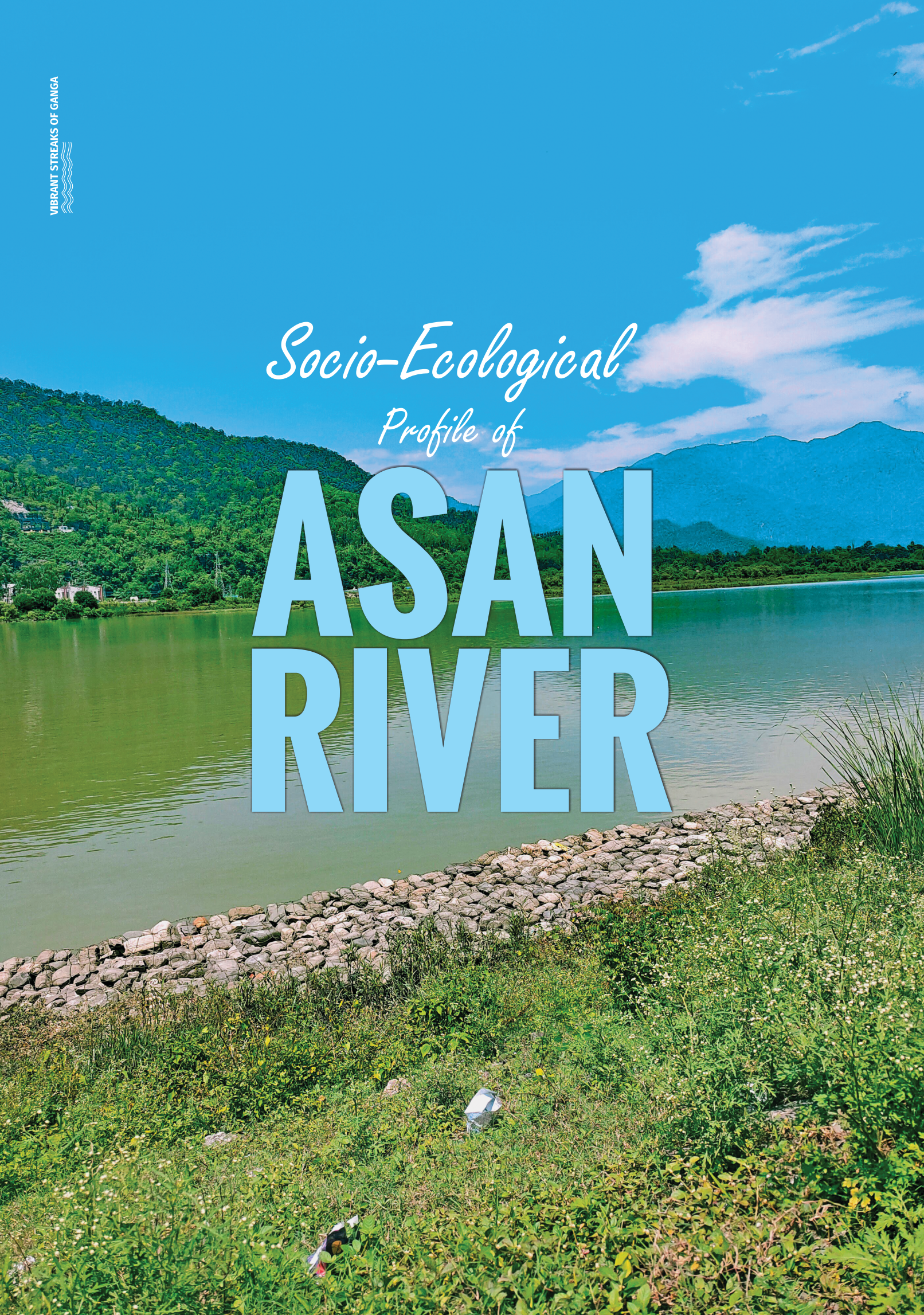
VIBRANT STREAKS OF GANGA



Socio-Ecological Profile of ASAN RIVER

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SOCIO- ECOLOGICAL PROFILE OF ASAN RIVER

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preface

India, as a megadiverse country, is home to a diverse range of landscapes and ecosystems, including freshwater ecosystems that comprise rivers and associated wetlands. Among them, the Ganga River basin is an important life-support system that has sustained human civilizations. The Ganga River, which flows across the five states is a vital source of life for more than 40 per cent of India's billion-plus population. The Ganga River is fed by several tributaries, which contribute to the river's resourcefulness by providing adequate nutrients, drift, and favourable ecological conditions for the species it houses. On the contrary, such tributaries also bring with them numerous pollutants and toxic waste resulting in the increase of the pollution load on the Ganga River.

The Wildlife Institute of India through the *Biodiversity Conservation and Ganga Rejuvenation Project* funded by the Ministry of Jal Shakti "National Mission for Clean Ganga" under its flagship programme '*Namami Gange*' has been working towards the conservation of the Ganga River, to strengthen concerted efforts for restoration of its biodiversity value. During the project's first phase, which focused on the detailed biodiversity profiling of the Ganga River, the importance of conservation of its tributaries in supporting the biodiversity of Ganga River was realized. As a result, phase II of the project "*Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga*" was designed to develop a comprehensive restoration and long-term plan for the Ganga River's tributaries.

In view of this the project undertook study of major tributaries of Ganga River and studied smaller tributaries in the Ganga basin. Asan is one of the most major rivers that drains the Doon valley. It originates from the Chandrabani village in Dehradun, Uttarakhand and serves as one of Yamuna's principal tributaries. Based on the secondary literature review, the report attempts to compile the socio-ecological profile of the Asan River and will enable the reader to better understand the variety of the flora and fauna of the Asan River, change in forest cover and land use land cover patterns, and the threats faced by the River. This report aims to highlight the need for more focused scientific studies of the Asan River, conservation efforts, to develop a knowledge base for the species of Asan River, aid in biological restoration, and assist policy planners and managers to judiciously use water from the Asan River, given the needs of the species therein.

Ruchi Badola
Syed Ainul Hussain

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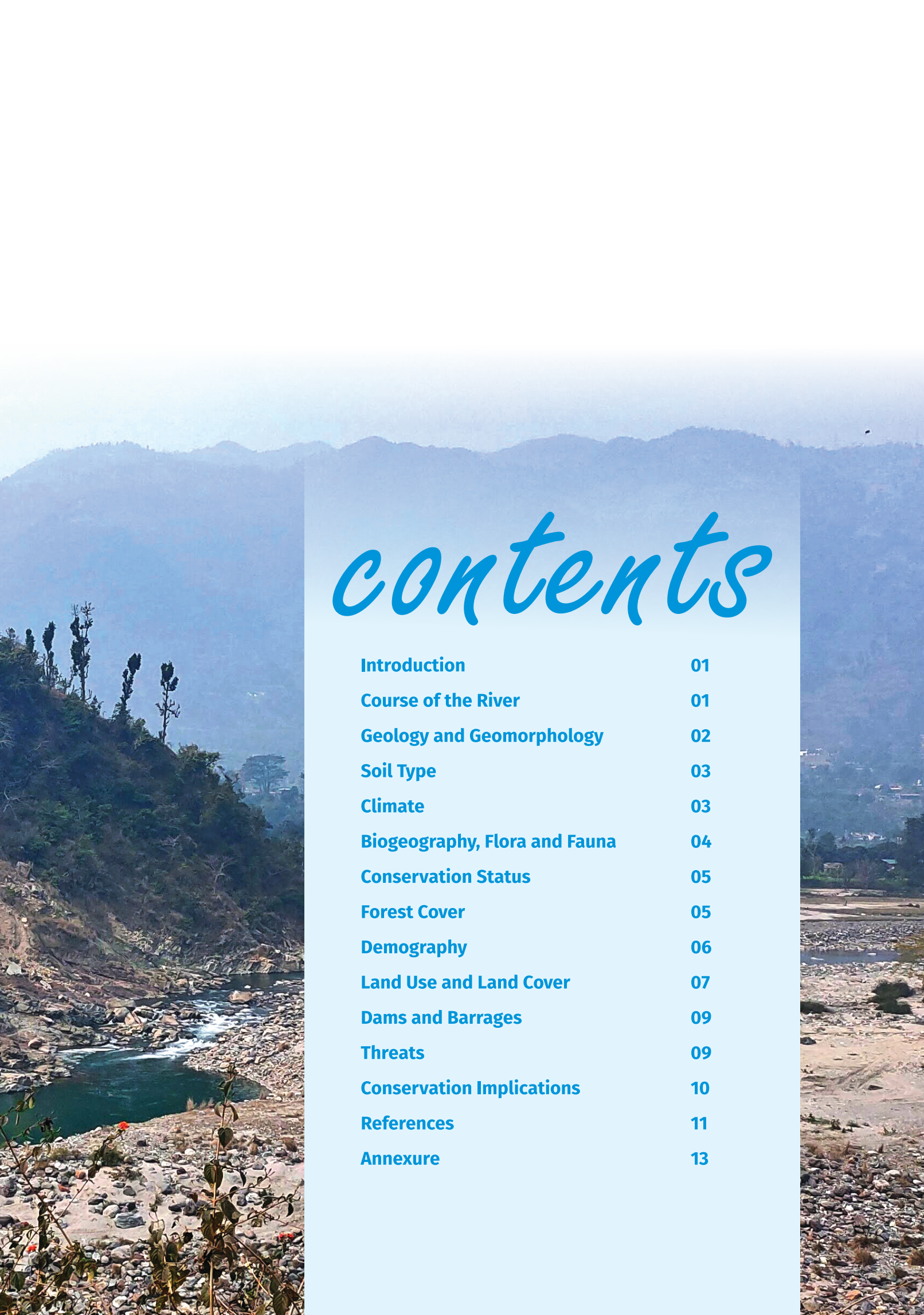

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INTRODUCTION

Asan River, a tributary of the Yamuna River, flows for about 40 km through the doon valley (Figure 1). It flows between Lower Himalaya in the north to the Siwalik in the south (Sharma et al., 2020; Sharma, 2021). It is a sixth-order stream that forms one of the critical watersheds in the Doon valley, which supports a human population of about 0.455 million in rural and urban areas (Sharma et al., 2020; Sharma et al., 2021). One protected area, the Asan Conservation Reserve, falls in the Asan River basin. Agriculture is the major source of livelihood in the area (Kumria, 2017). According to Hindu mythology *Rig Veda*, the Asan River was known as *Asmavanti* (Mishra et al., 2022).

