab was the driving force for this innovating assignment. His ever-available help and personal involvement made our field visits very comfortable. His continuous support in terms of logistics and technical ideas were extremely useful for carrying forward this work in the shortest possible time and we would like to put on record our gratitude to him for his active involvement.

Dr. V.B. Mathur, Director, Wildlife Institute of India (WII) has always been an inspiration for this work. We sincerely acknowledge his ever-available support and encouragement for completion of this assignment. Dr. G.S. Rawat, Dean, WII has provided all required technical guidance for the task and we wish to convey our sincere thanks to him for his contributions.

Ms. M. Geethanjali, Conservator of Forests (WL) had taken lot of initiative for smooth conduct of fieldwork. She also facilitated the training programmes for the forest officials and staff during the course of this assignment. We wish to thank her for her persistent support.

Field visits for this project was conducted smoothly owing to the personal presence and involvement of Sh. Harbhajan Singh, Divisional Forest Officer (Wildlife), Ropar and Sh. Sunil Kumar, Range Officer (Wildlife), Mohali.

We owe our sincere gratitude to both of them for their valuable help and support. In the last leg of this work, we have received proactive support from Miss U.R. Vidyasagari, present Divisional Forest Officer (Wildlife), Ropar for carrying forward the field surveys for entomology component and we would like to acknowledge her involvement in the assignment. Throughout this assignment we have received the logistics and technical support from various officers of Punjab Forest and Wildlife Protection Department. We would particularly like to mention the help received from Sh. Tejinder Singh, Divisional Forest Officer, Mohali and Sh. Charanjit Singh, Divisional Forest Officer, Ropar. During our discussions with the community as part of socio-economic component, Sh. Sandeep Kumar, Community Motivator had been of great help and we express our sincere gratitude for his contribution.

We would also like to mention the support of all the faculty colleagues and staff of WII, whose back support was always a great strength for this project team. Sh. Neeraj Gupta, Secretarial Assistant, WII has played a very important role in designing of this document. His ever available support for this work is deeply acknowledged. We could not have done this work so comfortably without the office support of our staff Sh. Hira Lal Sharma and Sh. Atar Singh Panwar. We wish to thank them for making our time comfortable always.



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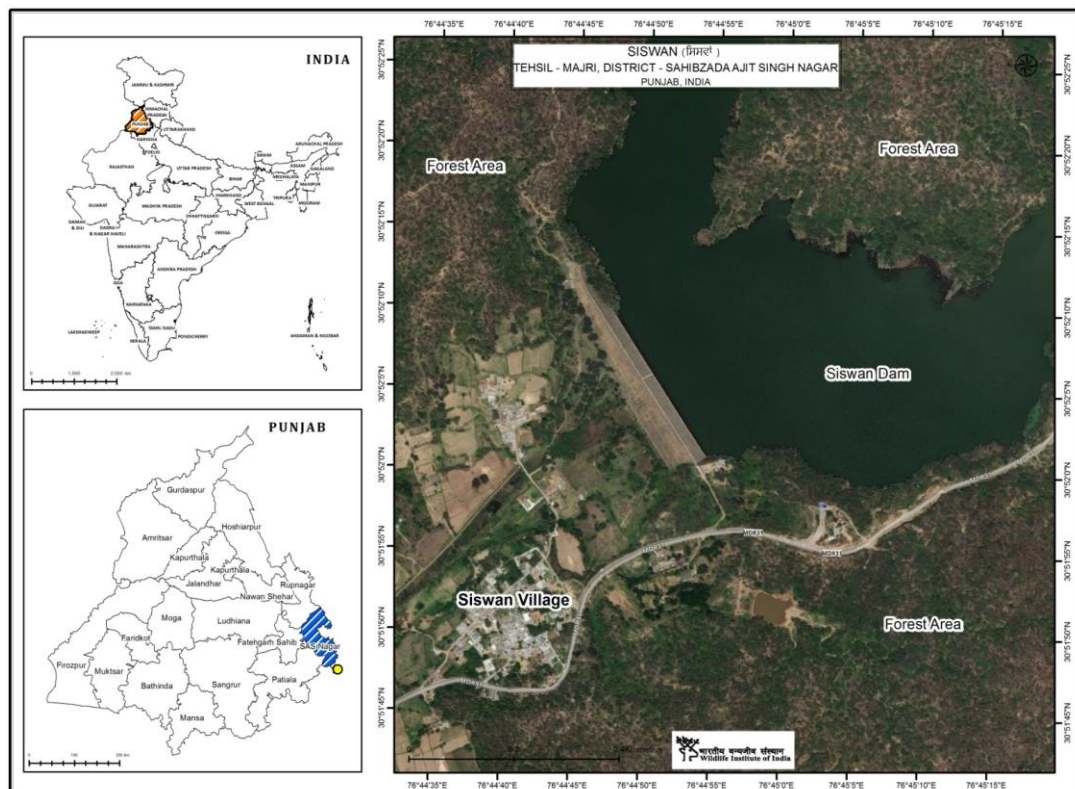
Ecological Assessment of Siswan Reserve



Background

The State of Punjab comes under the biogeographical zone - 4A-Semi Arid Zone.- Punjab plains and 5.57% of its total geographical area are forests. Punjab has a network of seventeen PAs (13 Wildlife Sanctuaries, 3 Community Reserves and 1 Conservation Reserve) comprising about 0.70% of the area of the state. Being an agriculture state, there is limited scope for establishment of more wildlife sanctuaries. However, there are many patches of wilderness, which could be protected for the purpose of biodiversity conservation under the categories of conservation reserve and community reserve. Punjab is the first State to take a lead in the establishment of its first two Community Reserves (CRs) i.e. Keshopur–Chhamb Community Reserve in District Gurdaspur and Lalwan Community Reserve in District Hoshiarpur during the year 2007. Thereafter, they have declared another community reserve (Panniwala-Gumjal Community Reserve in Fazilka district) and conservation reserve (Rakh Sarai Amanat Khan Conservation Reserve in Amritsar District) to their PA network. Similar proposal is currently under consideration of Government to declare Siswan forest as community reserve.

Siswan 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. Siswan Reserve is located on Chandigarh-Baddi road (Map 1), 18 km from district headquarters of Sahibzada Ajit Singh Nagar and 17 km from the State capital Chandigarh. The area is undulating and sub-mountainous with an average altitude of 246m above sea level. This forest has an important reservoir (30°52'8.71"N, 76°45'0.66"E) constructed on the slope facing Siswan village under Kandi Area Development Plan (KADP), which is the lifeline for the wildlife in this area. On the slope facing Mirzapur village, there is another similar reservoir important from conservation point of view. Because of these reservoirs, this is a unique habitat blend of forest and wetland ecosystems. Major portion of this area is under the jurisdiction of Village Panchayats. However, some portions of land also belong to Government and there are some private land holdings also towards Mirzapur village. Currently the area is being managed by Department of Forest and Wildlife Preservation, Punjab and is closed under section 4 and 5 of Punjab Land Preservation Act, 1900.



Map1: Location of Siswan Reserve

Wildlife Institute of India (WII) received a project from Chief Wildlife Warden, Government of Punjab during 2016 for developing this area as an ecotourism destination. WII was also asked to provide its technical advice on the project and for developing its wildlife habitat. A team of scientists from WII visited the Siswan reserve in July 2016 and suggested measures for developing this area as a potential wildlife and ecotourism site. During this brief visit, it was revealed that the area has good population of Sambar and other associates species including birds. It was realized that a detailed ecological assessment of the area could throw more light on the wildlife values here. In the light of this, a project for ecological assessment of Siswan reserve was submitted to CWLW, Punjab and the present report is an outcome of this initiative.

Objectives

This study was undertaken with the following objectives:

- (i) Generate floral and faunal baseline information.
- (ii) Understand mutual linkages and issues, between local communities and the reserve
- (iii) Sensitize the local staff about ecological importance of this area and its attributes.

Methodology

Being the first study of its kind in this area and limitation of time, a series of rapid surveys were carried out by a team of WII faculty and researchers for various taxa from October 2016 to June 2017. Surveys were carried out for generating information about large mammals, birds, reptiles, amphibians, insects and vegetation. To assess peoples perspective concerning the reserve participatory methods of focused group discussions (FGDs), social and resource mapping and time line surveys were undertaken. Visits for various rapid assessments were made more productive by conducting capacity building exercises for department staff simultaneously (Figure 1). The detailed methodology for different taxa is provided in their respective components.



Figure 1: Capacity building of Staff during Camera trap exercise

Broad results and discussions

The results of the study for different ecological taxa are provided as follows:

LARGE MAMMALS

Methodology

Thirty camera traps were installed at different locations in Siswan Community Reserve for a period of 20 days in May 2017 (Figure 2). The camera traps were installed with the primary objective to prepare an inventory of mammalian assemblage of Siswan Community Reserve. The camera traps were operational for a 24 hours period all through the 20 days of sampling.

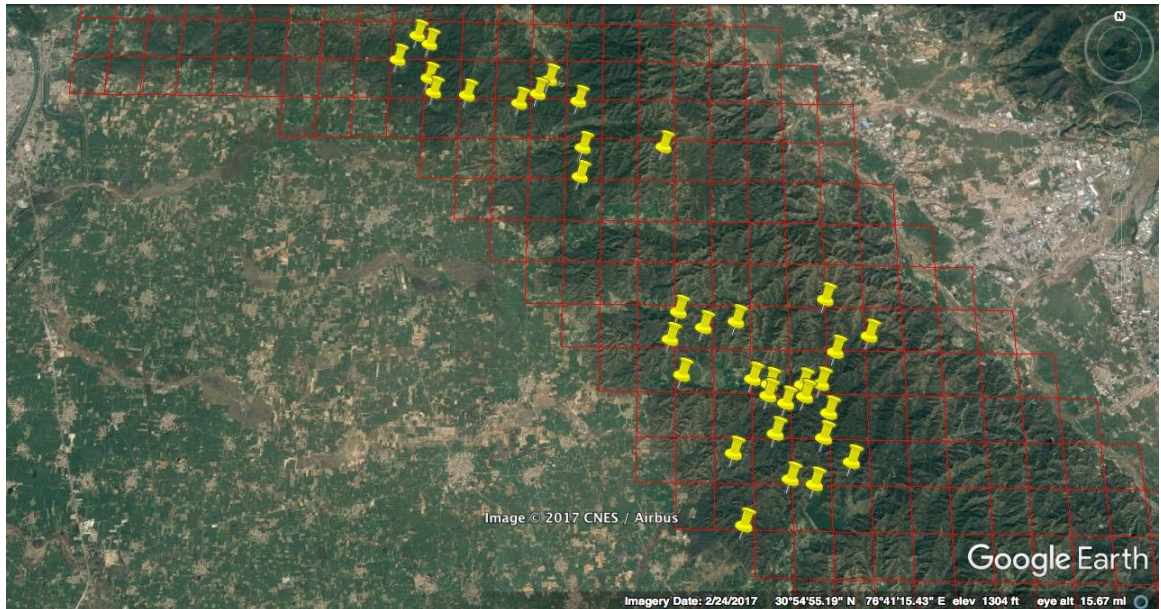


Figure 2: Locations of 30 camera traps deployed in Siswan Reserve during May 2017.

