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7 Annex

Annex 1. List of Fauna species identified within the project area.

Annex 1A. List of bird species identified within the project area.

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
1	Columbidae	Spotted Dove	*Spilopelia chinensis*	Resident	LC	OWS
2	Columbidae	Common Emerald Dove	*Chalcophaps indica*	Resident	LC	OWS
3	Columbidae	Zebra Dove	*Geopelia striata*	Resident	LC	OWS
4	Columbidae	White-eared Brown Dove (Short-billed)	*Phapitreron leucotis brevirostris/ occipitalis*	Endemic	LC	OWS
5	Columbidae	Pink-necked Green Pigeon	*Treron vernans*	Resident	LC	OWS
6	Cuculidae	Philippine Coucal	*Centropus viridis*	Endemic	LC	OWS
7	Caprimulgidae	Great Eared Nightjar	*Lyncornis macrotis*	Resident	LC	OWS
8	Caprimulgidae	Philippine Nightjar	*Caprimulgus manillensis*	Endemic	LC	OWS
9	Apodidae	Ridgetop Swiftlet	*Collocalia isonota*	Endemic	LC	OWS
10	Apodidae	Ameline Swiftlet	*Aerodramus amelis*	Endemic	LC	OWS
11	Apodidae	Asian Palm Swift	*Cypsiurus balasiensis*	Resident	LC	OWS
12	Rallidae	Barred Rail	*Gallirallus torquatus*	Resident	LC	OWS
13	Rallidae	Plain Bush-hen	*Amaurornis olivacea*	Endemic	LC	OWS
14	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	Resident	LC	OWS
15	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	Migratory	LC	OWS
16	Laridae	Whiskered Tern	*Chlidonias hybrida*	Migratory	LC	OWS
17	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Resident	LC	OWS
18	Ardeidae	Nankeen Night Heron	*Nycticorax caledonicus*	Resident	LC	OWS
19	Ardeidae	Pacific Reef Heron	*Egretta sacra*	Resident	LC	OWS
20	Ardeidae	Little Egret	*Egretta garzetta*	Migratory	LC	OWS
21	Ardeidae	Javan Pond Heron	*Ardeola speciosa*	Resident	LC	OWS
22	Ardeidae	Eastern Cattle Egret	*Bubulcus coromandus*	Migratory	LC	OWS
23	Ardeidae	Medium Egret	*Ardea intermedia*	Migratory	LC	OWS
24	Accipitridae	Grey-faced Buzzard	*Butastur indicus*	Migratory	LC	OWS
25	Accipitridae	Brahminy Kite	*Haliastur indus*	Resident	LC	OWS

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
26	Tytonidae	Eastern Grass Owl	*Tyto longimembris*	Resident	LC	OWS
27	Strigidae	Everett's Scops Owl	*Otus everetti*	Endemic	LC	OWS
28	Alcedinidae	Brown-breasted Kingfisher	*Halcyon gularis*	Endemic	LC	OWS
29	Alcedinidae	Collared Kingfisher	*Todiramphus chloris*	Resident	LC	OWS
30	Meropidae	Blue-tailed Bee-eater	*Merops philippinus*	Resident	LC	OWS
31	Megalaimidae	Coppersmith Barbet	*Psilopogon haemacephalus*	Resident	LC	OWS
32	Psittaculidae	Guaiabero	*Bolbopsittacus lunulatus*	Endemic	LC	OWS
33	Psittaculidae	Philippine Hanging Parrot	*Loriculus philippensis*	Endemic	LC	CR
34	Acanthizidae	Golden-bellied Gerygone	*Gerygone sulphurea*	Resident	LC	OWS
35	Campephagidae	Pied Triller	*Lalage nigra*	Resident	LC	OWS
36	Artamidae	White-breasted Woodswallow	*Artamus leucorynchus*	Resident	LC	OWS
37	Rhipiduridae	Philippine Pied Fantail	*Rhipidura nigritorquis*	Endemic	LC	OWS
38	Monarchidae	Black-naped Monarch	*Hypothymis azurea*	Resident	LC	OWS
39	Laniidae	Brown Shrike	*Lanius cristatus*	Migratory	LC	OWS
40	Laniidae	Long-tailed Shrike	*Lanius schach*	Resident	LC	OWS
41	Corvidae	Large-billed Crow	*Corvus macrorhynchos*	Resident	LC	OWS
42	Locustellidae	Tawny Grassbird	*Cincloramphus timoriensis*	Resident	LC	OWS
43	Locustellidae	Striated Grassbird	*Megalurus palustris*	Resident	LC	OWS
44	Hirundinidae	Pacific Swallow	*Hirundo tahitica*	Resident	LC	OWS
45	Hirundinidae	Barn Swallow	*Hirundo rustica*	Migratory	LC	OWS
46	Pycnonotidae	Yellow-wattled Bulbul	*Microtarsus urostictus*	Endemic	LC	OWS
47	Pycnonotidae	Yellow-vented Bulbul	*Pycnonotus goiavier*	Resident	LC	OWS
48	Timaliidae	Brown Tit-Babbler	*Macronus striaticeps*	Endemic	LC	OWS
49	Sturnidae	Asian Glossy Starling	*Aplonis panayensis*	Resident	LC	OWS
50	Sturnidae	Crested Myna	*Acridotheres cristatellus*	Resident	LC	OWS
51	Muscicapidae	Grey-streaked Flycatcher	*Muscicapa griseisticta*	Migratory	LC	OWS
52	Muscicapidae	Pied Bush Chat	*Saxicola caprata*	Resident	LC	OWS
53	Dicaeidae	Red-keeled Flowerpecker	*Dicaeum australe*	Endemic	LC	OWS

