BIODIVERSITY ASSESSMENT AND MANAGEMENT PLAN FOR ZYDUS WELLNESS LIMITED, SIKKIM

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SUBMITTED TO:

Zydus Wellness, Sikkim

SUBMITTED BY:

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1 INTRODUCTION

1.1 Zydus Wellness

Zydus Wellness Products Ltd. is a global leader among consumer wellness companies with health and holistic well-being defining the core of its values. With the launch of India's first zero calorie replacement of sugar, called Sugar Free, in 1988, Zydus Wellness began its journey as is India's leading consumer Wellness Company.Additionally, they manufacture a variety of other innovative, industry leading products like Ghee, Tomato ketchup, Complan, Glucon-D & Everyuth, etc. Headquartered in Ahmedabad, Zydus Wellness enjoys a pan-India marketing presence through a distribution network comprising.

The Company is committed towards environmental responsibility and sustainability. This environmental policy outlines our commitment to minimize our environmental impact and fostering a culture of sustainability within their organization. They also focus on biodiversity protection, energy management, waste disposal, environmental awareness, reducing natural resource consumption and abiding to the environmental laws.

1.2 Business and Biodiversity

Biodiversity, which includes ecosystems, species, and genetic diversity, is critical to the health and stability of the Earth's natural systems. According to the Convention on Biological Diversity, Biodiversity is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems". Its significance is multifaceted, providing critical ecological functions such as pollination, nutrient cycling, and climate regulation while also supporting global food security through various crops and livestock breeds. Furthermore, biodiversity has an inherent value, revitalizing both human existence, culture and spirituality.

Businesses activities lead to both direct and indirect impacts on biodiversity and nature's contributions to people, playing a vital role in shaping the health of natural ecosystems. Business operations like manufacturing, production, urban development, mining, agriculture, etc. can result in lost or degraded habitats, overharvesting of species, and pollution, which can directly threaten biodiversity and disturb ecological balance. Indirect influences of business on biodiversity are mediated through socioeconomical and governance frameworks, where policies favouring commercial growth can weaken conservation efforts. Incentivizing or subsidizing unsustainable practices, further aggravates these impacts by land use changes and resource depletion. By adopting sustainable practices and biodiversity considerations in their operations and decision-making processes, businesses can contribute to the preservation of ecosystems and the sustainable provision of nature's contributions to people.

1.3 Scope of Work

- Identification of all floral and faunal species by qualified taxonomist/botanist/zoologist within core and buffer areas (baseline study).
- Segregation of identified species in Schedule-I, II, III and IV classes with special emphasis on cataloguing taxa which are facing risk of extinction (red list), endangered, vulnerable, threatened & rare species
- Impacts on species of high conservation significance (highly threatened species) existing within the habitats of project area with recommendations for conservation measures to be adopted.
- Identification of exotic species and plan for eradication/de weeding.
- Direct impact of loss of forest and non-forest land on habitats and associated biodiversity.
- Impact on water resources and wetland ecosystems.
- Effects of dust and noise pollution on habitat quality of available faunal groups.
- Measures to avoid/reduce the impacts on biodiversity and associated ecosystem services during the life of the business operations.
- Suggested list of native floral species which need to be planted while taking up afforestation activities to offset loss of biodiversity or carbon emissions.
- Measures for long term neutralization of the impacts on biodiversity

1.4 Legislative and Policy Requirements

1.4.1 The Kunming Montreal Biodiversity Framework

The framework identifies gaps in the Aichi target and is built around a theory of change which recognizes that urgent policy action globally, regionally, and nationally is required to transform economic, social and financial models so that the trends that have exacerbated biodiversity loss will stabilize in the next 10 years (by 2030) and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention's vision of "living in harmony with nature by 2050".

The framework theory assumes that transformative actions are taken to:

- put in place tools and solutions for implementation and mainstreaming
- reduce the threats to biodiversity
- ensure sustainable use of biodiversity to meet people's needs

The draft Framework comprises 21 targets and 10 'milestones' proposed for 2030, en route to 'living in harmony with nature' by 2050. The targets are proposed with the aim to achieve above mentioned objectives. No national targets have been set yet under the post-2020 - Global Biodiversity Framework.

1.4.2 India's Biodiversity Targets

India's Biodiversity underpins ecosystem functions and services that are of great human value. In order to sustain the nature-dependent livelihood of the country, the Government of India has developed National Policy and Macrolevel Action Strategy on Biodiversity in 1999 in accordance with the Convention of Biodiversity (CBD). India has prepared 12 National Biodiversity Targets (NBTs) using the Strategic Plan for Biodiversity (SP) 2011-2020 for Biodiversity as the broad framework (**Figure 1**).

Figure 1: India's National Biodiversity Targets

1.4.3 The Wildlife (Protection) Amendment Act, 2022

The Indian Parliament passed the Wildlife (Protection) Act in 1972 for the safeguard and protection of the wildlife in the country. This act has been revised and amended in the year 2022. The Wild Life (Protection) Amendment Act, 2022, categorizes the wildlife of India into four different schedules, two of which are for animals, third for plants and fourth for the regulation of international trade in endangered species, which are mentioned below in the table. These schedules are rendered varying degrees of protection, with animals falling under Schedule I and Schedule II being accorded maximum protection. Description of each Schedule is detailed below in the table.

Table 1: Wild Life (Protection) Amendment Act, 2022

Schedule	Description
Schedule I	• Provided absolute protection - offences under these are prescribed the highest penalties
Schedule II	• Protected, penalties lower than that of Schedule I
Schedule III	• Plants which are prohibited from cultivation and planting
Schedule IV	• Regulation of international trade in endangered species of wild fauna and flora

Thus, schedule I is the most essential from a conservation point of view. Whereas animals under schedule II are also accorded high protection, and their trade is prohibited. To implement conservation measures, it is necessary to know whether any of the species listed on these schedules are present in each area, as well as their population status and threats.

1.4.4 The Biological Diversity Act, 2002

This Act provides conservation of biological diversity, and mechanism for equitable sharing of benefits arising out of the use of traditional biological resources and knowledge

The Act prescribes that "any person or corporation or organization of foreign origin needs to procure prior permission from the National Biodiversity Authority (NBA) to obtain any biological resource or knowledge associated with a biological resource found in India, either for research or commercial utilization"

If a person, violates the regulatory provisions he will be punishable with imprisonment for a term extending up to five years, or with fine which may extend up to 10 lakh rupees and where the damage caused exceeds 10 lakh rupees such fine may commensurate with the damage caused, or with both.

- Any offence under this Act is non-bailable and cognizable.

1.4.5 The Taskforce on Nature Based Financial Disclosures (TNFD)

TNFD refers to the Task Force on Nature-related Financial Disclosures. It's an initiative that resembles the Task Force on Climate-related Financial Disclosures (TCFD). The TNFD aims to develop a framework that companies and financial institutions can use to evaluate and reveal their dependencies and impacts on nature. The objective of TNFD is to assist corporations and financial institutions in identifying and managing risks related to biodiversity loss and ecosystem degradation. Additionally, it aims to leverage opportunities associated with nature-positive activities. This framework can assist investors, lenders, and insurers in making well-informed decisions about their investments and lending practices concerning nature-related risks and opportunities.

The Task Force on Nature-related Financial Disclosures (TNFD) has set forth some primary goals, which include:

1. **Enhanced understanding:** To increase awareness and understanding among financial institutions, corporations, investors, and other stakeholders regarding the significance of nature-related risks and opportunities in financial decision-making.
2. **Improved risk management:** To provide a standardized framework for identifying, assessing, and managing nature-related risks within financial institutions and corporations' operations, supply chains, and investment portfolios.
3. **Disclosure standardization:** To develop consistent and comparable metrics, methodologies, and disclosures for nature-related risks and opportunities, which will be similar to the Task Force on Climate-related Financial Disclosures (TCFD), to facilitate transparency and decision-making.
4. **Integration into Financial Decision-Making:** To promote the integration of nature-related considerations into mainstream financial decision-making processes, including investment, lending, insurance, and corporate strategy.
5. **Encouraging Nature-positive Investments:** To stimulate investment in nature-positive activities and projects that contribute to biodiversity conservation, ecosystem restoration, and sustainable land use practices.
6. **Resilient Financial Systems:** To strengthen the resilience of financial systems and economies by addressing nature-related risks and dependencies, thereby reducing vulnerability to shocks and disruptions associated with biodiversity loss and ecosystem degradation.
7. **Contributing to Global Goals:** To support the achievement of global sustainability goals, such as the United Nations Sustainable Development Goals (SDGs) and the objectives of the Convention on Biological Diversity (CBD), by aligning financial flows with environmentally sustainable outcomes. Overall, the TNFD aims to bring about a shift towards a more sustainable and resilient financial system that recognizes and values nature's contributions to economic prosperity and human well-being.

1.4.6 Business Responsibility and Sustainability Reporting

BRSR stands for Business Responsibility and Sustainability Reporting. This term is often used in the context of corporate reporting requirements related to sustainability and social responsibility. BRSR frameworks typically outline guidelines for companies to disclose their performance and impacts on various environmental, social, and governance (ESG) factors. It entails the systematic disclosure of a company's performance and impacts across environmental, social, and governance (ESG) dimensions. Below is a brief overview of BRSR:

1. **Scope:** BRSR encompasses an extensive range of factors, including environmental stewardship, social responsibility, ethical governance practices, employee welfare, community engagement, human rights, and more.
2. **Purpose:** The primary objective of BRSR is to provide stakeholders, such as investors, customers, employees, regulators, and communities, with transparent and reliable information about a company's non-financial performance. This enables stakeholders to evaluate a company's sustainability practices, assess its long-term viability, and make informed decisions. Several countries and regulatory bodies have introduced guidelines or mandatory reporting requirements for BRSR to institutionalize sustainability reporting and ensure consistency and comparability of disclosures across companies.
3. **Standards and frameworks:** Various international standards and frameworks exist to guide BRSR, such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), the Task Force on Climate-related Financial Disclosures (TCFD), and others. These frameworks provide principles, indicators, and guidelines for companies to structure their sustainability disclosures. Integration with Financial Reporting: BRSR is increasingly being integrated with financial reporting to provide a comprehensive view of a company's overall performance and value creation. Integrated reporting frameworks, such as the International Integrated Reporting Council (IIRC) framework, aim to merge financial and non-financial information into a single, cohesive report.
4. **Stakeholder engagement:** Effective BRSR involves engaging with stakeholders to identify material issues, set targets, and establish meaningful performance indicators. Companies often conduct stakeholder consultations and engage in dialogue to understand stakeholder expectations and concerns.
5. **Benefits:** Adopting robust BRSR practices offers several benefits, including improved risk management, enhanced reputation and brand value, access to capital, increased stakeholder trust and loyalty, and a competitive advantage in attracting talent and customers.

1.4.7 Dow Jones Sustainability Index

The Dow Jones Sustainability Indices (DJSI) are a family of indices containing one main DJSI World global index, along with various geographic region-based indexes such as: Europe, Nordic, North America and Asia Pacific, operated through a strategic partnership between S&P Dow Jones Indices and RobecoSAM (Sustainable Asset Management). DJSI evaluates the performance of numerous public companies based on their sustainable practices.

1. **Scope:** It has well defined general as well as specific sustainability criteria for each of the 60 industry types defined as per the Industry Classification Benchmark (ICB).
2. **Stakeholder engagement:** To be listed in the DJSI, the long-term economic, environmental, and social performance of a company is assessed based on its sustainable practices in issues such as corporate governance, risk management, branding, climate

change mitigation, supply chain standards and labour management. The companies not operating in a sustainable manner are usually rejected from the Index.

3. **Benefits:** Established in 2012 by the merger of S&P Indices and Dow Jones Indexes, they are the pioneer sustainability benchmarks having a global relevance and have become a standard reference in sustainability investing for capitalists and companies.

DJSI holds industries to keep a check on the biodiversity at its operational unit with consideration of the risks associated with the operations and proposes to take action accordingly.

2 STUDY AREA

The Biodiversity Assessment was undertaken for the two Zydus Wellness uinit located in in Mamring Block Namthang Elakha, Namchi district of South Sikkim. The unit is involved in production of Glucon-D, Everyuth and Sugar Free.

For the proposed study, the two units (core area) and surrounding 5 km radius buffer area was considered. The core area primarily composed of infrastructure, and plantation, while the surrounding buffer area was majorly covered by forest area. Teesta river was the major waterbody observed in the study area, flowing in close proximity to the northern part of the operation units.

Figure 2: Map of the study area

3 APPROACH AND METHODOLOGY

3.1 Bioidversity Assessment

Biodiversity assessment is the collection of baseline data on the ecosystem and biodiversity present at a given location and their interactions with each other. This includes both off-site and on-site studies where data was collected.

For onfield assessment, Stratified Random Sampling method was used wherein the study area was divided into different strata based on their land use pattern, and randomly sampling points were selected for the study.