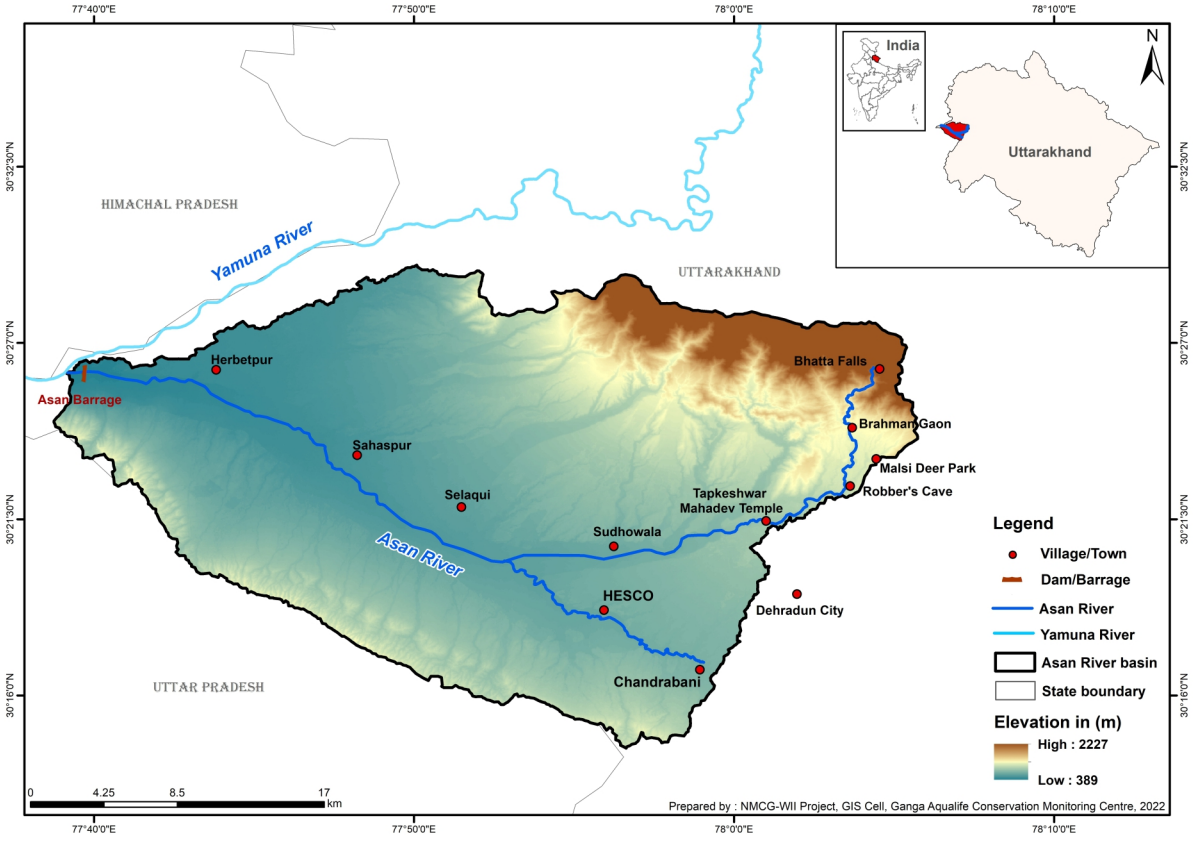


Figure 1. Map of Asan River

COURSE OF THE RIVER

Asan is a rain-fed river that originates from Chandrabani village in Dehradun, Uttarakhand, and flows through Uttarakhand, and has a basin in two states, Uttarakhand and Uttar Pradesh (Mohan et al., 2009). It has a catchment of ~701.15 km^2, of which about 98.8% of the catchment area falls in Uttarakhand and only 1.2% in Uttar Pradesh. Traversing through Badowala, Jhajra, Sahaspur, Sabhawala, Herbertpur and Dhalipur, the Asan River drains the western half of Dehradun valley. A barrage built over the river, at Dahlipur, just before its confluence

with the Yamuna River has converted the landscape into a reservoir, which is popularly known as Asan reservoir (also called Dhalipur Lake). The reservoir is situated at the confluence of the Eastern Yamuna Canal and the Asan River. The Asan joins the Yamuna River just below the Asan barrage at Kulhal near Paonta, which also forms the Himachal Pradesh border (Mohan et al., 2009; Hussain, 2015). The drainage pattern of the Asan river is primarily dendritic to sub-dendritic, parallel to sub-parallel, trellis, angular, rectangular, intermittent, and braided (Kedareswarudu and Kumar, 2013). Tons, Suarna and Sitla Rao are the tributaries of the Asan River (Figure 2).

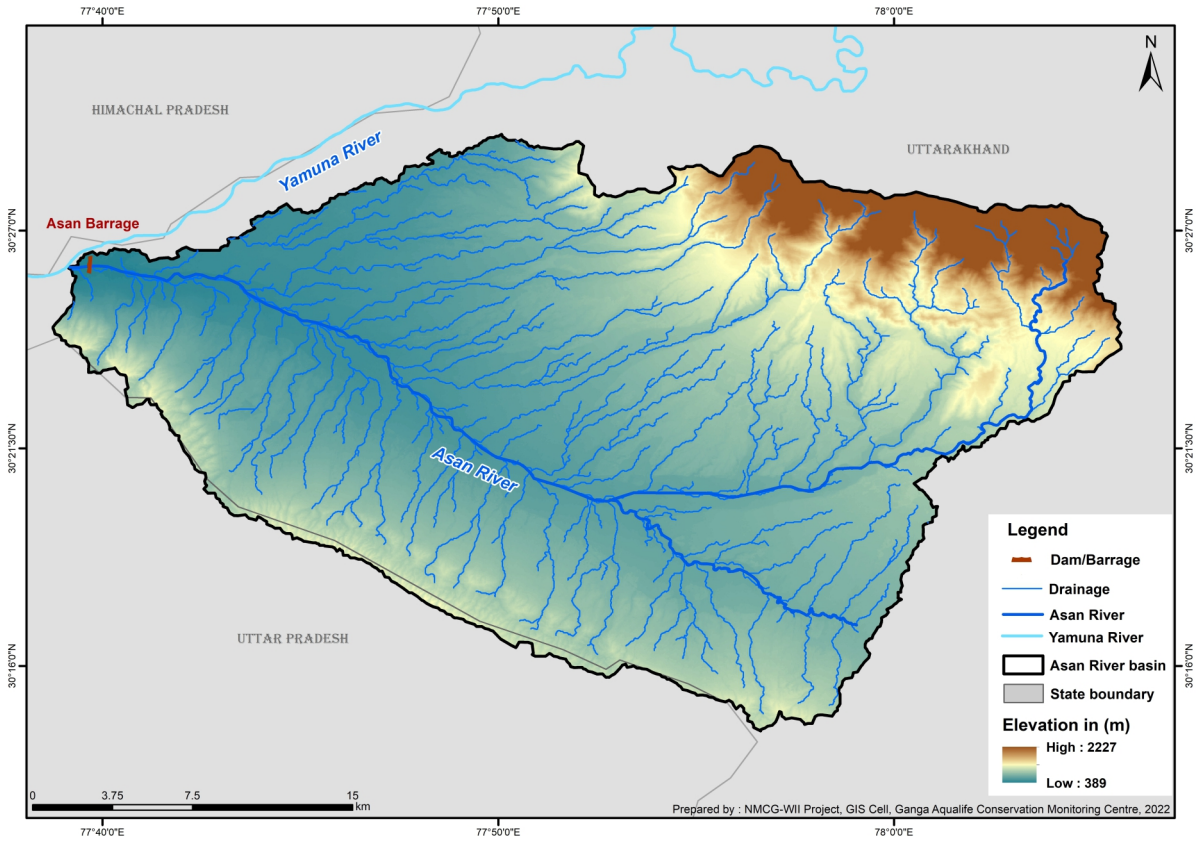


Figure 2. Drainage map of Asan River

GEOLOGY AND GEOMORPHOLOGY

The Asan River is divided into four major hydrogeological units due to the variation in geology and landforms, namely lesser Himalaya, Siwaliks, Doon gravels, and alluvial fans (Sharma, 2021). Lesser Himalaya in the northern part of the river basin is comprised of deformed sedimentary, low-grade metamorphic, and igneous rocks from the Middle Proterozoic to the Cambrian age (Sharma, 2021). Siwaliks covering the southern basin of the river, are formed by the molassic deposit of the Neogene Quaternary age, mainly comprised of shale, sandstone, siltstone, and conglomerate. Doon gravel covers the central basin of the river and represents the recent alluvium (Sharma, 2021). Alluvial fans represent one of the major geomorphological units formed by alluvium deposits (sand, gravel, and silt). Gemorphologically, Asan is represented by floodplains, young terrace, older terrace, lower piedmont of doon gravel, upper piedmont of the older terrace, the residual hill of older doon gravel, moderately dissected structural hill, highly dissected structural hill and denudation hill (Sharma, 2021).

Asan River

SOIL TYPE

According to FAO-UNESCO (1977), the catchment of the Asan River is represented by 59.71% of Fluvisols soil and 40.29% of Cambisols soil. Fluvisols soil occurs in the southern and western parts of the catchment and Cambisols in the northern and north-western parts.

CLIMATE

The climate of the area is sub-tropical to tropical, and depending on the altitude; it varies from tropical to cold (Garg et al., 2012). Summers from March to June are hot and more or less dry, with the minimum and maximum temperatures ranging from 14°C to 38°C. Winters from October to February are cold, with minimum and maximum temperatures ranging from 2°C to 21°C, and January is the coldest month. The area receives annual mean precipitation of 200 cm during monsoon (from July to September) (Mohan et al., 2009).

BIOGEOGRAPHY, FLORA AND FAUNA

The Asan River flows through only the Gangetic Plains biogeographic zone and Upper Gangetic Plains (7A) biotic province. Its basin falls in two biogeographic zones, the Himalaya and the Gangetic Plains and two biotic provinces, Western Himalaya (2B) and Upper Gangetic Plains (7A). According to Champion and Seth (1968), the forest area around the Asan River in Doon valley is grouped under the tropical moist deciduous forest type (3C/C2b), which is further divided into north Indian tropical moist deciduous forest, moist sal bearing forest, bhabar dun sal forest. This area is dominated by *Shorea robusta, Lagerstroemia parviflora, Adina cordifolia, Mallotus philippensis, Litsea glutinosa, Syzygium cumini, Ehretia laevis, Litsea glutinosa, Clerodendrum viscosum,* and *Millettia auriculata*. According to FSI (2009), the forest area around the Asan River basin is dominated by moist Siwalik sal forest (3C/C2) and dry Siwalik sal forest (5B/C2). Scientifically, there is a lack of studies on the flora of the Asan River, and seldom studies provide information on the flora of the Asan. The aquatic vegetation of the Asan reservoir is dominated by *Typha elephantina* and represented by species such as *Potamogeton pectinatus, Ceratophyllum demersum* and *Eichhornia crassipes* (Mohan et al., 2009).