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
54	Dicaeidae	Orange-bellied Flowerpecker	*Dicaeum trigonostigma*	Resident	LC	OWS
55	Nectariniidae	Brown-throated Sunbird	*Anthreptes malacensis*	Resident	LC	OWS
56	Nectariniidae	Purple-throated Sunbird	*Leptocoma sperata*	Resident	LC	OWS
57	Nectariniidae	Olive-backed Sunbird (Garden)	*Cinnyris jugularis*	Endemic	LC	OWS
58	Nectariniidae	Orange-tufted Spiderhunter	*Arachnothera flammifera*	Endemic	LC	OWS
59	Nectariniidae	Naked-faced Spiderhunter	*Arachnothera clarae*	Endemic	LC	OWS
60	Estrildidae	White-bellied Munia	*Lonchura leucogastra*	Resident	LC	OWS
61	Estrildidae	Chestnut Munia	*Lonchura atricapilla*	Resident	LC	OWS
62	Fringillidae	Eurasian Tree Sparrow	*Passer montanus*	Resident	LC	OWS
63	Motacillidae	Grey Wagtail	*Motacilla cinerea*	Migratory	LC	OWS
64	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	Resident	LC	OWS

*CR = critically endangered; EN = endangered; VU = vulnerable; NT = threatened; LC = least concern;
OTS = other threatened species; PE = Philippine endemic; ME = Mindanao endemic; I= Introduced; R = Resident; (-) not data.

Annex 1B. List of amphibians and reptiles within the project area.

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
1	Agamidae	Green-winged Flying Lizard	*Draco cyanopterus*	Endemic	LC	OWS
2	Agamidae	Philippine Sailfin Lizard	*Hydrosaurus pustulatus*	Endemic	LC	OTS
3	Bufonidae	Cane Toad	*Rhinella marina*	Introduced	LC	-
4	Colubridae	Maren's Bronzeback	*Dendrelaphis marenae*	Native	LC	OWS
5	Colubridae	Philippine Bronzeback	*Dendrelaphis philippinensis*	Endemic	LC	OWS
6	Dicroglossidae	Luzon Wart Frog	*Fejervarya vittigera*	Endemic	LC	OWS
7	Dicroglossidae	Chinese Edible Frog	*Hoplobatrachus rugulosus*	Introduced	LC	-
8	Dicroglossidae	Mindanao Fanged Frog	*Limnonectes cf. magnus*	Endemic	NT	OTS
9	Dicroglossidae	Small disked Frog	*Limnonectes leytensis*	Endemic	LC	OWS
10	Elapidae	Samar Cobra	*Naja samarensis*	Endemic	LC	OTS
11	Gekkonidae	Four-clawed Gecko	*Gehyra mutilata*	Native	LC	OWS
12	Gekkonidae	Tokay Gecko	*Gekko gecko*	Native	LC	OWS
13	Gekkonidae	Spotted House Gecko	*Gekko monarchus*	Native	LC	OWS
14	Gekkonidae	Common House Gecko	*Hemidactylus frenatus*	Native	LC	OWS
15	Gekkonidae	Flat-tailed House Gecko	*Hemidactylus platyurus*	Native	LC	OWS
16	Microhylidae	Philippine Sticky Frog	*Kalophrynus sinensis*	Endemic	LC	OWS
17	Microhylidae	Banded Bullfrog	*Kaloula pulchra*	Introduced	LC	-
18	Pythonidae	Reticulated python	*Malayopython reticulatus*	Native	LC	OTS
19	Ranidae	Common Green Frog	*Hylarana erythraea*	Introduced	LC	-
20	Rhacophoridae	Common Tree Frog	*Polypedates leucomystax*	Native	LC	OWS
21	Scincidae	Graceful Burrowing Skink	*Brachymeles gracilis*	Endemic	LC	OWS
22	Scincidae	Common Sun Skink	*Eutropis multifasciata*	Native	LC	OWS
23	Scincidae	Emerald Tree Skink	*Lamprolepis smaragdina philippinica ssp.*	Endemic	LC	OWS
24	Scincidae	Four-striped Lipinia	*Lipinia quadrivittata*	Native	LC	OWS
25	Scincidae	Banded Sphenomorphus	*Sphenomorphus fasciatus*	Endemic	LC	OWS

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
26	Varanidae	Yellow-headed Monitor Lizard	*Varanus cumingi*	Endemic	LC	OTS

*CR = critically endangered; EN = endangered; VU = vulnerable; NT = threatened; LC = least concern; OTS = other threatened species; PE = Philippine endemic; ME = Mindanao endemic; I= Introduced; R = Resident; (-) not data.

Annex 1C. List of volant and non-volant mammals within the project area.

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2019-09
1	Murinae	Asian Rat	*Rattus tanezumi*	Native	LC	OWS
2	Pteripodidae	Dagger-toothed Long-nosed Fruit Bat	*Macroglossus minimus*	Native	LC	OWS
3	Pteripodidae	Geoffroy's rousette	*Rousettus amplexicaudatus*	Native	LC	OWS
4	Pteripodidae	Greater Musky Fruit Bat	*Ptenochirus jagori*	Endemic	LC	OWS
5	Pteripodidae	Lesser Dog-faced Fruit Bat	*Cynopterus brachyotis*	Native	LC	OWS

*CR = critically endangered; EN = endangered; VU = vulnerable; NT = threatened; LC = least concern; OTS = other threatened species; PE = Philippine endemic; ME = Mindanao endemic; I= Introduced; R = Resident; (-) not data.

Annex 2. List of Flora species identified within the project area.

Annex 2A. List of Trees within the project area.