Following methodology was used for flora and fauna assessment:

	Habit/ Taxa	Method
Flora Survey	Trees	• 10 m circular plot (List Count Method)
	Shrubs and Climbers	• 5 m concentric circle (List Count Method)
	Herbs	• 1 m x 1 m quadrat
Fauna Survey	Avifauna	• Point Center Count • Aquatic: Total Count
	Herpetofauna	• Visual Encounter • Opportunistic sighting
	Mammals	• Direct Sighting (Visual Encounter) • Indirect sightings (droppings, scat, other tracts and signs)
	Other insects and Arachnids	• Opportunistic sighting

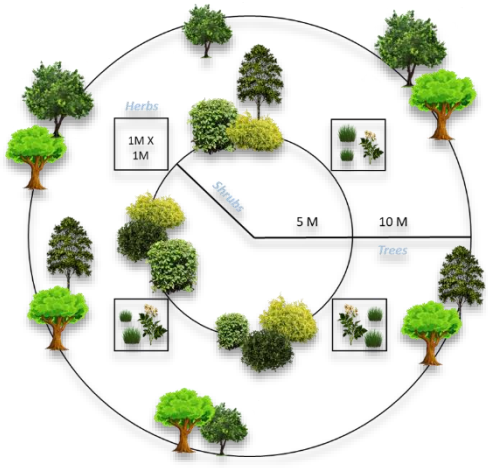

Figure 4. Flora assessment methodology

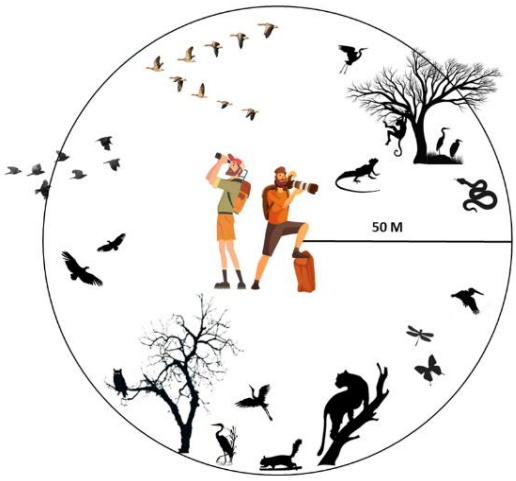

Figure 4. Fauna assessment methodology

The species were analysed for different attributes such as Simpson's diversity index and Shannon and Weiner diversity index; conservation status of the species as per IUCN and WPA, 2022. Also, the bird species were assessed for their residential and migratory status.

For latest scientific names of flora, website (https://www.ipni.org/) was referred. Global Invasive Species Database (GISD) and data from Invasive Species Compendium – Commonwealth Agricultural Bureaux International (ISC-CABI) were referred to assess indigenous status and invasiveness of floral species.

Tools such as Google Earth Pro, Arch GIS, GPS Essentials, and NatureNotes (Application developed by Terracon for data collection) were used for the study.

3.2 Dependency and Impact Assesment

An Ecosystem Services Review tool was used to idendity priority ecosystem services. Ecosystem Services Review is a tool developed by the World Resources Institute (WRI), World Business Council for Sustainable Development (WBCSD), and Meridian Institute. It helps industries to identify their dependencies and impacts on biodiversity and ecosystem services. The output of the exercise is a better understanding of risks and dependencies as well as strategic action plans for consideration of ecosystem services in the future activities of the industries. It is a tool for corporate strategy development and can augment existing environmental management systems. A predefined tool was used to carry out the exercise, which included rigorous discussions with the client.

Figure 5: Ecosystem Service Review Methodology

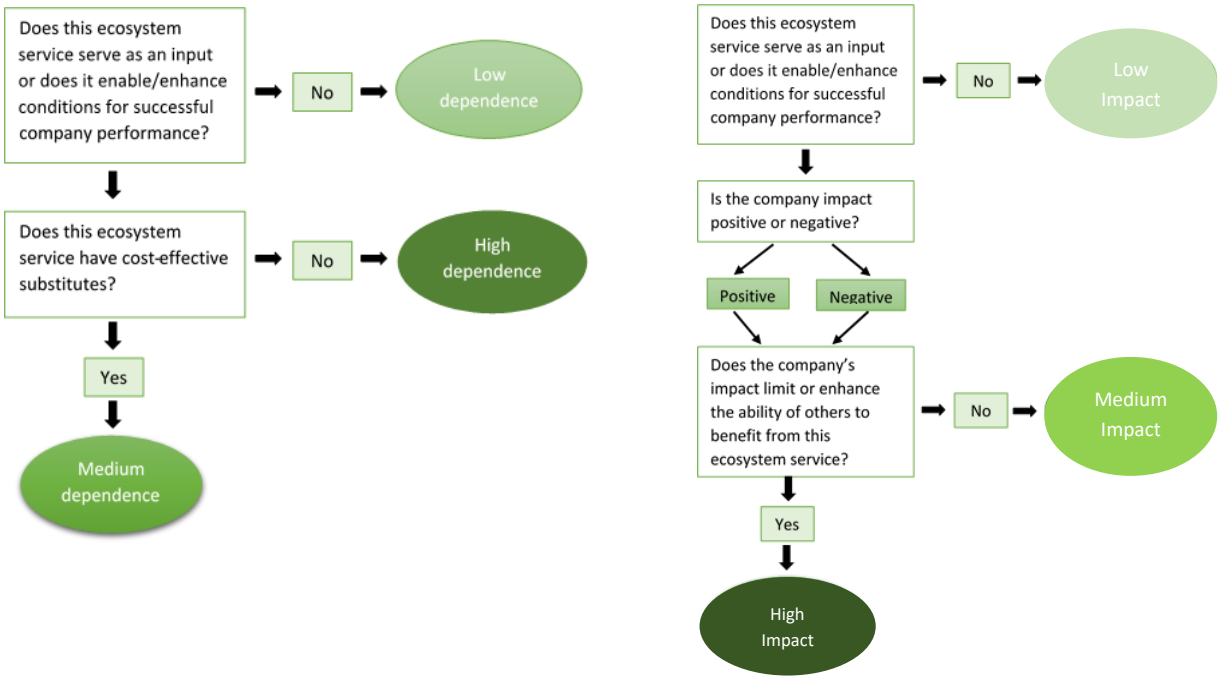

Figure 6: Method to Identify Priority Ecosystem Services

4 BIODIVERSITY OBSERVATION AND ANALYSIS

4.1 Habitats

The core area is significantly altered, with Built-Up serving as the most frequently observed habitat, followed by plantation, whereas while aligning with the secondary data, and based on the baseline assessment, it was inferred that the habitats prevailing in the 5 km buffer area were predominantly covered by the undulating terrain consisting of dense to moderate dense Sub-Tropical Broad-Leaved Hill Forest patches, juxtaposed with the riparian habitat supported by the Teesta river, and a significant amount of areas were heavily modified to establish the human built-up and cropland habitats.

4.2 Flora Observations

The core area was heavily modified for industrial purposes, and predominantly two habitats, namely Built-Up, and Plantation were observed during the assessment.

Built-up within the core area of the Zydus wellness, Sikkim was heavily modified, and lion's share of the area was utilised for infrastructures, mostly the flora species were found along the vacant edges of the habitat. Permanent vegetation constituted by the tree species was mostly cultivated exotic species, alongside a few native species. The following tree species were specifically observed from the premises of the habitat, Monkey's Puzzle (*Araucaria columnaris*), Neem (*Azadirachta indica*), Duabanga (*Duabanga grandiflora*), and Cuban Royal Palm (*Roystonea regia*). Among the tree species, it was inferred that the Cuban Royal Palm (*Roystonea regia*) was the most frequently encountered species within the core area. Woody perennial shrub species were mostly cultivated for aesthetic purposes, and the following species were frequently encountered, Copperleaf (*Acalypha wilkesiana*), Papaya (*Carica papaya*), Ti Plant (*Cordyline fruticosa*), Chinese Shoe Flower (*Hibiscus rosa-sinensis*), and a very few individuals of invasive species Common Lantana (*Lantana camara*). Climbing species were sparse, and only a few individuals of *Cayratia* sp., and *Cyclea* sp. were noted from the sampling premises. Herbaceous flowering ephemerals noted from the adjoining premises of the habitat were found to be contrasting with the surplus fern species, and the following members were observed, Fringed Po Toothache Plant (*Acmella ciliata*), Floss Flower (*Ageratum houstonianum*), (*Dicliptera* sp.), Rock Weed (*Pilea microphylla*), Chinese Knotweed (*Polygonum chinense*), Sweet Broom Weed (*Scoparia dulcis*), (*Stellaria* sp.), and Madagascar Periwinkle (*Vinca rosea*). A very few individuals of Goat Weed (*Ageratum conyzoides*), and Devil Weed (*Chromolaena odorata*) were also associated with the natural patch.

The greenbelt plantation zones feature a mix of native and exotic tree species, including Monkey's Puzzle (*Araucaria columnaris*), Neem (*Azadirachta indica*), Japanese Sago Palm (*Cycas revoluta*), Mango (*Mangifera indica*), and Guava (*Psidium guajava*). Numerous woody shrubs used for hedges and aesthetic purposes include Giant Milkweed (*Calotropis gigantea*),

Night Blooming Jasmine (*Cestrum nocturnum*), and Poinsettia (*Euphorbia pulcherrima*). The area hosts the Fire Flame Vine (*Pyrostegia venusta*) as the only climbing species. Among herbaceous plants, Buffalo Grass (*Axonopus compressus*) is commonly used as ground cover species, accompanied by Hairy Bitter Cress (*Cardamine hirsuta*), Brahmi (*Centella asiatica*), and *Paspalum* sp.

The following habitats were sampled from the 5 km buffer area, namely, Forest, Riparian, Cropland, and Built-Up.

Based on the sampling carried out from the Sub-Tropical Broad-Leaved Hill Forest located in the buffer zone, the following tree species were observed from the habitat, (*Bauhinia* sp.), (*Celtis* sp.), Duabanga (*Duabanga grandiflora*), (*Wrightia sikkimensis*), (*Macaranga* sp.), Kumkum Tree (*Mallotus philippensis*), Sal (*Shorea robusta*) Hairy Sterculia (*Sterculia villosa*), and Indian Laurel (*Terminalia elliptica*). Understorey shrub species formed isolated patches within the habitat, and the following species were recorded, (*Boehmeria* sp.), (*Clerodendrum* sp.), Indian Squirrel Tail (*Colebrookea oppositifolia*), Erect Flemingia (*Flemingia stricta*), (*Phlogacanthus* sp.), Burr Bush (*Triumfetta rhomboidea*), and Fire Flame Bush (*Woodfordia fruticosa*). A plethora of climbing species were observed from the edges of the habitat, namely Maloo Creeper (*Bauhinia vahlii*), (*Cayratia* sp.), (*Dioscorea* sp.), East Himalayan Derris (*Aganope thyrsifolia*), Rusty Mimosa (*Senegalia pennata*), and Sweet Clock Vine (*Thunbergia fragrans*), simultaneously dense growth of exotic invasive climbing weed, Mile A Minute Weed (*Mikania micrantha*) was found to be competing with the native species, by smothering all over them. Herbaceous ephemerals were concentrated towards the periphery rather than towards the centre of the forest patches, and the following members were noted, Crofton Weed (*Ageratina Adenophora*), Brazilian Red Hots (*Alternanthera brasiliana*), (*Dicliptera* sp.), Elephant Foot (*Elephantopus scaber*), Curved Lepidagathis (*Lepidagathis incurva*), Salt of the Cow (*Phaulopsis imbricata*), (*Pogonantherum* sp.) and Long-Stalk Sida (*Sida cordata*). Exotic invasive weeds Goat Weed (*Ageratum conyzoides*), and Devilweed (*Chromolaena odorata*) formed scattered isolated patches along the fringes of the habitat.

The riparian habitat along the Teesta River featured permanent vegetation constituted by tree species primarily at the edges. Notable species included Grey Downy Balsam (*Garuga pinnata*), Sal (*Shorea robusta*), *Bombax* sp., *Celtis* sp., Peepal (*Ficus religiosa*), and Kumkum Tree (*Mallotus philippensis*). However, shrub and climber populations were minimal. Wetland associated herbaceous ephemerals like (*Neyraudia arundiacea),* and Sarkanda (*Saccharum bengalense*) were also noted, along with terrestrial species such as Devil's Horsewhip (*Achyranthes aspera*), Floss Flower (*Ageratum houstonianum*), Beggar's Tick (*Bidens pilosa*), Thickhead (*Crassocephalum crepidioides*), and American Black Nightshade (*Solanum americanum*). Additionally, epiphytic species observed included Bengal Succulent Vine (*Dischidia bengalensis*) and *Dendrobium* sp.

