THE HABITATS TRUST

ECOLOGICAL RESTORATION OF NATIVE HABITATS OF ODISHA – AN ASSESSMENT OF THE OLYMPIC FOREST PROJECT

TECHNICAL REPORT

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Natural mixed-deciduous forests adjacent to tribal farmland in Simlipal Tiger Reserve, the largest protected area in the state of Odisha.

As technical advisors to the Abhinav Bindra Foundation (ABFT) on their Olympic Forest project in partnership with the Government of Orissa, the following report will furnish the preliminary assessment of the project by my associate Mr. Praveen B. R. and myself. Based on this assessment, our recommendations and relevant information are shared herewith.

Background

The state of Odisha is deemed one of the states in India with a large extent of vegetation cover with at least 44% of the total land surface area apparently under it (Nag et al., 2022). It supports a diversity of native habitats ranging from a variety of forest types [Semi-Evergreen, Sal, Mixed Deciduous, Dry Deciduous and Mangrove, among others], grasslands, and wetlands (FSI, 2000). However, it is also known that many of these remaining blocks have been subject to habitat destruction and degradation, and the introduction of exotic species, all of which have presumably altered these habitats from their original functional state (e.g., Stella et al., 2022). Global ramifications of such habitat loss include loss of native biodiversity, decline of ecosystem services to regional human populations, and the inability of remaining habitats to be resilient to extreme weather events now exacerbated by human-caused global warming [primarily by excessive greenhouse gas emissions], among many other increasing problems (Dobson et al., 2006; Mooney et al., 2009; Gonçalves-Souza et al., 2020). This deviation from their original ecologically functional state also renders these now degraded and reduced habitats to be less capable of performing their vital role in various global biogeochemical cycles including the carbon cycle (Dal Corso et al., 2020).

The decline in habitat and ecosystem extent and quality over the past century have resulted in roughly between ~3% to ~50% intact biomes remaining globally today, depending on varying definitions of intactness by different authors (Plumptre et al., 2021; Riggio et al., 2020). But what they all agree on is that wilderness areas have all but disappeared in many biomes such as tropical and subtropical broadleaf forests [where the bulk of global biodiversity resides] of which only 0.96% remains (Williams et al., 2020). This, in turn, has now manifested into what is today recognized as the climate emergency, so much so that it is now disrupting human security and wellbeing (Gardner & Bullock, 2021; McHugh et al., 2021). In response to this, various strategies aimed at mitigating and potentially reversing atmospheric greenhouse gas levels and habitat loss have been encouraged, including the declaration of the current decade as the "United Nations Decade on Restoration," although most techniques currently put into practice, though well-intentioned, are neither scientifically validated nor in consultation with local communities, particularly marginalized ones, and contrarily to objectives can be detrimental to both ecological and social frameworks where implemented (Aronson et al., 2020; Fleischman et al., 2020; 2022). Over the past couple of decades, carbon credit schemes have also seen increased scrutiny in their capacity to genuinely deliver on commitments towards reducing greenhouse gases with their effectiveness being deemed doubtful (Bachram, 2004; Pearse & Böhm, 2014).

It is thus understandable that the motivation for the Olympic Forest concept by the International Olympic Committee (IOC) is rooted in the currently popular trend of carbon sequestration to offset carbon emissions. While its efficacy is still a highly debated and contentious topic, the concept of tree planting needs to be upgraded to that of ecological restoration with the focus on restoring functional ecosystems which does not necessarily include trees in many

terrestrial habitat types. It is within this context that I provide the results of our preliminary assessment of select sites earmarked for the Olympic Forest in Odisha that were visited by my associate Mr. Praveen B. R. and myself.

Sites Visit Report

We first visited the Simlipal Tiger Reserve, Mayurbhanj district north of Bhubaneshwar on the 18th of July to show ABFT's representative Mr. Karan Singh what relatively intact habitats look like and to see a variety of habitat types that can perhaps be considered reference habitats for ecological restoration. However, due to there being restrictions on entry into the core area of the reserve owing to the recent killing of forest department staff by poachers and this being a security concern, we were limited in our ability to see and document intact reference habitats. Further, we visited one Olympic Forest site at **Mendhasala Reserve Forest** [RF] (Fig. 1A & B) in Bhubaneshwar City Forest Division the next day on the 19th of July. The site is a historical corridor for elephants that now largely reside in the 175 sq.km Chandaka Elephant Sanctuary 5.2 Kms east of the site (as the

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Fig. 1. A. & **B.** Olympic Forest site at Mendhasala Reserve Forest; **C.** & **D.** the Medicinal Plants Knowledge Centre, which is the nursery that generated saplings for both the Olympic Forest project. It also has a variety of local native species which were shown to us by the Odisha Forest Department officials.

crow flies), with herds still moving through the Olympic Forest site (Odisha Forest Department [OFD], pers. comm.). The plantation drive at this site had begun a couple of weeks earlier in July and comprised a target of 15,000 saplings of a fairly homogenous mix of 12 common and widespread Indian species (Table 1). A demonstration of planting was made to us, where a pit is dug, and with the sapling planted a mix of cowdung or compost manure along with the insecticide Lindane of the brand Gamaxine was added to the pit prior to covering it up. It was also communicated to us by the OFD that the selection of tree species was in the gambit of their utility in the Ayurveda market in tandem with being a park for visitors from the city. While this seems logical as a plantation drive, it violates the principles of ecological restoration.

This visit was followed by a trip to the regional nursery called the 'Medicinal Plants Knowledge Centre' managed by the OFD (Fig. 1C & D). Here we assessed the feasibility of the nurseries for the production of saplings needed for restoration based on visual observations and discussions with OFD personnel. This facility currently generates saplings of various species on a large scale, including those planted in the Olympic Forests as well as several native to Odisha species. There is a 1-acre plot used for seed collection and nursery operations and many saplings