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DENR DAO 2017-11
1	Anacardiaceae	Mangga	*Mangifera indica*	I	DD	-
2	Araliaceae	Malapapaya	*Polyscias nodosa*	N	LC	OWS
3	Bignoniaceae		*Tabebuia sp.*	I	-	-
4	Bignoniaceae	African Tulip	*Spathodea campanulata*	I	LC	-
5	Burseraceae	Bogo	*Garuga floribunda*	N	LC	OWS
6	Cannabaceae	Hanagdong	*Trema orientale*	N	LC	OWS
7	Combretaceae	Talisay	*Terminalia catappa*	N	LC	OWS
8	Durionaceae	Durian	*Durio zibethinus*	I	-	-
9	Euphorbiaceae	Binunga	*Macaranga tanarius*	N	LC	OWS
10	Euphorbiaceae	Alim	*Melanolepis multiglandulosa*	N	LC	OWS
11	Fabacaeae	Narra	*Pterocarpus indicus*	N	EN	VU
12	Fabacaeae	Acacia	*Samanea saman*	I	LC	-
13	Fabacaeae	Indigo	*Indigofera hirsuta*	N	-	OWS
14	Fabacaeae	Falcata	*Falcataria falcata*	I	LC	-

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DAO 2017-11
15	Fabacaeae	Brazilian firetree	*Schizolobium parahyba*	I	LC	-
16	Fabacaeae	Ipil-ipil	*Leucaena leucocephala*	I	CD	-
17	Fabacaeae	Madre de Cacao	*Gliricidia sepium*	I	LC	-
18	Lamiaceae	Gmelina	*Gmelina arborea*	I	LC	-
19	Lauraceae	Avocado	*Persea americana*	I	LC	-
20	Malvaceae	Matan-ag	*Kleinhovia hospita*	N	LC	OWS
21	Meliaceae	Santol	*Sandoricum koetjape*	N	LC	OWS
22	Meliaceae	Mahogany	*Swietenia macrophylla*	I	VU	-
23	Meliaceae	Bayante	*Aglaia rimosa*	N	NT	OWS
24	Meliaceae	Lansones	*Lansium domesticum*	N	-	OWS
25	Meliaceae	Igyo	*Didymocheton gaudichaudianus (Dysoxylum gaudichaudianum)*	N	-	OWS
26	Moraceae	Panama rubber	*Castilla elastica*	I	LC	-
27	Moraceae	Tagisan bayawak	*Ficus variegata*	N	LC	OWS
28	Moraceae	Tibig	*Ficus nota*	N	LC	OWS
29	Moraceae	Tipolo	*Artocarpus blancoi*	E	LC	OWS
30	Moraceae	Kamansi	*Artocarpus camansi*	I	-	-
31	Moraceae	Nangka	*Artocarpus heterophyllus*	I	-	-
32	Moraceae	Balete	*Ficus balete*	N	LC	OWS
33	Moraceae	Hauili	*Ficus septica*	N	LC	OWS
34	Myrtaceae	Tambis	*Syzygium aqueum*	I	-	-
35	Myrtaceae	Bagras	*Eucalyptus deglupta*	N	VU	OWS
36	Oxalidaceae	Iba	*Averrhoa bilimbi*	I	-	-
37	Sapotaceae	Caimito	*Chrysophyllum cainito*	I	LC	-
38	Verbenaceae	M	*Vitex parviflora*	N	LC	EN

*CR = critically endangered; EN = endangered; VU = vulnerable; NT = threatened; LC = least concern; OTS = other threatened species; PE = Philippine endemic; ME = Mindanao endemic; I= Introduced; R = Resident; (-) not data.

Annex 2B. List of amphibians and reptiles within the project area.

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DAO 2017-11
Understory						
1	Arecaceae	Lubi	*Cocos nucifera*	N	-	OWS
2	Arecaceae	Anahaw	*Saribus rotundifolius*	N	-	OWS
3	Arecaceae	Manila Palm	*Adonidia merrillii*	N	VU	OWS
4	Caricaceae	Papaya	*Carica papaya*	I	DD	NA
5	Musaceae	Saging	*Musa balbisiana*	N	LC	OWS
6	Piperaceae	Buyo - Buyo	*Piper aduncum*	I	LC	NA
7	Poaceae	Kawayan	*Bambusa spinosa*	I	DD	NA
8	Poaceae	Pole Bamboo	*Schizostachyum sp.*	I	-	NA
9	Poaceae	Yellow Bamboo	*Bambusa vulgaris*	I	-	NA
10	Urticaceae	Handamay	*Pipturus arborescens*	N	-	OWS
Groundcover						
11	Acathaceae		*Asystasia gangetica*	I	-	NA
12	Araceae	Badjang	*Alocasia macrorrhizos*	N	-	OWS
13	Araceae	Gabi	*Colocasia esculenta*	N	LC	OWS
14	Araceae	Dumb cane	*Dieffenbachia seguine*	I	-	NA
15	Araceae		*Syngonium podophyllum*	I	-	NA
16	Araceae		*Syngonium angustatum*	I	-	NA
17	Araceae	Karlang	*Xanthosoma sagittifolium*	I	-	NA
18	Araceae		*Peltandra virginica*	I	-	NA
19	Araceae		*Zantedeschia aethiopica*	I	-	NA
20	Asteraceae		*Synedrella nodiflora*	I	-	NA
21	Asteraceae	Hagonoy	*Chromolaena odorata*	I	-	NA
22	Asteraceae	kokog banog	*Pseudelephantopus spicatus*	I	-	NA
23	Asteraceae		*Sphagneticola trilobata*	I	-	NA
24	Cleomaceae		*Sieruela rutidosperma*	I	-	NA
25	Convolvuceae		*Ipomoea obscura*	N	-	OWS
26	Convolvuceae	Camote crops	*Ipomoea triloba*	I	LC	NA