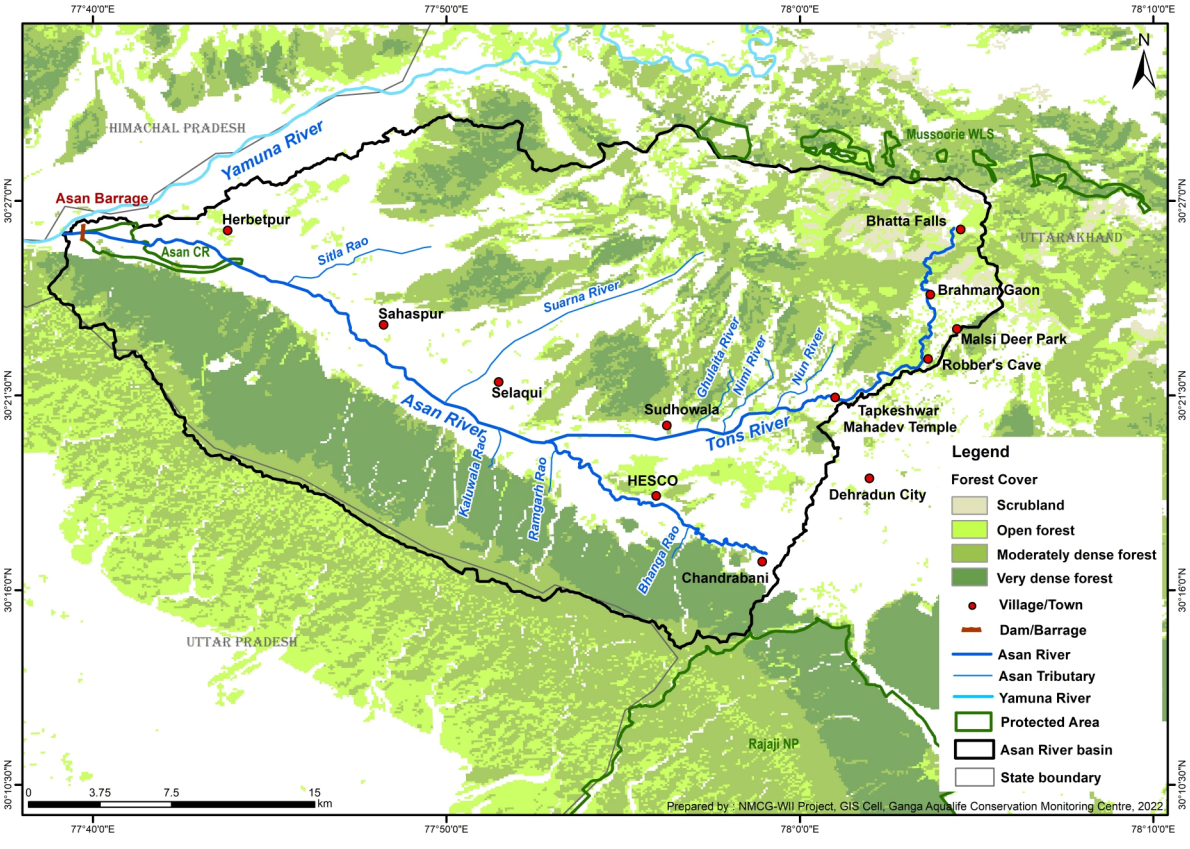
Asan River is mostly known for its avifaunal diversity and seldomly studied for its biodiversity. Most of the studies are from the Asan Conservation Reserve and Asan Barrage. Hussain (2015) reported 44 fish species belonging to 29 genera, 11 families, and five orders from the Asan River and its tributaries. This includes Endangered *Tor putitora* and Vulnerable *Naziritor chelynoides* and *Schizothorax richardsonii*. Tak et al. (2003) reported 20 mammal species belonging to 17 families, one reptilian species, 95 bird species belonging to 19 families, 40 fish species belonging to 10 families, and four amphibians belonging to three families from the Asan Conservation Reserve.

CONSERVATION STATUS

In 2005, a 444-ha stretch located at the Asan and Yamuna rivers confluence was declared as a Conservation Reserve by the Government of Uttarakhand under Section 36 A of the Wild Life (Protection) Act, 1972. The Conservation Reserve protects native flora and fauna and allows sustainable resource extraction from the Reserve. Later in 2020, Asan Conservation Reserve was declared as a Ramsar Site (Site number 2437) (Ramsar site Information Service, 2022). Asan Conservation Reserve plays an important role in maintaining hydrological regimes by supporting the biodiversity and the hydroelectricity production of the Barrage. Asan Conservation Reserve provides a home to the critically endangered red-headed vulture (*Sarcogyps calvus*), white-rumped vulture (*Gyps bengalensis*) and Baer's pochard (*Aythya baeri*). The reserve also supports more than 1% of the biogeographical populations of red-crested pochard (*Netta rufina*) and ruddy shelduck (*Tadorna ferruginea*). Endangered golden mahseer (*Tor putitora*) have also been reported from the area (Ramsar site Information Service, 2022). Siltation, the proliferation of weeds and invasive species, illegal biomass collection and unsustainable tourism are significant threats to the Asan wetland and its biodiversity.

FOREST COVER

According to the Forest Survey of India (2015 & 2019), the catchment of the Asan River is dominated by non-forest cover, followed by very dense forest, moderately dense forest, open forest, and scrubland (Figures 3a & 3b). From 2015 to 2019, an increase of 6.36% and 1.58% was recorded for the very dense forest and non-forest, respectively. However, a decrease of 5.87% and 2.01% was recorded for moderately dense and open forests, respectively (Table 1).



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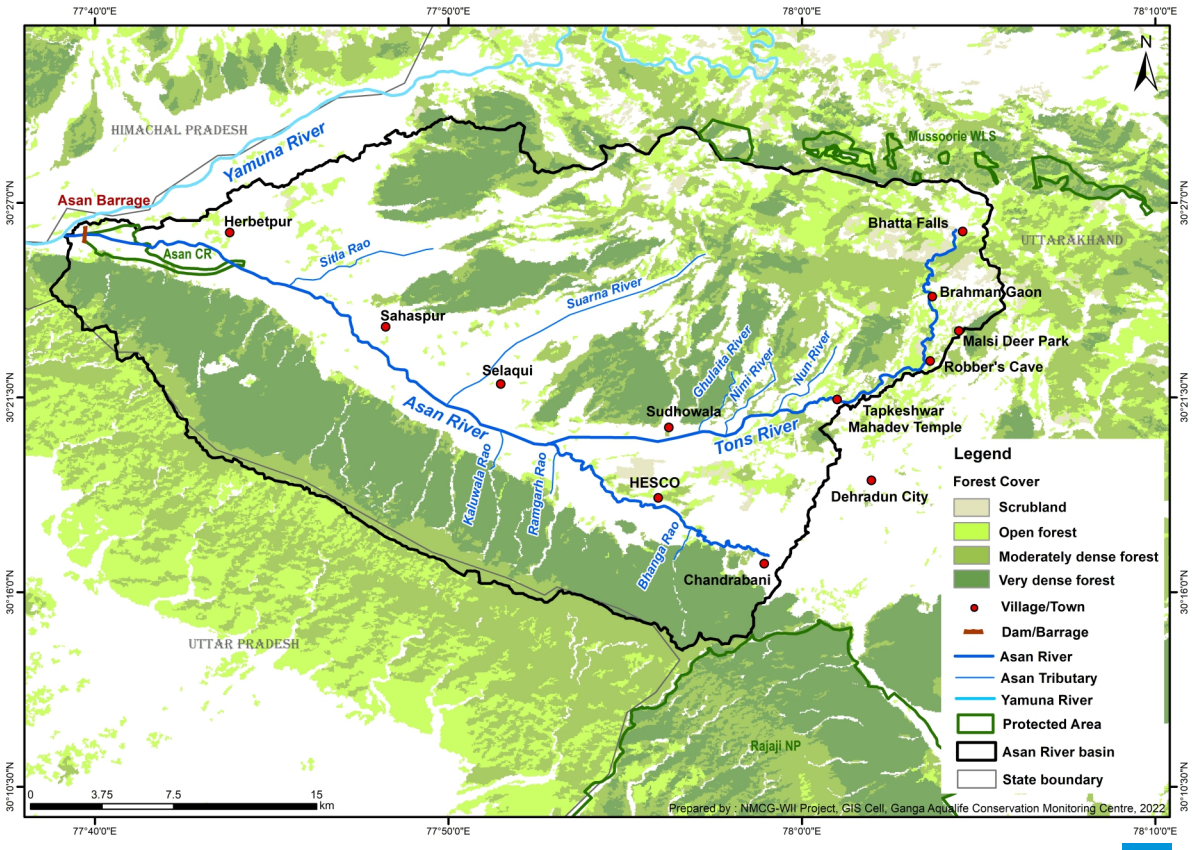

Figure 3. Forest Cover of Asan River basin in a) 2015 and b) 2019

b

Table 1. Summary statistics of the forest cover of the Asan River basin from 2015 to 2019.

S.No.	Forest Cover Classes	2015		2019		Change (2015 to 2019)	
		Area (km²)	Area (%)	Area (km²)	Area (%)	Area (km²)	Area (%)
1	Scrubland	10.94	1.56	10.51	1.5	-0.43	-0.06
2	Open Forest	72.67	10.36	58.56	8.35	-14.11	-2.01
3	Moderately Dense Forest	157.59	22.48	116.49	16.61	-41.1	-5.87
4	Very Dense Forest	172.53	24.61	217.14	30.97	44.61	6.36
5	Non-forest	287.42	40.99	298.45	42.57	11.03	1.58
	Total Area	**701.15**	**100**	**701.15**	**100**		

Source: FSI (2015 & 2019)

DEMOGRAPHY

Asan River basin supports a human population of 7.76 lakh (GOI, 2011). There are five blocks in the Dehradun district that fall in the Asan River basin, Doiwala, Sahaspur, Vikasnagar, Raipur and Forest CD Block Dehradun. Doiwala, with a 2.2 lakh human population, is the most populated of these blocks (Figure 4a & 4b and Table 2). From 2001 to 2021, there was an increase of 58.77% in the human population of the Asan River basin, higher than for India's at 17.7% (GOI, 2011). In ten years, Forest CD Block and Raipur Block have witnessed a considerable increase in the human population.

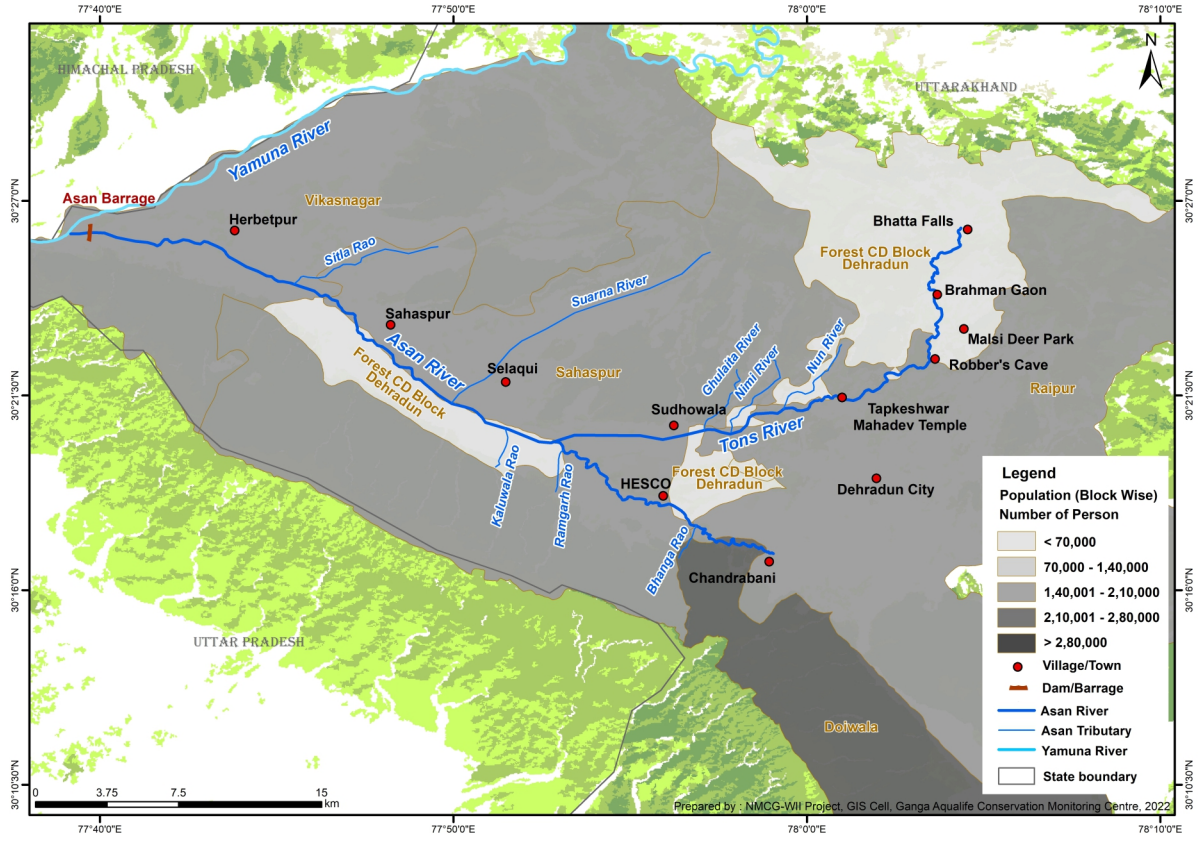

Figure 4. Human population status of the Asan River basin (2011)