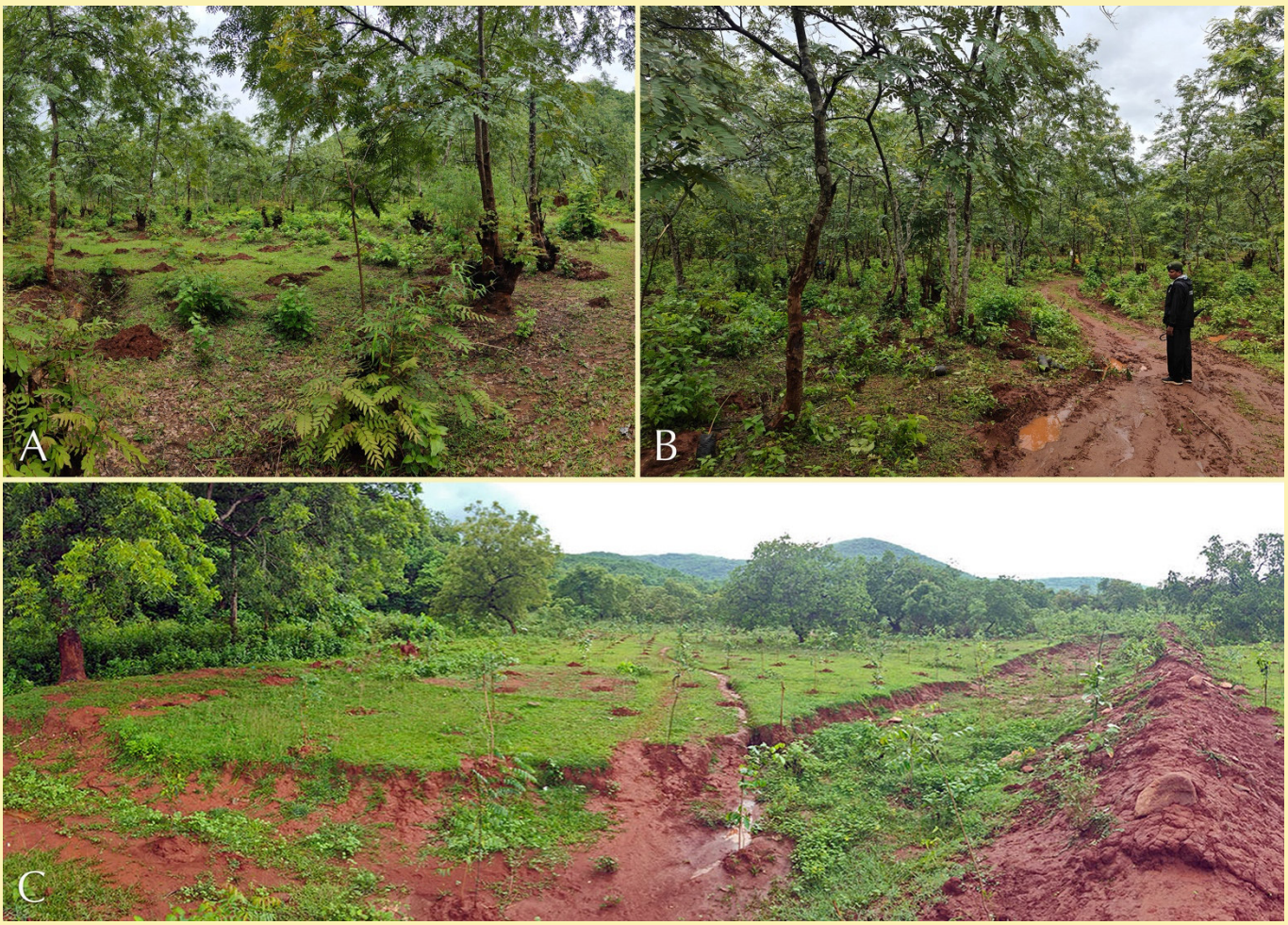

Fig. 2. A. & **B.** Olympic Forest site at Satalandi Reserve Forest, where selected tree saplings have been planted amidst an existing *Senna siamea* monoculture plantation; and **C.** saplings planted in grids in the Mahagir Reserve Forest, where the site borders a natural forest on one side and a cashew plantation on the other three sides. It is also evident that soil conditioning appropriate to facilitate establishment of subterranean communities that would boost carbon sequestration potential is not implemented here.

in 1/2, 1 and 2 kg grow bags of varying height were observed and all saplings were arranged according to species and age. There is also a seed storage facility where seeds are procured and stored during the seed collection period. The saplings were for sale to the general public and for the OFD's plantation needs. With about 40 workers engaged here on a daily basis, this facility demonstrates it has the capacity to expand operations to include more site-specific native species with different needs and capacities pertaining to ecological restoration.

The third day's visit was to three sites in Satalandi RF and Mahagir RF. The species planted here are the same as with the previous site visited. The **Satalandi RF** Olympic Forest site is a former plantation that is in close proximity to Kapilasa Wildlife Sanctuary. The site is a monoculture plantation dominated by *Senna siamea* trees, which were planted by the OFD around 10 years ago. We also noted that the site was where OFD had planted a species mix of Jamun (*Syzygium cumini*), Mango (*Mangifera indica*), Indian Beech tree (*Ponagamia pinnata*), Sisso (*Dalebergia sissoo*), Neem (*Azadirachta indica*), Indian Gooseberry (*Emblica officinalis*), Sacred Fig

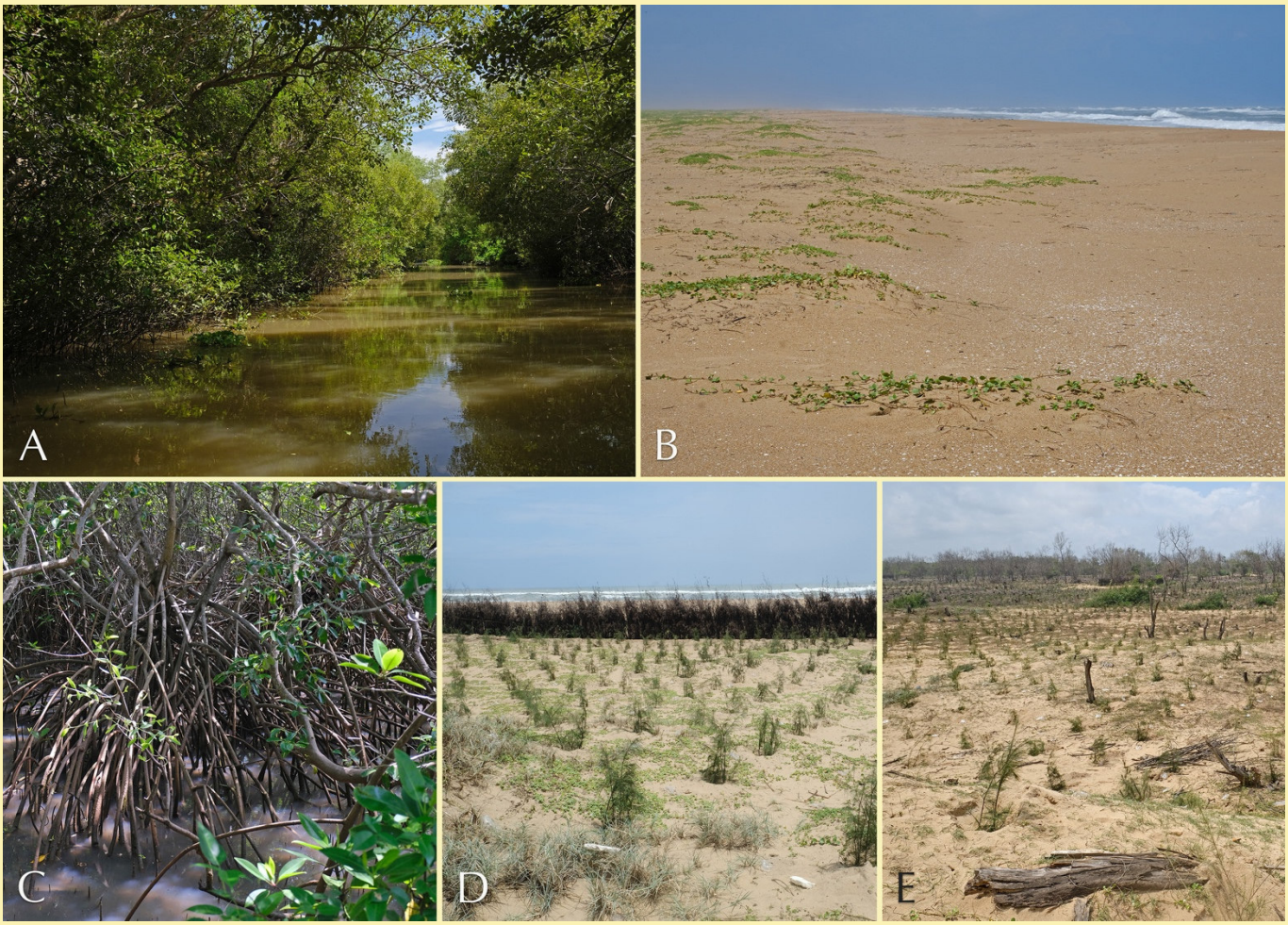

Fig. 3. Native and converted coastal habitats in and around the Sahana Reserve Forest in Puri district, Odisha: **A.** native mangrove forest adjoining estuarine canals adjoining the Mahanadi River delta; **B.** sandy beach habitat which support unique plant and animal species and serves as nesting site for Olive Ridley Turtles; **C.** mangrove tree roots in the lagoon that serves as nursery for many coastal and estuarine fish species and also obstructs extreme wave action during inclement weather; **D.** modified habitat for the Olympic Forest Project with saplings of *Casuarina equisetifolia* planted in monoculture format on the beach with waves visible behind the fence in the background; and **E.** sandy habitat extensively planted with *Casuarina equisetifolia* saplings.

(*Ficus religiosa*), Beechwood (*Gmelina arborea*) Banyan Fig (*Ficus benghalensis*) Jackfruit (*Artocarpus heterophyllus*), Wood Apple (*Feronia elephantum*), Nile Tulip (*Markhamia lutea*) and Indian Almond (*Terminalia catappa*), most of which are planted for commercial value with little attention to ecological integration. It is amidst the *Senna siamea* trees on this site that the Olympic Forest samplings have been planted this month. The second site for the day that was visited was the **Mahagir RF**, which is situated at the edge of the Harichandapur Telkoi RF. The site was once encroached and cultivated land, where the encroachment was eventually cleared by the OFD. This site is surrounded by natural forest on one side and a cashew plantation (managed by the Odisha Forest Development Corporation [OFDC]) on the remaining side. At this site too, the OFD had planted a species mix akin to the site at Satalandi RF. These two sites had more corridor and geneflow potential with the adjacent degraded habitat, and less firewood collection and NTFP pressure as the local communities are understood to be relatively economically stable. However, the potential of iron ore and other mineral mining in the area is high so the long-term fate of these lands is uncertain.