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DAO 2017-11
27	Convolvuceae	Five finger	*Distimake dissectius*	I	-	NA
28	Convolvuceae	Merremia	*Decalobanthus peltatus*	N	LC	OWS
29	Convolvuceae		*Ipomoea sp.*	I	-	NA
30	Cucurbitaceae	Native ampalaya	*Momordica charantia*	I	-	NA
31	Cyperaceae		*Fimbristylis dichotoma*	N	LC	OWS
32	Euphorbiaceae	Tawa-tawa	*Euphorbia hirta*	I	-	NA
33	Fabaceae		*Aeschynomene americana*	I	-	NA
34	Fabaceae		*Macroptilium atropurpureum*	I	-	NA
35	Fabaceae	Trapuko	*Centrosema pubescens*	I	-	NA
36	Fabaceae		*Chamaecrista mimosoides*	I	-	NA
37	Fabaceae	Sampinit	*Mimosa diplotricha*	I	-	NA
38	Fabaceae	Makahiya	*Mimosa pudica*	I	LC	NA
39	Fabaceae	cover crop	*Neustanthus phaseoloides*	N	-	OWS
40	Fabaceae	Stylo grass	*Stylosanthes humilis*	I	-	NA
41	Lamiaceae		*Hyptis capitata*	I	-	NA
42	Malvaceae		*Corchorus aestuans*	I	-	NA
43	Malvaceae	Saloyot	*Corchorus olitorius*	I	-	NA
44	Malvaceae	kuba kuba	*Sida rhombifolia*	N	-	OWS
45	Malvaceae	Dupang	*Urena lobata*	I	LC	NA
46	Nephrolepidaceae	Fern	*Nephrolepis biserrata*	N	-	OWS
47	Poaceae	Tagik tagik	*Digitaria sp.*	I	-	NA
48	Poaceae	Signal grass	*Urochloa brizantha*	I	-	NA
49	Poaceae	Para grass	*Urochloa mutica*	I	LC	NA
50	Poaceae	Cogon grass	*Imperata cylindrica*	N	LC	OWS
51	Poaceae	Buffalo Grass	*Megathyrsus maximus*	I	-	NA
52	Poaceae		*Eleusine indica*	I	LC	NA
53	Poaceae		*Oplismenus hirtellus*	N	-	OWS
54	Poaceae		*Panicum sp.*	N	-	OWS
55	Poaceae	Carabao grass	*Paspalum conjugatum*	I	LC	NA

	Family	Common Name	Scientific Name	Distributional status	Conservation status	
					IUCN	DAO 2017-11
56	Poaceae		*Paspalum scrobiculatum*	I	LC	NA
57	Poaceae	Napier grass	*Cenchrus purpureus*	I	LC	NA
58	Poaceae		*Rottboellia cochinchinensis*	N	-	NA
59	Poaceae	Manila grass	*Zoysia matrella*	N	-	OWS
60	Solanaceae	Talong talong	*Solanum torvum*	N	-	OWS
61	Thelypteridaceae	Ferns	*Christella arida*	N	-	OWS
62	Verbenaceae		*Lantana camara*	I	-	NA

*CR = critically endangered; EN = endangered; VU = vulnerable; NT = threatened; LC = least concern; OTS = other threatened species; PE = Philippine endemic; ME = Mindanao endemic; I= Introduced; R = Resident; (-) not data.

Annex 2C. List of common plant species that can be used for rewilding.

Family	Species	Common Name	Habitat
Araceae	*Aglaonema cordifolium*	Aglaonema	Damp places near streams
Araceae	*Aglaonema densinervium*	Aglaonema	Damp places near streams
Araceae	*Aglaonema philippinense*	Aglaonema	Damp places or slopes near streams
Araceae	*Epipremnum pinnatum*		Thickets and forests
Araceae	*Homalomena philippinensis*	Payaw	Along small streams in forests at low elevation
Araceae	*Rhaphidophora korthalsii*		Forests and thickets
Araceae	*Schismatoglottis plurivenia*		Lowland forests, especially along wet ravines and stream embankments
Araceae	*Scindapsus pictus*	Silver Pothos	Thickets and forests
Araceae	*Spathiphyllum commutatum*		Damp places near streams
Araliaceae	*Polyscias nodosa*	Malapapaya	Disturbed lowland forests and associated thickets
Burseraceae	*Garuga floribunda*	Bogo	Low to medium elevation thickets and secondary forests
Combretaceae	*Terminalia catappa*	Talisay	Throughout the Philippines along the seashore, also often planted inland
Commelinaceae	*Amischotolype hispida*		Low and medium elevation forests, thickets and old clearings
Commelinaceae	*Pollia thyrsiflora*		Lowland and medium elevation forests
Commelinaceae	*Pollia secundiflora*		Lowland and medium elevation forests
Fabaceae	*Erythrina subumbrans*	Dapdap	Low and medium elevation thickets, secondary forests, etc. occasionally planted
Fabaceae	*Pterocarpus indicus*	Narra	Low and medium elevation forests

Family	Species	Common Name	Habitat
Ebenaceae	*Diospyros blancoi*	Kamagong	Primary and secondary forests at low and medium elevation, including limestone. Also commonly planted in and about towns for its large and edible fruits
Euphorbiaceae	*Macaranga grandifolia*	Takip-asin	In second-growth forests at low elevation
Euphorbiaceae	*Macaranga tanarius*	Binunga	In second-growth forests at low elevation
Lythraceae	*Lagerstroemia speciosa*	Banaba	Mostly in secondary forests at low and medium elevation
Dilleniaceae	*Dillenia philippinensis*	Katmon	Common in lowland and medium elevation forests, commonly cultivated as shade tree and for its edible fruits
Dilleniaceae	*Dillenia megalantha*	Katmon bayani	Forests and riverbanks
Lamiaceae	*Vitex parviflora*	Molave/Tugas	Common in both secondary and primary forests
Lamiaceae	*Callicarpa micrantha*		Lowland open places along streams
Lamiaceae	*Clerodendrum intermedium*	Kasopangil	Lowland and medium elevation thickets, secondary forests, and open damp places.
Lamiaceae	*Clerodendrum minahassae*	Bagawak na Puti	Widespread throughout the archipelago, in most islands and provinces
Marantaceae	*Donax canniformis*	Bamban	Common in low and medium elevation secondary forests, especially along streams
Marantaceae	*Phrynium pubinerve*	Hagikhik	Low and medium elevation forests.
Marantaceae	*Phrynium bracteosum*	Hagikhik	Low and medium elevation forests.
Melastomaceae	*Melastoma malabathricum*	Malatungaw	Common in thickets and secondary forests
Meliaceae	*Aglaia rimosa*	Bayante	Common in primary forests at low and medium elevation, also in thickets and secondary forests along rivers
Meliaceae	*Didymocheton gaudichaudianus (Dysoxylum gaudichaudianum)*	Igyo	Primary and secondary lowland forests, thickets
Moraceae	*Artocarpus blancoi*	Antipolo	Thickets and forests at low and medium elevation
Moraceae	*Ficus benjamina*	Balete	Forest and secondary growth at low elevation
Moraceae	*Ficus botryocarpa*		Forests at low elevation
Moraceae	*Ficus nota*	Tibig	Lowland and montane forest, often along stream