During the cropland habitat sampling, Tapioca (*Manihot esculenta*) was found to be the predominant crop, followed by Banana (*Musa paradisiaca* cv.). The steeply terraced foothills were cultivated for various crops, bordered by a true forest patch. Notable permanent vegetation included Tiger Wood (*Bischofia javanica*), Duabanga (*Duabanga grandiflora*), and East Indian Almond (*Terminalia myriocarpa*). In addition to Tapioca, invasive species such as Common Lantana (*Lantana camara*) and Mile-A-Minute Weed (*Mikania micrantha*) were prevalent. Herbaceous ephemerals were sparse, with a few species observed at the habitat's edge, including Floss Flower (*Ageratum houstonianum*) and Devilweed (*Chromolaena odorata*).

The built-up habitat was sampled near the premises of Yarlam guest house, which was indeed vastly modified, and the species encountered from the premises were mostly cultivated, exotic members. The most frequent, and denser tree species was the Golden Cane Palm (*Dypsis lutescens),* followed by the Weeping Fig (*Ficus benjamina* 'variegata'), and Umbrella Plant (*Schefflera arboricola* 'variegata'). Shrub species were restricted to two species, namely, Bougainvillea (*Bougainvillea spectabilis*), and (Yucca sp.). Potted herbaceous ephemerals noted from the premises of the habitat were, (*Calathea* sp.), Spider Plant (*Chlorophytum comosum*), Jade Plant (*Portulacaria afra*), and (*Sedum* sp.).

Table 2: Summary of Findings (Flora)

Sr. no.	Habit	Number of Species		
		Core	Buffer	Study Area
1	Trees	25	23	43
2	Shrubs	21	13	18
3	Herbs and Grasses	4	7	72
4	Climbers	43	34	9

4.2.1 Trees

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Alstonia scholaris*	Scholars tree	Apocynaceae	Native	LC	-	+	-
2	*Araucaria columnaris*	Christmas tree	Araucariaceae	Exotic	LC	-	+	-
3	*Artocarpus heterophyllus*	Jackfruit tree	Moraceae	Native	-	-	+	-
4	*Azadirachta indica*	Margosa tree	Meliaceae	Native	LC	-	+	-
5	*Bauhinia sp.*		Fabaceae	Native		-	-	+
6	*Bischofia javanica*	Tiger Wood	Euphorbiaceae	Native		-	-	+
7	*Bombax ceiba*	Silk cotton tree	Malvaceae	Native	LC	-	+	-
8	*Celtis sp.*		Cannabaceae	Native		-	-	+
9	*Cyathea sp.*	Tree Fern	Cyatheaceae	Native		-	-	+
10	*Cycas revoluta*	Sago palm	Cycadaceae	Exotic	LC	-	+	-
11	*Duabanga grandiflora*	Duabanga	Lythraceae	Native		-	+	+
12	*Dypsis lutescens*	Golden cane palm	Arecaceae	Exotic	NT	-	+	+
13	*Elaeocarpus sp.*		Elaeocarpaceae	Native		-	+	-
14	*Ficus auriculata*	Elephant Ear Fig	Moraceae	Native		-	-	+
15	*Ficus benjamina 'variegata'*	Weeping Fig	Moraceae	Native	LC	-	+	+
16	*Ficus microcarpa*	Chinese banyan	Moraceae	Native	LC	-	+	-
17	*Ficus religiosa*	sacred fig tree	Moraceae	Native	-	-	+	+
18	*Grevillea robusta*	Silver oak	Proteaceae	Exotic	LC	-	+	-
19	*Wrightia sikkimensis*	Indrajao	Apocynaceae	Native	NT	-	-	+
20	*Litchi chinensis*	Litchi	Sapindaceae	Exotic	-	-	+	-
21	*Livistona chinensis*	Chinese fan palm	Arecaceae	Exotic	-	-	+	-
22	*Macaranga sp.*	-	Euphorbiaceae	Native	-	-	-	+
23	*Magnolia sp.*	-	Magnoliaceae	Native	-	-	-	+
24	*Mallotus philippensis*	Kum Kum Tree	Euphorbiaceae	Native	LC	-	-	+
25	*Mangifera indica*	Mango	Anacardiaceae	Native	DD	-	+	-
26	*Moringa oleifera*	Drumstick tree	Moringaceae	Native	LC	-	-	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
27	*Nerium oleander*	Oleander	Apocynaceae	Native	-	-	+	-
28	*Nyctanthes arbor-tristis*	Queen of the night	Oleaceae	Native	-	-	+	-
29	*Oroxylum indicum*	Indian Trumpet Flower	Bignoniaceae	Native	-	-	-	+
30	*Pandanus nepalensis*	Himalayan Screw Pine	Pandnaceae	Native		-	-	+
31	*Phoenix roebelenii*	Pygmy Date Palm	Arecaceae	Native	-	-	+	-
32	*Platycladus orientalis*	Oriental thuja	Cupressaceae	Exotic	NT	-	+	-
33	*Polyalthia longifolia*	Mast tree	Annonaceae	Exotic	-	-	+	-
34	*Psidium guajava*	Guava	Myrtaceae	Native	LC	Invasive	+	+
35	*Roystonea regia*	Royal bottle palm	Arecaceae	Exotic	LC	-	+	-
36	*Schefflera arboricola variegata*	Umbrella Plant	Araliaceae	Exotic		-	+	+
37	*Shorea robusta*	Sal	Dipterocarpaceae	Native	LC	-	-	+
38	*Sterculia villosa*	Hairy Sterculia	Malvaceae	Native	LC	-	-	+
39	*Tecoma stans*	Yellow Trumpet Flower	Bignoniaceae	Exotic		-	+	-
40	*Tectona grandis*	Teak	Lamiaceae	Native	EN	-	-	+
41	*Terminalia elliptica*	Asan	Combretaceae	Native	-	-	-	+
42	*Terminalia myriocarpa*	East Indian Almond	Combretaceae	Native		-	-	+

Note:
LC: Least Concern; EN: Endangered; DD: Data Deficient

4.2.2 Shrubs

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Acalypha wilkesiana*	Copperleaf	Euphorbiaceae	Exotic	-	-	+	-
2	*Boehmeria sp.*	-	Urticaceae	Native	-	-	+	+
3	*Bougainvillea spectabilis*	Bougainvillea	Nyctaginaceae	Exotic	-	-	-	+
4	*Calotropis gigantea*	Crown Flower	Apocynaceae	Native	-	-	+	-

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
5	*Carica papaya*	Papaya	Cariacaceae	Exotic	DD	-	+	-
6	*Cestrum nocturnum*	Night-blooming jasmine	Solanaceae	Exotic	LC	Invasive	+	-
7	*Citrus x limon*	Lemon	Rutaceae	Exotic	-	-	+	-
8	*Clerodendrum sp.*	-	Verbenaceae	Native	-	-	-	+
9	*Codiaeum variegatum*	Croton	Euphorbiaceae	Exotic	LC	-	+	-
10	*Colebrookea oppositifolia*	Indian squirrel tail	Lamiaceae	Native	LC	-	-	+
11	*Cordyline fruticosa*	Palm Lily	Agavaceae	Exotic	LC	-	+	-
12	*Dieffenbachia sp.*	Dumb Cane	Araceae	Exotic		-	-	+
13	*Duranta erecta*	Sky flower	Verbenaceae	Exotic	LC	-	+	-
14	*Euphorbia pulcherrima*	Christmas flower	Euphorbiaceae	Exotic	LC	-	+	-
15	*Euphorbia tithymaloides*	Devil's backbone	Euphorbiaceae	Exotic	LC	-	+	-
16	*Flemingia stricta*	Erect Flemingia	Fabaceae	Native	-	-	-	+
17	*Furcraea foetida*	Giant Cabuya	Asparagaceae	Native	-	-	-	+
18	*Gardenia jasminoides*	Cape jasmine	Rubiaceae	Native	-	-	+	-
19	*Hibiscus rosa-sinensis*	Shoe flower	Malvaceae	Exotic	-	-	+	-
20	*Ixora coccinea*	Red ixora	Rubiaceae	Native	-	-	+	-
21	*Jasminum sp.*	Jasmine	Oleaceae	Native	-	-	+	-
22	*Lantana camara*	Lantana	Verbenaceae	Exotic	-	Invasive	+	+
23	*Malvaviscus penduliflorus*	Pendulous Sleeping Hibiscus	Malvaceae	Exotic	-	-	+	-
24	*Manihot esculenta*	Tapioca	Euphorbiaceae	Native	-	-	-	+
25	*Mussaenda sp.*	Mussaenda	Rubiaceae	Exotic	-	-	+	-
26	*Phlogacanthus sp.*	-	Acanthaceae	Native	-	-	-	+
27	*Reinwardtia indica*	Yellow Flax	Linaceae	Native	-	-	+	-
28	*Rhapis excelsa*	Broadleaf lady palm	Arecaceae	Exotic	-	-	+	-
29	*Rosa sp.*	Rosa	Rosaceae	Exotic	-	-	+	-
30	*Triumfetta rhomboidea*	Burr Bush	Malvaceae	Native	-	-	-	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
31	*Woodfordia fruticosa*	Fire Flame Bush	Lythraceae	Native	LC	-	-	+
32	*Yucca sp.*	Yucca	Asparagaceae	Exotic	-	-	-	+
33	*Oreocnide frutescens subsp. occidentalis*	Himalayan Woody Rhea	Urticaceae	Native	-	-	-	-
Note: LC: Least Concern; DD: Data Deficient								

4.2.3 Herbs

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Achyranthes aspera*	Prickly Chaff Flower	Amaranthaceae	Native	-	-	-	+
2	*Acmella ciliata*	Fringed Pod Toothache Plant	Asteraceae	Native	-	-	+	-
3	*Ageratina adenophora*	Mexican devil	Asteraceae	Exotic	-	-	-	+
4	*Ageratum conyzoides*	Goat weed	Compositae	Exotic	LC	Invasive	+	+
5	*Ageratum houstonianum*	Floss flower	Compositae	Exotic	-	-	+	-
6	*Alocasia sp.*	-	Araceae	Native	-	-	+	-
7	*Alternanthera brasiliana*	Joy Weed	Amaranthaceae	Exotic	-	-	-	+
8	*Alternanthera sessilis*	Sessile Joyweed	Amaranthaceae	Native	LC	-	+	-
9	*Amorphophallus sp.*	-	Araceae	Native	-	-	-	+
10	*Axonopus compressus*	Tropical Carpet Grass	Poaceae	Exotic	LC	-	+	-
11	*Bambusa sp.*	-	Poaceae	Native	-	-	+	-
12	*Bidens pilosa*	Black Fellows	Asteraceae	Exotic	-	-	-	+
13	*Bryophyllum pinnatum*	Air Plant	Crassulaceae	Exotic	-	-	+	-
14	*Calathea sp.*	-	Marantaceae	Exotic	-	-	-	+
15	*Cardamine hirsuta*	Hairy Bitter Cress	Brassicaceae	Native	-	-	+	-