Results

Through the camera trapping exercise twelve species of large mammals at different locations were captured (Table 1 to 11). It clearly establishes the presence of minimum three different leopards (*Panthera pardus fusca*) in Siswan. Due to lack of adequate number of recaptures no population estimation of leopards could be possible during this exercise. 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 photo captured. A detailed account of capture locations of each of the mammal species photo captured during the survey are presented below:

Leopard (*Panthera pardus fusca*):



Leopard-1 (Male) (L01)



Leopard-2 (L02)



Leopard-3 (L03)

Table 1: Capture locations of Leopard

Leopard	Location	Date	Lat	long	Beat
L01	Bari Track 2	13.05.2017	30.57.52.1	76.38.37.7	Mirzapur
	Kakot Baddi track 1	15.05.2017 17.05.2017 20.05.2017	30.58.04.3	76.40.34.1	Mirzapur
L02	Bardar- Baddi Track 1	12.05.2017	30.57.02.4	76.41.09.1	Mirzapur
L03	Bardar- Baddi Track 1	15.05.2017	30.57.02.4	76.41.09.1	Mirzapur

Barking Deer (*Muntiacus muntjak*):

Table 2: Capture locations of Barking Deer

	Location	Date	Lat	long	Beat
	Siswan chow	13.5.2017	30.53.20.3	76.45.03.3	Siswan
	Siswan sot	13.5.2017	30.53.00.3	76.44.57.7	Siswan
	Mirzapur Rest house drainge 1	16.5.2017	30.54.53.4	76.45.03.7	Mirzapur
	Sibrawala Mirzapur	13.5.2017	30.54.33.9	76.43.38.1	Mirzapur
	Bardar-Baddi Track 2	20.5.2017	30.56.36.8	76.41.06.7	Mirzapur
	Bari Track 3	12.5.2017	30.58.05.1	76.38.32.1	Mirzapur
	Naurangpur Track 1	25.05.2017	30.58.37.1	76.38.31.1	Mirzapur
	Naurangpur Track 2	17.05.2017	30.58.44.7	76.38.18.5	Mirzapur
	Kakot Baddi Track 1	22.05.2017	30.58.04.3	76.40.34.1	Mirzapur

Indian Hare (*Lepus nigricollis*):

Table 3: Capture locations of Indian Hare

	Location	Date	Lat	long	Beat
	Sinhawala, Mirzapur dam ander	12.05.2017	30.54.28.6	76.43.07.0	Mirzapur
	Kakot Baddi Track 2	12.05.2017	30.57.51.2	76.40.23.0	Mirzapur

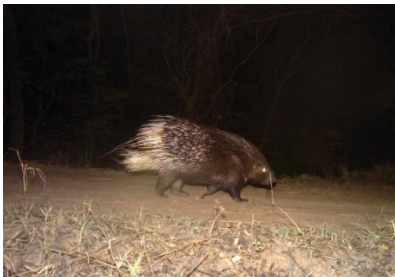
Golden Jackal (*Canis aureus*):

Table 4: Capture locations of Golden Jackal

	Location	Date	Lat	long	Beat
	Near Badal Resort	13.05.2017	30.51.51.0	76.43.42.0	Mirzapur


Indian Crested Porcupine (*Hystrix indica*):

Table 5: Capture locations of Indian Crested Porcupine

	Location	Date	Lat	long	Beat
	Mirzapur Rest house drainge 2	12.05.2017	30.54.23.4	76.45.43.9	Mirzapur
	Mirzapur road ander	14.05.2017	30.54.09.8	76.45.11.5	Mirzapur
	Sinhawala, Mirzapur dam ander	11.05.2017	30.54.28.6	76.43.07.0	Mirzapur
	mirzapur dam trail 2	22.05.2017	30.54.18.1	76.42.35.1	Mirzapur
	Mirzapur Trail	20.05.2017	30.53.42.3	76.44.39.1	Mirzapur
	Mirzapur trail 2	20.05.2017	30.53.43.3	76.44.56.4	Mirzapur
	siswan chow	19.05.2017	30.53.20.3	76.45.03.3	Siswan
	Naurangpur Track 2	20.05.2017	30.58.44.7	76.38.18.5	Mirzapur
	Naurangpur Track 3	24.05.2017	30.58.22.0	76.37.59.6	Mirzapur
	Kakot Baddi Track 1	16.05.2017	30.58.04.3	76.40.34.1	Mirzapur
	Kakot Baddi Track 2	20.05.2017	30.57.51.2	76.40.23.0	Mirzapur

Northern Plains Langur (*Semnopithecus entellus*):

Table 6: Capture locations of Northern Plains Langur

	Location	Date	Lat	long	Beat
	Mirzapur Rest house drainge 1	25.05.2017	30.54.53.4	76.45.03.7	Mirzapur

Rhesus Macaque (*Macaca mulatta*):

Table 7: Capture locations of Rhesus Macaque

	Location	Date	Lat	long	Beat
	Siswan Dwn Nala	16.05.2017	30.53.02.9	76.44.12.8	Siswan


Jungle Cat (*Felis chaus*):

Table 8: Capture locations of Jungle Cat

	Location	Date	Lat	long	Beat
	Sinhawala, Mirzapur dam ander	18.05.2017	30.54.28.6	76.43.07.0	Mirzapur
	Bari Track 2	14.05.2017	30.57.52.1	76.38.37.7	Mirzapur
	Kakot Baddi Track 2	20.05.2017	30.57.51.2	76.40.23.0	Mirzapur

Indian Wild Boar (*Sus scrofa cristatus*):

Table 9: Capture locations of Indian Wild Boar

	Location	Lat	long	Beat
	Siswan chow	30.53.20.3	76.45.03.3	Siswan
	Siswan Sot	30.53.00.3	76.44.57.7	Siswan
	Siswan Road opposite trail	30.53.27.4	76.44.22.9	Siswan
	Siswan Dwn Nala	30.53.02.9	76.44.12.8	Siswan
	Siswan dam from highway 2	30.52.27.4	76.44.25.7	Siswan
	Siswan Dam	30.52.23.7	76.44.47.8	Siswan
	Mirzapur Rest house drainge 1	30.54.53.4	76.45.03.7	Mirzapur
	Mirzapur Rest house drainge 2	30.54.23.4	76.45.43.9	Mirzapur
	Mirzapur road ander	30.54.09.8	76.45.11.5	Mirzapur
	Mirzapur Dam	30.53.49.1	76.42.46.2	Mirzapur
	Bardar.Baddi Track 2	30.56.36.8	76.41.06.7	Mirzapur
	Bari Track 2	30.57.52.1	76.38.37.7	Mirzapur
	Bari Track 3	30.58.05.1	76.38.32.1	Mirzapur
	Naurangpur Track 1	30.58.37.1	76.38.31.1	Mirzapur
	Naurangpur Track 2	30.58.44.7	76.38.18.5	Mirzapur
Kakot Baddi Track 2	30.57.51.2	76.40.23.0	Mirzapur	


Common Palm Civet (*Paradoxurus hermaphroditus*):

Table 10: Capture locations of Common Palm Civet

	Location	Date	Lat	long	Beat
	Kakot Baddi Track 2	14.05.2017	30.57.51.2	76.40.23.0	Mirzapur

Small Indian Civet (*Viverricula indica*):

Table 11: Capture locations of Small Indian Civet

	Location	Date	Lat	long	Beat
	Kakot Baddi Track 2	23.05.2017	30.57.51.2	76.40.23.0	Mirzapur

Sambar Deer (*Rusa unicolor*):



Captured at all Locations



Common Hoopoe

AVIFAUNA

Methodology

Two bird surveys were undertaken in the Siswan during 21st and 23rd March and 16th and 17th June 2017. Bird survey was carried out in all habitat types. Bird detection was based on direct sightings as well as identifying bird vocalizations. Bird sounds were also recorded for compiling bird songs of the area as well as for identification of some species. Besides early mornings and day time, late evening surveys were also conducted to record nocturnal birds.

Results

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 areas in Punjab, which extend to Himachal Pradesh, adds to bird richness and is important for long term conservation of avifauna of Siwalik foothills.

A total of 116 bird species (Table 12) were recorded in the area, comprising of both resident and migratory species (altitudinal migrants and breeding visitors). Due to

time limitation the survey could not be repeated in all the seasons and the list provided here is by no means exhaustive, but it should be considered as a baseline to which further surveys can add.

March visit was during migration time of many species and hence a number of migrants were recorded, whereas number of species recorded in June is less owing to the migrants having left the area by then, but a few breeding visitors like Paradise flycatcher, cuckoos and India pitta were seen during June only. Since seasonal coverage was limited to early spring and summer it can be assumed that the number of species for the area would certainly increase if survey is undertaken during winter. Out of 114 confirmed species, 33 are migrants to or travel through the area including breeding visitors, the remaining 81 species recorded are resident.

The area has great educational and tourism potential because of its proximity to the city of Chandigarh. Regular monitoring of birds in the area, covering all seasons, can provide useful information on breeding, wintering and migratory birds passing through, the area. Such information can be valuable to understand the impacts of climate change on bird migration and populations on a time scale.

Educational institutes, nature conservation organizations and individuals should be encouraged to develop research and awareness programmes for seasonal monitoring of birds.