Table 2. Block-wise human population statistics of the Asan River basin for 2011

District	Name	Population		Decadal Change (%)
		2001 (%)	2011 (%)	
Dehradun	Vikasnagar	105393 (21.56)	165663 (21.35)	60270 (57.19)
	Sahaspur	138901 (28.42)	184381 (23.76)	45480 (32.74)
	Raipur	88628 (18.13)	165386 (21.31)	76758 (86.61)
	Doiwala	138321 (28.3)	221513 (28.54)	83192 (60.14)
	Forest CD Block Dehradun	17565 (3.59)	39143 (5.04)	21578 (122.85)
	Total	**488808**	**776086**	**287278 (58.77)**

Source: Government of India, 2011

LAND USE AND LAND COVER OF THE AREA

Based on NRSC data (2008-09 and 2018-19), two Land Use and Land Cover (LULC) maps of the Asan River basin were prepared. The Land Use and Land Cover of the Asan River basin can be categorised into 11 categories: built-up, Kharif crop, rabi crop, double/triple crop, fallow land, plantation, evergreen forest, deciduous forest, degraded/ scrub forest wasteland, and waterbodies. From 2008-09, the Asan River basin was dominated by 54.95% of deciduous forest, followed by 17.64% of double/triple crop, 6.28% of wasteland, 4.88% of built-up area, 4.54% of fallow land, 4.12% of waterbodies, 2.24% of evergreen forest, 1.86% of plantation, 1.83% of Kharif crop,

1.12% of degraded/scrub forest and 0.54% of rabi crop. From 2018-19 the basin was dominated by 54.3% of deciduous forest, followed by 17.9% of double/triple crop, 5.73% of built-up area, 4.81% of Kharif crop, 4.7% of wasteland, 4.14% of waterbodies, 2.28% of evergreen forest, 1.99% of fallow land, 1.92% of plantation, 1.17% of degraded/scrub forest, and 1.06% of rabi crop. LULC maps revealed that over a period of ten years, there was an increase of 2.89%, 0.85%, 0.52% and 0.26% in the Kharif crop, built-up area, rabi crop and double/triple crop, respectively. And a decrease of 2.55%, 1.58% and 0.65% in the fallow land, wasteland and deciduous forest area, respectively (Figures 5a & 5b and Table 3).

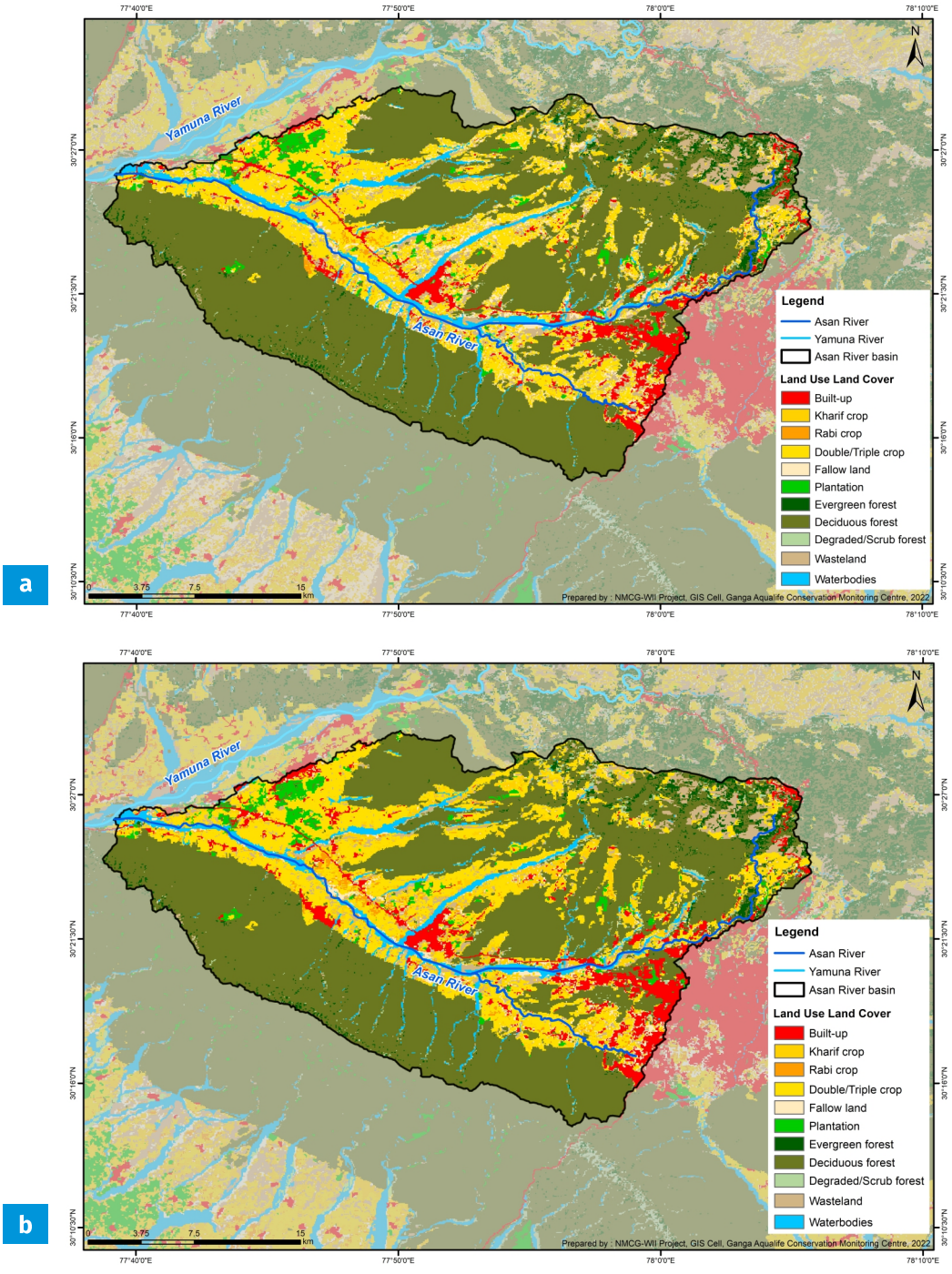

Figure 5. LULC map of Asan River basin a) 2008-09 and b) 2018-19

Table 3. LULC statistics of the Asan River basin for 2008-09, 2018-19 and 2008 to 2019.

S. No.	LULC Classes	2008-09		2018-19		Change (2008-19)	
		Area (km²)	Area (%)	Area (km²)	Area (%)	Area (km²)	Area (%)
1	Built-up	34.22	4.88	40.17	5.73	5.95	0.85
2	Kharif crop	12.83	1.83	33.74	4.81	20.91	2.98
3	Rabi crop	3.77	0.54	7.45	1.06	3.68	0.52
4	Double/Triple crop	123.7	17.64	125.48	17.9	1.78	0.26
5	Fallow land	31.81	4.54	13.92	1.99	-17.89	-2.55
6	Plantation	13.05	1.86	13.49	1.92	0.44	0.06
7	Evergreen forest	15.74	2.24	16	2.28	0.26	0.04
8	Deciduous forest	385.26	54.95	380.69	54.3	-4.57	-0.65
9	Degraded/Scrub forest	7.87	1.12	8.18	1.17	0.31	0.05
10	Wasteland	44.02	6.28	32.98	4.7	-11.04	-1.58
11	Waterbodies	28.88	4.12	29.05	4.14	0.17	0.02
	Total Area	701.15	100	701.15	100		

Source: NRSC (2009 and 2019)

DAMS AND BARRAGES

Asan Barrage was built on the Asan River in 1967 at the confluence of the Eastern Yamuna Canal and the Asan River in the Doon valley. Asan barrage, with a length of 288 m and 2.5 cumecs design flood discharge, was built for hydroelectric purposes. The steady supply of about 198.2 cusecs of water from the Asan barrage to Kulhal Power Station helps the station to generate about 14 million units per year (Hussain, 2007). Siltation due to the barrage construction created a permanent freshwater wetland on the Asan river and bird-friendly habitats. It also helps in flood control and supplies water for irrigation and domestic use (WWF, 2012).

THREATS

In a decade (2001 to 2011), the human population has increased by ~59% in the basin, which has evidently impacted the LULC of the basin. Increasing development activities have resulted in deforestation in the River's basin, which has caused habitat fragmentation (Kumria, 2017). The increasing human population in the Asan River basin has resulted in building construction for both residential and non-residential purposes. This has led to concretisation and a decrease in rainwater infiltration rate and groundwater recharge (CGWB, 2022). Therefore, urbanisation and encroachment in the basin have the potential to impact the river hydrology and cause urban flooding. Industrialisation in the Asan River basin also threatens surface water and groundwater quality (CGWB, 2022). The study conducted by Tripathi et al. (2008) reported that effluents discharged from the industries around Dehradun into the Asan River have resulted in a decrease in dissolved oxygen, biological oxygen demand, chemical oxygen demand, and an increase in free CO_2, turbidity, hardness, and change in pH of river water. The study conducted by Mishra et al. (2022) also reported heavy water pollution due to anthropogenic pressure. Agricultural encroachment and mining of boulders and sand from the Asan River and its surrounding areas are other issues threatening the riverine habitat and its associated species.

CONSERVATION IMPLICATIONS

The tributaries are known to increase in channel and habitat complexities, depth, and change in substrate composition, which increases the mainstem diversity downstream of the tributaries (Benda et al., 2004; Fernandez et al., 2004). Apart from contributing to the flow and aquatic diversity of the mainstem the tributaries also contribute to the pollution load to the mainstem. Any conservation actions for the mainstem, thus should also be directed at the tributaries. Thus the smaller tributaries of the Ganga River were taken up for study. Asan River, despite being an important tributary of the Yamuna River hasn't received the attention of the research institutions. The secondary literature review of the Asan River highlights the need for more scientific studies focusing on biodiversity both in terms of flora and fauna, ecotoxicology and physicochemical parameters of river water and identification of threats to understand the ecological status of the Asan River. Most of the ecological information for the Asan River is from the Asan Conservation Reserve, which highlights that the reserve plays an important role in the conservation of the aquatic species of the region. Involving communities in the conservation of this tributary through various ways will certainly aid in the further rejuvenation of the River. The HESCO (Himalayan Environmental Studies and Conservation Organization) located on the banks of the River has demonstrated the rejuvenation of the smaller rivers by local participation. Such practices may be upscaled and replicated with site-specific interventions.