The fourth and last day's visit was first to the Astaranga Mega Nursery in Puri district. This nursery is similar to the nursery in Bhubaneshwar but spread out over a much larger campus with the capacity to generate a larger number of saplings, particularly those belonging to the coastal habitats of Odisha. Then we proceeded to visit the **Sahana RF** on the coast (Fig. 3), which is an established Casuarina (*Casuarina equisetifolia*) plantation. During our visit, we saw that the area had been recently clear-felled and replanted, including newly planted areas on the beach (Fig. 3D).

To conclude, it was observed that the OFD is planting a subset of species already in the Green India Mission list, which itself has risks when implemented at a national level (Jha, 2012; Tambe et al., 2022). Almost all the species chosen for the Olympic Forest Project are widespread across most parts of India and do not represent the unique floristic community that once prevailed in Odisha. If the list of species can be modified to include more representative species (depending on the site) of the floral communities of Odisha based on reference sites in intact habitats in protected areas, then it would be the first step in aligning with global best practice principles of ecological restoration. This will also lead to better ecosystem services such as carbon capture, apart from biodiversity conservation.

Assessment & Recommendations

Based on our visit to four representative sites proposed for the Olympic Forest project in Odisha, we suggest two of the sites and an additional eight (these sites are yet to be visited and the current assessment has been made purely from maps) for ecological restoration from the list of 22 provided to us (Table 3). Additional details on the currently approved ten sites are given in Table 4. These may change once more detailed information becomes available. Lastly, given that there are well established nurseries and resources already in place, we see potential for incorporating recommendations to match globally attested ecological restoration parameters without losing out on regional sensibilities.

Plant Species

Odisha has ~2325 plant species, with ~410 being the number of tree species naturally occurring in the state (Table 2). These species are not uniformly distributed in the state, dictated by

temperature, precipitation regime, soil conditions and biogeographic history, among other parameters. Species closer to the east are more tropical semi-evergreen in character while species are more moist-deciduous to dry deciduous types as one moves towards the drier west of the state. Similarly, elevation plays a critical role in determining species distribution with more wet- and cool-adapted species dominating the summits of high hills where they are typically isolated from species in adjacent plains and other high hills. A much more diverse community of tree species that are adapted to local climatic and soil conditions make for a functional habitat and accelerate carbon sequestration potential as much of the carbon absorbed by trees is transferred to below-ground biomass which includes native microbes that are symbiotic with native tree species.

Techniques

In many instances, the practice of ecological restoration takes steps to bring back former habitats to a relatively similar state of species composition in order to restore functionality. This requires basic preparation of chosen sites that includes soil conditioning (without using any potent and concentrated chemical supplements which can discourage soil microbial activity), sapling

Fig. 4. Map of Odisha state showing 22 sites (marked by yellow triangles) chosen by the Government of Odisha for the Olympic Forest Project. Four of these sites were visited in this trip.

preparation with microbial inoculants (where required), randomized planting, protection and monitoring of the site from disturbances including grazing and trampling till establishment.

Nursery

Currently, the Orissa Forest Department (OFD) nurseries' focus is on plants/trees that have commercial value, i.e., in the realms of ayurvedic medicine, as avenue trees, as fruit trees, etc. We recommend that the OFD set up nurseries for species representative of original intact habitats and those paramount to ecological restoration. Given that the nurseries have the space, resources, and technical expertise with raising generalist species and transplanting them, there is potential for including more wild species (which the OFD would not have issues with because they manage all remaining wilderness areas in the state) and developing techniques for their optimal collection, germination, growth, transplanting, monitoring and establishment.

Fig. 5. Scenes from the buffer zone of Simlipal Tiger Reserve; **A.** dwellings of the Santal tribal people; **B.** extensive areas of forest in the buffer zone hardly have any understorey plants due to a combination of human-set fires and overgrazing and most small- to mid-sized trees have been lopped; and C. the bark of a large tree inside the forest has been girdled (marked by the arrow) to expedite its death and eventual fall after which it can be collected as firewood in addition to clearing the forest.

Site Potential

Of the four sites visited, two were comparatively more ideally located for ecological restoration than the other two. The Mendhasala Reserve Forest, being too close to the growing Bhubaneshwar city, may face challenges (see Appendix 1 for site priority criteria), while the Sahana RF site is sandy beach habitat that is being exploited for wood with the monoculture *Casuarina* plantation. The two sites in Satalandi RF and Mahagir RF were more optimal due to their proximity to protected areas with relatively intact habitat and adjacent economically more secure populations who don't depend on forest resources. A preliminary assessment of the remaining sites whose ground truthing is not carried out by us is given in Table 3. In this preliminary assessment, eight additional sites appear to be conducive to ecological restoration intervention. However, further information is required to provide more concrete evidence.

Community Participation

It is, without doubt, a vital step to include various human stakeholders (ranging from local communities to decision makers to corporation directors) to ensure the successful long-term ecological restoration of a given piece of land. A first step would be to ensure these stakeholders are sensitised and made adequately aware of the problems and the solutions required in this domain and their respective roles in guaranteeing the success of the initiative. During our visit to Odisha, we observed significant degradation of the buffer zone of the state's largest and most high-profile protected area, the Simlipal Tiger Reserve, caused by uncontrolled fires in tandem with selective lopping of dead young trees (killed in such fires), along with what appears to be deliberate girdling of forest trees. We were also informed that there were calls for mobile towers and better roads inside the park. This revealed the fact that the younger generation of these tribes have different aspirational values from their elders (which needs to be respected and accommodated as all people have a democratic right to basic needs required to exist in the 21st century), and their needs and ecological footprint are also different from previous generations. So, without sensitizing such marginalised communities on the ecological crisis and how perhaps they can be beneficiaries in these ecological restoration and carbon sequestration projects, it would be futile to simply implement such programs in areas with human settlements dependent on wild habitats and their resources.

Evaluation of Success

We recommend that the traditional approach of using number of trees planted as a yardstick for measuring success should be replaced. Given the advances in science and a more refined understanding of ecosystems and forests, a restoration index would work more optimally in matching ecological restoration objectives. Thus, we would suggest deviating from "*X number of trees planted*" as an achievement and instead, a scientific and more optimal measure would be "*50 acres of wetland restored to a functional state, comprising of ~130 species of historically present plants, 46 species of migrating waterfowl, 32 species of fishes, etc., supporting fishing communities with sustainable harvests, and the restored vegetation and soil substrate beneath having carbon sequestration potential of 360 tons per acre over 10 years*."

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Tables

Table 1. List of tree species being planted for the Olympic Forest Project in different sites of Odisha.

Sl. No.	Common Name	Scientific Name	Natural distributional range in India
1	Karanja	*Pongamia pinnata*	Greater part of India in the plains of Uttar-Pradesh, Bihar, Odisha, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.
2	Neem	*Azadirachta indica*	Indigenous to South Asia, possibly originating in northern Myanmar and the Assam region of India. Neem's natural habitat is dry, deciduous, mixed forest.
3	Amla	*Phylanthus emblica*	Throughout India except Jammu & Kashmir, Himachal Pradesh.
4	Arjun	*Terminalia arjuna*	Uttar Pradesh, Bihar, Maharashtra, Madhya Pradesh, West Bengal, Odisha and South and Central India.
5	Bahada	*Terminalia bellerica*	Throughout India except Jammu & Kashmir, Himachal Pradesh, Sikkim, Arunachal Pradesh.
6	Sishu	*Dalbergia sissoo*	Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan, Uttar Pradesh, Delhi, Bihar, Odisha, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Meghalaya, Tripura, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Pondicherry, Tamil Nadu, Karnataka and Kerala.
7	Gamhar	*Gmelina arborea*	Throughout India from the foot of Himalayas to Kerala and the Andamans, in moist, semi-deciduous and open forests up to an altitude of 1500m above MSL.
8	Bamboo	*Dendrocalamus strictus*	Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Orissa, Jharkhand, Bihar, West Bengal, Assam and Tripura.
9	Bamboo	*Bambusa bamboo*	Throughout India, except Jammu & Kashmir, Himachal Pradesh, Sikkim.
10	Jamun	*Syzgium cumini*	Evergreen forests in the in the plains of India.
11	Button Tree	*Terminalia phyllyreifolia*	Kerala, Tamil Nadu, Karnataka, Maharashtra, Andhra Pradesh, Chhattisgarh and Odisha.

Table 2. A preliminary list of 412 native tree species naturally occurring in Odisha state (the total number is expected to change with additional literature surveys).