Table 12: List of birds seen during March and June visits to the Area

R- Resident, M- Migrants Incl. Altitudinal

Sn.	Species	Location of sighting	Status	Month of sighting*	
1	Little Grebe	Siswan Lower Lake	R	March	June
2	Great Cormorant	Mirazapur Reservoir	R	March	June
3	Little Cormorant	Both Siswan and Mirzapur	R	March	June
4	Cattle Egret	Siswan Lower Area	R	X	June
5	Little Egret	Siswan Reservoir	R	March	X
6	Great Egret	Mirazapur Reservoir	R	March	X
7	Grey Heron	Mirazapur Reservoir	M	March	X
8	Indian Pond Heron	Village area close to Siswan	R	March	June
9	Painted Stork	Mirazapur Reservoir	R	March	X
10	Ruddy Shelduck	Both Siswan and Mirzapur	M	March	X
11	Shoveller	Mirazapur Reservoir	M	March	X
12	Pintail	Both Siswan and Mirzapur	M	March	X
13	Indian Spotbil Duck	Siswan Lower Area	R	March	June
14	Common Pochard	Both Siswan and Mirzapur	M	March	X
15	White-eyed Pochard	Siswan Nature Trail	M	March	X

Sn.	Species	Location of sighting	Status	Month of sighting*	
16	Black Kite	Siswan Nature Trail	R	March	June
17	Accipiter spp	Siswan Nature Trail	?	March	X
18	Oriental Honey.buzzard	Siswan Nature Trail	R	March	June
19	White.eyed Buzzard	Siswan Nature Trail	R	March	X
20	Short.toed Eagle	Siswan Nature Trail	R	X	June
21	Crested Serpent Eagle	Siswan Nature Trail	R	March	X
22	Aquila app	Siswan Nature Trail	?	March	X
23	Egyptian Vulture	Mirzapur Reservoir	R	March	X
24	Peregrine Falcon	Siswan Nature Trail	R	X	June
25	Barred Buttonquail	Near Siswan Reservoir	R	X	June
26	Black Francolin	Siswan Nature Trail	R	X	June
27	Red Junglefowl	Siswan Nature Trail	R	March	June
28	Peafowl	Siswan Nature Trail	R	March	June
29	Common Moorhen	Village area close to Siswan	R	March	X
30	Eurasian Coot	Both Siswan and Mirzapur	M	March	X
31	White.breasted Waterhen	Village area close to Siswan	R	March	June
32	Black.winged Stilt	Siswan Reservoir	R/M	March	X
33	Red.wattled Lapwing	Both Siswan and Mirzapur	R	March	June
34	Little Ringed Plover	Siswan Reservoir	M	March	X
35	Green Sandpiper	Mirzapur Reservoir	M	March	X
36	Brown.headed Gull	Siswan Reservoir	M	March	X
37	Rock Pigeon	Village area close to Siswan	R	March	June
38	Eurasian Collared Dove	Siswan Nature Trail	R	March	June
39	Laughing Dove	Village area close to Siswan	R	March	June
40	Red.collared Dove	Siswan Nature Trail	R	X	June
41	Yellow.footed Green Pigeon	Siswan Nature Trail	R	March	June
42	Plum.headed Parakeet	Siswan Nature Trail	R	March	June
43	Rose.ringed Parakeet	Siswan Nature Trail	R	March	X
44	Alexandrine Parakeet	Village area close to Siswan	R	March	X
45	Greater Coucal	Siswan Nature Trail	R	March	June
46	Indian Scops Owl	Siswan Nature Trail	R	March	June
47	Large.tailed Nightjar	Siswan Nature Trail	R	March	June
48	Spotted Owlet	Mirzapur FRH	R	March	June
49	Common Hoopoe	Village area close to Siswan	R	March	June
50	White.throated Kingfisher	Village area close to Siswan	R	March	June
51	Common Kingfisher	Village area close to Siswan	R	March	June
52	Stork.billed Kingfisher	Siswan Lower Area	R	X	June
53	Little Green Bee.eater	Siswan Nature Trail	R	March	June
54	Blue.tailed Bee.eater	Near Siswan Reservoir	M	X	June
55	Grey Hornbill	Siswan Nature Trail	R	March	June
56	Coppersmith Barbet	Village area close to Siswan	R	March	X
57	Brown.headed barbet	Siswan Nature Trail	R	March	X
58	Great Barbet	Village area close to Siswan	R	March	X
59	Jacobine Cuckoo	Siswan Nature Trail	M	X	June
60	Asian Koel	Village area close to Siswan	R	X	June?

Sn.	Species	Location of sighting	Status	Month of sighting*	
61	Grey.bellied Cuckoo	Siswan Lower Area+near Trail	M	X	June
62	Eurasian Cuckoo	Siswan Nature Trail	M	X	June
63	Indian cuckoo	Siswan Nature Trail	M	X	June
64	Common hawk Cuckoo	Siswan Lower Area+near Trail	R	X	June
65	Common Hoopoe	Siswan Nature Trail	R	X	June
66	Yellow.fronted Pied Woodpecker	Siswan Nature Trail	R	March	June
67	Black.rumped Flameback	Siswan Nature Trail	R	March	June
68	White Wagtail	Both Siswan and Mirzapur	M	March	X
69	Grey.throated Martin	Siswan Lower Area	R	March	X
70	Common Woodshrike	Siswan Nature Trail	R	March	June
71	Common Iora	Siswan Nature Trail	R	June	June
72	Large Cuckooshrike	Siswan Nature Trail	R	March	June
73	Black.headed Cuckooshrike	Siswan Nature Trail	M	X	June
74	Scarlet Minivet	Siswan Nature Trail	R	March	X
75	Red.rumped swallow	Siswan Lower Area	M	X	June
76	Red.vented Bulbul	Siswan Nature Trail	R	March	June
77	Himalayan Bulbul	Siswan Nature Trail	R	March	June
78	Black Bulbul	Siswan Nature Trail	M	March	X
79	Red.whiskered Bulbul	Siswan Lower Area	R	June	June
80	Indian Robin	Siswan Nature Trail	R	March	June
81	Oriental Magpie Robin	Siswan Lower Area	R	March	June
82	Black Redstart	Siswan Nature Trail	M	March	X
83	Pied Bushchat	Village area, Siswan and Mirzapur	R	March	June
84	Orange.headed thrush	Siswan Lower Area	M	X?	June
85	Redbreasted flycatcher	Siswan Nature Trail	M	March	X
86	Verditer Flycatcher	Siswan Nature Trail	M	March	X
87	Paradise Flycatcher	Siswan Nature Trail	M	X	June
88	Yellow.eyed Babbler	Village area close to Siswan	R	March	June
89	Tickell's Flycatcher	Siswan Lower Area+near Trail	R	March	June
90	Black.chinned Babbler	Village area close to Siswan	R	March	June
91	Tawny.bellied Babbler	Village area close to Siswan	R	March	X
92	Jungle Babbler	Siswan Nature Trail	R	March	June
93	Jungle Prinia	Siswan Nature Trail	R	March	June
94	Grey.breasted prinia	Siswan Nature Trail	R	March	June
95	Graceful Prinia	Siswan Lower Area	R	March	X
96	Plain Prinia	Siswan Lower Area	R	X	June
97	Ashy Prinia	Siswan Lower Area	R	X	June
98	Common Tailorbird	Siswan Nature Trail	R	March	June
99	Hume's Warbler	Siswan Nature Trail	M	March	X
100	Olivaceous Leaf warbler	Siswan Nature Trail	M	March	X
101	Lesser White.throat	Siswan Nature Trail	M	March	X
102	Blue.whistlingthrush	Siswan Lower Area	M	March	X
103	Oriental White.eye	Village area close to Siswan	R	March	June

Sn.	Species	Location of sighting	Status	Month of sighting*	
104	Purple Sunbird	Siswan Nature Trail	R	March	June
105	Thickbilled Flowerpecker	Siswan Nature Trail	R	X	June
106	Ortolon Bunting	Siswan Nature Trail	M	March	X
107	White.capped bunting	Siswan Reservoir area	M	March	X
108	Chestnut.shouldered Patronia	Siswan Nature Trail	R	June	June
109	Black drongo	Siswan Reservoir	R	March	June
110	Spangled Drongo	Village area close to Siswan	R	March	X
111	Pied Myna	Village area close to Siswan	R	March	X
112	Grey.headed Myna	Village area close to Siswan	R	March	X
113	Indian Golden Oriole	Siswan Lower Area+near Trail	M	X	June
114	Jungle Crow	Siswan Nature Trail	R	March	X
115	House Crow	Siswan Lower Area	R	X	June
116	Rufous Treepie	Siswan Nature Trail	R	March	June
* Sightings in one season do not necessary mean that they were absent during the other season as it was quick survey.					



Indian Pitta



Indian Bullfrog

HERPETOFAUNA

Methodology

A field visit was made to the reserve during June 2017. The objective of the visit was to interact with frontline staff and carry out a rapid inventory of reptiles and amphibians of Siswan Reserve. Amphibian sampling was carried out during late evening and night hours. Rapid documentation of herpeto-faunal species as well as orientation of the frontline staff was conducted around the Jayanti Dam site in Siswan reserve. This opportunity was also used for discussing the basic characteristics for identification of frogs and toads, methods to locate these species and handling of frogs in the field. Frogs were surveyed in the area using acoustic search, visual encounter search and active search method.

Results

A total of seven species of amphibians (all anurans) were recorded during nocturnal survey. These are - *Hoplobatrachus tigerinus*, *Fejervarya* cf. *pierrie*, *Fejervarya*

teraiensis, *Euphlyctis cyanophlyctis*, *Microhyla ornata*, *Duttaphrynus melanostictus*, *Duttaphrynus stomaticus*, belonging to three families.

Reptiles recorded from the area include three species, representing both lizards and snakes within one family each.

Details of different species are provided as follows:

AMPHIBIAN

FAMILY: BUFONIDAE

1. *Duttaphrynus melanostictus* (Schneider, 1799) Common Asian Toad

This toad can be identified with large round warts on the dorsal skin, sides with smaller ones with each wart tipped with black in mature individuals. Apart from this, it has two large ellipsoidal parotid glands behind the eyes, preorbital, postorbital, and orbito-tympanic ridges are present. Its tympanum is distinct, second finger longer than first, relatively short hind limbs, which produce hopping as opposed to jumping locomotion. One individual was observed (SVL 55 mm) on 21st June at 19:25 hrs active along a trail close to Siswan guest house.