Asan Conservation reserve

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ANNEXURE I

Mammalian species of the Asan River Basin

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Bovidae	Goral	*Naemorhedus goral* (Hardwicke, 1825)	VU	Schedule III	a
Canidae	Golden Jackal	*Canis aureus* (Linnaeus, 1758)	LC	Schedule II	a
Cercopithecidae	Rhesus Macaque	*Macaca mulatta* (Zimmermann, 1780)	LC	Schedule II	a
	Hanuman Langur	*Semnopithecus entellus* (Dufresne, 1797)	LC	Schedule II	a
Cervidae	Chital	*Axis axis* (Erxleben, 1777)	LC	Schedule III	a
	Sambar	*Rusa unicolor* (Kerr, 1792)	VU	Schedule III	a
	Barking Deer	*Muntiacus vaginalis* (Boddaert, 1785)	LC	Schedule III	a
Elephantidae	Indian Elephant	*Elephas maximus* (Linnaeus, 1758)	EN	Schedule I	a
Felidae	Leopard	*Panthera pardus* (Linnaeus, 1758)	VU	Schedule I	a
Herpestidae	Small Indian Mongoose	*Herpestes auropunctatus* (Hodgson, 1836)	LC	Schedule II	a
	Indian Crested Porcupine	*Hystrix indica* (Kerr, 1792)	LC	Schedule IV	a
	Indian Grey Mongoose	*Herpestes edwardsii* (É. Geoffroy Saint-Hilaire, 1818)	LC	Schedule II	b
Laporidae	Indian Black-naped Hare	*Lepus nigricollis* (F. Cuvier, 1823)	LC	Schedule IV	a
Manidae	Indian Pangolin	*Manis crassicaudata* (É. Geoffroy, 1803)	EN	Schedule I	a
Muridae	Lesser Bandicoot Rat	*Bandicota bengalensis* (Gray, 1835)	LC	Schedule IV	a
	Large Bandicoot Rat	*Bandicota indica* (Bechstein, 1800)	LC	Schedule IV	a
Sciuridae	Five-striped Palm Squirrel	*Funambulus pennanti* (Wroughton, 1905)	LC	Schedule IV	a
Suidae	Wild Boar	*Sus scrofa* (Linnaeus, 1758)	LC	Schedule III	a
Teropodidae	Indian Flying Fox	*Pteropus giganteus* (Brünnich, 1782)	LC	Schedule IV	a
	Indian Pipistrelle	*Pipistrellus coromandra* (Gray, 1838)	LC	Schedule II	a
Viverridae	Small Indian Civet	*Viverricula indica* (É. Geoffroy Saint-Hilaire, 1803)	LC	Schedule II	a

[a]Sati & Sinha (2003); [b]Mohan et al. (2009)