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
16	*Celosia argentea var. cristata*	Cockscomb	Amaranthaceae	Exotic	LC	-	+	-
17	*Centella asiatica*	Indian Pennywort	Apiaceae	Native	LC	-	+	-
18	*Chlorophytum comosum*	Spider Plant	Asparagaceae	Exotic	-	-	-	+
19	*Chromolaena odorata*	Bitter bush	Compositae	Exotic	-	Invasive	+	-
20	*Cosmos sulphureus*	Sulphur/Orange cosmos	Compositae	Exotic	-	-	+	-
21	*Crassocephalum crepidioides*	Fireweed	Asteraceae	Exotic	-	-	-	+
22	*Crinum sp.*	-	Amaryllidaceae	Native	-	-	+	-
23	*Cymbopogon flexuousus var. sikkimensis*	East Indian Lemon Grass	Poaceae	Native	-	-	-	+
24	*Cynodon dactylon*	Bermuda Grass	Poaceae	Native	-	-	+	-
25	*Cyperus cyperoides*	Common Flat Sedge	Cyperaceae	Native	LC	-	+	-
26	*Dendrobium sp.*	-	Orchidaceae	Native	-	-	-	+
27	*Dianella tasmanica*	Flax Lily	Liliaceae	Exotic	-	-	+	-
28	*Dicliptera sp.*	-	Acanthaceae	Native	-	-	+	-
29	*Dieffenbachia sp.*	Dumb Cane	Araceae	Exotic	-	-	-	+
30	*Digitaria sp.*	-	Poaceae	Native	-	-	+	-
31	*Dischidia bengalensis*	Bengal Succulent Vine	Apocynaceae	Native	LC	-	-	+
32	*Drymaria sp.*	-	Caryophyllaceae	Native	-	-	+	-
33	*Drynaria sp.*	-	Polypodiaceae	Native	-	-	+	-
34	*Elephantopus scaber*	Elephant Foot	Asteraceae	Native	-	-	-	+
35	*Emilia sonchifolia*	Purple Sow Thistle	Compositae	Native	-	-	+	-
36	*Equisetum diffusum*	Himalayan Horsetail	Equisetaceae	Native	-	-	+	-
37	*Erigeron sp.*	-	Asteraceae	Native	-	-	-	+
38	*Geranium sp.*	-	Geraniaceae	Exotic	-	-	+	-
39	*Gerbera jamesonii*	Gerber daisy	Compositae	Exotic	-	-	+	-
40	*Hippeastrum sp.*	-	Amaryllidaceae	Native	-	-	+	-
41	*Lepidagathis incurva*	Curved Lepidagathis	Acanthaceae	Native	-	-	-	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
42	*Mazus pumilus*	Asian mazus	Phrymaceae	Native	-	-	+	-
43	*Mitracarpus hirtus*	Tropical Girdlepod	Rubiaceae	Exotic	-	-	-	+
44	*Musa paradisiaca cv.*	Banana Plant	Musaceae	Exotic	-	-	-	+
45	*Nasturtium sp.*	-	Brassicaceae	Native	-	-	-	+
46	*Ocimum tenuiflorum*	Holy basil	Lamiaceae	Native	-	-	+	-
47	*Oxalis corniculata*	Creeping Oxalis	Oxalidaceae	Exotic	-	-	+	-
48	*Paspalum conjugatum*	Carabao grass	Poaceae	Exotic	LC	-	+	+
49	*Phaulopsis imbricata*	Himalayan Ruellia	Acanthaceae	Exotic	LC	-	-	+
50	*Pilea microphylla*	Gunpowder plant	Urticaceae	Exotic	-	-	+	+
51	*Piper sp.*	-	Piperaceae	Native	-	-	-	+
52	*Pogonatherum sp.*	-	Poaceae	Native	-	-	-	+
53	*Polygonum chinense*	Chinese Knotweed	Polygonaceae	Native	-	-	+	+
54	*Portulacaria afra*	Elephant's Food	Portulacaceae	Exotic	-	-	-	+
55	*Pouzolzia sp.*	-	Urticaceae	Native	-	-	+	-
56	*Pyrrosia sp.*	-	Polypodiaceae	Native	-	-	+	-
57	*Saccharum bengalense*	Elephant grass	Poaceae	Native	-	-	-	+
58	*Salvia misella*	River sage	Lamiaceae	Exotic	-	-	-	+
59	*Scadoxus multiflorus*	Blood Lily	Amaryllidaceae	Exotic	-	-	+	-
60	*Scoparia dulcis*	Sweet Broom Weed	Plantaginaceae	Exotic	-	-	+	-
61	*Sedum sp.*	-	Crassulaceae	Exotic	-	-	-	+
62	*Sida cordata*	Flannel weed	Malvaceae	Native	-	-	-	+
63	*Solanum americanum*	American Black Nightshade	Solanaceae	Exotic	-	-	-	+
64	*Solanum xanthocarpum*	Thorny Nightshade	Solanaceae	Native	-	-	-	+
65	*Spathiphyllum wallisii*	Peace lily	Araceae	Exotic	-	-	+	-
66	*Stellaria sp.*	-	Caryophyllaceae	Native	-	-	+	-
67	*Syndrella nodiflora*	Cinderella weed	Asteraceae	Exotic	-	-	-	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
68	*Tagetes erecta*	Marigold	Compositae	Exotic	-	-	+	-
69	*Thysanolaena latifolia*	Tiger Grass	Poaceae	Native	-	-	+	+
70	*Tradescantia pallida*	Purple heart	Commelinaceae	Exotic	-	-	+	-
71	*Tradescantia zebrina*	Wandering Jew	Commelinaceae	Exotic	-	-	+	-
72	*Vinca rosea*	Periwinkle	Apocynaceae	Exotic	-	-	+	-

Note:
LC: Least Concern

4.2.4 Climbers

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN	IUCN STATUS	GISD STATUS (INDIA)	CORE	BUFFER
1	*Bauhinia vahlii*	Maloo Creeper	Fabaceae	Native	-	-	-	+
2	*Cayratia sp.*	-	Vitaceae	Native	-	-	+	+
3	*Cyclea sp.*	-	Menispermaceae	Native	-	-	+	-
4	*Dioscorea sp.*	-	Dioscoreaceae	Native	-	-	-	+
5	*Mikania micrantha*	Climbing Hempeed	Compositae	Exotic	-	Invasive	+	+
6	*Mucuna sp.*	-	Fabaceae	Native	-	-	-	+
7	*Pyrostegia venusta*	Golden shower trumpet	Bignoniaceae	Exotic	-	-	+	-
8	*Thunbergia fragrans*	sweet clock vine	Acanthaceae	Native	-	-	-	+
9	*Senegalia pennata*	Rusty Mimosa	Fabaceae	Native	-	-	-	+

4.3 Fauna Observations

During the biodiversity survey conducted at the Zydus Wellness project site in Sikkim, a diverse range fauna was documented, highlighting the ecological richness of the area. Observations included 50 species of birds, 18 species of butterflies, as well as one mammal and one reptile species.

The study recorded several species, such as the Steppe Eagle (*Aquila nipalensis*), classified as "Endangered" on the IUCN Red List, and is also protected under Schedule I of the Wildlife Protection Act (WPA), 2022. Other protected bird species included the Crested Goshawk (*Accipiter trivirgatus*), Himalayan Buzzard (*Buteo refectus*), and Mountain Hawk-Eagle (*Nisaetus nipalensis*).

In the core area of the site, 25 bird species were documented, including three raptor species, the Collared Falconet (*Microhierax caerulescens*), Crested Goshawk (*Accipiter trivirgatus*), and Steppe Eagle (*Aquila nipalensis*).

The stream flowing alongside the plant emerged as an important habitat for avifauna. Birds such as the Black-throated Sunbird (*Aethopyga saturata*), Red-billed Leiothrix (*Leiothrix lutea*), Scarlet-backed Flowerpecker (*Dicaeum cruentatum*), Indian White-eye (*Zosterops palpebrosus*), Grey-headed Canary Flycatcher (*Culicicapa ceylonensis*), Blue Whistling-thrush (*Myophonus caeruleus*), Yellow-browed Warbler (*Phylloscopus inornatus*), Hume's Leaf-warbler (*Phylloscopus humei*), and Pygmy Cupwing (*Pnoepyga pusilla*) were recorded in this habitat.

The study area also supported several migratory bird species during the survey such as Blyth's Reed-warbler (*Acrocephalus dumetorum*), Common Sandpiper (*Actitis hypoleucos*), Red-breasted Flycatcher (*Ficedula parva*), White Wagtail (*Motacilla alba*), Hodgson's Redstart (*Phoenicurus hodgsoni*), Hume's Leaf-warbler (*Phylloscopus humei*), Yellow-browed Warbler (*Phylloscopus inornatus*), and Siberian Stonechat (*Saxicola maurus*).

The survey documented a total of 18 butterfly species, with 10 species specifically observed within the core area. Species recorded in the core include Large Yeoman (*Cirrochroa aoris*), Plain Tiger (*Danaus chrysippus*), Red-spot Jezebel (*Delias descombesi*), Himalayan Common Palmfly (*Elymnias hypermnestra*), Purple Sapphire (*Heliophorus epicles*), Common Crow (*Euploea core*), Common Cerulean (*Jamides celeno*), Lemon Pansy (*Junonia lemonias*), Common Sailer (*Neptis hylas*), and Common Earl (*Tanaecia julii*).

Mammals and Reptiles

Among mammals, secondary data provided by the staff highlighted the rescue of an Indian Pangolin (*Manis crassicaudata*). This species is classified as "Endangered" on the IUCN Red

List and is afforded the highest level of legal protection under Schedule I of the Wildlife Protection Act (WPA), 2022.

Reptile species observed were the Changeable Lizard (*Calotes versicolor*) within the study area. Secondary data further suggested the presence of the Monocled Cobra (*Naja kaouthia*).

The Himalayas are globally recognized as a major biodiversity hotspot, characterized by diverse ecosystems and a high concentration of endemic and ecologically significant species. Sikkim, situated within this biodiversity hotspot, is characterized by its unique altitudinal gradients and varied climatic zones, which support an exceptional diversity of flora and fauna, including several endemic and migratory species. This rich ecological landscape provides ZydusWellness with valuable opportunities to undertake conservation initiatives and biodiversity-focused activities such as habitat restoration, species conservation programs, and community-based biodiversity management which will contribute in preserving Sikkim's natural heritage

Table 3: Summary of Findings (Fauna)

Sr. no.	Taxon	Number of Species		
		Core	Buffer	Study Area
1	Birds	25	41	43
2	Butterfly	10	13	18
3	Mammals	2	3	3
4	Herpetofauna	2	2	2

4.3.1 Birds

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS	WPA, 2022 (SCHEDULE)	CORE	BUFFER
1	*Accipiter trivirgatus*	Crested Goshawk	Accipitridae	LC	R	I	+	-
2	*Aquila nipalensis*	Steppe Eagle	Accipitridae	EN	R	I	+	-
3	*Buteo refectus*	Himalayan Buzzard	Accipitridae	LC	-	I	-	+
4	*Nisaetus nipalensis*	Mountain Hawk-eagle	Accipitridae	NT	R	I	-	+
5	*Ardeola grayii*	Indian Pond-heron	Ardeidae	LC	R	II	-	+
6	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae	LC	R	II	+	+
7	*Orthotomus sutorius*	Common Tailorbird	Cisticolidae	LC	R	II	+	+
8	*Columba livia*	Rock Dove	Columbidae	LC	R	-	+	+
9	*Corvus splendens*	House Crow	Corvidae	LC	R	-	+	+
10	*Lonchura striata*	White-rumped Munia	Estrildidae	LC	R	II	+	-
11	*Microhierax caerulescens*	Collared Falconet	Falconidae	LC	R	II	+	-
12	*Delichon dasypus*	Asian House Martin	Hirundinidae	LC	W	II	+	+
13	*Lanius schach*	Long-tailed Shrike	Laniidae	LC	R	II	-	+
14	*Leiothrix lutea*	Red-billed Leiothrix	Leiothrichidae	LC	R	II	+	-
15	*Motacilla alba*	White Wagtail	Motacillidae	LC	W	II	-	+
16	*Copsychus saularis*	Oriental Magpie-robin	Muscicapidae	LC	R	II	+	+
17	*Ficedula parva*	Red-breasted Flycatcher	Muscicapidae	LC	W	II	+	+
18	*Myophonus caeruleus*	Blue Whistling-thrush	Muscicapidae	LC	R	II	+	+
19	*Phoenicurus fuliginosus*	Plumbeous Water-redstart	Muscicapidae	LC	R	II	-	+
20	*Phoenicurus hodgsoni*	Hodgson's Redstart	Muscicapidae	LC	W	II	-	+
21	*Saxicola ferreus*	Grey Bushchat	Muscicapidae	LC	R	II	-	+
22	*Saxicola maurus*	Siberian Stonechat	Muscicapidae	-	W	II	-	+
23	*Aethopyga saturata*	Black-throated Sunbird	Nectariniidae	LC	R	II	+	-
24	*Aethopyga siparaja*	Crimson Sunbird	Nectariniidae	LC	R	II	-	+
25	*Phalacrocorax fuscicollis*	Indian Cormorant	Phalacrocoracidae	LC	R	II	-	+
26	*Phylloscopus humei*	Hume's Leaf-warbler	Phylloscopidae	LC	W	II	+	+

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	MIGRATORY STATUS	WPA, 2022 (SCHEDULE)	CORE	BUFFER
27	*Phylloscopus inornatus*	Yellow-browed Warbler	Phylloscopidae	LC	W	II	+	-
28	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	LC	R	II	+	+
29	*Pycnonotus leucogenys*	Himalayan Bulbul	Pycnonotidae	LC	R	II	+	+
30	*Rubigula flaviventris*	Black-crested Bulbul	Pycnonotidae	LC	R	II	-	+
31	*Actitis hypoleucos*	Common Sandpiper	Scolopacidae	LC	W	II	-	+
32	*Sitta cinnamoventris*	Chestnut-bellied Nuthatch	Sittidae	LC	R	II	-	+
33	*Culicicapa ceylonensis*	Grey-headed Canary-flycatcher	Stenostiridae	LC	R	II	+	+
34	*Acridotheres tristis*	Common Myna	Sturnidae	LC	R	II	+	+
35	*Mixornis gularis*	Pin-striped Tit-babbler	Timaliidae	LC	R	II	+	-
36	*Zosterops palpebrosus*	Indian White-eye	Zosteropidae	LC	R	II	+	+
37	*Pnoepyga pusilla*	Pygmy Cupwing	Pnoepygidae	LC	R	II	+	-
38	*Phoenicurus leucocephalus*	White-capped Water-redstart	Muscicapidae	LC	R	II	+	+
39	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	Dicaeidae	LC	R	II	+	-
40	*Passer domesticus*	House Sparrow	Passeridae	LC	R	II	-	+
41	*Phylloscopus whistleri*	Whistler's Warbler	Phylloscopidae	LC	R	II	-	+
42	*Pteruthius aeralatus*	White-browed Shrike-babbler	Vireonidae	LC	R	II	-	+
43	*Motacilla maderaspatensis*	White-browed Wagtail	Motacillidae	LC	R	II	-	+