2. *Duttaphrynus stomaticus* (Lutken 1864)

This species was most frequently encountered around human habitation of the study area. At least 15 individuals were observed in the Siswan guest house. The species can be identified by observing absence of cranial ridge, presence of distinct tympanum and comparatively short hind limb.

FAMILY: DICROGLOSSIDAE

3. *Fejervarya cf. pierrei* (Dubois, 1975), Pierre's Cricket Frog

A few characteristics to identify this frog are – oblong body, oval and short hindlimb, pointed head, relative finger length $2=4<1<3$, no skin fringe on fifth toe, dorsum with broken longitudinal skin folds, weakly barred hind limbs, brownish olive dorsum with irregular dark brown marks and dark bars along margins of lower jaw. This record is unvouchered and the species is identified based on combination of above mentioned characters and body size, which is larger than *F. syhadrensis* and *F. nepalensis* and smaller than *F. teraiensis*.

Although many individuals of this species were observed in a 50m aquatic edge of Jayanti dam, eight individuals were measured (5 males and 3 females; snout to vent length -29.37.74 mm). Most sightings are within 10 m from the water-body (moist surface). This frog readily take refuge among soil crevices.

4. *Fejervarya teraiensis* (Dubois, 1984), Terai Cricket Frog

These frogs are generally large with a stout body having a relative finger length which is $2=4<1<3$. The first finger is distinctly longer than second, a distinct skin fringe along outer side of fifth toe. Their dorsum is olive in colour with dark irregular spots and no mid-dorsal line. Males have a diagnostic W-shaped mark on the throat. This record is unvouchered and the species were identified based on a combination of the above mentioned characters as well as body size, which is larger than all other synoptic *Fejervarya* species. Five individuals of the species were recorded (SVL 33.4.45.3 mm) . Three individuals had distinct and broad mid-dorsal line. One individual was encountered, while it was feeding on a cricket (insect). This species is reported to be present in the entire terai zone of Nepal from 71.400 m elevation (Sleisch and Kastle, 2002).

5. *Hoplobatrachus tigerinus* (Daudin, 1802), Indian Bullfrog

The bullfrog is characterized by an almost triangular head, dorsum with short, irregular skin folds and with a cream, colored mid-dorsal line, large tympanum partly covered by a supra-tympanic fold on the top. One individual (SVL 147 mm) was recorded on 16 June at 18:30 hrs on the aquatic edge of Jayanti dam. The individual was a yellow colored male with distinct vocal sacs. It was encountered buried in sand with its snout protruding out. Species was identified based on combination of above-mentioned characters and no specimen were collected from the field.

6. *Euphlyctis cyanophlyctis* (Schneider, 1799), Indian Skipping Frog

This frog can be identified by a flat head with an elongated and ovoid body, eyes in a nearly dorsal position on the head. When its body is flat and elongated it is dorsally covered with small tubercles. Its limbs are stout, tips of digits pointed, fingers free, and toes completely webbed. The species is known to occur at elevations between 225 m to 378 m and widely distributed in India. It was identified based on photographs and distinctive call.

FAMILY: MICROHYLIDAE

7. *Microhyla ornata* (Duméril and Bibron, 1841) Ornate Pygmy Frog.

This one is a small frog with a triangular body, indistinct tympanum, free fingers and rudimentary webbed toes. It is dorsally reddish to dark brown and ventrally white. The frog has a large, dark brown, irregular mark extending from eye level to the lower part of the back, sides, and hind limbs. Males are known to have a dark throat. A chorus was recorded amidst moist grass close to Jayanti Dam site at 19:00 hrs and a single individual (♂, SVL 19 mm) was photographed and identified based on external morphological characters.

REPTILES - LIZARDS

FAMILY: AGAMIDAE

***Calotes versicolor* (Daudin, 1802) Indian Garden Lizard.**

The species can be identified by its light brown dorsal color, with black lines radiating from the eyes, and with two separated spines above the ear. One gravid female (SVL 81 mm) was observed on 20th June at 11:45 hrs, along the Siswan forest trail during the day. Another male (SVL 87 mm) was found at 19:47 hrs sleeping on a *Calotropis* plant 1.5 m above ground, close to the Jayanti Dam site.

REPTILES - SNAKES

FAMILY: NATRICIDAE

***Xenochrophis piscator* (Schneider, 1799)**

It is commonly known as Checkered Keelback with dorsum marked with conspicuous large black blotches getting darker anteriorly, lighter posteriorly. It also has an inverted “V” nuchal mark with a post ocular distinct stripe. Its venter is white, with the scales darker only at the outer edge. An



individual was recorded on the aquatic edge of Jayanti Dam site and another encountered at 20:00 hrs on a metaled road close to Siswan Forest Rest House.



Ixias pyrene

ENTOMOFAUNA

Methodology

The present study was designed for rapid assessment of the diversity of insects and arachnids in forest area of Siswan. The insect and arachnid sampling survey was done through the Siswan Nature Trail from Siswan dam through the forests ending at Mirzapur dam. A total of ten points were selected at 1000m interval for sampling. Sampling was done both at day (between 6:00 hrs until 10:00 hrs) and night (between 18:00 hrs until 22: 00 hrs) (see Figure 5 and Table 13).

The following three methods were used to sample –

(i) Hand picking: Insects under order Coleoptera (the beetles), Isoptera (termites), Blattoida (cockroaches) and Dermaptera (earwigs) and arachnids were hand-picked and collected for sampling.

(ii) **Sweep netting:** Insects under order Lepidoptera (butterfly), Hymenoptera (bees and wasps), Odonata (dragonfly and damshelly) and Plecoptera (stonefly) were collected using a sweep net.

(iii) **Light trap:** During evening and night sampling light traps were used to collect insects, specially, Lepidoptera (moths) and Coleoptera (the beetles).

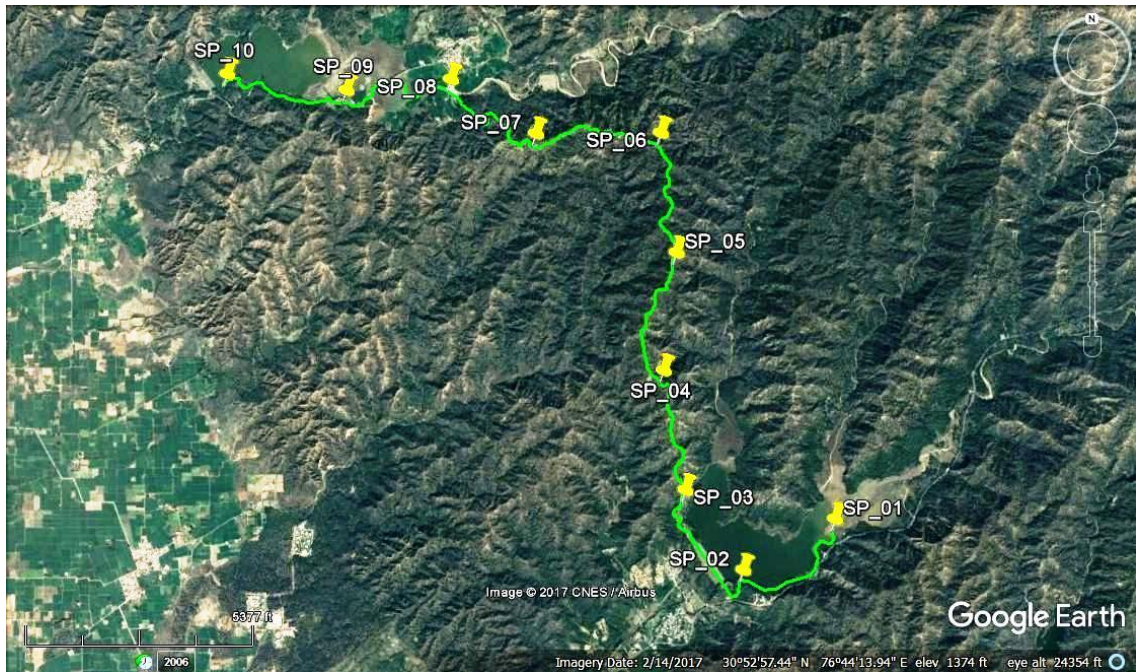


Figure 4: Sampling points (yellow pins) along the Siswan Nature Trail (green line)

Table 13: GPS location of 10 sampling points along the Siswan Nature Trail

	Latitude	Longitude
Sampling point 01	30°52'11.89"N	76°45'23.43"E
Sampling point 02	30°52'0.43"N	76°44'58.32"E
Sampling point 03	30°52'19.22"N	76°44'42.97"E
Sampling point 04	30°52'46.98"N	76°44'37.41"E
Sampling point 05	30°53'13.98"N	76°44'41.21"E
Sampling point 06	30°53'41.45"N	76°44'37.57"E
Sampling point 07	30°53'41.91"N	76°44'4.15"E
Sampling point 08	30°53'55.24"N	76°43'41.25"E
Sampling point 09	30°53'53.08"N	76°43'12.88"E
Sampling point 010	30°53'57.26"N	76°42'40.58"E

Results

Diversity of Entomo-fauna:



Junonia hierta



Calochroa bicolor



Spidimorpha westwoodi

From this study insect of nine orders namely Blattoida (cockroaches and termites), Coleoptera (the beetles), Dermaptera (earwigs), Hemiptera (the bugs), Hymenoptera (bees and wasps), Lepidoptera (butterfly and moth), Odonata (dragonfly and damshelly), Orthoptera (grasshoppers and crickets), and Plecoptera (stonefly) were recorded. Distribution of 169 species recorded from the area under different orders is as follows (Table 14 and 15 and Figurer 4):

Table 14 : Numbers of species recorded under 9 orders of insects from Siswan

Insect order	Number of species found
Blattoida	3 species
Coleoptera	61 species
Dermaptera	2 species
Hemiptera	18 species
Hymenoptera	6 species
Lepidoptera (butterfly)	17 species
Lepidoptera (moth)	36 species
Odonata	8 species
Orthoptera	17 species
Plecoptera	1 species
TOTAL 169 species	

Diversity of arachnids:

Arachnids are the group of arthropods that include spiders, opiliones, scorpions, pseudoscorpions, solifugae, ticks and mites. This is the second largest class under phylum Arthropoda after class Insecta. Most arachnids are carnivorous, typically preying on insects, and terrestrial, living on land.