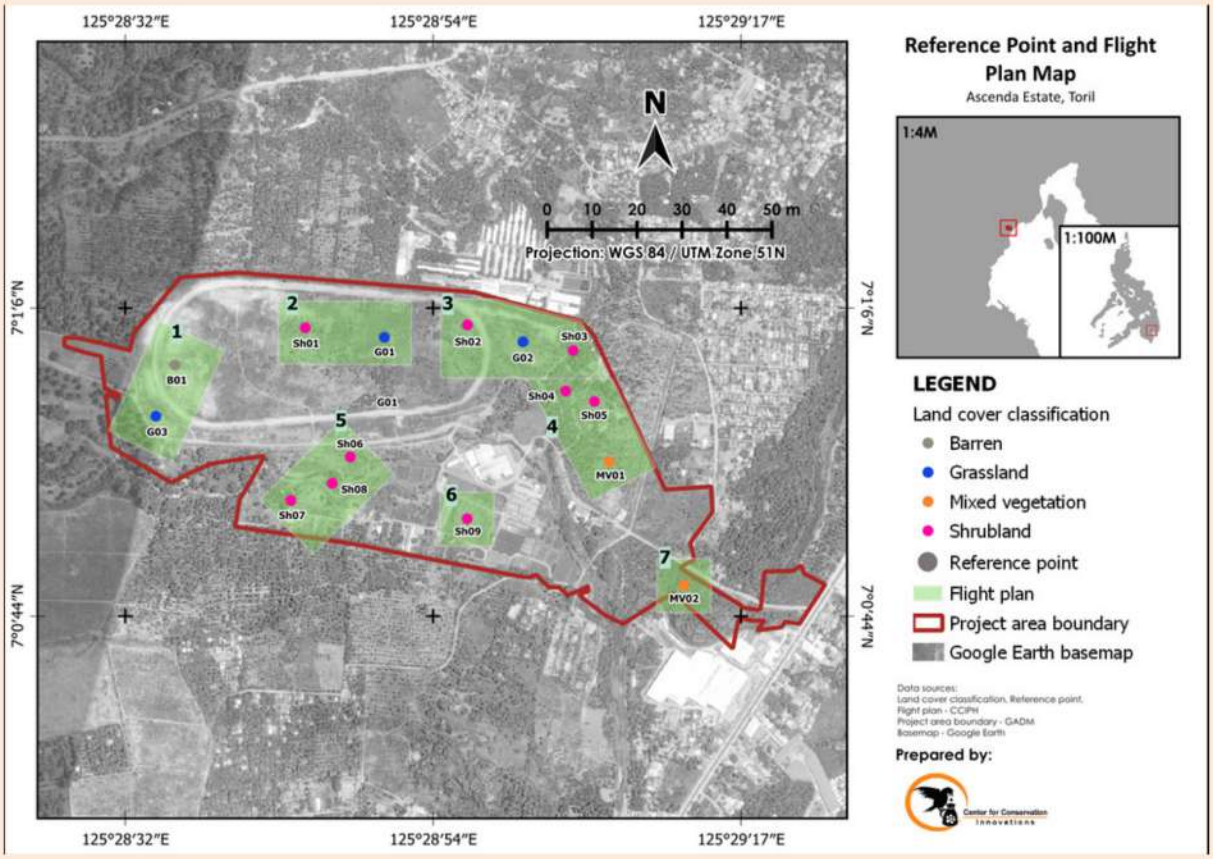
Family	Species	Common Name	Habitat
Moraceae	*Ficus septica*	Hauili	Lowland and montane forests or secondary growth, often near rivers
Moraceae	*Ficus variegata*	Tangisang bayawak	Forest and secondary growth
Myrtaceae	*Decaspermum parviflorum*		In all or most Philippine islands and provinces, in thickets and secondary forests
Myrtaceae	*Eucalyptus deglupta*	Bagras	Low elevation forest, plantation, usually cultivated
Primulaceae	*Ardisia elliptica*	Tagpo	Common in primary forests at low and medium elevation
Rubiaceae	*Mussaenda philippica*	Kahoy dalaga	Common in thickets and secondary forests at low and medium elevation
Rutaceae	*Murraya paniculata*	Kamuning	Native but usually cultivated
Sapindaceae	*Nephelium ramboutan-ake*	Kapulasan, Wild Rambutan	Low elevation forest
Vitaceae	*Leea aculeata*	Amamali	Mainly secondary vegetation, particularly riverine areas

*Photos in https://www.philippineplants.org/

Annex 3. Water quality parameters measured in all four sites of Lipadas River in the Ascenda Estate, Toril Davao.

Water quality parameter	Site				mean	DAO Class C limit
	1	2	3	4		
pH	7.55	7.35	7.19	7.19	7.32	6.5 - 9.0
TDS (ppm)	25.11	23.56	27.56	21.33	24.39	-
water temp (C°)	24.08	24.94	25.72	26.62	25.34	25-31
EC (µs/cm)	52.67	46	53.56	37.91	47.53	-
salinity (ppm) salt	25.22	25.56	28.78	28.44	27	-
atmospheric temp (C°)	25.1	25.63	27.9	27.1	26.43	-
flow rate (sec)	2	0.53	3.33	2.67	2.13	-
wetted width	15.65	16.08	16.23	7.97	13.98	-
turbidity (cm)	76	53	67	58	63.5	-

Annex 4. Map showing the reference points and flight plan.



Annex 5. Flight missions were conducted in Ascenda, Toril, Davao City.