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ANNEXURE II

Bird species of the Asan River Basin

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
sittacidae	Alexandrine Parakeet	*Psittacula eupatria* (Linnaeus, 1766)	NT	Schedule IV	b
Apodidae	Alpine Swift	*Tachymarptis melba* (Linnaeus, 1758)	LC	NL	b
Dicruridae	Ashy Drongo	*Dicrurus leucophaeus* (Vieillot, 1817)	LC	Schedule IV	b
Cisticolidae	Ashy Prinia	*Prinia socialis* (Sykes, 1832)	LC	NL	a, b
Alaudidae	Ashy-crowned Sparrow-lark	*Eremopterix griseus* (Scopoli, 1786)	LC	Schedule IV	b
Cuculidae	Asian Koel	*Eudynamys scolopaceus* (Linnaeus, 1758)	LC	Schedule IV	b
Ciconiidae	Asian Openbill	*Anastomus oscitans* (Boddaert, 1783)	LC	Schedule IV	a, b
Monarchidae	Indian Paradise-flycatcher	*Terpsiphone paradisi* (Linnaeus, 1758)	LC	Schedule IV	b
Strunidae	Asian Pied Starling	*Gracupica contra* (Linnaeus, 1758)	LC	Schedule IV	b
Recurvirostridae	Pied Avocet	*Recurvirostra avosetta* (Linnaeus, 1758)	LC	Schedule IV	a, b
Anatidae	Baer's Pochard	*Aythya baeri* (Radde, 1863)	CR	Schedule IV	b
Sturnidae	Bank Myna	*Acridotheres ginginianus* (Latham, 1790)	LC	Schedule IV	b
Anatidae	Bar-headed Goose	*Anser indicus* (Latham, 1790)	LC	Schedule IV	a, b
Hirundinidae	Barn Swallow	*Hirundo rustica* (Linnaeus, 1758)	LC	NL	a, b
Turnicidae	Barred Buttonquail	*Turnix suscitator* (Gmelin, 1789)	LC	Schedule IV	b
Ploceidae	Baya Weaver	*Ploceus philippinus* (Linnaeus, 1766)	LC	Schedule IV	a, b
Laniidae	Bay-backed Shrike	*Lanius vittatus* (Valenciennes, 1826)	LC	NL	b
Ardeidae	Eurasian Bittern	*Botaurus stellaris* (Linnaeus, 1758)	LC	Schedule IV	a
Pycnonotidae	Black Bulbul	*Hypsipetes leucocephalus* (Gmelin, 1789)	LC	Schedule IV	b
Dicruridae	Black Drongo	*Dicrurus macrocercus* (Vieillot, 1817)	LC	Schedule IV	b
Phasianidae	Black Francolin	*Francolinus francolinus* (Linnaeus, 1766)	LC	Schedule IV	b
Threskiornithidae	Red-naped Ibis	*Pseudibis papillosa* (Temminck, 1824)	LC	Schedule IV	b
Accipitridae	Black Kite	Milvus migrans (Boddaert, 1783)	LC	Schedule I	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Muscicapidae	Black Redstart	*Phoenicurus ochruros* (Gmelin, 1774)	LC	Schedule IV	b
Ciconiidae	Black Stork	*Ciconia nigra* (Linnaeus, 1758)	LC	Schedule IV	a, b
Laridae	Black-bellied Tern	*Sterna acuticauda* (Gray, 1832)	EN	NL	a, b
Ardeidae	Black-crowned Night-heron	*Nycticorax nycticorax* (Linnaeus, 1758)	LC	Schedule IV	a, b
Laridae	Black-headed Gull	*Larus ridibundus* (Linnaeus, 1766)	LC	NL	a, b
Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus* (Latham, 1790)	NT	Schedule IV	a, b
Oriolidae	Black-hooded Oriole	*Oriolus xanthornus* (Linnaeus, 1758)	LC	Schedule IV	b
Podicipedidae	Black-necked Grebe	*Podiceps nigricollis* (Brehm, 1831)	LC	Schedule IV	a, b
Picidae	Black-rumped Flameback	*Dinopium benghalense* (Linnaeus, 1758)	LC	Schedule IV	b
Accipitridae	Black-winged Kite	*Elanus caeruleus* (Desfontaines, 1789)	LC	Schedule I	b
Scolopacidae	Black-tailed Godwit	*Limosa limosa* (Linnaeus, 1758)	NT	Schedule IV	b
Recurvirostridae	Black-winged Stilt	*Himantopus himantopus* (Linnaeus, 1758)	LC	Schedule IV	b
Muscicapidae	Blue Rock-thrush	*Monticola solitarius* (Linnaeus, 1758)	LC	Schedule IV	b
Muscicapidae	Blue-capped Rock-thrush	*Monticola cinclorhyncha* (Vigors, 1832)	LC	Schedule IV	b
Meropidae	Blue-tailed Bee-eater	*Merops philippinus* (Linnaeus, 1766)	LC	NL	b
Muscicapidae	Bluethroat	*Cyanecula svecica* (Linnaeus, 1758)	LC	Schedule IV	b
Muscicapidae	Blyth's Reed-warbler	*Acrocephalus dumetorum* (Blyth, 1849)	LC	Schedule IV	a, b
Accipitridae	Bonelli's Eagle	*Aquila fasciata* (Vieillot, 1822)	LC	Schedule I	b
Accipitridae	Brahminy Kite	*Haliastur indus* (Boddaert, 1783)	LC	Schedule I	a
Sturnidae	Brahminy Starling	*Sturnia pagodarum* (Gmelin, 1789)	LC	Schedule IV	b
Picidae	Indian Pygmy Woodpecker	*Picoides nanus* (Vigors, 1832)	LC	Schedule IV	b
Megalaimidae	Brown-headed Barbet	*Psilopogon zeylanicus* (Gmelin, 1788)	LC	Schedule IV	b
Laridae	Brown-headed Gull	*Larus brunnicephalus* (Jerdon, 1840)	LC	Schedule IV	a, b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Ardeidae	Cattle Egret	*Bubulcus ibis* (Linnaeus, 1758)	LC	Schedule IV	a, b
Sittidae	Chestnut-bellied Nuthatch	*Sitta cinnamoventris* (Blyth, 1842)	LC	NL	b
Passeridae	Chestnut-shouldered Petronia	*Gymnoris xanthocollis* (Burton, 1838)	LC	NL	b
Sturnidae	Chestnut-tailed Starling	*Sturnia malabarica* (Gmelin, 1789)	LC	Schedule IV	b
Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus* (Pennant, 1769)	LC	Schedule IV	a, b
Accipitridae	Cinereous Vulture	*Aegypius monachus* (Linnaeus, 1766)	NT	Schedule IV	b
Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus* (Gmelin, 1789)	LC	Schedule IV	a, b
Motacillidae	Citrine Wagtail	*Motacilla citreola* (Pallas, 1776)	LC	Schedule IV	a, b
Acrocephalidae	Clamorous Reed-warbler	*Acrocephalus stentoreus* (Ehrenberg, 1833)	LC	NL	b
Leiotrichidae	Common Babbler	*Argya caudata* (Dumont, 1823)	LC	Schedule IV	b
Phylloscopidae	Common Chiffchaff	*Phylloscopus collybita* (Vieillot, 1817)	LC	NL	b
Rallidae	Common Coot	*Fulica atra* (Linnaeus, 1758)	LC	Schedule IV	b
Anatidae	Common Goldeneye	*Bucephala clangula* (Linnaeus, 1758)	LC	Schedule IV	b
Scolopacidae	Common Greenshank	*Tringa nebularia* (Gunnerus, 1767)	LC	Schedule IV	b
Cuculidae	Common Hawk-cuckoo	*Hierococcyx varius* (Vahl, 1797)	LC	Schedule IV	b
Upupidae	Common Hoopoe	*Upupa epops* (Linnaeus, 1758)	LC	NL	b
Falconidae	Common Kestrel	*Falco tinnunculus* (Linnaeus, 1758)	LC	Schedule IV	b
Alcedinidae	Common Kingfisher	*Alcedo atthis* (Linnaeus, 1758)	LC	Schedule IV	b
Aegithinidae	Common lora	*Aegithina tiphia* (Linnaeus, 1758)	LC	Schedule IV	b
Anatidae	Goosander	*Mergus merganser* (Linnaeus, 1758)	LC	Schedule IV	b
Rallidae	Common Moorhen	*Gallinula chloropus* (Linnaeus, 1758)	LC	Schedule IV	b
Sturnidae	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	LC	Schedule IV	b
Anatidae	Common Pochard	*Aythya ferina* (Linnaeus, 1758)	VU	Schedule IV	a, b
Scolopacidae	Common Redshank	*Tringa totanus* (Linnaeus, 1758)	LC	Schedule IV	b
Fringillidae	Common Rosefinch	*Carpodacus erythrinus* (Pallas, 1770)	LC	Schedule IV	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Scolopacidae	Common Sandpiper	*Actitis hypoleucos* (Linnaeus, 1758)	LC	Schedule IV	a, b
Anatidae	Common Shelduck	*Tadorna tadorna* (Linnaeus, 1758)	LC	Schedule IV	a, b
Muscicapidae	Common Stonechat	*Saxicola torquatus* (Linnaeus, 1766)	LC	NL	b
Apodidae	Common Swift	*Apus apus* (Linnaeus, 1758)	LC	Schedule IV	b
Cistocolidae	Common Tailorbird	*Orthotomus sutorius* (Pennant, 1769)	LC	NL	a, b
Anatidae	Common Teal	*Anas crecca* (Linnaeus, 1758)	LC	Schedule IV	a
Vangidae	Common Woodshrike	*Tephrodornis pondicerianus* (Gmelin, 1789)	LC	NL	b
Megalaimidae	Coppersmith Barbet	*Psilopogon haemacephalus* (Müller, 1776)	LC	Schedule IV	b
Anatidae	Cotton Pygmy-goose	*Nettapus coromandelianus* (Gmelin, 1789)	LC	Schedule IV	b
Emberizidae	Crested Bunting	*Emberiza lathami* (Gray, 1831)	LC	Schedule IV	b
Accipitridae	Crested Goshawk	*Accipiter trivirgatus* (Temminck, 1824)	LC	Schedule I	b
Alcedinidae	Crested Kingfisher	*Megaceryle lugubris* (Temminck, 1834)	LC	Schedule IV	b
Alaudidae	Crested Lark	*Galerida cristata* (Linnaeus, 1758)	LC	Schedule IV	b
Accipitridae	Crested Serpent-eagle	*Spilornis cheela* (Latham, 1790)	LC	Schedule I	b
Nectariniidae	Crimson Sunbird	*Aethopyga siparaja* (Raffles, 1822)	LC	Schedule IV	b
Turdidae	Rufous-throated Thrush	*Turdus ruficollis* (Pallas, 1776)	LC	Schedule IV	b
Anhingidae	Oriental Darter	*Anhinga melanogaster* (Pennant, 1769)	NT	NL	b
Hirundinidae	Dusky Crag Martin	*Ptyonoprogne concolor* (Sykes, 1832)	LC	NL	b
Ardeidae	Grey Heron	*Ardea cinerea* (Linnaeus, 1758)	LC	Schedule IV	a
Anatidae	Greylag Goose	*Anser anser* (Linnaeus, 1758)	LC	Schedule IV	a
Ardeidae	Great Egret	*Ardea alba* (Linnaeus, 1758)	LC	Schedule IV	a
Ardeidae	Purple Heron	*Ardea purpurea* (Linnaeus, 1766)	LC	Schedule IV	a, b
Accipitridae	Egyptian Vulture	*Neophron percnopterus* (Linnaeus, 1758)	EN	Schedule IV	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Cuculidae	Common Cuckoo	*Cuculus canorus* (Linnaeus, 1758)	LC	Schedule IV	b
Scolopacidae	Eurasian Curlew	*Numenius arquata* (Linnaeus, 1758)	NT	Schedule IV	b
Oriolidae	Eurasian Golden Oriole	*Oriolus oriolus* (Linnaeus, 1758)	LC	Schedule IV	b
Accipitridae	Griffon Vulture	*Gyps fulvus* (Hablizl, 1783)	LC	Schedule I	b
Falconidae	Eurasian Hobby	*Falco subbuteo* (Linnaeus, 1758)	LC	Schedule IV	b
Accipitridae	Eurasian Marsh-harrier	*Circus aeruginosus* (Linnaeus, 1758)	LC	Schedule I	b
Accipitridae	Eurasian Sparrowhawk	*Accipiter nisus* (Linnaeus, 1758)	LC	Schedule I	b
Anatidae	Eurasian Wigeon	*Mareca penelope* (Linnaeus, 1758)	LC	Schedule IV	b
Picidae	Eurasian Wryneck	*Jynx torquilla* (Linnaeus, 1758)	LC	Schedule IV	b
Coraciidae	European Roller	*Coracias garrulus* (Linnaeus, 1758)	LC	Schedule IV	b
Anatidae	Falcated Duck	*Mareca falcata* (Georgi, 1775)	NT	Schedule IV	a
Anatidae	Ferruginous Duck	*Aythya nyroca* (Güldenstädt, 1770)	NT	Schedule I	a, b
Anatidae	Gadwall	*Mareca strepera* (Linnaeus, 1758)	LC	Schedule IV	a, b
Cisticolidae	Jungle Prinia	*Prinia sylvatica* (Jerdon, 1840)	LC	NL	a
Anatidae	Garganey	*Spatula querquedula* (Linnaeus, 1758)	LC	Schedule IV	a, b
Megalaimidae	Great Barbet	*Psilopogon virens* (Boddaert, 1783)	LC	Schedule IV	b
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo* (Linnaeus, 1758)	LC	Schedule IV	a, b
Podicipedidae	Great Crested Grebe	*Podiceps cristatus* (Linnaeus, 1758)	LC	Schedule IV	a, b
Burhinidae	Great Thick-knee	*Esacus recurvirostris* (Cuvier, 1829)	NT	Schedule IV	b
Paridae	Great Tit	*Parus major* (Linnaeus, 1758)	LC	Schedule IV	b
Cuculidae	Greater Coucal	*Centropus sinensis* (Stephens, 1815)	LC	NL	b
Accipitridae	Greater Spotted Eagle	*Clanga clanga* (Pallas, 1811)	VU	Schedule I	b
Anatidae	Greater White-fronted Goose	*Anser albifrons* (Scopoli, 1769)	LC	Schedule IV	b
Meropidae	Green Bee-eater	*Merops orientalis* (Latham, 1802)	LC	NL	b
Scolopacidae	Green Sandpiper	*Tringa ochropus* (Linnaeus, 1758)	LC	Schedule IV	a, b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Phylloscopidae	Greenish Warbler	*Phylloscopus trochiloides* (Sundevall, 1837)	LC	NL	b
Muscicapidae	Grey Bushchat	*Saxicola ferreus* (Gray, 1846)	LC	NL	b
Phasianidae	Grey Francolin	*Francolinus pondicerianus* (Gmelin, 1789)	LC	Schedule IV	b
Motacillidae	Grey Wagtail	*Motacilla cinerea* (Tunstall, 1771)	LC	NL	a, b
Cuculidae	Grey-bellied Cuckoo	*Cacomantis passerinus* (Vahl, 1797)	LC	Schedule IV	b
Cisticolidae	Grey-breasted Prinia	*Prinia hodgsonii* (Blyth, 1844)	LC	NL	b
Stenostiridae	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis* (Swainson, 1820)	LC	Schedule IV	b
Picidae	Grey-headed Woodpecker	*Dendropicos spodocephalus* (Bonaparte, 1850)	LC	Schedule IV	b
Laridae	Gull-billed Tern	*Gelochelidon nilotica* (Gmelin, 1789)	LC	NL	b
Pycnonotidae	Himalayan Bulbul	*Pycnonotus leucogenys* (Gray, 1835)	LC	Schedule IV	b
Accipitridae	Himalayan Griffon	*Gyps himalayensis* (Hume, 1869)	NT	Schedule IV	b
Passeridae	House Sparrow	*Passer domesticus* (Linnaeus, 1758)	LC	NL	b
Apodidae	Little Swift	*Apus affinis* (Gray, 1830)	LC	NL	b
Corvidae	House Crow	*Corvus splendens* (Vieillot, 1817)	LC	Schedule IV	b
Sylviidae	Lesser Whitethroat	*Curruca curruca* (Linnaeus, 1758)	LC	NL	b
Alaudidae	Indian Bushlark	*Mirafra erythroptera* (Blyth, 1845)	LC	Schedule IV	b
Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis* (Stephens, 1826)	LC	Schedule IV	a, b
Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris* (Scopoli, 1786)	LC	Schedule I	b
Charadriidae	Little Ringed Plover	*Charadrius dubius* (Scopoli, 1786)	LC	Schedule IV	a
Scotocercidae	Pale-footed Bush-warbler	*Hemitesia pallidipes* (Blanford, 1872)	LC	NL	a
Ardeidae	Indian Pond-heron	*Ardeola grayii* (Sykes, 1832)	LC	Schedule IV	a, b
Rallidae	Purple Swamphen	*Porphyrio porphyrio* (Linnaeus, 1758)	LC	Schedule IV	a, b
Laridae	River Tern	*Sterna aurantia* (Gray, 1831)	VU	NL	a, b
Muscicapidae	Indian Robin	*Saxicoloides fulicatus* (Linnaeus, 1766)	LC	Schedule IV	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Coraciidae	Indian Roller	*Coracias benghalensis* (Linnaeus, 1758)	LC	Schedule IV	b
Gruidae	Sarus Crane	*Grus antigone* (Linnaeus, 1758)	VU	Schedule IV	a
Estrildidae	Indian Silverbill	*Euodice malabarica* (Linnaeus, 1758)	LC	Schedule IV	b
Estrildidae	Scaly-breasted Munia	*Lonchura punctulata* (Linnaeus, 1758)	LC	Schedule IV	a
Cisticolidae	Graceful Prinia	*Prinia gracilis* (Lichtenstein, 1823)	LC	NL	a
Accipitridae	Indian Vulture	*Gyps indicus* (Scopoli, 1786)	CR	Schedule I	b
Laridae	Whiskered Tern	*Chlidonias hybrida* (Pallas, 1811)	LC	NL	a, b
Motacillidae	White Wagtail	*Motacilla alba* (Linnaeus, 1758)	LC	NL	a, b
Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis* (Linnaeus, 1758)	LC	Schedule IV	a, b
Hirundinidae	Wire-tailed Swallow	*Hirundo smithi* (Leach, 1818)	LC	NL	a, b
Ardeidae	Intermediate Egret	*Ardea intermedia* (Wagler, 1829)	LC	Schedule IV	b
Leiotrichidae	Jungle Babbler	*Argya striata* (Dumont, 1823)	LC	Schedule IV	b
Sturnidae	Jungle Myna	*Acridotheres fuscus* (Wagler, 1827)	LC	Schedule IV	b
Strigidae	Jungle Owlet	*Glaucidium radiatum* (Tickell, 1833)	LC	Schedule IV	b
Charadriidae	Kentish Plover	*Charadrius alexandrinus* (Linnaeus, 1758)	LC	Schedule IV	b
Leiotrichidae	Large Grey Babbler	*Argya malcolmi* (Sykes, 1832)	LC	Schedule IV	b
Motacillidae	White-browed Wagtail	*Motacilla maderaspatensis* (Gmelin, 1789)	LC	NL	a, b
Corvidae	Large-billed Crow	*Corvus macrorhynchos* (Wagler, 1827)	LC	NL	b
Columbidae	Laughing Dove	*Spilopelia senegalensis* (Linnaeus, 1766)	LC	Schedule IV	b
Phylloscopidae	Lemon-rumped Leaf-warbler	*Phylloscopus chloronotus* (Gray & Gray, 1846)	LC	NL	b
Anatidae	Lesser Whistling-duck	*Dendrocygna javanica* (Horsfield, 1821)	LC	Schedule IV	b
Anatidae	Lesser White-fronted Goose	*Anser erythropus* (Linnaeus, 1758)	VU	Schedule IV	b
Megalaimidae	Lineated Barbet	*Psilopogon lineatus* (Vieillot, 1816)	LC	Schedule IV	b
Phalacrocoracidae	Little Cormorant	*Microcarbo niger* (Vieillot, 1817)	LC	Schedule IV	a, b
Ardeidae	Little Egret	*Egretta garzetta* (Linnaeus, 1766)	LC	Schedule IV	a, b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Podicipedidae	Little Grebe	*Tachybaptus ruficollis* (Pallas, 1764)	LC	Schedule IV	a, b
Ardeidae	Green-backed Heron	*Butorides striata* (Linnaeus, 1758)	LC	Schedule IV	b
Scolopacidae	Little Stint	*Calidris minuta* (Leisler, 1812)	LC	Schedule IV	b
Laridae	Little Tern	*Sternula albifrons* (Pallas, 1764)	LC	NL	a
Anatidae	Long-tailed Duck	*Clangula hyemalis* (Linnaeus, 1758)	VU	Schedule IV	b
Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus* (Bangs & Phillips, 1914)	LC	Schedule IV	b
Laniidae	Long-tailed Shrike	*Lanius schach* (Linnaeus, 1758)	LC	NL	b
Anatidae	Mallard	*Anas platyrhynchos* (Linnaeus, 1758)	LC	Schedule IV	a, b
Anatidae	Marbled Teal	*Marmaronetta angustirostris* (Ménétriés, 1832)	VU	Schedule IV	b
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis* (Bechstein, 1803)	LC	Schedule IV	b
Hirundinidae	Northern House Martin	*Delichon urbicum* (Linnaeus, 1758)	LC	NL	b
Charadriidae	Northern Lapwing	*Vanellus vanellus* (Linnaeus, 1758)	NT	NL	b
Anatidae	Northern Shoveler	*Spatula clypeata* (Linnaeus, 1758)	LC	Schedule IV	a, b
Cisticolidae	Tawny-flanked Prinia	*Prinia subflava* (Gmelin, 1789)	LC	NL	a
Motacillidae	Olive-backed Pipit	*Anthus hodgsoni* (Richmond, 1907)	LC	Schedule IV	b
Muscicapidae	Oriental Magpie-robin	*Copsychus saularis* (Linnaeus, 1758)	LC	Schedule IV	b
Zosteropidae	Indian White-eye	*Zosterops palpebrosus* (Temminck, 1824)	LC	NL	b
Pandionidae	Osprey	*Pandion haliaetus* (Linnaeus, 1758)	LC	Schedule I	a, b
Motacillidae	Paddyfield Pipit	*Anthus rufulus* (Vieillot, 1818)	LC	Schedule IV	b
Ciconiidae	Painted Stork	*Mycteria leucocephala* (Pennant, 1769)	NT	Schedule IV	a, b
Accipitridae	Pallas's Fish-eagle	*Haliaeetus leucoryphus* (Pallas, 1771)	EN	Schedule IV	b
Laridae	Pallas's Gull	*Larus ichthyaetus* (Pallas, 1773)	LC	NL	b
Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus* (Scopoli, 1786)	LC	Schedule IV	a, b
Muscicapidae	Pied Bushchat	*Saxicola caprata* (Linnaeus, 1766)	LC	NL	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Alcedinidae	Pied Kingfisher	*Ceryle rudis* (Linnaeus, 1758)	LC	Schedule IV	b
Anatidae	Northern Pintail	*Anas acuta* (Linnaeus, 1758)	LC	Schedule IV	a
Hirundinidae	African Plain Martin	*Riparia paludicola* (Vieillot, 1817)	LC	NL	b
Cisticolidae	Plain Prinia	*Prinia inornata* (Sykes, 1832)	LC	NL	b
Muscicapidae	Plumbeous Water-redstart	*Phoenicurus fuliginosus* (Vigors, 1831)	LC	Schedule IV	b
Psittacidae	Plum-headed Parakeet	*Himalayapsitta cyanocephala* (Linnaeus, 1766)	LC	Schedule IV	b
Nectariniidae	Purple Sunbird	*Cinnyris asiaticus* (Latham, 1790)	LC	Schedule IV	b
Estrildidae	Red Avadavat	*Amandava amandava* (Linnaeus, 1758)	LC	NL	a, b
Anatidae	Red-crested Pochard	*Netta rufina* (Pallas, 1773)	LC	Schedule IV	a
Accipitridae	Red-headed Vulture	*Sarcogyps calvus* (Scopoli, 1786)	CR	Schedule IV	b
Falconidae	Red-headed Falcon	*Falco chicquera* (Daudin, 1800)	NT	Schedule IV	b
Podicipedidae	Red-necked Grebe	*Podiceps grisegena* (Boddaert, 1783)	LC	Schedule IV	b
Hirundinidae	Red-rumped Swallow	*Cecropis daurica* (Linnaeus, 1771)	LC	NL	b
Muscicapidae	Red-throated Flycatcher	*Ficedula albicilla* (Pallas, 1811)	LC	Schedule IV	b
Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	LC	Schedule IV	b
Charadriidae	Red-wattled Lapwing	*Vanellus indicus* (Boddaert, 1783)	LC	NL	a, b
Pycnonotidae	Red-whiskered Bulbul	*Pycnonotus jocosus* (Linnaeus, 1758)	LC	Schedule IV	b
Charadriidae	River Lapwing	*Vanellus duvaucelii* (Lesson, 1826)	NT	NL	b
Columbidae	Rock Dove	*Columba livia* (Gmelin, 1789)	LC	Schedule IV	b
Psittacidae	Rose-ringed Parakeet	*Alexandrinus krameri* (Scopoli, 1769)	LC	Schedule IV	b
Motacillidae	Rosy Pipit	*Anthus roseatus* (Blyth, 1847)	LC	Schedule IV	b
Anatidae	Ruddy Shelduck	*Tadorna ferruginea* (Pallas, 1764)	LC	Schedule IV	a, b
Scolopacidae	Ruff	*Calidris pugnax* (Linnaeus, 1758)	LC	Schedule IV	b
Corvidae	Rufous Treepie	*Dendrocitta vagabunda* (Latham, 1790)	LC	Schedule IV	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Cisticolidae	Rufous-fronted Prinia	*Prinia buchanani* (Blyth, 1844)	LC	NL	a
Alaudidae	Sand Lark	*Alaudala raytal* (Blyth, 1844)	LC	Schedule IV	b
Hirundinidae	Sand Martin	*Riparia riparia* (Linnaeus, 1758)	LC	NL	b
Estrildidae	Scaly-breasted Munia	*Lonchura punctulata* (Linnaeus, 1758)	LC	NL	b
Campephagidae	Scarlet Minivet	*Pericrocotus flammeus* (Forster, 1781)	LC	Schedule IV	b
Accipitridae	Shikra	*Accipiter badius* (Gmelin, 1788)	LC	Schedule I	b
Glareolidae	Little Pratincole	*Glareola lactea* (Temminck, 1820)	LC	NL	a
Campephagidae	Small Minivet	*Pericrocotus cinnamomeus* (Linnaeus, 1766)	LC	Schedule IV	b
Laniidae	Southern Grey Shrike	*Lanius meridionalis* (Temminck, 1820)	VU	NL	b
Dicruridae	Spangled Drongo	*Dicrurus bracteatus* (Gould, 1842)	LC	Schedule IV	b
Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha* (Forster, 1781)	LC	Schedule IV	a, b
Columbidae	Spotted Dove	*Spilopelia chinensis* (Scopoli, 1786)	LC	Schedule IV	b
Scolopacidae	Spotted Redshank	*Tringa erythropus* (Pallas, 1764)	LC	Schedule IV	a
Strigidae	Spotted Owlet	*Athene brama* (Temminck, 1821)	LC	NL	b
Charadriidae	Spur-winged Lapwing	*Vanellus spinosus* (Linnaeus, 1758)	LC	NL	a
Accipitridae	Steppe Eagle	*Aquila nipalensis* (Hodgson, 1833)	EN	Schedule I	b
Ploceidae	Streaked Weaver	*Ploceus manyar* (Horsfield, 1821)	LC	Schedule IV	b
Hirundinidae	Streak-throated Swallow	*Petrochelidon fluvicola* (Blyth, 1855)	LC	NL	b
Leiotrichidae	Striated Babbler	*Argya earlei* (Blyth, 1844)	LC	Schedule IV	b
Motacillidae	Tawny Pipit	*Anthus campestris* (Linnaeus, 1758)	LC	Schedule IV	b
Scolopacidae	Temminck's Stint	*Calidris temminckii* (Leisler, 1812)	LC	NL	a, b
Scolopacidae	Terek Sandpiper	*Xenus cinereus* (Güldenstädt, 1775)	LC	Schedule IV	b
Muscicapidae	Tickell's Blue-flycatcher	*Cyornis tickelliae* (Blyth, 1843)	LC	Schedule IV	b
Phylloscopidae	Tickell's Leaf-warbler	*Phylloscopus affinis* (Tickell, 1833)	LC	NL	b
Motacillidae	Tree Pipit	*Anthus trivialis* (Linnaeus, 1758)	LC	Schedule IV	b