From this study 09 families of Arachnids are found. These are Araneidae (Orb weaver spiders), Hersiliidae (Tree trunk spider), Oxyopidae (Lynx spider), Pisauridae (Nursery web spider), Salticidae (Jumping spider), Tetragnathidae (Long-jawed orb weaver spider), Lycosidae (Wolf spider), Buthidae (Scorpion) and Trombidiidae (Red Velvet Mites).

Discussion

Conservation issues mostly focus on the ecological impact of management practices and their aim is to provide practical background for sustainable management. The present study, conducted in Siswan has made a significant contribution towards increasing knowledge of insect species distributions in this area. This area has extremely high entomofauna diversity and a total of 169 species of insects from 9 orders and 9 families of arachnids were sampled during the study. Considering the high insect diversity in this area, efforts should be continued to ensure that the area is conserved not only for the large vertebrates (which attract considerable attention), but also for the invertebrates. Furthermore since no previous work on spiders has been conducted in this area, the study unfolds new distribution records for all species found in this area.

Eight orders of insects namely- Lepidoptera (butterfly and moth), Coleoptera (the beetles), Hemiptera (the bugs), Hymenoptera (bees and wasps), Isoptera (termites), Odonata (dragonfly and damselfly), Orthoptera (grasshoppers and crickets), Blattoida (cockroaches), Dermaptera (earwigs) and Plecoptera (stonefly) have been recorded through this study.

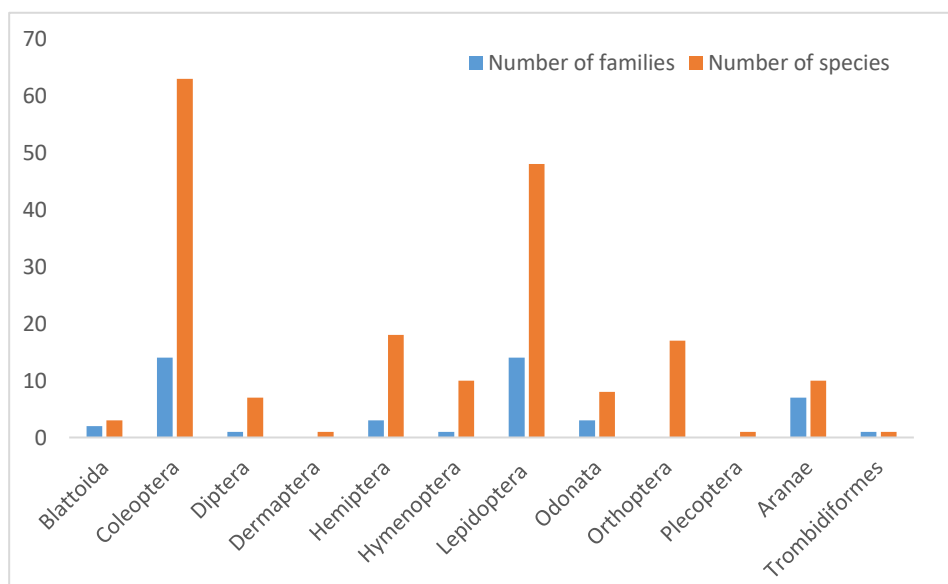


Figure 4: Insects and spiders recorded from Siswan

Table 15: Insects recorded from Siswan

Insects Order	Families	Species	Unidentified species
1. Blattoida	Blattidae	<i>Periplanata amaricana</i>	
	Ectobiidae	<i>Blatella germanica</i>	
	-	Isoptera sp.	01
2. Coleoptera	Carabidae	<i>Calochroa bicolor</i>	
		<i>Scarites</i> sp.	01
		Carabidae sp.	02
	Cerambycidae	Elaphidion sp.	01
		Cerambycidae sp.	03
	Cetoniidae	Cetoniidae sp.	
	Chrysomelidae	<i>Spidimorpha westwoodi</i>	
		<i>Zygogramma bicolorata</i>	
		Chrysomelidae sp.	03
		<i>Spidimorpha</i> sp.	
		<i>Agelastica</i> sp.	
	Coccinellidae	<i>Chiidopsis bipunctata</i>	
		<i>Coccinella septumpunctata</i>	
		<i>Henosepilachna</i> sp.	
		<i>Epilachna vigintioctopunctata</i>	
		Coccinellidae sp.	01
	Curculionidae	Curculionidae sp.	02
	Elateridae	Elateridae sp.	02
		<i>Athous</i> sp.	
	Histeridae	<i>Carcinops pumilio</i>	
		<i>Margarinotus brunneus</i>	
		<i>Spilodiscusbipagiatus</i> sp.	01
	Hybosoridae	<i>Hybosorus orientalis</i>	
	Hydrophilidae	<i>Hydrophilus</i> sp.	
	Meloidae	<i>Epicauta conferta</i>	
		<i>Epicauta</i> sp.	
		<i>Hycleus</i> sp.	
	Rutelidae	<i>Anomala dimidiata</i>	
		<i>Anomala varicolor</i>	
	Scarabaeidae	<i>Aphodius moestus</i>	
		<i>Aphodius</i> sp.	02
		<i>Catharsius capucinus</i>	
<i>Digitonthophagus bonasus</i>			
<i>Oniticellus cinctus</i>			
<i>Onitis philemon</i>			
<i>Gymnopleurus cyaneus</i>			
<i>Onthophagus dama</i>			

Insects Order	Families	Species	Unidentified species
		<i>Onthophagus mopsus</i>	
		<i>Onthophagus ramocellus</i>	
		<i>Onthophagus</i> sp.	03
		<i>Sisyphus longipes</i>	
		<i>Tiniocellus spinipes</i>	
		<i>Garreta degeani</i>	
		Scarabaeidae sp.	02
		<i>Copris surdus</i>	
		<i>Catharsius molossus</i>	
		<i>Euoniticellus pallipes</i>	
		<i>Alphitobius</i> sp.	
		<i>Eleodes</i> sp.	
		<i>Tenebrio molitor</i>	
3. Dermaptera	-	Dermaptera sp.	02
4. Diptera	Syrphidae	Syrphidae sp.	02
	Tiplidae	Tiplid sp.	05
5. Hemiptera	Belostomatidae	Belostomatidae sp.	01
	Pseudococcidae	<i>Sternorrhyncha</i> sp.	01
	Pyrrhocoridae	<i>Pyrrhocoris</i> sp.	01
	-	Unidentified	15
6. Hymenoptera	Apidae	<i>Apis</i> sp.	01
	Apidae	<i>Bombus</i> sp.	01
	Apidae	<i>Xylocopa latipes</i>	
	Apidae	<i>Xylocopa</i> sp.	01
	-	Unidentified	06
7. Lepidoptera Butterflies	Hesperiidae	<i>Pelopidas</i> sp.	02
	Lycaenidae	<i>Tarucus nara</i>	
		<i>Zizeeria karsandra</i>	
		<i>Zizina otis</i>	
	Nymphalidae	<i>Danaus chrysippus</i>	
		<i>Ariadne ariadne</i>	
		<i>Junonia hierta</i>	
		<i>Junonia orithya</i>	
		<i>Junonia</i> sp.	
		<i>Mycalesis mineus</i>	
		<i>Thaumantis diores</i>	
		<i>Ypthima baldus</i>	
		<i>Ypthima nareda</i>	
	Pieridae	<i>Catopsilia pomona</i>	
		<i>Cepora nerissa</i>	
<i>Ixias pyrene</i>			

Insects Order	Families	Species	Unidentified species
Moths	Askpathanidae		01
	Erebidae		05
	Eupterotidae		01
	Geometridae		14
	Gelechidae		01
	Limacodidae		01
	Noctuidae		07
	Notodontidae		01
	Pyralidae	<i>Diaphania indica</i>	
8. Odonata	Coenagrionidae	<i>Ischnura senegalensis</i>	
	Gomphidae	<i>Ictinogomphus rapax</i>	
	Libellulidae	<i>Brachythemis contaminata</i>	
		<i>Orthetrum luzonicum</i>	
		<i>Neurothemis tullia</i>	
		<i>Orthetrum glaucum</i>	
		<i>Rhyothemis variegata</i>	
		<i>Trithemis pallidinervis</i>	
-	Unidentified	02	
9. Orthoptera	-	Unidentified	17
10. Placoptera	-	Unidentified	01
Spiders			
1. Aranae	Araneidae	<i>Neoscona theisi</i>	
	Araneidae	<i>Araneus</i> sp.	01
	Hersiliidae	<i>Hersilia savignyi</i>	
	Lycosidae	<i>Lycosa</i> sp.	01
	Oxyopidae	<i>Peucetia</i> sp.	01
	Oxyopidae	<i>Oxyopes</i> sp.	01
	Pisauridae	<i>Pisauridae</i> sp.	01
	Salticidae	<i>Hyllus</i> sp.	01
	Salticidae	<i>Salticidae</i> sp.	01
	Tetragnathidae	<i>Leucauge decorata</i>	
2. Trombidiformes	Trombidiidae	<i>Trombidium grandissimum</i>	



FLORA AND VEGETATION

Methodology

The Siwalik forests of Punjab in and around Siswan dam area can be categorized into Acacia-Dalbergia-mixed dry deciduous forest and dry deciduous scrub and forests based on physiognomy (qualitatively). A reconnaissance survey was conducted at Siswan area and curvilinear transects were identified to capture species diversity, which has covered both the bottom and top of slopes, flat areas as well as undulating terrain on either side of the dam, forming the catchment area. Even though species along transects were recorded and identified (Table 16), to capture ecological attributes of the vegetation, various random sites were selected and the data was collected based on traditional methods following Misra (1968). In each site ten, 10m×10 m random quadrats were laid for the enumeration of trees (individuals >31.5 cm circumference at breast height (cbh). The density, frequency and total basal area was calculated (Misra, 1968; Muller.Dombois and Ellenberg, 1974), and Importance Value Index (IVI) was calculated by summing up the relative values of density,

frequency and total basal area (Curtis, 1959). Altogether, data was collected from 26 sites for ecological attributes and associations were identified based on quantitative data.