Sl. No.	Family	Scientific Name	Habitat (information for only select species available)
1	Acanthaceae	*Avicennia alba*	Littoral forests
2	Acanthaceae	*Avicennia officinalis*	Mangrove Swamps
3	Anacardiaceae	*Buchanania cochinchinensis*	Deciduous Forests
4	Anacardiaceae	*Lannea coromandelica*	Deciduous Forests
5	Anacardiaceae	*Nothopegia heyneana*	Semi-Evergreen Forests and Deciduous Forests
6	Anacardiaceae	*Rhus chinensis*	Evergreen Forests
7	Anacardiaceae	*Semecarpus anacardium*	Moist Deciduous and Semi-Evergreen Forests
8	Anacardiaceae	*Spondias pinnata*	Moist Deciduous and Semi-Evergreen Forests
9	Annonaceae	*Alphonsea lutea*	Evergreen Forests
10	Annonaceae	*Alphonsea lutea*	Evergreen Forests
11	Annonaceae	*Alphonsea ventricosa*	Hill Forests
12	Annonaceae	*Dasymaschalon longiflorum*	Evergreen Forests
13	Annonaceae	*Miliusa tomentosa*	Dry and Moist Deciduous Forests
14	Annonaceae	*Miliusa velutina*	Dry and Moist Deciduous Forests, Evergreen Forests
15	Annonaceae	*Huberantha cerasoides*	Moist Deciduous and Semi-Evergreen Forests
16	Annonaceae	*Huberantha korinti*	Dry Deciduous Forests, Scrub Forests, Riparian Forests
17	Annonaceae	*Monoon longifolium*	
18	Annonaceae	*Monoon simiarum*	Evergreen Forests
19	Annonaceae	*Polyalthia suberosa*	Dry Deciduous Forests
20	Apocynaceae	*Alstonia scholaris*	Moist Deciduous forests
21	Apocynaceae	*Calotropis gigantea*	
22	Apocynaceae	*Holarrhena pubescens*	Dry Deciduous Forests and Scrub Forests
23	Apocynaceae	*Wrightia arborea*	Dry Deciduous Forests and Scrub Forests
24	Apocynaceae	*Wrightia tinctoria*	Dry Deciduous Forests
25	Aquifoliaceae	*Ilex umbellulata*	
26	Araliaceae	*Aralia montana*	
27	Araliaceae	*Heteropanax fragrans*	
28	Araliaceae	*Heptapleurum stellatum*	Dry Deciduous Forests
29	Araliaceae	*Trevesia palmata*	
30	Bignoniaceae	*Dolichandrone falcata*	
31	Bignoniaceae	*Dolichandrone spathacea*	Mangrove Swamps and Marshes
32	Bignoniaceae	*Heterophragma quadriloculare*	Dry Deciduous Forests
33	Bignoniaceae	*Oroxylum indicum*	Riparian zones of Mixed Deciduous Forests
34	Bignoniaceae	*Radermachera xylocarpa*	Deciduous Forests
35	Bignoniaceae	*Stereospermum angustifolium*	Deciduous Forests

36	Bignoniaceae	*Stereospermum colais*	Moist Deciduous and Semi-Evergreen Forests
37	Bignoniaceae	*Stereospermum chelonoides*	Moist Deciduous and Semi-Evergreen Forests
38	Bixaceae	*Cochlospermum religiosum*	Moist and Dry Deciduous Forests, Rocky Outcrops
39	Boraginaceae	*Cordia macleodii*	
40	Boraginaceae	*Ehretia acuminata*	
41	Boraginaceae	*Ehretia aspera*	
42	Boraginaceae	*Cordia dichotoma*	Dry Deciduous Forests
43	Burseraceae	*Boswellia serrata*	Deciduous Forests
44	Burseraceae	*Commiphora caudata var. caudata*	Dry Deciduous Forests
45	Burseraceae	*Garuga pinnata*	Dry Deciduous Forests
46	Burseraceae	*Protium serratum*	Dry Deciduous Forests
47	Calophyllaceae	*Mammea suriga*	
48	Calophyllaceae	*Mesua ferrea*	Evergreen Forests
49	Calophyllaceae	*Calophyllum inophyllum*	Mangrove Swamps and Marshes
50	Cannabaceae	*Celtis timorensis*	
51	Cannabaceae	*Trema politoria*	
52	Capparaceae	*Capparis grandis*	
53	Capparaceae	*Crateva adansonii subsp. odora*	Dry deciduous forests and scrub jungles
54	Capparaceae	*Crateva magna*	Semi-Evergreen forests, also along river banks
55	Capparaceae	*Crateva religiosa*	
56	Casuarinaceae	*Casuarina equisetifolia*	Planted in avenues and coastal sands by social forestry programs
57	Celastraceae	*Elaeodendron glaucum*	Deciduous forests
58	Celastraceae	*Euonymus glaber*	Common near streams
59	Celastraceae	*Gymnosporia bailadillana*	
60	Celastraceae	*Gymnosporia acuminata*	Eastern Ghats hills
61	Celastraceae	*Gymnosporia thomsonii*	
62	Celastraceae	*Siphonodon celastrineus*	
63	Clusiaceae	*Garcinia cowa*	Evergreen and shola forests along streams
64	Clusiaceae	*Garcinia xanthochymus*	
65	Combretaceae	*Terminalia phillyreifolia*	Dry deciduous forests
66	Combretaceae	*Terminalia anogeissiana*	Moist and dry deciduous forests
67	Combretaceae	*Lumnitzera littorea*	Tidal forests
68	Combretaceae	*Terminalia elliptica*	Dry deciduous forests
69	Combretaceae	*Terminalia arjuna*	
70	Combretaceae	*Terminalia bellirica*	Semi-evergreen and moist deciduous forests, also in the plains
71	Combretaceae	*Terminalia catappa*	Grown as ornamental tree
72	Combretaceae	*Terminalia chebula*	Dry and moist deciduous forests
73	Combretaceae	*Terminalia citrina*	
74	Combretaceae	*Terminalia elliptica*	Occasional on hills to 1400m, sometimes along river banks.

75	Combretaceae	*Terminalia elliptica*	
76	Cornaceae	*Alangium salviifolium*	Dry deciduous forests
77	Dilleniaceae	*Dillenia aurea*	Deciduous forests
78	Dilleniaceae	*Dillenia indica*	Moist deciduous forests
79	Dilleniaceae	*Dillenia pentagyna*	Moist deciduous forests
80	Dipterocarpaceae	*Shorea robusta*	Tropical dry deciduous forests, Tropical moist deciduous forests
81	Dipterocarpaceae	*Shorea roxburghii*	Tropical dry deciduous forests
82	Ebenaceae	*Diospyros candolleana*	Evergreen,semi-evergreen and moist deciduous forests
83	Ebenaceae	*Diospyros chloroxylon*	Open deciduous forests
84	Ebenaceae	*Diospyros montana*	Dry deciduous forests
85	Ebenaceae	*Diospyros ebenum*	
86	Ebenaceae	*Diospyros malabarica*	Stream banks of mixed forests, Evergreen forests and sacred groves
87	Ebenaceae	*Diospyros melanoxylon*	Dry deciduous forests
88	Ebenaceae	*Diospyros montana*	Moist deciduous, dry deciduous and semi-Evergreen forests
89	Ebenaceae	*Diospyros ovalifolia*	Dry evergreen, semi-evergreen and deciduous forests
90	Ebenaceae	*Diospyros sylvatica*	Damp forests, deciduous forests, evergreen, Semi-Evergreen forests
91	Ebenaceae	*Diospyros ferrea*	Dry deciduous forests
92	Ebenaceae	*Diospyros exsculpta*	
93	Elaeocarpaceae	*Elaeocarpus serratus*	Evergreen and Semi-Evergreen forests, also in the plain
94	Elaeocarpaceae	*Elaeocarpus tectorius*	Moist deciduous and Evergreen forests
95	Elaeocarpaceae	*Elaeocarpus variabilis*	Moist deciduous and Evergreen forests
96	Elaeocarpaceae	*Elaeocarpus stipularis var. siamensis*	
97	Euphorbiaceae	*Alchornea mollis*	
98	Euphorbiaceae	*Blachia umbellata*	Evergreen and semi-Evergreen forests
99	Euphorbiaceae	*Croton persimilis*	Scrub forests, also in the plains
100	Euphorbiaceae	*Tritaxis glabella*	Evergreen forests
101	Euphorbiaceae	*Euphorbia antiquorum*	Scrub jungles, foothills of deciduous forests
102	Euphorbiaceae	*Excoecaria agallocha*	Banks of backwaters and mangrove forests
103	Euphorbiaceae	*Shirakiopsis indica*	Along backwaters and mangrove forests
104	Euphorbiaceae	*Jatropha curcas*	
105	Euphorbiaceae	*Lasiococca comberi*	Along rocky ravines
106	Euphorbiaceae	*Macaranga denticulata*	
107	Euphorbiaceae	*Macaranga peltata*	Moist deciduous forests, secondary forests and in plains
108	Euphorbiaceae	*Mallotus philippensis*	Mixed forests
109	Euphorbiaceae	*Falconeria insignis*	Evergreen forests
110	Euphorbiaceae	*Suregada lanceolata*	Dry deciduous forests
111	Euphorbiaceae	*Suregada multiflora*	Dry deciduous forests
112	Euphorbiaceae	*Vernicia fordii*	
113	Euphorbiaceae	*Vernicia montana*	