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Anatidae	Tufted Duck	*Aythya fuligula* (Linnaeus, 1758)	LC	Schedule IV	a, b
Sittidae	Velvet-fronted Nuthatch	*Sitta frontalis* (Swainson, 1820)	LC	NL	b
Muscicapidae	Verditer Flycatcher	*Eumyias thalassinus* (Swainson, 1838)	LC	Schedule IV	b
Sittidae	Wallcreeper	*Tichodroma muraria* (Linnaeus, 1766)	LC	NL	b
Motacillidae	Water Pipit	*Anthus spinoletta* (Linnaeus, 1758)	LC	Schedule IV	b
Phylloscopidae	Western Crowned Leaf-warbler	*Phylloscopus occipitalis* (Blyth, 1845)	LC	NL	b
Rhipiduridae	White-browed Fantail	*Rhipidura aureola* (Lesson, 1830)	LC	NL	b
Muscicapidae	White-capped Water -redstart	*Phoenicurus leucocephalus* (Vigors, 1831)	LC	NL	a, b
Charadriidae	White-tailed Lapwing	*Vanellus leucurus* (Lichtenstein, 1823)	LC	NL	b
Rhipiduridae	White-throated Fantail	*Rhipidura albicollis* (Vieillot, 1818)	LC	NL	b
Anatidae	Eurasian Wigeon	*Mareca penelope* (Linnaeus, 1758)	LC	Schedule IV	a
Scolopacidae	Wood Sandpiper	*Tringa glareola* (Linnaeus, 1758)	LC	Schedule IV	b
Ciconiidae	Asian Woollyneck	*Ciconia episcopus* (Boddaert, 1783)	NT	Schedule IV	b
Motacillidae	Western Yellow Wagtail	*Motacilla flava* (Linnaeus, 1758)	LC	NL	b
Stenostiridae	Yellow-bellied Fairy-fantail	*Chelidorhynx hypoxanthus* (Blyth, 1843)	LC	NL	b
Fringillidae	Yellow-breasted Greenfinch	*Chloris spinoides* (Vigors, 1831)	LC	Schedule IV	b
Picidae	Yellow-crowned Woodpecker	*Leiopicus mahrattensis* (Latham, 1801)	LC	Schedule IV	b
Paradoxornithidae	Yellow-eyed Babbler	*Chrysomma sinense* (Gmelin, 1789)	LC	Schedule IV	b
Charadriidae	Yellow-wattled Lapwing	*Vanellus malabaricus* (Boddaert, 1783)	LC	NL	a
Cisticolidae	Zitting Cisticola	*Cisticola juncidis* (Rafinesque, 1810)	LC	NL	b

[a]Tak& Sati (2003); [b]Mohan et al. (2009)