Results

A total of 160 species of plants belonging to different families were recorded from the area (Table 16). Additionally the composition of different associations of plant communities was also assessed. The study reveals detailed composition of seven different plant associations from this area (Table 17 -23).

Table 16: List of plants of Siswan Reserve

S. No.	Botanical Name	Family	Habit
1.	<i>Abrus precatorius</i>	Fabaceae	C
2.	<i>Abutilon indicum</i>	Malvaceae	H
3.	<i>Acacia catechu</i>	Fabaceae	T
4.	<i>Acacia modesta</i>	Fabaceae	T
5.	<i>Acacia nilotica</i>	Fabaceae	T
6.	<i>Achyranthes aspera</i>	Amaranthaceae	H
7.	<i>Adhatoda vasica</i>	Acanthaceae	S
8.	<i>Aegle marmelos</i>	Rutaceae	T
9.	<i>Agave sp.</i>	Agavaceae	H
10.	<i>Ageratum conyzoides</i>	Asteraceae	H
11.	<i>Ajuga bracteosa</i>	Lamiaceae	H
12.	<i>Albizia lebbek</i>	Fabaceae	T
13.	<i>Alternanthera philoxeroides</i>	Amaranthaceae	H
14.	<i>Alternanthera sessilis</i>	Amaranthaceae	H
15.	<i>Alysicarpus vaginalis</i>	Fabaceae	H
16.	<i>Amaranthus spinosus</i>	Amaranthaceae	H
17.	<i>Amaranthus viridis</i>	Amaranthaceae	H
18.	<i>Anagallis arvensis</i>	Primulaceae	H
19.	<i>Anisomeles indica</i>	Lamiaceae	H
20.	<i>Anogeissus latifolia</i>	Combretaceae	T
21.	<i>Argemone mexicana</i>	Papaveraceae	H
22.	<i>Arundo donax</i>	Poaceae	G
23.	<i>Asparagus adscendens</i>	Liliaceae	S
24.	<i>Azadirachta indica</i>	Meliaceae	T
25.	<i>Barleria cristata</i>	Acanthaceae	H
26.	<i>Bauhinia variegata</i>	Fabaceae	T
27.	<i>Bidens pilosa</i>	Asteraceae	H
28.	<i>Blumea lacinata</i>	Asteraceae	H
29.	<i>Boerhavia diffusa</i>	Nyctaginaceae	H
30.	<i>Bombex ceiba</i>	Bombacaceae	T
31.	<i>Brassica campestris</i>	Brassicaceae	H
32.	<i>Butea monosperma</i>	Fabaceae	T
33.	<i>Caesalpinia decapetala</i>	Fabaceae	C
34.	<i>Calotropis procera</i>	Asclepiadaceae	H
35.	<i>Cannabis sativa</i>	Cannabaceae	H
36.	<i>Capparis decidua</i>	Capparaceae	S
37.	<i>Capparis zeylanica</i>	Capparaceae	S
38.	<i>Cardamine impatiens</i>	Brassicaceae	H
39.	<i>Carex sp.</i>	Cyperaceae	Sd
40.	<i>Carissa opaca</i>	Apocynaceae	S
41.	<i>Carissa sp.</i>	Apocynaceae	S
42.	<i>Cassia fistula</i>	Fabaceae	T
43.	<i>Cassia occidentalis</i>	Fabaceae	H
44.	<i>Cassia tora</i>	Fabaceae	H
45.	<i>Celastrus paniculatus</i>	Celastraceae	C
46.	<i>Chenopodium album</i>	Chenopodiaceae	H
47.	<i>Chenopodium ambrosioides</i>	Chenopodiaceae	H
48.	<i>Chrysopogon aciculatus</i>	Poaceae	G
49.	<i>Chrysopogon fulvus</i>	Poaceae	G
50.	<i>Cissampelos pareira</i>	Menispermaceae	C
51.	<i>Colebrookia oppositifolia</i>	Lamiaceae	S
52.	<i>Commelina benghalensis</i>	Commelinaceae	H
53.	<i>Convolvulus</i>	Convolvulaceae	H

S. No.	Botanical Name	Family	Habit
	<i>arvensis</i>		
54.	<i>Cordia dichotoma</i>	Boraginaceae	T
55.	<i>Croton bonplandianum</i>	Euphorbiaceae	H
56.	<i>Cryptolepis buchani</i>	Asclepiadaceae	C
57.	<i>Cuscuta reflexa</i>	Cuscutaceae	C
58.	<i>Cynodon dactylon</i>	Poaceae	G
59.	<i>Cyperus compressus</i>	Cyperaceae	Sd
60.	<i>Cyperus rotundus</i>	Cyperaceae	Sd
61.	<i>Dalbergia sissoo</i>	Fabaceae	T
62.	<i>Datura metel</i>	Solanaceae	H
63.	<i>Dendrocalamus strictus</i>	Poaceae	G
64.	<i>Desmodium microphyllum</i>	Fabaceae	H
65.	<i>Desmodium triflorum</i>	Fabaceae	H
66.	<i>Dicliptera roxburghiana</i>	Acanthaceae	H
67.	<i>Digitaria sp.</i>	Poaceae	G
68.	<i>Dioscorea bulbifera</i>	Dioscoreaceae	C
69.	<i>Dodonea angustifolia</i>	Sapinaceae	S
70.	<i>Ehretia laevis</i>	Ehretiaceae	T
71.	<i>Eleusine indica</i>	Poaceae	G
72.	<i>Embelica officinalis</i>	Euphorbiaceae	T
73.	<i>Eragrostis sp.</i>	Poaceae	G
74.	<i>Erythrina suberosa</i>	Fabaceae	T
75.	<i>Euohorbia hirta</i>	Euphorbiaceae	H
76.	<i>Euphorbia royleana</i>	Euphorbiaceae	S
77.	<i>Ficus racemosa</i>	Moraceae	T
78.	<i>Ficus religiosa</i>	Moraceae	T
79.	<i>Flacourtia indica</i>	Flacourtiaceae	S
80.	<i>Fumaria indica</i>	Fumariaceae	H
81.	<i>Gnaphalium pensylvanicum</i>	Asteraceae	H
82.	<i>Grewia disperma</i>	Tiliaceae	T
83.	<i>Ichnocarpus frutescens</i>	Apocynaceae	C
84.	<i>Imperata cylindrica</i>	Poaceae	G
85.	<i>Indigofera heterantha</i>	Fabaceae	S
86.	<i>Iopomea pes.tigridis</i>	Convolvulaceae	C
87.	<i>Ipomoea carnea</i>	Convolvulaceae	S
88.	<i>Ipomoea quamoclit</i>	Convolvulaceae	C
89.	<i>Justicia procumbens</i>	Acanthaceae	H
90.	<i>Lannea coromandelica</i>	Anacardiaceae	T

S. No.	Botanical Name	Family	Habit
91.	<i>Lantana camara</i>	Verbenaceae	S
92.	<i>Lathyrus aphaca</i>	Fabaceae	H
93.	<i>Lespedeza juncea</i>	Fabaceae	H
94.	<i>Leucaena leucocephala</i>	Fabaceae	T
95.	<i>Leucas aspera</i>	Lamiaceae	H
96.	<i>Leucas cephalotes</i>	Lamiaceae	H
97.	<i>Majus pumilus</i>	Scrophulariaceae	H
98.	<i>Malva parviflora</i>	Malvaceae	H
99.	<i>Malvastrum coromandelianum</i>	Malvaceae	H
100.	<i>Medicago polymorpha</i>	Fabaceae	H
101.	<i>Melia azedarach</i>	Meliaceae	T
102.	<i>Mellilotus alba</i>	Fabaceae	H
103.	<i>Millettia extensa</i>	Fabaceae	T
104.	<i>Mimosa pudica</i>	Fabaceae	H
105.	<i>Moringa oliefera</i>	Moringaceae	T
106.	<i>Morus alba</i>	Moraceae	T
107.	<i>Mucuna pruriens</i>	Fabaceae	C
108.	<i>Murraya koenigii</i>	Rutaceae	S
109.	<i>Neyraudia arundinacea</i>	Poaceae	G
110.	<i>Nicotiana plumbaginifolia</i>	Solanaceae	H
111.	<i>Nyctanthus arbor.tristis</i>	Oleaceae	T
112.	<i>Ougeinia oojeinensis</i>	Fabaceae	T
113.	<i>Oxalis corniculata</i>	Oxalidaceae	H
114.	<i>Parthenium hysterophorus</i>	Asteraceae	H
115.	<i>Paspalum sp.</i>	Poaceae	G
116.	<i>Phoenix sylvestris</i>	Arecaceae	T
117.	<i>Phyllanthus amarus</i>	Euphorbiaceae	H
118.	<i>Phyllanthus urinaria</i>	Euphorbiaceae	H
119.	<i>Plantago lanceolata</i>	Plantaginaceae	H
120.	<i>Plumbago zeylanica</i>	Plumbaginaceae	S
121.	<i>Poa annua</i>	Poaceae	G
122.	<i>Polygonum barbatum</i>	Polygonaceae	H
123.	<i>Polygonum hydropiper</i>	Polygonaceae	H
124.	<i>Portulaca pilosa</i>	Portulacaceae	H
125.	<i>Prosopis juliflora</i>	Fabaceae	T
126.	<i>Pueraria tuberosa</i>	Fabaceae	C
127.	<i>Ricinus communis</i>	Euphorbiaceae	S
128.	<i>Rungia pectinata</i>	Acanthaceae	H
129.	<i>Saccharum bengalense</i>	Poaceae	G

S. No.	Botanical Name	Family	Habit
130.	<i>Saccharum spontaneum</i>	Poaceae	G
131.	<i>Setaria pumila</i>	Poaceae	G
132.	<i>Sida acuta</i>	Malvaceae	H
133.	<i>Sida cordata</i>	Malvaceae	H
134.	<i>Sida cordifolia</i>	Malvaceae	H
135.	<i>Sida rhombifolia</i>	Malvaceae	H
136.	<i>Solanum nigrum</i>	Solanaceae	H
137.	<i>Solanum viarum</i>	Solanaceae	H
138.	<i>Sonchus asper</i>	Asteraceae	H
139.	<i>Sporobolus sp.</i>	Poaceae	G
140.	<i>Stellaria media</i>	Caryophyllaceae	H
141.	<i>Syzygium cumini</i>	Myrtaceae	T
142.	<i>Tectona grandis</i>	Verbenaceae	T
143.	<i>Tinospora cordifolia</i>	Menispermaceae	C
144.	<i>Toona ciliata</i>	Meliaceae	T
145.	<i>Trichodesma indicum</i>	Boraginaceae	H