Note:
I, II, III: Schedules of Wildlife Protection (Amendment) Act, 2022
LC: Least Concern; EN: Endangered; DD: Data Deficient
R: Resident; W: Winter Migrant

4.3.2 Butterflies

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	WPA SCHEDULE, 2022	CORE	BUFFER
1	*Appias albina*	Common Albatross	Pieridae	-	II	-	+
2	*Appias olferna*	Eastern Striped Albatross	Pieridae	-	-	-	+
3	*Delias descombesi*	Red-spot Jezebel	Pieridae	-	-	+	+
4	*Leptosia nina*	Psyche	Pieridae	-	-	-	+
5	*Ixias pyrene*	Yellow Orange-tip	Pieridae	-	-	-	+
6	*Ariadne ariadne*	Angled Castor	Nymphalidae	-	-	-	+
7	*Danaus chrysippus*	Plain Tiger	Nymphalidae	LC	-	+	+
8	*Euploea core*	Common Crow	Nymphalidae	LC	-	+	-
9	*Cirrochroa aoris*	Large Yeoman	Nymphalidae	-	-	+	-
10	*Tanaecia julii*	Common Earl	Nymphalidae	-	-	+	+
11	*Neptis hylas*	Common Sailer	Nymphalidae	-	-	+	+
12	*Junonia lemonias*	Lemon Pansy	Nymphalidae	-	-	+	-
13	*Symbrenthia lilaea*	Northern Common Jester	Nymphalidae	-	-	-	+
14	*Lethe rohria*	Common Treebrown	Nymphalidae	-	-	-	+
15	*Jamides celeno*	Common Cerulean	Lycaenidae	-	-	+	+
16	*Leptotes plinius*	Zebra Blue	Lycaenidae	-	-	-	+
17	*Elymnias hypermnestra*	Himalayan Common Palmfly	Nymphalidae	-	-	+	-
18	*Heliophorus epicles*	Purple Sapphire	Lycaenidae	-	-	+	-

Note:
I, II, III: Schedules of Wildlife Protection (Amendment) Act, 2022
LC: Least Concern

4.3.3 Mammals

S. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	WPA, 2022 (SCHEDULE)	Core	Buffer
1	*Callosciurus pygerythrus*	Hoary-bellied Squirrel	Sciuridae	LC	-	-	+
2	*Macaca mulatta**	Rhesus Macaque	Cercopithecidae	LC	-	+	+
3	*Manis crassicaudata**	Indian Pangolin	Manidae	EN	I	+	+

Note:
LC: Least Concern; EN: Endangered
I: Schedule of Wildlife Protection (Amendment) Act, 2022
*: Secondary data

4.3.4 Herpetofauna

S. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	WPA, 2022 (SCHEDULE)	Core	Buffer
1	*Calotes versicolor*	Changeable Lizard	Agamidae	LC	-	+	+
2	*Naja kaouthia**	Monocled Cobra	Elapidae	LC	II	+	+

Note:
LC: Least Concern; EN: Endangered
II: Schedule of Wildlife Protection (Amendment) Act, 2022
*: Secondary data

4.4 Quantitative Assessment

4.4.1 Shannon-Wiener Diversity Index

One tool for assessing the species diversity in a community is the Shannon Diversity Index, also known as the Shannon-Wiener Index. This index, represented by the letter H, is computed as follows: H = -Σpi * ln(pi). The species diversity in a given community increases with a greater value of H. The diversity decreases as the value of H decreases. A community with only one species is indicated by a value of H = 0.

Shannon-Wiener Diversity Index falls between 0 and 5.

4.4.1.1 Flora

Shannon-Wiener diversity index value for the flora is depicted below:

Table 4: Shannon-Wiener diversity Index (Flora)

	Sampling point	Latitude	Longitude	Trees	Shrubs	Climbers	Herbs
CORE	D3 P1 C	27.175347	88.5128787	1.80	0.49	0.00	1.73
	D3 P2 C	27.17539	88.5130848	1.79	1.29	0.35	1.95
	D3 P3 C	27.174628	88.5125656	0.00	0.00	0.69	2.02
	D3 P4 C	9.4743964	76.3474501	0.35	0.72	0.00	1.33
BUFFER	D2 P1 B	27.157393	88.5133795	0.30	1.04	0.88	2.04
	D2 P2 B	27.177989	88.51903	0.69	0.00	0.00	2.14
	D2 P3 B	27.181797	88.5243511	1.59	1.59	0.77	1.59
	D2 P4 B	27.185404	88.4890106	0.00	0.68	0.00	1.40
	D2 P5 B	27.186219	88.5043145	0.58	0.67	0.00	1.34

4.4.1.2 Fauna

Shannon-Wiener diversity index value for the fauna is depicted below:

Table 5: Shannon-Wiener diversity Index (Fauna)

	Sampling point	Latitude	Longitude	Birds	Butterflies
CORE	D3 P1 C	27.175347	88.5128787	2.17	1.04
	D3 P2 C	27.17539	88.5130848	0.84	0.69
	D3 P3 C	27.174628	88.5125656	1.51	0.00
	D3 P4 C	9.4743964	76.3474501	0.71	0.00
BUFF	D2 P1 B	27.157393	88.5133795	1.52	0.96

Sampling point	Latitude	Longitude	Birds	Butterflies
D2 P2 B	27.177989	88.51903	2.34	0.64
D2 P3 B	27.181797	88.5243511	0.00	1.93
D2 P4 B	27.185404	88.4890106	1.94	0.00
D2 P5 B	27.186219	88.5043145	1.47	0.00

4.4.2 Simpson's Diversity Index

Simpson's Biodiversity Index considers the dominance of species in a community. It is based on the probability that two individuals randomly selected from the community belong to the same species. A community dominated by one or two species is less diverse than one in which several different species have a similar abundance.

As species richness and evenness increase, the value of the indices also increases. The index ranges from 0 to 1, where:

D = 0 represents infinite diversity, meaning all species are equally abundant (perfect evenness).

D = 1 indicates minimum diversity, where a single species dominates the entire community (maximum dominance).

4.4.2.1 Flora

The Simpson's diversity index value for the flora is depicted below:

Table 6: Simpson's diversity index (Flora)

	Sampling points	Latitude	Longitude	Trees	Shrubs	Climbers	Herbs
CORE	D3 P1 C	27.175347	88.5128787	0.95	0.26	0.00	0.81
	D3 P2 C	27.17539	88.5130848	0.86	0.76	0.21	0.85
	D3 P3 C	27.174628	88.5125656	0.00	0.00	1.00	0.88
	D3 P4 C	9.4743964	76.3474501	0.57	0.76	0.00	0.75
BUFFER	D2 P1 B	27.157393	88.5133795	0.87	0.59	0.75	0.89
	D2 P2 B	27.177989	88.51903	0.83	0.00	0.00	0.92
	D2 P3 B	27.181797	88.5243511	0.86	0.81	0.49	0.75
	D2 P4 B	27.185404	88.4890106	0.00	0.51	0.00	0.73
	D2 P5 B	27.186219	88.5043145	0.56	0.60	0.00	0.76

4.4.2.2 Fauna

The Simpson's diversity index value for the fauna is depicted below:

Table 7: Simpson's diversity Index (Fauna)

	Sampling point	Latitude	Longitude	Birds	Butterflies
CORE	D3 P1 C	27.175347	88.5128787	0.90	0.83
	D3 P2 C	27.17539	88.5130848	0.00	1.00
	D3 P3 C	27.174628	88.5125656	0.77	0.00
	D3 P4 C	9.4743964	76.3474501	0.43	0.00
BUFFER	D2 P1 B	27.157393	88.5133795	0.84	0.67
	D2 P2 B	27.177989	88.51903	0.94	0.53
	D2 P3 B	27.181797	88.5243511	0.00	0.83
	D2 P4 B	27.185404	88.4890106	0.81	0.00
	D2 P5 B	27.186219	88.5043145	0.80	0.00

5 BIODIVERSITY IMPACT AND DEPENDENCIES

5.1 Inventory of Impact and Dependencies

Table 8: Dependency and Impact Matrix of Ecosystem Services

Company: Zydus Wellness Limited, Sikkim **Assessment scope:** Company operations **Product:** Fast-moving Consumer Goods		***Company DEPENDENCE on ecosystem services***			***Company IMPACT on ecosystem services***			
Ecosystem services	**Definitions**	1.Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful company performance? If "no" skip to question 3	Does this ecosystem service have service have cost-effective substitutes?	Comments or s upporting information	3. Does the company affect the quantity or quality of this ecosystem service? *If "no" skip to the next ecosystem service*	4. Is the company's impact positive or negative? - Positive: The company increases the quantity or quality of this ecosystem service - Negative: The company decreasesthe quantity or quality of this ecosystem service	5. Does the company's impact limit or enhance the ability of others to benefit from this ecosystem service?	**Comments or supporting information**
PROVISIONAL SERVICES								
Biomass fuel	Biological material derived from living or recently living organisms–both plant and animal–that serves as a source of energy.	Y	Y	Brickets are used as fuel in the operation. These are produced using natural agricultural waste and hence is an efficent solution to reducing dependency on non-conventional sources.	N			
Freshwater	Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses.	Y	N	The water is sourced from a nearby spring to the unit for domestic and commercial use. The unit also has a Zero-water discharge policy and hence the used water is recycled and further reused within the plant.	N			
REGULATING SERVICES								
Maintenance of air quality	Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a “source”) or extracting chemicals from the atmosphere (i.e., serving as a “sink”).	Y	Y	Forest act as a sink for Carbon dioxide and many other harmful pollutants. Though the operation adheres to the laws of the nationsl/ state pollution control board, the residual emissions are absorbed the surrounding forest area.	N			All the activities in the operations are undertaken within the permissible limit
Global climate regulation	Influence ecosystems have on the global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere.	Y	N	The company emits several green house gases andcurrently it is planning to become a carbon neutral operation. The dependency of the company is high on this service as it is a requirement for the regulatory and reputational purpose.	N			

Company: Zydus Wellness Limited, Sikkim **Assessment scope:** Company operations **Product:** Fast-moving Consumer Goods		***Company DEPENDENCE on ecosystem services***			***Company IMPACT on ecosystem services***			
Ecosystem services	**Definitions**	1.Does this ecosystem service serve as an input or does it enable/ enhance conditions for successful company performance? If "no" skip to question 3	Does this ecosystem service have service have cost-effective substitutes?	Comments or s upporting information	3. Does the company affect the quantity or quality of this ecosystem service? *If "no" skip to the next ecosystem service*	4. Is the company's impact positive or negative? - Positive: The company increases the quantity or quality of this ecosystem service - Negative: The company decreasesthe quantity or quality of this ecosystem service	5. Does the company's impact limit or enhance the ability of others to benefit from this ecosystem service?	**Comments or supporting information**
Regional/local climate regulation	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors.	Y	N	The company is highly dependent on the regional climate as activities like floods, forest fire and landslides are common events in the area and occurrence of any impacts the productivity of the plant	N			
Regulation of water timing and flows	Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape.	Y	N	In absence of flood control meaures, extreme rainfall can lead to flooding and prevent the movement of raw material and manpower. It can also lead to erosion and poor road conditions, water built up, surface runoff and damage to infrastructure in extreme situations	N			
CULTURAL SERVICES								
Recreation and ecotourism	Recreational pleasure people derive from natural or cultivated ecosystems.,	Y	?	Sikkim is a well-known tourist site and the surrounding region provides an optimal atomsphere for recreation and ecotourism activities. The sourrounding locations are explored by employees for recreational purpose	N			

The study highlights that the operation is highly dependent on freshwater for its operation. Additionally, it is also dependendt on other regulating services relate to climate, air quality and water timing anf flows.

Table 9: Summary of Priority Ecosystem Services

Ecosystem services		Dependency	Impact
Provisioning			
1	Biomass fuel	○	
2	Freshwater	●	
Regulating			
3	Maintenance of air quality	○	
4	Global climate regulation	●	
5	Regional/local climate regulation	●	
6	Regulation of water timing and flows	●	
Cultural			
7	Recreation and ecotourism	**?**	
Key ● **High** **+ Positive impact** ○ **Medium** **- Negative impact** **Low** **? Don't know**			

5.2 Inventory of Biodiversity Impacts

Following impcts were observed associared to biodiversity:

Sr. no.	Type of Impact	Details
1	Direct	Utilization of water resources may increase demand and may lead to its depletion
2	Indirect	Emission from the operation or vehicular movement may lead to increased pollutants in the environment
3	Direct	Presence of invasive species in the plant area may lead to its dispersal in other parts replacing the native flora of the site and surrounding
4	Direct	Impact on faunal species due to noise generated during operation
5	Indirect	Disposal of debris in plant areas may provide hideouts for snakes leading to more encounters with humans
6	Indirect	Presence of pigeons in the area may lead to increase of contamination and zoonotic diseases.