Date of flight mission	Sitio & Barangay	Flight Mission Name	Area covered (ha)
November 09, 2023	Sitio 1, Brgy. Marapangi	110923A	6.14
	Sitio 1, Brgy. Marapangi	110923B	5.41
	Sitio 1, Brgy. Marapangi	110923C	1.44
	Sitio 2, Brgy. Marapangi	110923D	4.28
	Sitio 2, Brgy. Marapangi	110923E	1.44
November 10, 2023	Sitio 1, Brgy. Marapangi	111023A	4.36
	Sitio 1, Brgy. Marapangi	111023B	9.12

Annex 6. Methodology on the development of the maps for land cover and change detection.

The HCVA analysis requires map information, which can be generated in-house to represent the different land cover classes present in the project site and to conduct an analysis of land cover change over a period of time within the timeframe of 2014-2023. The year 2014 coincides with the date when the initial baseline studies were made. The land cover map is used for species distribution modeling, as well as, assessing the status of vegetation and other land use in the area. On the other hand, the forest-cover change is analyzed through a change detection analysis determining which land cover has been altered over a particular time period.

The following is an outline of the satellite image data, software and steps in producing the aforementioned maps for the Toril, Davao site.

Images:
- 2014 and 2023 Pleiades imagery;
- Google Earth historical imagery;

Software packages:
- QGIS;
- R-studio; and
- Google Earth Pro.

Process:
- Creating training data, according to the indices established;
- Ground-truthing through capture of images through remotely piloted aircraft systems;
- Interpreting classes;
- Image processing through Random forest machine learning algorithm using R-studio;
- Assessing accuracy of the map outputs (random selection of validation points from reference data); and
- Refinement of the output.

Pleiades images, circa 2014 and 2023, were used as historical and contemporary images correspondingly for the land cover map and change analysis. They were: pre-processed in QGIS; clipped to region of interest (ROI), which includes the project area; reprojected to WGS 84/ UTM Zone 51N; and georectified so their pixels would match each other.

To properly analyze the pixels, represented in the satellite image, and to collect data for training purposes and comparison, the following indices were computed using the raster calculator in the QGIS software:

1.) NDVI (Normalized Difference Vegetation Index)
NDVI = (NIR - Red) / (NIR + Red)

2.) GNDVI (Green Normalized Difference Vegetation Index)
GNDVI = (NIR-Green) /(NIR+Green)

3.) EVI (Enhanced Vegetation Index)
EVI = G * ((NIR - R) / (NIR + 6 * R - 7.5 * B + 1))

4.) AVI (Advanced Vegetation Index)
AVI = [NIR * (1-Red) * (NIR-Red)]^ ⅓

5.) GCI (Green Chlorophyll Index)
GCI = (NIR) / (Green) - 1

6.) SAVI (Soil Adjusted Vegetation Index)
SAVI = ((NIR-Red) / (NIR + Red + L)) * (1 + L)

7.) SR/RVI (Simple Ratio)
SR = NIR/Red

8.) SI (Shadow Index)
SI = [(1-Red)*(1-Green)*(1-Blue)]^(1/3)

9.) NDI (normalized difference index)
NDI = (NIR-Blue)/(NIR+Blue)

10.) VARI (Visible Atmospherically Resistant Index)
VARI = (Green - Red) / (Green + Red - Blue)

11.) MBI (Modified Built-Up Index)
MBI = 2 * NIR + 1.5 * Red - 2.5 * Blue - 1 * Green

12.) NDSI (Normalized Difference Soil Index)
NDSI = (Red-Green)/(Red+Green)

13.) NDWI (Normalized Difference Water Index)
NDWI = (G-NIR)/(G+NIR)

14.) WSI (Water Stress Index)
WSI = (NIR-Green)/(NIR+Green)

where NIR is near infrared and Blue, Green and Red pertain to the visible color spectrum. The bands and indices were then stacked in the following order for the image processing using the random forest algorithm:

1) 2023-band1-blue
2) 2023-band2-green
3) 2023-band3-red
4) 2023-band4-nir
5) 2023-band5-ndvi
6) 2023-band6-gndvi
7) 2023-band7-evi
8) 2023-band8-avi
9) 2023-band9-gci
10) 2023-band10-savi
11) 2023-band11-sr
12) 2023-band12-si
13) 2023-band13-ndi
14) 2023-band14-vari
15) 2023-band15-mbi
16) 2023-band16-ndsi
17) 2023-band17-ndwi
18) 2023-band18-wsi

1) 2014-band1-blue
2) 2014-band2-green
3) 2014-band3-red
4) 2014-band4-nir
5) 2014-band5-ndvi
6) 2014-band6-gndvi
7) 2014-band7-evi
8) 2014-band8-avi
9) 2014-band9-gci
10) 2014-band10-savi
11) 2014-band11-sr
12) 2014-band12-si
13) 2014-band13-ndi
14) 2014-band14-vari
15) 2014-band15-mbi
16) 2014-band16-ndsi
17) 2014-band17-ndwi
18) 2014-band18-wsi

For the change detection mapping, we used both the historical and contemporary images, supplemented with Google-Earth-Pro's historical and contemporary imagery to determine the type of land cover existent in the year 2014. Additional training data were incorporated when the RPAS images from the field were acquired, as auxiliary data for the contemporary image stack. We also added other training data from the five transects lines of the biodiversity survey. From these we picked up at least 30 training shapefiles for each of the following change classes:

a. Bare to bare;
b. Bare to grasses;
c. Grasses to grasses;
d. Grasses to water;

e. Grasses to tree;
f. Shrubs to shrubs;
g. Shrubs to built-up;
h. Built-up to grasses;
i. Built-up to built-up;
j. Trees to trees;
k. Perennial crops to perennial crops;
l. Bamboo to bamboo
m. Water to grasses;
n. Water to built-up;
o. Water to water;
p. Water to waterlogged grasses; and
q. Water to waterlogged built-up,

For the contemporary and historical image stack, we used the following classes to represent the additional variety of forest or vegetation classes that manifested recently. The definitions of the land cover classes are shown in Annex 7.