S. No.	Botanical Name	Family	Habit
146.	<i>Tridax procumbens</i>	Asteraceae	H
147.	<i>Triumfetta rhomboidea</i>	Tiliaceae	H
148.	<i>Typha angustata</i>	Typhaceae	H
149.	<i>Urena lobata</i>	Malvaceae	H
150.	<i>Vallis solanaceae</i>	Apocynaceae	C
151.	<i>Veronica cinerea</i>	Asteraceae	H
152.	<i>Vicia sativa</i>	Fabaceae	H
153.	<i>Vitex negundo</i>	Verbenaceae	S
154.	<i>Xanthium indicum</i>	Asteraceae	H
155.	<i>Youngia japonica</i>	Asteraceae	H
156.	<i>Ziziphus jujuba</i>	Rhamnaceae	T
157.	<i>Ziziphus mauritiana</i>	Rhamnaceae	T
158.	<i>Ziziphus nummularia</i>	Rhamnaceae	S
159.	<i>Ziziphus oenoplia</i>	Rhamnaceae	S
160.	<i>Ziziphus xylopyra</i>	Rhamnaceae	S

Acacia mixed community : The forest is mainly dominated by *Acacia* species, viz. *A. catechu*, *A. nilotica* and *A. modesta*, while other species of mid-seral stage also occur in the forest, such as *Butea monosperma*, *Diospyros*, *Leucaena leucocephala*, *Lannea coromandelica* etc. The contribution of *A. catechu* is high as compared to other *Acacias* in terms of density and total basal cover (Table 17).

Table 17: Structural attributes of *Acacia* mixed community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Acacia</i> mixed community (6 stand)				
<i>Acacia catechu</i>	30-150	30-100	0.90-3.53	51.0-119.2
<i>Acacia modesta</i>	30-50	30	0.62-0.86	29.8-48.0
<i>Acacia nilotica</i>	10-20	10-20	0.45-1.76	19.2-55.8
<i>Anogeissus latifolia</i>	20-30	20-30	1.08-1.43	27.7-54.0
<i>Bombax ceiba</i>	10.0	10	0.58-1.24	17.8-19.7
<i>Butea monosperma</i>	10-50	10-50	0.16-2.08	16.0-55.5
<i>Dalbergia sissoo</i>	20-70	20-50	0.40-1.43	28.1-54.6
<i>Diospyros sp.</i>	10	10	0.11-0.29	8.7-12.8
<i>Ehretia laevis</i>	10-30	10-30	0.12-0.93	8.8-54.9
<i>Flacourtia indica</i>	10-20	10-20	0.10-0.27	7.8-25.8
<i>Grewia glabra</i>	10-40	10-40	0.34-1.25	17.0-58.0
<i>Lannea coromandelica</i>	10-40	10-40	0.51-2.47	13.5-73.6
<i>Laucaena leucocephala</i>	10-30	10-30	0.10-0.92	12.2-33.0

Acacia community: The forest is dominated either by *Acacia catechu*, *A. nilotica* or *A. modesta*, while other species are scattered randomly in the forest. The forest is widely scattered in the hill tops along with 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. The contribution of *A. catechu* is quite high as compared to other associates. The IVI of *Acacia* species in most of the sites is always above 125, which shows their dominance in the site (Table 18).

Table 18: Structural attributes of *Acacia* community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Acacia</i> community (7 stand)				
<i>Acacia catechu</i>	30-90	30-60	0.9-4.1	64.1-108.3
<i>Acacia modesta</i>	10-60	10-40	0.1-2.3	12.7-143.2
<i>Acacia nilotica</i>	40-50	40	0.8-1.0	54.0-66.8
<i>Anogeissus latifolia</i>	10-30	10-30	0.2-1.4	10.5-61.9
<i>Azadirachta indica</i>	20.0	20	0.3-0.6	19.8-31.0
<i>Bombax ceiba</i>	10.0	10	0.5	21.8
<i>Dalbergia sissoo</i>	10-20	10-20	0.2-1.3	13.1-31.5
<i>Diospyros sp.</i>	10-20	10-20	0.1-0.4	13.8-28.2
<i>Ehretia laevis</i>	20-30	20-30	0.2-0.6	28.0-39.3
<i>Flacourtia indica</i>	20-30	20-30	0.3-0.4	28.5-39.3
<i>Grewia glabra</i>	10	10	0.1	13.8-14.8
HB	20.0	20	0.5	29.2
<i>Lannea coromandelica</i>	20-30	20-30	0.5-1.1	29.7-69.7
<i>Oogenia oojenensis</i>	10.0	10	0.4	18.8

Leucaena community: 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*. In both the sites the density was high as compared to other associates (Table 19).

Table 19: Structural attributes of *Leucaena leucocephala* community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Leucaena</i> community (2 stand)				
<i>Acacia catechu</i>	40.0	40	0.8	34.3
<i>Acacia modesta</i>	30.0	30	0.7-0.8	27.5-66.1
<i>Acacia nilotica</i>	30.0	20	1.1	62.5
<i>Bombax ceiba</i>	20.0	20	0.6	19.6
<i>Butea monosperma</i>	20.0	20	0.4	17.7
<i>Dalbergia sissoo</i>	30.0	30	0.8-1.4	34.7-65.1
<i>Diospyros sp.</i>	20.0	20	0.5	18.2
<i>Ehretia laevis</i>	10.0	10	0.1	7.6
<i>Grewia glabra</i>	20.0	20	0.6	19.5
<i>Leucaena leucocephala</i>	40-150	40-90	1.9-4.2	106.1-121.0

***Anogeissus-Acacia* community:** This forest is found mostly on hill slopes with associates such as *Lannea coromandalica*, *Flacourtia indica*, *Grewia glabra* and *Dalbergia sissoo*. Both the species contribute equally for density as well as total basal area (Table 20).

Table 20: Structural attributes of *Anogeissus-Acacia* community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Anogeissus-Acacia</i> community (2 stand)				
<i>Acacia catechu</i>	40-50	40-50	1.2-2.7	83.1117.3
<i>Acacia modesta</i>	10-20	10-20	0.3-0.6	18.0-45.1
<i>Anogeissus latifolia</i>	30-50	30-50	1.0-1.8	69.7-92.6
<i>Dalbergia sissoo</i>	20.0	20	0.7	46.6
<i>Flacourtia indica</i>	10.0	10	0.2	15.3
<i>Grewia glabra</i>	10-20	10-20	0.2-1.5	21.2-50.5
<i>Lannea coromandelica</i>	20.0	20	1.0	40.8

***Dalbergia-Butea* community:** This forest is found generally in the valley bottom or the lower slopes at the base of the hill. The other associate species are *Bombax ceiba*, *Acacia catechu* and *Anogeissus latifolia* on hilly sides. In one of the sites both the species contributes equally for density and IVI, while in other sites contribution of *Dalbergia* is quite high owing to site characteristic features as *Dalbergia* prefers to grow along the water channels or riverine areas (Table 21).

Table 21: Structural attributes of *Dalbergia-Butea* mixed community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Dalbergia.Butea</i> community (1 stand)				
<i>Butea monosperma</i>	40.0	30	1.2	77.0
<i>Dalbergia sissoo</i>	30.0	30	1.5	76.7
<i>Bombax ceiba</i>	20.0	20	0.9	50.1
<i>Lannea coromandelica</i>	20.0	20	0.4	38.3
TC	10.0	10	0.3	22.1
<i>Anogeissus latifolia</i>	10.0	10	0.2	18.3
PS	10.0	10	0.1	17.6

Mixed Community: Siswan dam area is largely dominated (45%) by mixed community forests. Several species such as *Dalbergia sissoo*, *Lannea coromandelica*, *Diospyros sp.*, *Acacia modesta*, *Flacourtia indica*, *Anogeissus latifolia*, *Grewia glabra*, *Laucaena leucocephala* and *Nyctanthes arbor.tristis* form various associations and are governed mainly by the soil, aspect and slope of the site (Table 22).

Table 22: Structural attributes of mixed community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (TBA, m ² ha ⁻¹)	Importance Value Index (IVI)
Mixed community (6 stand)				
<i>Acacia catechu</i>	50-80	50-60	1.2-1.8	46.9-74.8
<i>Acacia modesta</i>	20-60	20-50	0.5-1.7	20.4-57.5
<i>Acacia nilotica</i>	30.0	20	2.4	49.4
<i>Anogeissus latifolia</i>	30-40	30-40	0.6-2.1	34.2-58.1
<i>Azadirachta indica</i>	10.0	10	0.2	10.6
<i>Bombax ceiba</i>	10-20	10-30	0.7-2.0	17.0-41.2
<i>Butea monosperma</i>	40-60	30-50	1.2-3.0	36.2-63.7
CF	30.0	20	0.5	22.5
<i>Dalbergia sissoo</i>	20-110	20-50	0.3-3.0	20.5-92.9
<i>Diospyros sp.</i>	10-30	10-50	0.2-1.0	10.4-39.5
<i>Flacourtia indica</i>	20-40	20-40	0.3-0.9	16.7-43.8
<i>Grewia glabra</i>	20-50	20-50	0.6-1.3	24.0-49.9
HB	20.0	20	0.4	17.9
<i>Lannea coromandelica</i>	10-60	10-50	0.6-3.4	12.4-72.4
<i>Laucaena leucocephala</i>	20.0	20	1.0-2.5	29.3-34.6
<i>Nyctanthes arbo.tistris</i>	20.0	20	0.5	24.6
<i>Phoenix humilis</i>	10.0	10	0.1	7.7

Moringa-mixed community: In few places *Moringa* forms patches along with *Acacia* and *Dalbergia* with *Lantana* and *Adhatoda* underneath (Table 23).

Table 23: Structural attributes of *Moringa*-mixed community.