6 BIODIVERSITY MANAGEMENT PLAN

6.1 Objective

The Biodiversity Management Plan (BMP) aims to reduce the impact of the operation process on the biodiversity of the study area to achieve 'No-net Loss'. Following objectives needs to be adopted to sustain the biodiversity of the area in association with the operation:

- Education, awareness, and involvement of stakeholders in the protection of biodiversity
- Conservation and enhancement of the habitat
- Increase Biodiversity Value of the Site
- Reduce Threats on the Biodiversity
- Maintain a database and reporting biodiversity related measures in public domain

6.2 Path to No-net Loss

A mitigation hierarchy (Avoidance-Minimisation-Restoration-Biodiversity Offset). Conservation initiatives and actions that aid in the process of species conservation and enhancing the habitat can contribute towards achieving No-net Loss.

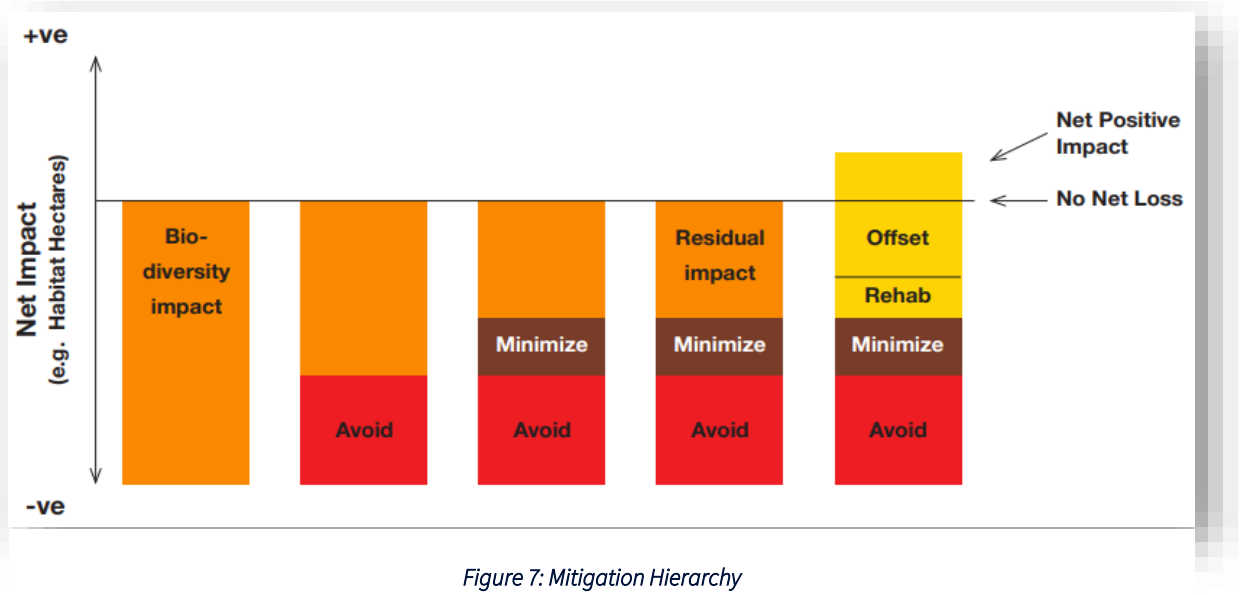

Figure 7: Mitigation Hierarchy

Impact and Dependencies of the operation on Biodiversity and Ecosystem Services were identified. Base on the biodiversity risk of each impact, a mitigation category has been assigned to the impacts and the strategies and action plans have been suggested accordingly.

Table 10: Corelation between the impacts and mitigation hierarchy

Impacts	Description of the Impact	Mitigation Hierarchy
Impact 1	Utilization of water resources may increase demand and may lead to its depletion	**Minimization**

Impacts	Description of the Impact	Mitigation Hierarchy
Impact 2	Emission from the operation or vehicular movement may lead to increased pollutants in the environment	**Minimize**
Impact 3	Presence of invasive species in the plant area may lead to its dispersal in other parts replacing the native flora of the site and surrounding	**Minimization + Restoration**
Impact 4	Impact on faunal species due to noise generated during operation	**Minimization**
Impact 5	Disposal of debris in plant areas may provide hideouts for snakes leading to more encounters with humans	**Avoidance**
Impact 6	Presence of pigeons in the area may lead to increase of contamination and zoonotic diseases.	**Minimization**

6.3 Strategies and Action Plans

6.3.1 Biodiversity Management System

Concept/Requirement

A comprehensive Biodiversity Management System can be established on group level to oversee the preservation of biodiversity both within the plant as well as its surrounding habitats. This system should consist of members with diverse expertise in Biodiversity and Environmental Management. Additionally, the creation of this system should be accompanied by a well-designed training program that encompasses the necessary tasks and functions for its effective operation.

The BMS should have protocols for data collection, compilation, and evaluation, and maintaining a consistent database. On unit level a Biodiversity Champion should be engage for taking ownership and responsibility for biodiversity, facilitated by foundational knowledge gained through various training and awareness programs.

Role of Biodiversity Management System

The Biodiversity Champion will undertake the following responsibilities:

- Overseeing the successful execution of the Biodiversity Action Plan
- Tracking the advancement of the Biodiversity Action Plan's implementation
- Conducting biodiversity awareness sessions for employees and colleagues
- Establishing an accessible information-sharing platform
- Managing, executing, and overseeing the 'Biodiversity Protocols and Procedures' outlined below.

Significance	• Active participation of employees and locals in conservation of habitats and species • Providing opportunities to talent driven individuals

6.3.2 Enhancing Education and Awareness related to Biodiversity

6.3.2.1 Awareness about Biodiversity

Preserving biodiversity of an area necessitates the participation of every segment of the community. Building awareness about the local biodiversity, wildlife population dynamics, and the human-induced threats they face is vital to engage communities actively in conservation efforts.

The percentage of the employees sensitised on biodiversity and ecosystem services during reporting period should be indicated. The following formula can be used for calculation.

$$Percentage\ of\ employees\ sensitized\ on\ biodiversity = \frac{Total\ number\ of\ employees\ sensitized}{Total\ Employees} \times 100$$

Based on the qualification and managerial level, the employees can be divided into different groups and accordingly the sessions can be arranged.

6.3.2.2 Capacity Building Sessions

Concept/ Requirement

To conserve biodiversity effectively, it's crucial to first understand and recognize its significance. Often, the richness of flora and fauna compositions in our surroundings goes unnoticed until a situation demands attention. Therefore, raising awareness among both employees and citizens about local biodiversity and its vital role in human well-being is essential for its preservation.

Implementation Measures

- One of the ways through which awareness can be achieved is by conducting capacity building sessions, wherein the locals are directly or through indirect means like photographs are introduced to the local biodiversity. This can be done through following techniques:
- Conducting introductory workshops that will showcase interesting images of habitats and existing biodiversity.
- Celebrating a yearly “Biodiversity Festival” that will closely involve practitioners, NGOs, students, locals, and talent driven individuals. Through the festival, biodiversity of the region can be showcased with present state, impacts, mitigation efforts taken by the operation towards conservation.
- Identifying talented individuals and involve them in conservation and monitoring efforts.
- Support and encourage improved training and professional development for teachers, employees and others involved in building awareness about biodiversity.

- Conducting Nature trails in the different habitats and biodiverse regions in the study area.

Significance	• Active participation of employees and locals in conservation of habitats and species • Providing opportunities to talent driven individuals

6.3.2.3 Installation of Biodiversity Information Posters in the Study area

Concept/ Requirement

Posters and signage carrying information of the existing biodiversity in the core, as well as the study area, will take the work of capacity building sessions a step further, regularly exposing the residents to their biodiversity. Along with displaying specific important species found in the study area, these signage boards will also hold information on the importance of the dominant natural habitat of the study area especially the forest species. Impact of human activities on scrublands and their species and measures to reduce this impact and conserve the habitat will be displayed on these installations. Installation of graphical signages in the local languages along with awareness sessions for the residents in their surroundings is essential for the purpose of awareness.

Figure 8: Representative Image of Information Board

Examples of Poster for the Sikkim Plant:

1. Snake Awareness posters
2. Birds in the plant area
3. Native flora of Sikkim
4. Importance of Biodiversity Conservation
5. Human- Biodiversity Relationship

Significance	Biodiversity Awareness among employees and locals regarding local biodiversity and contribution in their conservation

6.3.2.4 Celebration of 25 Wildlife and Environmental days

Concept/ Requirement

International organizations and agencies dedicated some days in the year to various biodiversity and various elements of the environment. These days aim to create awareness and encourage public action for conservation.

Organizing events to celebrate these days sustainably supports the aim of generating awareness about the environment, biodiversity and its conservation. The celebration can be marked by the conduction of talks by experts on the theme of the day, organization of relevant activities like nature trails, competitions and drives to create protect or clean habitats, etc. The employees, students and residents of the unit should be informed of these events and their participation should be encouraged and rewarded. CSR-driven initiatives like awards and scholarships to the most sustainable and environmentally aware village/community in the study area and students actively participating in events organized to create awareness and conserve the biodiversity of the region.

Date	Days related to Biodiversity/ Environment
2nd February	World Wetland Day
14th March	International Day of Action for Rivers
20th March	World Sparrow Day
22nd April	Earth Day
22nd May	World Biodiversity Day
5th June	World Environment Day
1st July to 7th July	Van Mahotsava Saptah
23rd September	World River Day
1st October to 7th October	Wildlife Week
3rd October	World Habitat Day
12th October	World Migratory Bird Day
21st November	World Fisheries Day
5th December	World Soil Day

Significance	Awareness among employees and locals regarding local biodiversity and contribution in their conservation

6.3.2.5 Integration of QR Code/ Label for the Awareness and Management of Tree Species in the Plant Area

Concept/ Requirement

With the rapid advancement of technology, the integration of innovative tools such as Quick Response (QR) codes offers a promising avenue to enhance educational experiences, particularly in the study of diverse tree species. This initiative aims to explore the potential of using QR codes to provide comprehensive information about various trees located within the core area of

QR codes have already proven to be an efficient method for tracking and managing assets in large-scale operations across multiple sectors. In the context of a plant manufacturing unit, QR coding of trees can significantly contribute to enhancing sustainability, improving the management of green cover, and promoting environmental responsibility. In India, where biodiversity preservation is a growing concern, this technology can play a crucial role in protecting and monitoring native tree species within industrial premises.

The use of QR codes for environmental education and biodiversity conservation is gaining traction in India. For instance, New Delhi Municipal Corporation has installed QR codes on almost 4,000 trees in in Major Gardens, Avenues, Markets and NDMC Schools to highlight their ecological, medicinal, and religious significance (Daily Excelsior), through India's first ecology based environmental consultancy – Terracon Ecotech Private Limited.

Implementation Measures

Steps for Implementing Tree QR Coding:

1. **Inventory & Mapping**
   - Start by identifying and mapping all trees within the premises.
   - This process should include recording the GPS coordinates of each tree, along with data on its species, age, and current health status.
2. **Selection of QR Code Technology**
   - Choose a QR code platform that supports integration with a centralized database and offers data analytics capabilities.
   - The platform should be user-friendly, secure, and scalable to meet future requirements.
3. **Tree Labelling:**
   - Generate and print durable QR code labels.
   - Ensure the labels are weather-resistant and designed to withstand harsh environmental conditions.

- Attach the QR codes to trees using non-invasive, tree-friendly materials.

4. **Database Development:**
   - Create a centralized online database to store detailed information on each tree, such as growth metrics, species, health logs, and any maintenance or interventions (e.g., pruning or disease treatment).
5. **Integration with Environmental Reports**
   - Incorporate the collected tree data into regular environmental reports for stakeholders, including governmental bodies, local NGOs, and corporate sustainability teams.
6. **Continuous Monitoring & Maintenance:**
   - Establish a periodic review process to monitor tree health and ensure that the QR code system is updated regularly to reflect any changes.

Draft design for tree label with QR code

The following image illustrates a sample draft design of a tree label featuring a QR code:

Figure 9: Draft design for tree label with QR code (Representative Picture)

Information to be displayed upon scanning the QR Code:

- Botanical Name
- Common Name (English and Local)

- General description of the plant including their biogeographical region, habit, IUCN status, and its special characters & phenology
- Ecological Significance (5-6 lines)
- Medicinal Uses (5-6 lines)

6.3.3 Enhancement of Greenbelt through inclusion of Native Species

Concept/Requirement

Native plants are an important part of our natural heritage. Ecological approach should be adopted while enhancing biodiversity of any area. Even just a modest number of native plants in an area provide far better food, shelter, and nesting for local wildlife than any kind of non-native plant can. Most types of butterflies, other pollinators, and many mammals and insects depend on very specific native plant varieties for their survival. This fosters a healthy, balanced ecosystem which is more resistant to damage by pests and diseases., (Ozyavuz, 2013).

Upon analysing the species composition at the Zydus Wellness, Sikkim unit, it was inferred that most of the ornamental species observed in the horticultural garden were exotic in origin. To promote sustainability and conservation, it is advisable to prioritize the inclusion of native species in higher frequency and density to maintain a suitable environment.