114	Euphorbiaceae	*Antidesma ghaesembilla*	Mixed forests
115	Euphorbiaceae	*Euphorbia nivulia*	Scrub forests, dry deciduous forests and rocky places
116	Euphorbiaceae	*Trewia nudiflora*	Along riverbanks in evergreen and semi-Evergreen forests
117	Fabaceae	*Senegalia catechu*	Dry deciduous forests
118	Fabaceae	*Senegalia chundra*	Dry deciduous forests
119	Fabaceae	*Acacia donaldii*	
120	Fabaceae	*Vachellia horrida*	Dry deciduous forests, scrub jungles
121	Fabaceae	*Senegalia lenticularis*	
122	Fabaceae	*Vachellia leucophloea*	Dry deciduous forests
123	Fabaceae	*Vachellia nilotica subsp. indica*	
124	Fabaceae	*Senegalia polyacantha*	Dry deciduous forests
125	Fabaceae	*Vachellia tomentosa*	
126	Fabaceae	*Albizia amara*	Dry deciduous forests
127	Fabaceae	*Albizia chinensis*	Evergreen and deciduous forests, also in the plains
128	Fabaceae	*Albizia odoratissima*	
129	Fabaceae	*Albizia procera*	Moist deciduous forests, along streams and sometimes planted
130	Fabaceae	*Albizia thompsonii*	Deciduous forests
131	Fabaceae	*Piliostigma malabaricum*	Valleys of forests, Deciduous forests
132	Fabaceae	*Bauhinia purpurea*	Deciduous forest and Planted
133	Fabaceae	*Bauhinia racemosa*	Dry and moist deciduous forests
134	Fabaceae	*Phanera roxburghiana*	
135	Fabaceae	*Phanera roxburghiana*	
136	Fabaceae	*Phanera roxburghiana*	Mixed forests
137	Fabaceae	*Butea monosperma*	Deciduous forests
138	Fabaceae	*Cassia fistula*	Dry and moist deciduous forests
139	Fabaceae	*Cynometra iripa*	
140	Fabaceae	*Dalbergia lanceolaria*	Mixed deciduous forests and hill slopes
141	Fabaceae	*Dalbergia latifolia*	Dry and moist deciduous forests, also in the plains
142	Fabaceae	*Dalbergia lanceolaria subsp. paniculata*	Dry deciduous forests, hill slopes and scrub jungles
143	Fabaceae	*Dalbergia sissoo*	Planted
144	Fabaceae	*Ougeinia oojeinensis*	Mixed and deciduous forests
145	Fabaceae	*Dichrostachys cinerea*	Scrub forests and foot hills of dry deciduous forests
146	Fabaceae	*Erythrina fusca*	Mostly planted and in wild along banks of rivers
147	Fabaceae	*Erythrina suberosa*	Dry deciduous forests and often planted
148	Fabaceae	*Erythrina suberosa*	Deciduous forests
149	Fabaceae	*Erythrina variegata*	Dry deciduous forests
150	Fabaceae	*Intsia bijuga*	Tidal forests
151	Fabaceae	*Piliostigma malabaricum*	
152	Fabaceae	*Pongamia pinnata*	Dry Evergreen to Dry Deciduous Forests, Deciduous forests

153	Fabaceae	*Prosopis cineraria*	Scrub forests
154	Fabaceae	*Pterocarpus marsupium*	Deciduous forests, also in the plains
155	Fabaceae	*Pterocarpus santalinus*	Deciduous forests, also planted
156	Fabaceae	*Saraca asoca*	Evergreen forests, also grown as ornamental tree
157	Fabaceae	*Senna siamea*	Planted and self sown
158	Fabaceae	*Xylia xylocarpa*	Associated with sal forests, moist deciduous forests
159	Salicaceae	*Homalium nepalense*	Moist deciduous forests
160	Achariaceae	*Hydnocarpus laurifolia*	
161	Salicaceae	*Xylosma longifolium*	Evergreen and semi-Evergreen forests
162	Hernandiaceae	*Gyrocarpus americanus*	Dry deciduous forests
163	Lamiaceae	*Gmelina arborea*	Deciduous forests and in the plains
164	Lamiaceae	*Gmelina asiatica*	Dry deciduous forests and wastelands
165	Lamiaceae	*Premna barbata*	
166	Lamiaceae	*Premna corymbosa*	Foothills of the ghats, also in dry forests
167	Lamiaceae	*Premna mollissima*	Moist deciduous forests
168	Lamiaceae	*Premna mollissima*	Foothills , scrub or open forests of all hill ranges
169	Lamiaceae	*Premna mollissima*	
170	Lamiaceae	*Premna tomentosa*	Dry deciduous forests
171	Lamiaceae	*Tectona grandis*	Moist deciduous forests and also raised in plantations
172	Lamiaceae	*Vitex altissima*	Moist deciduous and semi-Evergreen forests, also in sacred groves
173	Lamiaceae	*Vitex glabrata*	
174	Lamiaceae	*Vitex leucoxylon*	Along river banks, streams in evergreen and semi-Evergreen forests
175	Lamiaceae	*Vitex peduncularis*	Near streams in moist deciduous forests
176	Lamiaceae	*Vitex pinnata*	Banks of streams in moist deciduous forests
177	Lamiaceae	*Vitex quinata*	Moist deciduous forests
178	Lauraceae	*Actinodaphne angustifolia*	In shaded valleys, semi-Evergreen forests
179	Lauraceae	*Beilschmiedia roxburghiana*	
180	Lauraceae	*Cinnamomum tamala*	
181	Lauraceae	*Cinnamomum verum*	Evergreen and riparian forests, also cultivated
182	Lauraceae	*Cryptocarya amygdalina*	Subtropical broad-leaved hill forests, Tropical evergreen forests
183	Lauraceae	*Litsea glutinosa*	Deciduous and semi-Evergreen forests
184	Lauraceae	*Litsea laeta*	
185	Lauraceae	*Litsea monopetala*	Semi-Evergreen forests
186	Lauraceae	*Litsea nitida*	
187	Lauraceae	*Neocinnamomum caudatum*	
188	Lauraceae	*Neolitsea cassia*	Evergreen and shola forests
189	Lauraceae	*Neolitsea foliosa*	In valleys of forests and on high plateaus
190	Lauraceae	*Machilus glaucescens*	Evergreen, semi-evergreen and moist deciduous forests
191	Lauraceae	*Machilus glaucescens*	Banks of streams in Evergreen forests