Species	Density (trees ha ⁻¹)	Frequency (%)	Total basal area (m ² ha ⁻¹)	Importance Value Index (IVI)
<i>Moringa</i> sp.	50.0	40	5.1	114.8
<i>Acacia nilotica</i>	40.0	40	2.4	79.2
<i>Dalbergia sissoo</i>	50.0	40	1.5	75.9
<i>Lannea coromandelica</i>	20.0	20	0.3	30.1
Total	160.0	140	9.3	300.0

In a nutshell, vegetation of Siswan dam area is dominated by early successional species and have several associations, primarily governed by topographic features. This initial investigation provides baseline information about different associations/communities which could be monitored over time. This could also help in undertaking further studies for understanding the linkages between different associations/communities with their abiotic and other associated faunal attributes.

An interesting finding of this study is that the hilly tops at few locations of the reserve are full of *Tinospora sinensis*. In the event of this area being declared as community reserve, augmentation and sustainable harvesting of *Tinospora* could offer an opportunity of alternate livelihood to the local communities.



Focused group discussion with the villagers

HUMAN DIMENSIONS

There are two villages around this reserve i.e. Siswan and Mirzapur. However, the forest of this reserve belong to village Siswan. Therefore, understanding the linkages between village Siswan and this reserve is important. With this objective in mind focus group discussion with the village communities of Siswan was carried out during the course of this work. The objective of this exercise was to assess people's perspective regarding existing status and proposed management of the adjoining forest area.

Methodology

Focused group discussion (FGD) was conducted with few village representatives in the presence of the *gram pradhan* (village headman). The intention was to implore the villagers about their dependence on the surrounding region of the dam and identify the stakeholders, if a process of community participation for natural resource management has to be initiated in the region. The exercise also comprised of social mapping and problem prioritization for a clearer perspective of the tradeoffs that might have to be considered for effective management of proposed community reserve in this area with environmental stewardship and livelihood security.

About the village

Village Siswan is spread over an area of 1,678 ha. The most prominent landmark for the village is Siswan Dam that was created in 1997-98. It is a low dam with 24 m height and the water it stores is used for irrigating agriculture across 950 ha of land. Over the years the area near the dam has emerged as a popular getaway spot for tourists from nearby places. Presently, the forest department is considering the prospects of converting the adjoining region of the dam into a community reserve. However, people seem to be apprehensive about the implications of the above proposal in the absence of any extensive dialogue between the villagers and the forest department. Some basic information about the village is shown below in table 24.

Table 24. Basic information about Siswan village

1. Name of Gram Panchayat	Gram Panchayat Siswan		
2. Name of the District	Sahibzada Ajit Singh Nagar		
3. Forest area (Protected Forest)	3300 acre		
4. Agriculture land	200 acre		
5. Fallow land/ waste land	37 acre		
6. Water bodies	8 acre		
7. Habitation/ homestead area	10 acre		
8. Total households (HH)	98		
	Male	Female	Total
9. Scheduled Caste	112	90	202
10. Other Backward Caste	70	65	135
11. Others	72	65	137
Total	254	220	474
12. Percentage of total literates	79%	75%	77%
13. Landless (HH)	40		
14. Marginal land holding - 0.1 to 2.5 Acre (HH)	27		
15. Marginal land holding - > 2.5 acre (HH)	10		
	Cattle	Goats	Poultry
16. Livestock holding	72	15	37

Major findings

According to the villagers, land around the village (*pind*) belongs to the Gram Panchayat. However, they also mention that land holders are not from the *pind*, but are mostly outsiders. Legend has it that after the 1947 partition, government took custodian of the land belonging to the Muslim families who relocated to Pakistan. Thus most of the land that belongs to the *pind* today is what had been purchased by the villagers from the government back then. There seems to be some confusion over land rights and by and large it could be assessed that villagers were unclear about the implication of giving up village land.

- It was found that since most households did not have livestock there was no dependence on the forest for fodder which is mostly bought from markets.
- Around 25% of the households in Siswan do not use LPG cylinders for cooking. Hence these households along with few other who complement LPG usage with fuel-wood depend on the forest for fire-wood.
- People do not harvest fish from the reservoir. Nevertheless, irrigation department, in charge of the Siswan reservoir, allows fish to be harvest from the reservoir periodically after 5 years to contractors who are not from Siswan. According to sources from the villages fishes worth ten lakhs is auctioned during harvests. Villagers could not get the contract for the same since it involves a lot of money which they cannot afford.
- On the whole there seemed to be a consensus among the people about the village not having any benefits or making profits from the reservoir.

Some of the problems faced by the villagers are as follows:.

- Crop depredation by swamp deer and sambar deer but only for a few households whose agricultural lands are farther away from the pind. Furthermore, the ex-gratia provided by the forest department according to the villagers is meager.
- No medical facility available in less than 5 km of the village.

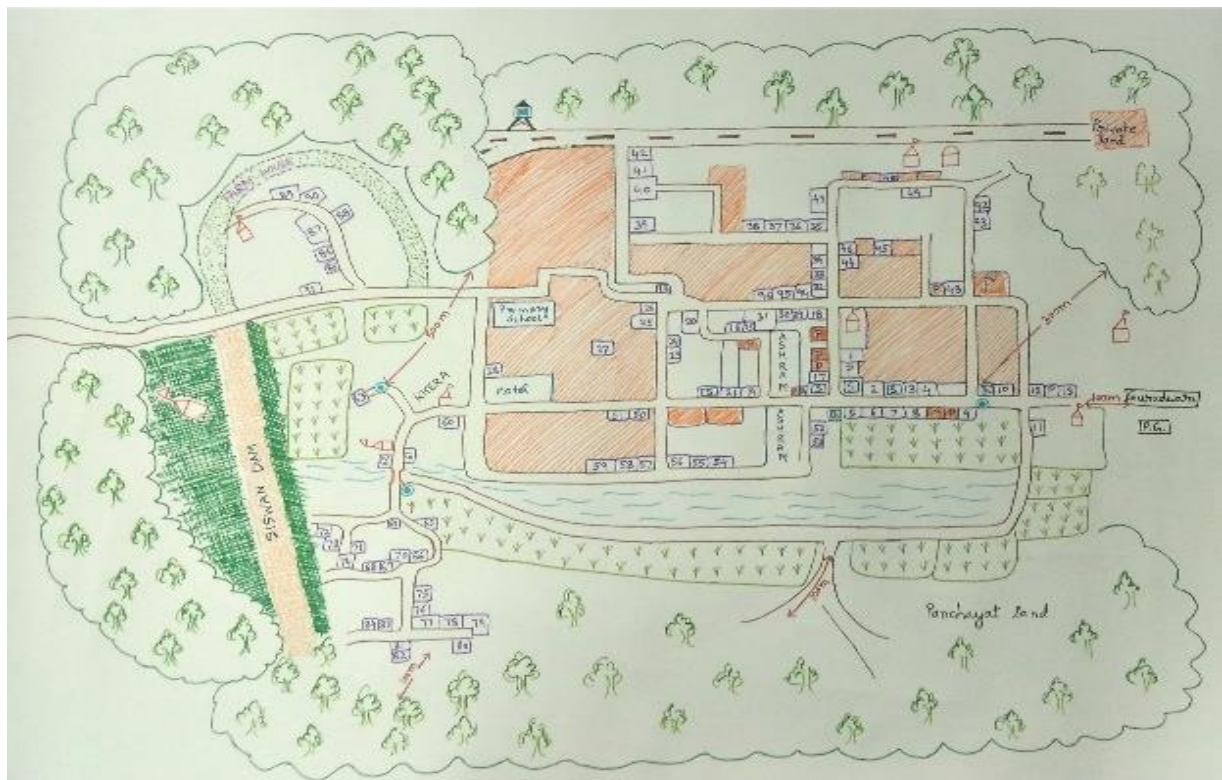


Figure 5: Social mapping of Siswan

- The closest high school is 10 km away in Bhootgarh. Students find it difficult to commute 10km to and fro every day for schooling and consequently are moving out for education.
- Although the villagers do not depend heavily on livestock rearing, the few who do complained of not having a veterinary hospital close to the village (there is one 5 km away).

Table 25: Different livelihood sources of Siswan

Source of livelihood	Number of Households
1. Agriculture	12
2. Forestry	42
3. Animal Husbandry	36
4. Wage labour	40
5. Small-scale business	25
6. Service/Job	32

The exercise of social mapping (Figure 5) instructed that poverty in the village is dictated by being unemployed or being a wage labor and not being able to do agriculture, such as for those who are differently-abled, in their old age or abandoned. And the better-off in the village were those who had government job such as a fourth class job with the irrigation department and pension holders. Mostly villagers are involved in the informal sector to earn a living. Various modes of livelihood being used by the villagers are provided in table 25.



Major Findings and Recommendations

1. This is a good patch of habitat with perforated connectivity with adjoining forests. Camera trap exercise reveals that presence of sambar, barking deer, wild pig, golden jackal, jungle cat as well as leopard along with other associated fauna of Siwalik ecosystem.
2. Due to the presence of diverse habitats of scrub forests, tree growth, water body and few grasslands, it also supports diverse bird populations, which can play an important role for long-term conservation of this Siwalik foothill ecosystem.
3. Because of relatively less disturbed habitat, the diversity of insects, amphibians and reptiles is comparatively higher.
4. Typical unique vegetation of Siwalik system of this area comprise of different plant associations .
5. Adjoining areas of reserve are under intensive agriculture and therefore dependencies of local communities on forest are comparatively less, however the human wildlife interface is an issue, which should be actively managed.
6. As this area is already in-principle declared as a community reserve, this ecological survey should be used as an opportunity for preparation of a scientific management plan and system of long term continuous monitoring supported by appropriate decentralized institutional arrangements, through the process of long-term engagement of communities and other stakeholders.
7. The Reserve also has good tourism potential as it is located adjoining to the city of Chandigarh and Mohali. Area is small and therefore cannot support mass tourism. However, eco-tourism activities with carefully worked out carrying capacities and by involvement of local communities could benefit both local people and conservation of this area. In fact, it could become an important destination of eco-tourism as well as conservation education in the state.
8. Active management of this area requires a team of devoted staff with adequate capacities. The protection of the area could be strengthened by building appropriate participatory mechanisms with the local communities.
9. There is a problem of feral dogs in the reserve which is negatively impacting the population of some of the ungulates. Area needs to be freed from feral dogs for its long term sustainability.





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