Implementation Measures

Particulars	Details
Diverse Native Flora Collections	➢ Continuously expand and diversify the plant collections to showcase a wide range of botanical specimens, including RET (rare endangered threatened plants), common native species, and plants with cultural and ethnobotanical significance. Use striking name boards for each species.
Maintain Data Fidelity	➢ Cross-verify the scientific names and common names of all the species under cultivation by referring to proper scientific websites; (https://indiabiodiversity.org), (http://www.flowersofindia.net), (https://bsi.gov.in) etc.
Long-Term Maintenance and Sustainability	➢ LTM involves the periodic maintenance of the health of flora species and garden premises to maintain its sustainability ➢ Practice sensible and environmentally friendly measures like; organic gardening, composting and using drip irrigation systems, thus maintaining the soil microbiota health and utilizing less water resources
Conservation Initiatives	➢ Practice plant conservation initiatives, such as ethnomedicinal seed banking, Rare Endangered and Threatened (RET) plant propagation, and native endangered species conservation

Based on the biogeographical area, and vegetation, the following enlisted species can be utilized to establish native species diversity:

Table 11: List of Species suggested for Greenbelt Enhancement

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	VEGETATION TYPE
Trees					
1	*Abies webbiana**	Indian Silver Fir	Pinaceae	NT	Evergreen.
2	*Aegle marmelos*	Indian Bael	Rutaceae	NT	Deciduous
3	*Archidendron monadelphum*	Kachlora	Fabaceae	-	Semi-Evergreen
4	*Azadirachta indica*	Neem	Meliaceae	-	Evergreen
5	*Betula utilis**	Himalayan Birch	Betulaceae	LC	Deciduous
6	*Bischofia javanica*	Tiger Wood	Euphorbiaceae	-	Semi-Evergreen
7	*Bombax ceiba*	Silk cotton tree	Malvaceae	LC	Deciduous
8	*Callicarpa arborea*	Beauty Berry Tree	Verbenaceae	-	Evergreen
9	*Castanopsis tribuloides*	Chinkapin	Fagaceae	-	Evergreen
10	*Cinnamomum tamala*	Indian Bay Leaf	Lauraceae	-	Evergreen
11	*Cyathea sp.**	Tree Fern	Cyatheaceae	-	Evergreen
12	*Diploknema butyracea**	Indian Butter Tree	Sapotaceae	LC	Evergreen
13	*Duabanga grandiflora*	Duabanga	Lythraceae	-	Evergreen
14	*Fraxinus floribunda*	Himalayan Ash	Oleaceae	LC	Deciduous
15	*Litsea cubeba*	Mountain Pepper	Lauraceae	-	Deciduous
16	*Mallotus philippensis*	Kum Kum Tree	Euphorbiaceae	LC	Evergreen
17	*Oroxylum indicum*	Indian Trumpet Flower	Bignoniaceae	LC	Deciduous
18	*Pandanus nepalensis*	Himalayan Screw Pine	Pandnaceae	-	Evergreen
19	*Shorea robusta*	Sal	Dipterocarpaceae	LC	Deciduous
20	*Sterculia villosa*	Hairy Sterculia	Malvaceae	LC	Deciduous
21	*Terminalia elliptica*	Asan	Combretaceae	LC	Deciduous
22	*Terminalia myriocarpa*	East Indian Almond	Combretaceae	LC	Evergreen
23	*Tetradium fraxinifolium*	Khanakpa	Rutaceae	LC	Evergreen
24	*Wrightia sikkimensis**	Indrajao	Apocynaceae	NT	Semi-Evergreen
25	*Quercus lamellosa*	Layered Acorn Oak	Fagaceae	LC	Evergreen
Shrubs					
1	*Citrus indica*	Indian Wild Orange	Rutaceae	EN	-
2	*Hydrangea febrifuga*	Blue Himalayan Hydrangea	Hydrangeaceae	-	-
3	*Ephedra gerardiana*	Somalata	Ephedraceae	-	-
4	*Berberis aristata*	Indian Barberry	Berberidaceae	LC	-
5	*Hippophae salicifolia*	Willow-Leaved Sea Buckthorn	Elaeagnaceae	-	-
6	*Rauvolfia serpentina*	Indian Sankeroot	Apocynaceae	EN	-
7	*Debregeasia saeneb*	Himalayan Wild Rhea	Urticaceae	-	Evergreen
Climbers					

SN	SCIENTIFIC NAME	COMMON NAME	FAMILY	IUCN STATUS	VEGETATION TYPE
1	*Bauhinia vahlii*	Maloo Creeper	Fabaceae	-	-
2	*Aganope thyrsiflora*	East Himalayan Derris	Fabaceae	-	-
3	*Piper sylvaticum*	Mountain Long Pepper	Piperaceae	-	-
4	*Dioscorea pyrifolia*	Pyriform Yam	Dioscoreaceae	-	-
5	*Dioscorea bulbifera*	Air Potato	Dioscoreaceae	LC	-
6	*Holostemma ada-kodien*	Ada Kodien	Asclepiadaceae	-	-
Herbs & Grasses					
1	*Begonia picta**	Painted Leaf Begonia	Begoniaceae	-	-
2	*Koenigia mollis*	Sikkim Knotweed	Polygonaceae	-	-
3	*Amomum subulatum*	Black Cardamom	Zingiberaceae	-	-
4	*Artemisia indica*	Indian Worm Wood	Asteraceae	-	-
5	*Kaempferia rotunda*	Bhumi Champa	Zingiberaceae	-	-
6	*Nardostachys jatamansi**	Indian Nard	Caprifoliaceae	CR	-
7	*Podophyllum hexandrum**	Himalayan May Apple	Berberidaceae	VU	-
8	*Equisetum diffusum*	Himalayan Horsetail	Equisetaceae	-	-
9	*Dischidia bengalensis*	Bengal Succulent Vine	Asclepiadaceae	-	-
10	*Brassica nigra*	Black Mustard	Brassicaceae	-	-
11	*Rubia cordifolia*	Indian Madder	Rubiaceae	-	-
12	*Swertia chirayita*	Chirayita	Gentianaceae	CR	-
13	*Saussurea costus*	Indian Costus	Asteraceae	CR	

6.3.4 Creating Habitat for Pollinators

Concept/Requirement

Bees and Butterflies are essential to the ecosystem, characterised by a co-evolutionary relationship with plants that underscores their interdependence. Their taxonomy is well-established, and their biology and life history are thoroughly understood. Research has quantified their physiological tolerances—including habitat preferences, temperature, and light requirements—correlating these factors with changes in ecosystem conditions, thus making butterflies effective indicators for assessing ecosystem health. In addition to pollination, butterflies serve as a food source for various organisms, assist in pest control, and contribute to other vital ecological functions. An increase in butterfly populations can have a positive impact on associated species, ultimately enhancing overall species diversity and abundance. However, it is important to note that the operational core manufacturing unit premises of the Zydus wellness, Sikkim predominantly consist of relatively frequent exotic

species to native flora species, which may limit the full ecological benefits typically provided by native species.

Implementation Measures

Since the core unit features a single open lawn area near the entry gate with a mix of native and exotic plant species, a small section of this space can be thoughtfully designated for a butterfly garden. Careful planning and implementation are essential to ensure its success. When developing the butterfly garden, special attention should be given to the strategic arrangement of nectar and larval host plants. Larval host plants should be placed in locations with minimal human disturbance to support optimal growth and habitat conditions. Over time, butterflies will be attracted to the flowering plants for nectar and may use the host plants for egg-laying, depending on the species present.

The following detailed plan of action shall be undertaken to develop a butterfly garden:

Steps	Description
Site Selection	• Preferred locations to establish a butterfly garden within the core area of the Zydus Wellness plant are the lawn behind the parking area.
	• This area can be potentially utilised to accommodate various native plants and eventually attract butterflies.
Planning	• A variety of nectar-rich flowers, and host plants to support all stages of the butterfly lifecycle has been provided below this table.
Soil Preparation	• Features such as rocks, logs, or shallow puddles for basking and puddling can also be incorporated under the locations mentioned in the site selection.
	• Remove any weeds or invasive plants that may compete with butterfly-friendly vegetation.
Planting of host plants	• Incorporate region-specific larval host plants for caterpillars to feed on.
Maintenance	• Water newly planted areas regularly, especially during dry spells, to establish healthy vegetation.
	• Mulch around plants to retain moisture, suppress weeds, and provide organic matter as it decomposes.
	• Monitor for pests and diseases, opting for natural or organic control methods to minimize harm to butterflies and other beneficial insects.
Monitoring and Evaluation	• Regularly observe the garden to track butterfly activity and species diversity.
	• Keep records of plant performance, noting any successes or challenges encountered.
	• Solicit feedback from visitors and volunteers to identify areas for improvement and future expansion.

The list of butterfly host plants is given below:

SN.	Common Name	Scientific Name	Larval Host Plant
1	Spotted Snow Flat	*Tagiades menaka*	*Dioscorea bulbifera*
2	Sylhet Water Snow Flat	*Tagiades litgiosa*	*Dioscorea pyrifolia*
3	Himalayan Red Lacewing	*Cethosia biblis tsamena*	*Passiflora* sp.
4	Oriental Striped Tiger	*Danaus genutia genutia*	*Holostemma ada-kodien*
5	Sylhet White-edged Blue Baron	*Euthalia phemius phemius*	*Mangifera indica*
6	Sikkim Common Tit	*Hypolycaena erylus himavantus*	*Ixora* spp.
7	Himalayan Yellow Coster	*Acraea issoria issoria*	*Debregeasia saeneb*
8	Himalayan Cabbage White	*Pieris canidia indica*	*Brassica nigra*
9	Chocolate-bordered Flitter	*Zographetus dzonguensis*	*Aganope thyrsiflora*
10	Sikkim Ace	*Halpe sikkima*	*Bambusa* spp.

Significance	• Promoting habitat heterogenicity and natural cycle • Increased habitat for faunal species

6.3.5 Management Plan for Concerned Species

Concept/ Requirement

The security personnel reported the presence of an Indian Pangolin in the core area. The pangolin was carefully rescued, ensuring its safety, and was subsequently released back into the wild. This sighting underscores the ecological significance of the surrounding forest, which appears to provide essential habitat conditions, such as abundant prey (ants and termites), shelter in burrows, and low levels of human disturbance. Snakes are also common visitors to the area and it is necessary to manage the population of the same and create awareness on its management and conservation.

Implementation Measures

If any wildlife is notifed within the project area, the following steps should be taken:

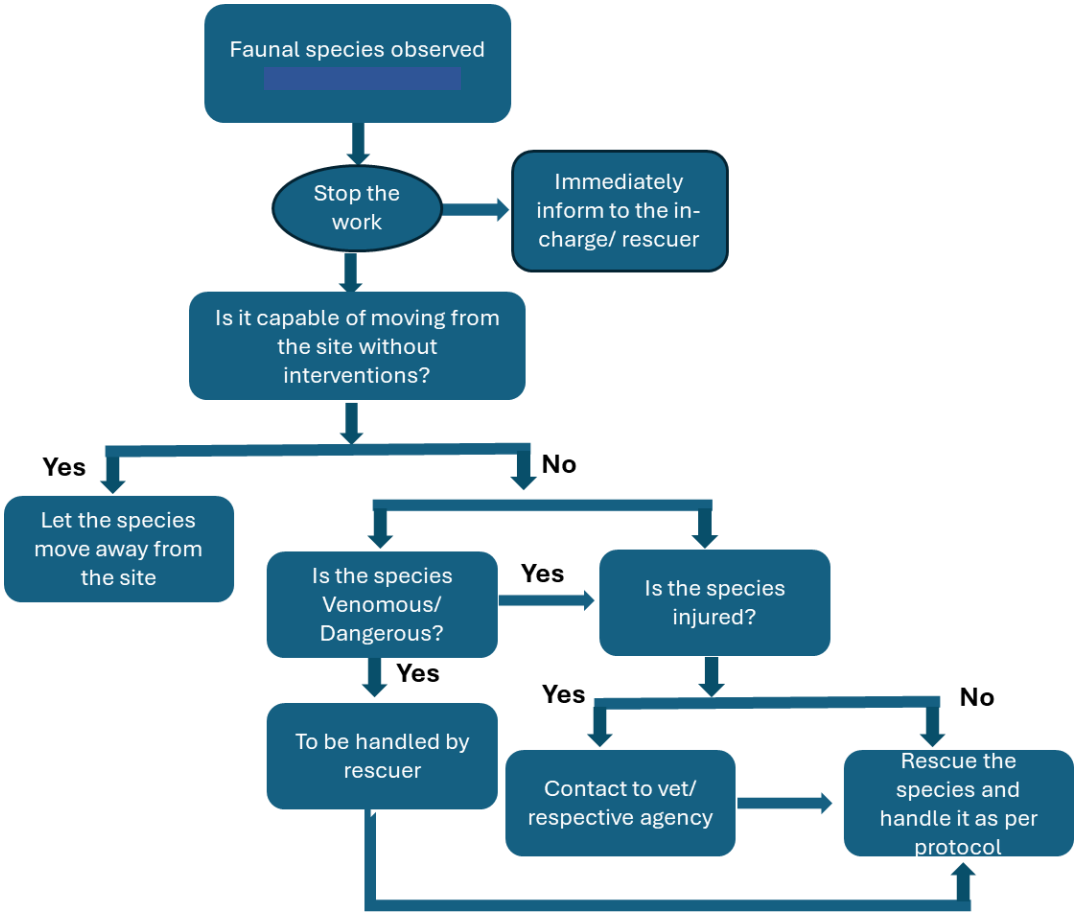

Figure 10 : Fauna handling and management during clearance and quarrying activity

A. Snake Management Plan

Dedicated snake rescuers who comply with all rules and regulations and follow ethical rescues to manage snakes in the site area should be hired. This must be done by consulting the forest department, which might have a list of certified snake rescuers. These rescuers will help maintain a record of snake rescue and activity, which will help estimate the snake population and diversity at the site and help in maintaining the details of the species.