192	Lauraceae	*Phoebe lanceolata*	Shady valleys of evergreen and semi-Evergreen forests
193	Lauraceae	*Phoebe wightii*	Evergreen and shola forests
194	Lecythidaceae	*Barringtonia acutangula*	Along riverbanks and water courses
195	Lecythidaceae	*Careya arborea*	Moist and dry deciduous forests, also in the plains
196	Loganiaceae	*Strychnos potatorum*	Dry deciduous and mixed forests
197	Lythraceae	*Duabanga grandiflora*	Subtropical and terai forests, especially on river banks
198	Lythraceae	*Lagerstroemia parviflora*	Moist and dry deciduous forests, also in plains
199	Lythraceae	*Punica granatum*	Cultivated
200	Lythraceae	*Sonneratia apetala*	Tidal forests
201	Lythraceae	*Sonneratia caseolaris*	Littoral and tidal swamp forests
202	Lythraceae	*Sonneratia griffithii*	
203	Magnoliaceae	*Magnolia champaca*	Evergreen forests
204	Malvaceae	*Bombax ceiba*	Coastal and Upland Moist deciduous forests
205	Malvaceae	*Brownlowia tersa*	Mangrove Swamps and Marshes
206	Malvaceae	*Eriolaena hookeriana*	Degraded deciduous and mixed forests
207	Malvaceae	*Eriolaena hookeriana*	
208	Malvaceae	*Firmiana colorata*	Deciduous forests
209	Malvaceae	*Grewia abutilifolia*	Deciduous forests, moist deciduous forests
210	Malvaceae	*Grewia bracteata*	Deciduous forests
211	Malvaceae	*Grewia helicterifolia*	Deciduous and Evergreen forests
212	Malvaceae	*Grewia bracteata*	Dry deciduous forests
213	Malvaceae	*Grewia orbiculata*	Semi-Evergreen forests and deciduous forests
214	Malvaceae	*Grewia polygama*	
215	Malvaceae	*Grewia rothii*	Evergreen, Deciduous and scrub forests
216	Malvaceae	*Grewia serrulata*	Widely distributed in mixed forests
217	Malvaceae	*Grewia tiliifolia*	Semi-evergreen, moist deciduous and deciduous forests
218	Malvaceae	*Heritiera fomes*	Tidal forests
219	Malvaceae	*Heritiera kanikensis*	
220	Malvaceae	*Heritiera littoralis*	Evergreen forests
221	Malvaceae	*Hibiscus tiliaceus*	Plains, mainly coastal and river banks
222	Malvaceae	*Hildegardia populifolia*	Rocky terrains in deciduous forests
223	Malvaceae	*Kydia calycina*	Moist deciduous and semi-Evergreen forests
224	Malvaceae	*Pterospermum xylocarpum*	Degraded forests and shallow ravines
225	Malvaceae	*Sterculia foetida*	Deciduous forests and in the plains along coastal areas
226	Malvaceae	*Sterculia villosa*	Deciduous forests
227	Malvaceae	*Thespesia populneoides*	
228	Melastomataceae	*Memecylon edule*	
229	Melastomataceae	*Memecylon umbellatum*	Semi-Evergreen forests and Sholas
230	Meliaceae	*Aglaia cucullata*	Tidal forests and Semi-Evergreen forests

231	Meliaceae	*Aglaia elaeagnoidea*	Semi-Evergreen forests, sacred groves in the plains
232	Meliaceae	*Aglaia elaeagnoidea*	
233	Meliaceae	*Aglaia lawii*	Evergreen, semi-Evergreen forests
234	Meliaceae	*Aglaia spectabilis*	In evergreen forest; in dump places and on moist evergreen hills
235	Meliaceae	*Aphanamixis polystachya*	Evergreen, semi-evergreen and shola forests, also in sacred groves
236	Meliaceae	*Azadirachta indica*	Dry deciduous forests, gardens, roadsides
237	Meliaceae	*Chukrasia tabularis*	Evergreen, semi-evergreen, moist deciduous and shola forests
238	Meliaceae	*Melia dubia*	Moist deciduous, semi-Evergreen forests
239	Meliaceae	*Soymida febrifuga*	Deciduous forests
240	Meliaceae	*Toona ciliata*	
241	Meliaceae	*Toona ciliata*	
242	Meliaceae	*Heynea trijuga*	Moist deciduous, evergreen, semi-evergreen and shola forests
243	Meliaceae	*Walsura trifoliolata var. ternata*	
244	Meliaceae	*Walsura trifoliolata subsp. trifoliolata*	Dry deciduous, moist deciduous, semi-evergreen, evergreen forests
245	Meliaceae	*Xylocarpus moluccensis*	Tidal forests
246	Meliaceae	*Xylocarpus granatum*	Mangrove forests, also aong the sea coasts
247	Meliaceae	*Toona ciliata*	Semi-evergreen and Evergreen forests
248	Moraceae	*Artocarpus heterophyllus*	Evergreen and semi-Evergreen forests
249	Moraceae	*Artocarpus lacucha*	Cool valleys
250	Moraceae	*Ficus amplissima*	Evergreen, moist and dry deciduous forests
251	Moraceae	*Ficus arnottiana*	Semi-evergreen and moist deciduous forests
252	Moraceae	*Ficus auriculata*	Near streams, also cultivated
253	Moraceae	*Ficus benghalensis*	Dry deciduous forests, also in the plains
254	Moraceae	*Ficus drupacea*	Semi-evergreen and moist deciduous forests
255	Moraceae	*Ficus elastica*	Planted as ornamental tree
256	Moraceae	*Ficus exasperata*	Stream banks of mixed forests and moist deciduous forests
257	Moraceae	*Ficus geniculata*	Mixed deciduous and deciduous forests
258	Moraceae	*Ficus hispida*	Moist deciduous and semi-Evergreen forests, also in plains
259	Moraceae	*Ficus microcarpa*	Evergreen and semi-Evergreen forests, also in the plains
260	Moraceae	*Ficus mollis*	Dry deciduous forests
261	Moraceae	*Ficus palmata*	Grows around villages, forest, wastelands, fields
262	Moraceae	*Ficus racemosa*	Semi-evergreen and deciduous forests, also in the plains
263	Moraceae	*Ficus religiosa*	
264	Moraceae	*Ficus rumphii*	
265	Moraceae	*Ficus semicordata*	
266	Moraceae	*Ficus virens*	Evergreen forests
267	Moraceae	*Ficus virens var. virens*	
268	Moraceae	*Streblus asper*	Open, scrub, moist and dry deciduous forests
269	Moraceae	*Taxotrophis taxoides*	Semi-evergreen and moist deciduous forests

270	Moraceae	*Ficus nervosa*	Semi-evergreen and Evergreen forests
271	Moraceae	*Ficus virens var. lambertiana*	
272	Moringaceae	*Moringa oleifera*	Cultivated
273	Myrtaceae	*Corymbia torelliana*	Planted
274	Myrtaceae	*Eugenia roxburghii*	Scrub forests & Evergreen forests
275	Myrtaceae	*Syzygium cumini*	Evergreen forests and also in the plains
276	Myrtaceae	*Syzygium cumini*	
277	Myrtaceae	*Syzygium hemisphericum*	Evergreen and shola forests
278	Myrtaceae	*Syzygium nervosum*	
279	Myrtaceae	*Syzygium praecox*	
280	Myrtaceae	*Syzygium siamense*	Cultivated
281	Myrtaceae	*Syzygium cuneatum*	
282	Ochnaceae	*Ochna gamblei*	Rocky areas in deciduous forests and hill tracts
283	Ochnaceae	*Ochna obtusata*	Deciduous forests
284	Oleaceae	*Chionanthus ramiflorus*	Subtropical moist deciduous, evergreen, shola and Terai forests
285	Oleaceae	*Ligustrum minii*	Mixed forests on hills above 900m; also in shola borders.
286	Oleaceae	*Chionanthus mala-elengi*	Semi-Evergreen forests
287	Oleaceae	*Nyctanthes arbor-tristis*	Open forests
288	Oleaceae	*Olea paniculata*	Moist deciduous and shola forests
289	Phyllanthaceae	*Antidesma acidum*	Semi-evergreen and moist deciduous forests and sacred groves
290	Phyllanthaceae	*Antidesma bunius*	Evergreen forests, also in sacred groves
291	Phyllanthaceae	*Antidesma montanum*	Along streams in dry evergreen , evergreen and shola forests
292	Phyllanthaceae	*Aporosa octandra*	Evergreen forests and mixed forest; near streams
293	Phyllanthaceae	*Baccaurea ramiflora*	Evergreen forests
294	Phyllanthaceae	*Bischofia javanica*	Evergreen and semi-Evergreen forests
295	Phyllanthaceae	*Cleistanthus monoicus*	
296	Phyllanthaceae	*Bridelia montana*	
297	Phyllanthaceae	*Bridelia glauca*	
298	Phyllanthaceae	*Bridelia retusa*	Deciduous forests
299	Phyllanthaceae	*Bridelia stipularis*	Semi-Evergreen forests
300	Phyllanthaceae	*Bridelia tomentosa*	
301	Phyllanthaceae	*Cleistanthus collinus*	Deciduous forests
302	Phyllanthaceae	*Cleistanthus patulus*	Stream banks of Mixed forests, also deciduous and Evergreen forests
303	Phyllanthaceae	*Glochidion ellipticum*	Evergreen and shola forests
304	Phyllanthaceae	*Glochidion lanceolarium*	
305	Phyllanthaceae	*Glochidion heyneanum*	Evergreen, deciduous and shola forests
306	Phyllanthaceae	*Glochidion zeylanicum*	Evergreen and semi-Evergreen forests, also in the plains
307	Phyllanthaceae	*Margaritaria indica*	Semi-Evergreen forests
308	Phyllanthaceae	*Phyllanthus emblica*	