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ANNEXURE III

Reptilian species of the Asan River Basin

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Agamidae	Oriental Garden lizard	*Calotes cf. versicolor* (Daudin, 1802)	LC	NL	c
Colubridae	Buff striped keelback	*Amphiesma stolatum* (Linnaeus, 1758)	LC	Schedule IV	c
Colubridae	Common Trinket snake	*Coelognathus helena* (Daudin, 1803)	LC	Schedule IV	c
Natricidae	Chequered Keelback	*Fowlea piscator* (Schneider, 1799)	LC	Schedule II	a
Colubridae	Indian Wolf snake	*Lycodon aulicus* (Linnaeus, 1758)	LC	Schedule IV	c
Colubridae	Twin spotted wolf snake	*Lycodon jara* (Shaw, 1802)	LC	Schedule IV	c
Colubridae	Indian Rat snake	*Ptyas mucosa* (Linnaeus, 1758)	LC	Schedule II	b, c
Colubridae	Cantor's Black-headed snake	*Sibynophis sagittarius* (Cantor, 1839)	LC	Schedule IV	c
Elapidae	Common krait	*Bungarus caeruleus* (Schneider, 1801)	LC	Schedule IV	c
Elapidae	Spectacled cobra	*Naja naja* (Linnaeus, 1758)	LC	Schedule II	c
Gekkonidae	Brook's House Gecko	*Hemidactylus cf. brooki* (Gray, 1845)	LC	NL	c
Gekkonidae	Northern House Gecko	*Hemidactylus flaviviridis* (Ruppell, 1835)	LC	NL	c
Scincidae	Himalayan Ground skink	*Ablepharus himalayanus* (Gunther, 1864)	LC	NL	c
Scincidae	Many keeled Grass skink	*Eutropis carinata* (Schneider, 1801)	LC	NL	c
Scincidae	Common Dotted Garden skink	*Riopa (Lygosoma) punctata* (Linnaeus, 1758)	LC	NL	c
Typhlopidae	Brahminy Blind snake	*Indotyphlops braminus* (Daudin, 1803)	LC	Schedule IV	c
Viperidae	Russell's viper	*Daboia russelli* (Shaw & Nodder, 1797)	LC	Schedule IV	c
Varanidae	Bengal Monitor lizard	*Varanus bengalensis* (Daudin, 1802)	NT	Schedule I	c

[a]Husain (2003); [b]Mohan et al. (2009); [c]Dhavale (2013)

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ANNEXURE IV

Amphibian species of the Asan River Basin

Family	Common Name/s	Scientific Name	IUCN status	IWPA status	Previous studies
Bufonidae	Asian Common Toad	*Duttaphrynus melanostictus* (Schneider, 1799)	LC	NL	c
	Indo-Gangetic Marbled Toad	*Duttaphrynus stomaticus* (Lütken, 1864)	LC	NL	c
Dicroglossidae	Indian Skipper Frog	*Euphlyctis adolfi* (Gunther, 1860)	LC	Schedule IV	c
Dicroglossidae	Nepal Cricket Frog	*Minervarya cf. nepalensis* (Dubois, 1975)	LC	NL	a
Dicroglossidae	Indian Bullfrog	*Hoplobatrachus tigerinus* (Daudin, 1802)	LC	Schedule IV	c
Dicroglossidae	Maskeyi's Burrowing Frog	*Sphaerotheca maskeyi* (Schleich and Anders, 1998)	LC	NL	b
Microhylidae	Ornate Narrow-mouthed frog	*Microhyla ornata* (Duméril and Bibron, 1841)	LC	NL	a, c

[a]Husain (2003); [b]Dhavale (2013); [c]Husain (2015)

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ANNEXURE V

Fish species of the Asan River Basin

Family	Common Name/s	Scientific Name	IUCN status	Previous studies
Amblycipitidae	Indian torrent catfish	*Amblyceps mangois* (Hamilton, 1822)	LC	a, b, c
Badidae	Badis	*Badis Badis* (Hamilton, 1822)	LC	a, b, c
Bagridae	Day's mystus	*Mystus bleekeri* (Day, 1877)	LC	a, b, c
	Striped dwarf catfish	*Mystus vittatus* (Bloch, 1794)	LC	a, b, c
Belonidae	Freshwater garfish	*Xenentodon cancila* (Hamilton, 1822)	LC	a, b, c
Channidae	Dawla	*Channa gachua* (Hamilton 1822)	LC	a, b, c
	Spotted snakehead	*Channa punctata* (Bloch, 1793)	LC	a, b, c
Cobitidae	Ghiwa	*Lepidocephalichthys goalparensis* (Pillai & Yazdani 1976)	LC	a, b, c
	Guntea loach	*Lepidocephalichthys guntea* (Hamilton, 1822)	LC	a, b, c
Cyprinidae	Chaguni	*Chagunius chagunio* (Hamilton, 1822)	LC	a, b, c
	Kalabans	*Bangana dero* (Hamilton, 1822)	LC	a, b, c
	Boala	*Labeo dyocheilus* (McClelland, 1839)	LC	a, b, c
	Glass-barb	*Pethia guganio* (Hamilton, 1822)	LC	a, b, c
	Swamp barb	*Puntius chola* (Hamilton, 1822)	LC	a, b, c
	Olive barb	*Systomus sarana* (Hamilton, 1822)	LC	c
	Pool barb	*Puntius sophore* (Hamilton, 1822)	LC	a, b, c
	Rosy barb	*Pethia conchonius* (Hamilton, 1822)	LC	a, b, c
	Ticto barb	*Pethia ticto* (Hamilton, 1822)	LC	a, b, c
	Dark mahseer	*Naziritor chelynoides* (McClelland, 1839)	VU	a, b, c
	Putitor mahseer	*Tor putitora* (Hamilton 1822)	EN	a, b, c
	Snowtrout	*Schizothorax richardsonii* (Gray, 1832)	VU	a, b, c
	Mahseer	*Tor tor* (Hamilton, 1822)	DD	a, b, c
	Sucker head	*Garra gotyla* (Gray, 1830)	LC	a, b, c
	Stone roller	*Crossocheilus latius* (Hamilton, 1822)	LC	a, b, c

Family	Common Name/s	Scientific Name	IUCN status	Previous studies
Danionidae	Morar	*Cabdio morar* (Hamilton, 1822)	LC	a, b, c
	Trout barb	*Raiamas bola* (Hamilton, 1822)	LC	c
	Barna Baril	*Opsarius barna* (Hamilton, 1822)	LC	a, b, c
	Hill Trout	*Barilius bendelisis* (Hamilton, 1807)	LC	a, b, c
	Jaya	*Aspidoparia jaya* (Hamilton, 1822)	LC	c
	Vagra Baril	*Barilius vagra* (Hamilton, 1822)	LC	a, b, c
	Zebra danio	*Danio rerio* (Hamilton, 1822)	LC	a, b, c
	Sind danio	*Danio devairo* (Hamilton, 1822)	LC	a, b, c
	Flying barb	*Esomus danrica* (Hamilton, 1822)	LC	a, b, c
	Slender rasbora	*Rasbora daniconius* (Hamilton, 1822)	LC	a, b, c
Heteropneustidae	Stinging catfish	*Heteropneustes fossilis* (Bloch, 1794)	LC	a, b, c
Mastacembelidae	Zig-zag eel	*Mastacembelus armatus* (Lacepède, 1800)	LC	a, b, c
	Barred spiny eel	*Macrognathus pancalus* (Hamilton, 1822)	LC	a, b, c
Nemacheilidae	Creek loach	*Schistura beavani* (Günther, 1868)	LC	a, b, c
	Mottled loach	*Paracanthocobitis botia* (Hamilton, 1822)	LC	a, b, c
	Polka-dotted Bengal Loach	*Nemacheilus corica* (Hamilton, 1822)	LC	a, b, c
	Stonefish	*Schistura rupecula* (McClelland, 1838)	LC	c
	Shimla Loach	*Paraschistura montana* (McClelland, 1838)	NL	c
	Doon Loach	*Nemacheilus doonenesis* (Tilak & Husain, 1977)	DD	a, b, c
Sisoridae	River cat	*Glyptothorax pectinopterus* (McClelland, 1842)	LC	a, b, c
	Vaghari	*Bagarius yarrelli* (Sykes, 1839)	VU	a, b

[a]Husain (2003); [b]Mohan et al. (2009); [c]Husain (2015)

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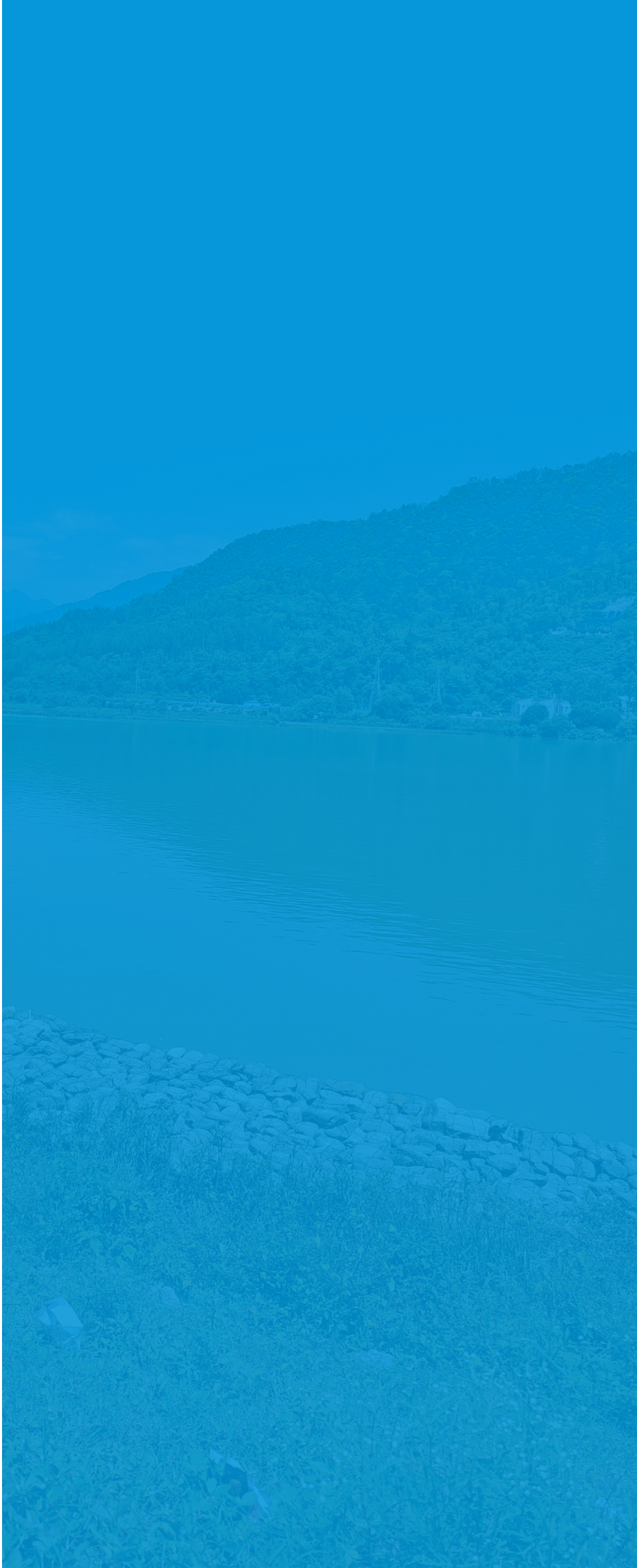
Asan - Yamuna Confluence
Yamuna River
Asan Barrage
39km
Asan Conservation Reserve
36km
Herbetpur
Sitla Rao
28km
Sahaspur
Jatowala
Asan River
Sherpur
Kaluwala Rao
25.76%
Agriculture Land
59.67%
Forest Cover
5.73%
Built-up Area
Land Use Land Cover Statistics
Source: Land Use Land Cover, NRSC,ISRO (2018 19)

Source of Tons River
Mussoorie Range
02km
Bhatta Falls
Tons River
Suarna River
21km
Selaqui
Industrial Area
24km
Sudhowala
Ghulaita River
Nimi River
Nun River
16km
10km
Robber's Cave
Shishambara Waste
Management Plan
Tons River
Tapkeshwar
Temple
08km
HESCO
Dehradun City
Asan River
Bhanga Rao
02km
Source of Asan River
Chandrabani Temple
(Gautam Kund)
WII Lake



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