Using Proper Snake-Catching Equipment for Snake Rescue:

Snake rescues are crucial to protect both snakes and humans. When snakes are encountered in the plant area, they can cause panic, leading to hasty actions that might harm the snake or pose risks to people. Professional snake rescue ensures that the animal is safely relocated to its natural habitat without endangering anyone. Proper equipment plays a pivotal role in achieving this balance of safety and effectiveness.

Two primary types of snake-catching tools are commonly used:

Snake Hook (Fig 1): A sturdy snake hook is a primary tool for handling snakes. It allows the rescuer to lift and maneuver the snake from a safe distance without causing harm or stress.

Snake Tongs (Fig 2 & 3): There are various types of tongs available on the market for snake rescue. However, tongs with teeth-like ends can cause harm or injury to the snake. Instead, tongs with rubber-coated, flattened tips should be used, as they are specifically designed to grip the snake gently yet securely, ensuring the rescuer can handle the animal without causing harm.

For the safe transportation of snakes, snake bags or tubes should be utilized. If temporary housing is required, escape-proof and ventilated containers are recommended to ensure the snake's safety and containment.

	
Suitable tools for snake handling	**Avoid usage of this tool**

While proper equipment is essential, it must be coupled with knowledge of snake behaviour, species identification, and safe handling techniques. Rescuers should undergo professional training to understand how to use the tools effectively while minimizing stress for the snake. Misidentification or improper handling can escalate risks, particularly with venomous species.

Actions to avoid conflicts	Actions in Case of Encounter
• Management of debris from construction activities • Record the type of snakes that are observed within the asset and surrounding region • Provide training to all staff on snake awareness and the actions that has to be taken in case a snake is seen or a staff member bitten • Keep emergency contact numbers of hospitals providing anti-venom, nearby rescuers, or forest department personnel, etc.	• Do not try to catch it yourself, neither try to kill it or take a photo of it as the snake might get agitated and try to attack in defence • Do not go behind the snake and try to take photographs • Leave it alone and give it space to get away • If snake enters any other human occupied area contact a local rescuer or forest department • One person observes the movement of snake • The security persons should be trained to handle snakes using tongs

Actions in Case of Snake Bite
• Call for help • Do not move the part on which snake has bitten to avoid increase of blood flow in other parts of body • Apply a pressure immobilisation bandage • Do not wash or cut the wound • Avoid oral suction of the bite • Do not consume any kind of medicine or apply any ointment without prescription • Take the patient immediately to the hospital • Provide doctor information of any symptoms such as drooping eyelids that manifested on the way to hospital & time of bite

Since most snakes in the study area are protected under Schedule I of the Wildlife Protection Act, 2022, it is crucial to handle them with care during rescues to avoid causing any harm to these protected reptile species.

Information collected for relocated individuals should include:

- Photos of the snake (including headshot) and location detected (including GPS coordinates), notes on habitat type (including rock availability and vegetation), location of the relocated site (including GPS coordinates) and notes on habitat are also necessary.
- A snake rescue and release database should be maintained to monitor cases of multiple rescues of the same snake.
- Awareness and Sensitizing programs of snake bite management, snake ecology, and misconceptions about snakes are essential parts of the management of Snakes.

- Teaching how to act when venomous snakes occur can be very efficient and cause less commotion during rescue.
- Also knowing about the availability of anti-venom in the event of snake bite is necessary.
- Do's and Don'ts Materials on Snake Bite management, Poster on common snakes of the study area etc. would be effective.

B. Pangolin Management Plan

The Indian Pangolin **(***Manis crassicaudata*) is a medium-sized, nocturnal mammal known for its distinctive protective scales. The population the species is declining, because of illegal wildlife trade, as it holds the unfortunate distinction of being the most trafficked wild mammal globally. Its scales are highly sought after for use in traditional medicine, and its meat is considered a delicacy in some regions. Compounding this crisis is habitat loss, driven by deforestation, urbanization, and agricultural expansion, which have led to a significant decline in its natural environments (Heighton and Gaubert, 2021).

Recognizing the urgent need for protection, the Indian Pangolin is protected under the Schedule I of Wildlife Protection Act, 2022, which grants it the highest level of legal protection. Additionally, it is listed in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), effectively banning its international trade (Mahmood et. al., 2019).

Conservation efforts:

- Promoting awareness about the ecological importance of pangolins and encouraging public involvement in conservation initiatives.
- Deploying camera traps to monitor pangolin populations and their movements effectively.
- Protecting and preserving existing forested habitats critical for pangolin survival.
- Establishing local rescue teams to address cases involving injured or rescued pangolins.
- Ensuring rescued pangolins undergo rehabilitation and are reintroduced into secure, monitored habitats.
- Collaborating with local communities to incorporate traditional knowledge and practices into conservation efforts.
- Promptly informing wildlife authorities, forest departments, or conservation organizations of pangolin sightings or incidents.

6.3.6 Invasive Species Management Plan

Concept/ Requirement

An invasive species denotes a non-indigenous plant species to a specific region and has been introduced to a new environment, intentionally or unintentionally. This species proliferates rapidly upon introduction, yielding significant ecological, economic, or human health impacts. Owing to the absence of natural predators or competitors, these plants tend to dominate the new environment, often resulting in the displacement of native plant species and the disruption of local ecosystems. A recent report published in the Journal of Applied Ecology indicates that approximately 66 per cent of India's natural ecosystems are at risk from invasive species. This finding results from a comprehensive national-level survey that covered 158,000 plots within 358,000 square kilometres of wild areas. The report underscores that 11 high-concern invasive plant species, including Common Lantana (*Lantana camara*), Mesquite (*Prosopis juliflora*), and Devilweed (*Chromolaena odorata*), have established a presence in 20 states throughout the country (Himanshu Nitnaware & Himanshu Nitnaware, 2023).

In urban environments, invasive species represent a significant threat to the conservation of biodiversity and the health of ecosystems. Human activity in these settings creates favourable conditions for the establishment and proliferation of these species. The removal of invasive species is a key management measure for the restoration and preservation of native ecosystems, but it necessitates meticulous planning and prioritization to ensure its effectiveness and efficiency. The control of invasive species populations is vital for the support of local native diversity.

Implementation Measures

On account of winter season baseline data acquisition, the following obnoxious exotic species were specifically identified and observed from the various habitats of the core area,

Table 12: List of Invasive Species observed in the Study area

SN	Scientific Name	Common Name	Family	Origin	IUCN Status	Core	Buffer
Trees							
1	*Psidium guajava*	Guava	Myrtaceae	Native	Least concern	**Y**	**Y**
Shrubs							
1	*Lantana camara*	Lantana	Verbenaceae	Exotic	-	**Y**	**Y**
Climbers							
1	*Mikania micrantha*	Climbing Hemp Weed	Compositae	Exotic	-	**Y**	**Y**
Herbs & Grasses							
1	*Ageratum conyzoides*	Goat weed	Compositae	Exotic	LC	**Y**	**Y**

2	*Chromolaena odorata*	Bitter bush	Compositae	Exotic	-	**Y**	**N**

Table 13: Management Plan for Invasive Species

SN.	Scientific name	Location In the Core	Mechanism/ Medium of spread	Reproduction mechanism	Methods of Eradication and Disposal	Methods of disposal	Representative Photo
1	*Psidium guajava*	Individuals were particularly observed from the plantation and garden premises.	Dispersal of seeds through the frugivorous birds and mammals	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit. 2. Eradicate the plant.	1. It is recommended to remove the existing individuals and make sure not to adopt these species for future plantation purposes. 2. Uprooting of plant at nonflowering stage. 3. Shredding of all parts. 4. Sun drying for 15 to 20 days. 5. Spreading in plantation site.	
2	*Cestrum nocturnum*	Individuals were specifically noted from the Greenbelt premises, as they were used as a hedge plant.	Mainly Humans and Seeds dispersed by birds, water, and wind.	Produces small berries with numerous seeds. Self-sustained propagation due to high seed viability. Can regrow from root fragments.	Mechanical removal, ensuring complete uprooting of roots to prevent regrowth.	1. Shred or chop removed parts. 2. Sun-dry for 15–20 days. 3. Compost or incinerate safely. Avoid dumping seeds in open areas to prevent spread.	
3	*Lantana camara*	A profuse outgrowth of Common Lantana was observed just outside the plant boundary fencing, as well as scattered individuals were noted from the premises of the water treatment plant.	Birds and Mammals (Sheep, Goats, Cattles)	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit.	1. Cut the stems and sun dry them for 15 days or 1 month. 2. Use them as fence material or craft. 3. Species shows the allelopathic effect. Hence shredding of parts and mixing in soil is not recommended.	
4	*Mikania micrantha*	This species was observed from the HSD tank premises and the water treatment tank premises.	Wind and Water	Produces large numbers of small, lightweight seeds that are wind-dispersed. Can also regenerate from stem fragments, promoting rapid colonization.	Manual or mechanical removal, ensuring all stems and roots are cleared.	1. Collect plant material, including roots and fragments. 2. Sun-dry for 10–15 days to prevent regrowth. 3. Burn or compost dried material safely to avoid spread.	

SN.	Scientific name	Location In the Core	Mechanism/ Medium of spread	Reproduction mechanism	Methods of Eradication and Disposal	Methods of disposal	Representative Photo
5	*Ageratum conyzoides*	A few individuals were observed from the water treatment tank premises.	1. Seeds are dispersed on the hairs of animals and attached to clothes and agricultural machinery. 2. Seeds are dispersed by wind and water	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit.	1. Cut the stems and sun dry them for 15 days or 1 month. 2. Use them as fence material or craft. 3. Species shows the allelopathic effect. Hence shredding of parts and mixing in soil is not recommended.	
6	*Chromolaena odorata*	Individuals were observed near the water treatment tank premises.	1. Seeds are dispersed on the hairs of animals and attached to clothes and agricultural machinery. 2. Seeds are dispersed by wind and water	Seeds and vegetative.	1. Mechanical - Uproot the plants before it sets fruit.	1. Cut the stems and sun dry them for 15 days or 1 month. 2. Use them as fence material or craft. 3. Species shows the allelopathic effect. Hence shredding of parts and mixing in soil is not recommended.	

6.3.7 Management of Feral Pigeon

Concept/ Requirement

Rock Dove (*Columba livia*), commonly found in urban areas, are highly adaptable and utilize buildings, bridges, and other man-made structures as roosting sites. These birds require minimal nesting material and often exploit architectural features that mimic their natural cliff-side habitats, such as flat or slightly sloped surfaces. However, Rock Doves are considered invasive species, posing risks to local ecosystems and causing nuisance to human environments.

To mitigate their impact and prevent roosting, it is essential to implement targeted management strategies. Understanding how urban structures replicate the birds' natural preferences is crucial for designing effective deterrent measures.

Implementation Measures

Bird Netters: Installing bird netting is an effective way to cover common roosting areas, such as roof-supporting rods, ledges, or beams. The netting creates a physical barrier, restricting access and preventing rock doves from utilizing these spaces for roosting or nesting.

Bird Slides: Bird slides, as illustrated in the figure, are another effective deterrent. These barriers are constructed at a 45-degree angle on ledges, preventing birds from gaining a foothold on metal frameworks or flat surfaces. By eliminating stable landing areas, bird slides also block access to potential nesting spots.

Figure 11: Bird slider for feral pigeon management

Implementing these measures in the plant can help minimize the roosting and nesting of Rock Doves in the plant.

6.3.8 Additional Strategies

6.3.8.1 Rainwater Harvesting

Rain water harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). As the plant is depended on natural spring for water usage. The dependency can be highly reduced through installation of rainwater harvesting ponds for

usage. This will also reduce the runoff in the plan area and help in better management of the resources.

6.3.8.2 Installation of Solar Panels

Solar panels are a carbon-neutral energy source because they produce less carbon than other energy sources, and they can be carbon neutral within a few years of installation. Installation of the solar panels will reduce the dependency on grids for water supply and will also help in contributing to global climate regulation.

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