309	Pittosporaceae	*Pittosporum densiflorum*	Moist, dry deciduous and shola forests
310	Plumbaginaceae	*Aegialitis rotundifolia*	Tidal forests
311	Primulaceae	*Aegiceras corniculatum*	Mangrove forests and marshy areas
312	Primulaceae	*Ardisia thyrsiflora*	Evergreen forests
313	Primulaceae	*Ardisia pauciflora*	Evergreen and shola forests
314	Putranjivaceae	*Drypetes assamica*	Semi-Evergreen forests
315	Putranjivaceae	*Putranjiva roxburghii*	Deciduous forests and sacred groves
316	Putranjivaceae	*Drypetes sepiaria*	Dry and moist deciduous forests, semi-Evergreen forests
317	Rhamnaceae	*Rhamnus virgata*	Moist deciduous forests, montane scrub jungles and shola forests
318	Rhamnaceae	*Ziziphus glabrata*	Dry deciduous forests
319	Rhamnaceae	*Ziziphus xylopyrus*	Dry and moist deciduous forests
320	Rhizophoraceae	*Bruguiera cylindrica*	Tidal forests
321	Rhizophoraceae	*Bruguiera parviflora*	Tidal forests
322	Rhizophoraceae	*Bruguiera sexangula*	Tidal forests
323	Rhizophoraceae	*Carallia brachiata*	Semi-Evergreen forests, plains and mangrove littoral
324	Rhizophoraceae	*Cassipourea ceylanica*	Along streams or steep slopes
325	Rhizophoraceae	*Ceriops tagal*	Tidal forests
326	Rhizophoraceae	*Kandelia candel*	Tidal forests
327	Rhizophoraceae	*Rhizophora apiculata*	Tidal forests
328	Rhizophoraceae	*Rhizophora mucronata*	Tidal forests
329	Rhizophoraceae	*Rhizophora stylosa*	Sandy sea shores
330	Rhizophoraceae	*Bruguiera gymnorrhiza*	Tidal forests
331	Rosaceae	*Prunus ceylanica*	Semi-evergreen and moist deciduous forests
332	Rosaceae	*Prunus pygeoides*	Moist valleys along the streams
333	Rubiaceae	*Neonauclea purpurea*	
334	Rubiaceae	*Canthiumera glabra*	Semi-Evergreen forests
335	Rubiaceae	*Discospermum abnorme*	Semi-Evergreen forests
336	Rubiaceae	*Benkara fasciculata*	
337	Rubiaceae	*Gardenia gummifera*	Deciduous forests
338	Rubiaceae	*Gardenia latifolia*	
339	Rubiaceae	*Gardenia resinifera*	Dry deciduous forests
340	Rubiaceae	*Ceriscoides turgida*	Moist deciduous forests
341	Rubiaceae	*Adina cordifolia*	Moist deciduous forests, also in the plains
342	Rubiaceae	*Hymenodictyon orixense*	Dry deciduous forests, also in the plains
343	Rubiaceae	*Hyptianthera stricta*	
344	Rubiaceae	*Ixora pavetta*	Dry and moist deciduous forests
345	Rubiaceae	*Meyna laxiflora*	Evergreen forests
346	Rubiaceae	*Meyna spinosa*	
347	Rubiaceae	*Mitragyna parvifolia*	Moist deciduous and deciduous forests

348	Rubiaceae	*Morinda citrifolia*	Waste lands, deciduos and mangrove forests
349	Rubiaceae	*Morinda coreia*	Moist and dry deciduous forests, also in the plains
350	Rubiaceae	*Morinda coreia*	
351	Rubiaceae	*Neolamarckia cadamba*	Along banks of rivers and streams in Evergreen forests
352	Rubiaceae	*Pavetta crassicaulis*	Scrub forests
353	Rubiaceae	*Tamilnadia uliginosa*	Moist deciduous forests, near wet places
354	Rubiaceae	*Wendlandia coriacea*	
355	Rubiaceae	*Wendlandia gamblei*	
356	Rubiaceae	*Wendlandia glabrata*	
357	Rubiaceae	*Wendlandia heynei*	
358	Rubiaceae	*Wendlandia tinctoria*	Stream banks of Sal forests
359	Rubiaceae	*Psydrax umbellata*	Moist deciduous forests and sacred groves, also mixed forests
360	Rutaceae	*Acronychia pedunculata*	Evergreen and semi-Evergreen forests
361	Rutaceae	*Aegle marmelos*	Deciduous forests, also temple premises and homesteads
362	Rutaceae	*Atalantia monophylla*	Dry deciduous forests
363	Rutaceae	*Chloroxylon swietenia*	Deciduous forests
364	Rutaceae	*Clausena heptaphylla*	Evergreen forests
365	Rutaceae	*Glycosmis mauritiana*	Undergrowth in Evergreen forests
366	Rutaceae	*Limonia acidissima*	Dry deciduous forests, also grown in homesteads
367	Rutaceae	*Merope angulata*	Tidal forests
368	Rutaceae	*Micromelum integerrimum*	
369	Rutaceae	*Micromelum minutum*	Semi-Evergreen forests
370	Rutaceae	*Bergera koenigii*	Cultivated
371	Rutaceae	*Naringi crenulata*	Dry forests, Semi-evergreen and moist deciduous forests, also in the plains
372	Rutaceae	*Tetradium glabrifolium*	
373	Rutaceae	*Zanthoxylum armatum*	Moist deciduous forests
374	Rutaceae	*Zanthoxylum rhetsa*	Evergreen and moist deciduous forests
375	Rutaceae	*Citrus maxima*	Cultivated
376	Sabiaceae	*Meliosma pinnata*	Evergreen broad-leaved forests
377	Sabiaceae	*Meliosma fordii*	Shola and Evergreen forests
378	Salicaceae	*Casearia tomentosa subsp. tomentosa*	Moist deciduous forests and forest plantations
379	Salicaceae	*Casearia graveolens*	Deciduous forests
380	Salicaceae	*Casearia rubescens*	Evergreen and semi-Evergreen forests
381	Salicaceae	*Flacourtia indica*	Found on the Ridges as well as on the arid, hilly tracts
382	Salicaceae	*Flacourtia montana*	Evergreen and semi-Evergreen forests
383	Salicaceae	*Homalium tomentosum*	
384	Salicaceae	*Populus ciliata*	
385	Salicaceae	*Salix tetrasperma*	Semi-Evergreen forests
386	Salvadoraceae	*Salvadora persica var. wightiana*	

387	Santalaceae	*Santalum album*	Foothills of dry deciduous forests and also in homesteads
388	Sapindaceae	*Lepisanthes senegalensis*	Dry deciduous forests and semi-Evergreen forests
389	Sapindaceae	*Sapindus emarginatus*	Dry deciduous forests and margins of grasslands
390	Sapindaceae	*Schleichera oleosa*	Dry deciduous, semi-evergreen and moist deciduous forests
391	Sapotaceae	*Madhuca longifolia var. latifolia*	Banks of rivers in mixed deciduous forests and semi-Evergreen forests
392	Sapotaceae	*Manilkara hexandra*	Dry deciduous forests
393	Sapotaceae	*Manilkara littoralis*	
394	Sapotaceae	*Mimusops elengi*	Semi-evergreen and Evergreen forests, also grown in homesteads
395	Sapotaceae	*Xantolis tomentosa*	Evergreen forests
396	Simaroubaceae	*Ailanthus excelsa*	Dry deciduous forests
397	Simaroubaceae	*Brucea mollis*	
398	Simaroubaceae	*Picrasma javanica*	Along fresh-water streams.
399	Lythraceae	*Sonneratia alba*	Mangrove forests
400	Staphyleaceae	*Staphylea cochinchinensis*	Evergreen forests
401	Styracaceae	*Styrax serrulatus*	
402	Symplocaceae	*Symplocos acuminata*	Hill forests along streams in evergreen, semievergreen and Sholas
403	Symplocaceae	*Symplocos racemosa*	Evergreen forests
404	Tamaricaceae	*Tamarix dioica*	
405	Tamaricaceae	*Tamarix indica*	On sandy river beds
406	Ulmaceae	*Holoptelea integrifolia*	Semi-Evergreen forests, also in the plains
407	Urticaceae	*Oreocnide integrifolia*	In deep ravines and glens in the hills of Evergreen forests
408	Cycadaceae	*Cycas beddomei*	Open deciduous forests
409	Cycadaceae	*Cycas sphaerica*	Deciduous forests
410	Cyatheaceae	*Cyathea andersonii*	Montane Evergreen Forests
411	Cyatheaceae	*Cyathea gigantea*	Montane Evergreen Forests
412	Cyatheaceae	*Cyathea spinulosa*	Montane Evergreen Forests

Table 3. List of sites currently under consideration for "tree-planting" as provided by the Government of Orissa to the ABFT, with our remarks and verdict about each site.