1 - Bare;
2 - Grasses;
3 - Shrubs;
4 - Built-up;
5 - Water;
6 - Trees;
7 - Perennial Crops;
8 - Bamboo;
9 - Waterlogged grasses; and
10 - Waterlogged built-up.

The generation of the land cover and change detection maps involved utilizing the machine learning algorithm called random forest available in R-studio. Thereafter, post-processing of the resulting maps was applied for: avoiding a "salt-and-pepper" effect; checking if tree pixels fall within the half-a-hectare provision in the forest definition; confining them within the area of interest (AOI) limits.

A total of 376 validation points were generated from the other drone images that were not used as training shapefiles and the random sample points from Google Earth. The change detection map's final accuracy assessment result is 95.48% which is above the 85% standard (Anderson, 1976).

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Annex 7. Description of the land cover classes.

Land Cover Class / Term	Definition	Reference
Tree stand	Formation where trees with woody stem, regardless of size and economic utility or end-use, including the parts thereof such as stumps, tops and branches.	DENR Administrative Order No. 2021 - 11
Grass	A land cover pertaining to those found in rangelands and pasture land; also includes all grasses from wild lands to recreational areas, as well as, agricultural and silvi-pastural systems; here, we lumped what might be considered as land with shrubs.	FAO. 2001. Global Forest Resources Assessment 2000 Main Report. FAO Forestry Paper No. 140. Rome.
Bamboo grass/ stand	Bamboo form of plantation or natural stand; or plantation, an aggregate of clumps occupying a specific area and sufficiently uniform in species composition, age, spacing and condition as to be distinguishable from the natural bamboo stand.	DENR Administrative Order No. 2021 - 26
Crop	Land cover with arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for defining forests.	The Intergovernmental Panel on Climate Change (IPCC). 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies (IGES) for the IPCC. 590pp.
Shrub	Woody vegetation, generally of more than 0.5 meter and less than 5 meters in height in maturity and without a definite crown. The growth habit can be erect, spreading or prostate. The height limits for trees and shrubs should be interpreted with flexibility, particularly the minimum tree and maximum shrub height, which may vary between 5 to 7 meters approximately.	FAO. 2001. Global Forest Resources Assessment 2000. Main Report. FAO Forestry Paper No. 140. Rome.
Bare	Considered as a type of land cover with few or no plants growing on it.	The Intergovernmental Panel on Climate Change (IPCC). 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies (IGES) for the IPCC. 590pp.

Land Cover Class / Term	Definition	Reference
Built-up / Settlement	This refers to any area that is populated by people grouped together as a community and any buildings or infrastructure therein.	The Intergovernmental Panel on Climate Change (IPCC). 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Institute for Global Environmental Strategies (IGES) for the IPCC. 590pp.
Waterlogged areas (grasses or built-up)	Areas where soils are temporarily saturated or where the water table is too shallow such that capillary rise of groundwater encroaches upon the root zone and may even reach the soil surface.	FAO. 1973. Drainage of Salty Soils. FAO Irrigation and Drainage Paper 16, Food and Agriculture Organization of the United Nations, Rome.
Water	This includes kinds of water bodies ranging from rivers, lakes to swamps.	FAO. 2001. Global Forest Resources Assessment 2000 Main Report. FAO Forestry Paper No. 140. Rome.

Annex 8. Toril HCV timeline from October 2023 until January 2024.

Activities	Purpose	Dates
Pre-Assessment and Field Preparation		
Project Inception	Discuss and level off on project objectives, timelines, and expected outputs	October 6, 2023
Stocktaking and collection of best available information	Gather best available information for the identification of HCVs from secondary data and other relevant sources	October 9 to 13, 2023
Field Assessment and Activities		
Reconnaissance Survey	Site scoping was conducted to define areas for base camps, transect lines, and logistical support.	October 17 to 18, 2023
Rapid Biodiversity Assessment	Biodiversity data collection and freshwater sampling were conducted for HCV 1 and 2.	November 6 to 20, 2023
Ground-truthing using foot patrols and Key Informant Interviews	Ground-truthing was conducted at each reference point to determine the presence of HCV 4, 5, and 6. Key Informant Interviews were also done to provide supplementary information.	November 6 to 20, 2023
Ground Truthing using Remotely Piloted Aircraft Systems	Ground-truthing using Remotely Piloted Aircraft Systems was conducted to validate and identify the extent of ecosystems (HCV 2) and detect changes between two time periods (HCV 3).	November 6 to 20, 2023

Activities	Purpose	Dates
Post-Field Activities		
Data analysis and interpretation	This activity used the gathered data to perform modeling, forest cover change analysis, remote sensing for reclassifying land cover classes, descriptive analysis, and GIS mapping for presenting information spatially.	January 17, 2024
Development of HCV Management and Monitoring Plan	We will develop an HCV management and mitigation plan to reduce the potential impacts of development activities on HCVs.	January 17, 2024
Report submission	Submission of the Final technical report	January 31, 2024

Annex 9. The team composition for the HCVA Toril assessment for the project.

Name and Role	Relevant Expertise and regional experience
Adryon Rozz Javier Operations Head/ Socio economic Specialist	• Masters of Science in Biology (*in progress*) • Eight years of experience in projects related to reducing emissions from deforestation and degradation, voluntary GHG programs, assessment and monitoring forest and wildlife conditions, socio-economic assessments, and assessing drivers of land use change • Extensive operational experience with reputation risk management, compliance issues and social safeguards in engaging indigenous peoples for private sector engagement • Project manager for Ayala Corporation's Mindoro Forest and Biodiversity Conservation Program and leads the social and cultural components of HCV assessments.
Ecology Team	
John Alberto Ordinario, MSc. Project Coordinator, Freshwater Assessment Lead	• Master of Science in Environmental Science • Two years of experience on research in marine mammals, marine biodiversity, molecular techniques, and population genetics. • Assisted project implementation on marine, freshwater, and terrestrial biodiversity research