Sl. No.	Site Name	Lat	Long	Remarks
1	Mendhasal RF	20.27086	85.72242	**4.5 Kms from the Chandaka WLS with no connectivity, but looks to be intact to degraded natural forest habitat. LOW PRIORITY SITE!**
2	Mendhasal RF	20.28	85.72201	**4.5 Kms from the Chandaka WLS with no connectivity, but looks to be intact to degraded natural forest habitat. LOW PRIORITY SITE!**
3	Pangarsingh PRF	20.28293	85.48669	**Isolated plot with no connectivity whatsoever; ecologically valueless, and a site for moderate carbon sequestration. LOW PRIORITY SITE!**
4	Tartua DPF	20.20487	85.60902	**Isolated plot with no connectivity whatsoever; ecologically valueless, and a site for moderate carbon sequestration. LOW PRIORITY SITE!**
5	Barunei	20.1576	85.64329	**Natural Grassland, which is an important functional habitat. REJECTED SITE!**
6	Kesipadar	19.9247	83.38684	**Bald Hill; already has natural forest cover. Why do tree planting here? REJECTED SITE!**
7	Kiram	19.78568	83.32347	**Bald Hill; a naturally rocky outcrop where native trees cannot grow. Wasted effort to plant trees here. REJECTED SITE!**
8	Padampur	19.94606	82.95766	**Bald Hill; already has natural forest cover. Why do tree planting here? REJECTED SITE!**
9	Bahair Khaman RF	20.79458	83.73417	**Isolated plot with no connectivity whatsoever; ecologically valueless, and a site for moderate carbon sequestration. LOW PRIORITY SITE!**
10	Kartang	20.9515	83.78033	**Isolated plot with no connectivity whatsoever; ecologically valueless, and a site for moderate carbon sequestration. LOW PRIORITY SITE!**
11	Bhaludunguri	21.02577	84.09026	**Degraded forest habitat that is part of a large forested block. PRIORITY SITE!**
12	Bhaludunguri	21.00889	84.10317	**Degraded forest habitat that is part of a large forested block. PRIORITY SITE!**
13	Sahana PRF	19.9547	86.33865	**An established *Casuraina* plantation that has been clear felled and recently planted. REJECTED SITE!**
14	Satalandi PRF	20.71608	85.93811	**Relatively less disturbed site with no dependant human populations in vicinity. PRIORITY SITE!**
15	Mahagir DPF	21.04179	85.95817	**Good site to create a lowland corridor between a semi-forested hillock and a large forest block. PRIORITY SITE!**
16	Subarnagiri RF C/13	20.61154	84.14085	**Degraded forest habitat that is part of a large forested block. PRIORITY SITE!**
17	Penajore RF C/2	20.66455	83.95986	**Already has natural forest cover. Boost any degradation by rehabilitating appropriate species. PRIORITY SITE!**
18	Sindurbhadi RF C/1	20.75171	83.97315	**Degraded forest habitat that is part of a moderately forested, but fragmented block. PRIORITY SITE!**
19	Arachangi B RF	20.35181	84.48803	**Already has natural forest cover. Boost any degradation by rehabilitating appropriate species. PRIORITY SITE!**
20	Brutanga South RF	20.32801	84.42346	**Already has natural forest cover. Boost any degradation by rehabilitating appropriate species. PRIORITY SITE!**
21	Bandhagada A RF	20.30278	84.2115	**Already has natural forest cover. Boost any degradation by rehabilitating appropriate species. PRIORITY SITE!**
22	Padipagu PRF	20.25904	84.40384	**Already has natural forest cover. Boost any degradation by rehabilitating appropriate species. PRIORITY SITE!**

Table 4. Intact natural habitats closest to the ten priority sites selected tentatively.

Sl. No.	Priority Sites	Lat	Long	Closest Intact Habitat	Aerial distance from Site (Kms)
1	Bhaludunguri	21.02577	84.0903	Redhakol-Charmal Forest Range	The site is inside the forest range.
2	Bhaludunguri	21.00889	84.1032	Redhakol-Charmal Forest Range	The site is inside the forest range.
3	Satalandi PRF	20.71608	85.9381	Kapilash WLS	0.87
4	Mahagir DPF	21.04179	85.9582	Harichandanpur-Telkoi Reserve Forest & Tomka Forest Block	0.59
5	Penajore RF C/2	20.66455	83.9599	Pulbani & Kalahandi RFs	The site is inside the Kalahandi Range
6	Arachangi B RF	20.35181	84.488	Pulbani Forest Area, Ghatiguda Forest, Satkosia TR & Tikabali-Pulbani Range	0.55
7	Brutanga South RF	20.32801	84.4235	Ghatiguda Forest, Tikabali-Pulbani Range	The site is inside the Tikabali-Pulbani Range
8	Bandhagada A RF	20.30278	84.2115	Kalahandi Range, Daringbadi-Udayagiri Range & Tikabali-Pulbani Range	9.65
9	Padipagu PRF	20.25904	84.4038	Pulbani & Tikabali-Pulbani Range	The site is inside the Tikabali-Pulbani Range
10	Subarnagiri RF	20.61154	84.14085	This is a corridor between Kalahandi Range and Phulbani Forest	This site is inside a large forest patch between Kalahandi and Phulbani

APPENDIX 1

Key Criteria for Land Prioritization

Ecological Restoration is now recognized world over as a vital intervention in the reduction of global warming and biodiversity extinction risk, apart from enhancing ecosystem services that benefits human society. To practice ecological restoration of complex habitats optimally in a scientific and financially prudent manner, it is vital to consider the following fundamental criteria prior to selecting sites outside protected areas for the purpose.

1. **Status of vegetation on sites (influences cost, resources and time required to be invested).**

   i. Fully intact native vegetation: *If a site has its intact native vegetation community representative of a functional ecosystem, then it needs merely to be secured and protected with little to no interference, since this is the ideal restoration reference.*
   ii. Partially degraded native vegetation: *If a site has suffered disturbance and degradation between ~10 to 50%, then the site needs moderate restoration intervention.*
   iii. Heavily degraded native vegetation: *If a site has suffered disturbance and degradation beyond ~50 to 75%, then the site needs significant restoration intervention.*
   iv. Entirely devoid of native vegetation beyond 75% degradation: *if the site supports absolutely no native vegetation, then it becomes least priority for restoration (more so if it is completely isolated from intact habitat), unless under special circumstances.*

2. **Proximity and connectivity of site to other functional habitats to facilitate colonisation of constituent biodiversity (other native wild plants, animals, fungi and micro-organisms) and enable optimal gene flow.**

   The more isolated from native habitat a site selected for restoration is, the less chances it has of reaching its ecological climax.

3. **Greater distance from human-dominated land use areas from selected sites.**

   The presence of people and infrastructure near and around sites can confound restoration objectives by:

   i. Unintentional conflict with and disturbance to people due to spill over of wild animal populations.
   ii. Fatality to wildlife by roads, high-tension wires, power lines, human-animal conflict, etc.
   iii. Destabilizing the balance between opportunities for ecosystem services that benefit human societal needs vs. dependence by human population for exploitation leading to deterioration of restored site.

4. **Social demographics in and around sites.**

   For restoration projects to succeed, people need to be invested in and value them since restored sites need a lot of time to mature into a functional state without being degraded or converted.

   This includes local communities (who, if not sustainable in their extraction practices of local resources, be it for grazing or Non-Timber Forest Produce collection, can degrade restored community of the site), policy & decision makers, and investors & corporates (who may be local, regional, or international, with interests to establish mines, industries, energy installations, etc.) all of whom can have an impact on how local landscapes are altered.

5. **Status of land type and management possibilities**.

   i. Protected Areas such as Wildlife Sanctuary, National Park, Tiger Reserve, etc.: *external human pressures minimal, unless de-notified/alteration to management plans*.
   ii. Reserved and Territorial Forests: *external human pressures can be moderate to less*.
   iii. Community Lands, Tribal Lands, Village Commons, etc.: *if social and economic equality is maintained and basic needs of community met, it will go a long way in preventing "Tragedy" of the Commons*.
   iv. Private Revenue Land: *intact or degraded habitats outside protected areas can be secured by purchase.*
   v. Abandoned Mines, Low Productive Pastureland, etc.: depending on location, such fallow and degraded lands can be treated and either ecologically restored or repurposed for green energy installations.

6. **Carbon sequestration potential for sites (optimised by proximity to functional habitat).**

   The more functional an ecosystem is, the more pathways and opportunities for carbon sequestration and storage there is.