Name and Role	Relevant Expertise and regional experience
Jennica Paula Masigan, MSc. Avifauna, Ecologist, HCVA specialist	• Master of Science in Biology major in Conservation Biology • More than 10 years of professional experience on biodiversity conservation, knowledge management and wildlife population studies • Has led HCV field campaigns and participated in HCV assessments, including USAID-DENR B+Wiser Sites, Buguey Watershed, Puerto Princesa Subterranean River National Park, Mt. Nacolod Local Conservation Area, Energy Development Corporation sites, West Mt. Bulanjao, Ayala Corporation's Mindoro Forest and Biodiversity Conservation Program, and Unifrutti. • Currently working on the development of the HCVA framework for the Philippines with DENR
Dr. Mary Ann Bautista Botanist, Biodiversity Assessment Lead	• Ph.D. in Botany • Twelve years of experience in plant taxonomy, plant collection and identification, molecular techniques, genome analysis, and phylogenetic and morphological analysis • Involved in developing the Rewilding Framework of the Philippines • Currently working on the development of the HCVA framework for the Philippines with DENR
Ramil Incorporado Research Associate, Flora Assessment	• Bachelor of Science in Forestry
Geospatial Team	
Dr. Oliver Coroza Geospatial Solutions Technology Team, Geospatial Assessment Lead	• Ph.D. in Environmental Planning • More than 30 years of experience in the application, teaching of cartographic modeling, and GIS for natural resources planning and management, land use and protected area planning, real estate management and facilities for urban application • Involved in geospatial technology applications to climate change policy, forest carbon, biodiversity conservation, ecosystem services mapping, and HCV mapping • Currently working on the development of the HCVA framework for the Philippines with DENR

Name and Role	Relevant Expertise and regional experience
Regina Aedrianne Felismino-Inovejas Geospatial Solutions Technology Team, Technical Associate	• Bachelor of Science in Forestry • Conducted aerial ground- truth survey using RPAS as a licensed drone pilot for land cover mapping in ALI sites such as Kan-irag, Toril and Arillo; • Eight years professional experience in generating GIS digital data, thematic maps, and processing of satellite and aerial imageries; • Participated in conducting HCV assessments by leading the ground and aerial truth surveys, and producing spatial outputs; • Currently working on the development of the HCVA framework for the Philippines with DENR; • Co-facilitated the Geospatial Training on Green Assessment for Ecosystem's Disaster Mapping and Aerial Ground truth survey to help improve DENR's management effectiveness of conservation areas and natural resources and crafted their respective training manuals.
Czeskian Realo Geospatial Solutions Technology Team, Technical Associate	• Bachelor of Science in Geography • Facilitated the creation of disaster maps (hazard, vulnerability, exposure and risk maps) for the identified eco-disaster risks in the mountainous area of Tublay, Benguet • Trained Tublay's disaster risk response technical working group in basic and advanced GIS to maximize the use of their generated disaster maps for disaster risk response and management • Conducted aerial ground- truth survey using RPAS as a licensed drone pilot for land cover mapping in ALI sites such as Lio, Nuvali, Sicogon, Toril and Arillo; • Co-facilitated the SIBOL's Geospatial Training on Green Assessment for Ecosystem's Disaster Mapping and Aerial Ground truth survey to help improve DENR's management effectiveness of conservation areas and natural resources and crafted their respective training manuals • Assisted in SIBOL'S Green Recovery Planning in PPSRNP, CNCH, San Vicente and Roxas sites in Palawan in determining target area for spontaneous natural regeneration, assisted natural regeneration and assisted natural regeneration with enrichment program through remote sensing techniques.
Mecci Gueverra Geospatial Solutions Technology Team, Geospatial Solutions Associate	• Bachelor of Science in Geodetic Engineering. • Conducted aerial ground- truth survey using RPAS as a GCP observer for land cover mapping in ALI sites such as Toril and Altaraza; • Participated in HCV assessment by producing land cover and change maps through satellite image processing.

Name and Role	Relevant Expertise and regional experience
Kristine Andaya Geospatial Solutions Technology Team, Remote Sensing Technologist	• Bachelor of Science in Geography • Conducted aerial ground- truth survey using RPAS as a licensed drone pilot for land cover mapping in ALI sites such as Nuvali, Toril and Arillo; • Eight years of professional experience in GIS and remote sensing • Participated in HCV assessment by conducting aerial ground truth surveys and producing land cover and change maps through satellite image processing; • Currently working on the development of the HCVA framework for the Philippines with DENR and the Green Restoration planning for Palawan sites devastated by Super Typhoon Odette; • Co-facilitated the Geospatial Training on Green Assessment for Ecosystem's Disaster Mapping and Aerial Ground truth survey to help improve DENR's management effectiveness of conservation areas and natural resources and crafted their respective training manuals;
Leila Cruz Geospatial Solutions Technology Team, Remote Sensing Assistant	• Bachelor of Science in Geodetic Engineering(Graduating 2024) • Working on remote sensing and GIS projects for 3 years since 2020. • Participated in HCV assessment by conducting aerial ground truth surveys and producing land cover and change maps through satellite image processing.
Socio Team	
Lawrence Empillo, MSc. Community Conservation Solutions Team Lead, Socioeconomic Assessment Lead	• Master of Science in Environmental Science and Ecosystem Management • Twelve years of experience in environmental studies, community organizing, preparation of biodiversity and socio-economic inventories, the social component of REDD+ projects, research on drivers of land use change, and HCV assessments • Experience in engagement with indigenous communities and other upland communities
Julie Ann Gelbolingo Research Associate for ground truthing	• Bachelor of Science in Forestry • Four years of experience conducting tree carbon inventory and carbon stock assessment that involves establishing baseline and methodologies for carbon accounting of eligible projects • Experience in flora identification
Victor Yayen Research Associate for ground truthing	• Bachelor of Science in environmental Science • Three years experience in research field works that involve tree inventory and carbon stock assessment, and study on drivers of land use change • Experience in community organizing