

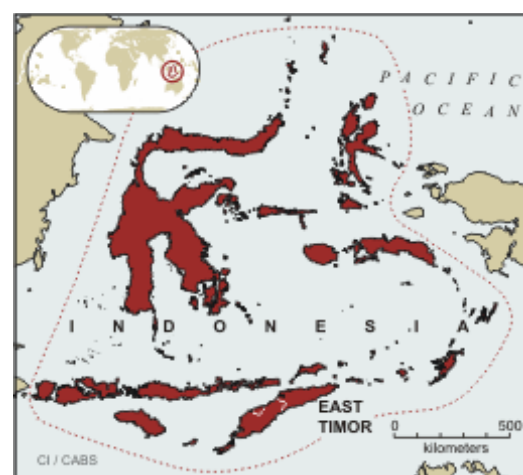
(2) Biodiversity in Sulawesi Island

Wallacea is a famous and essential biogeographical island group in eastern Indonesia which includes Sulawesi Island (which is about 178,700 km²). Sulawesi Island is the largest of these islands occupying about 53% of the island aggrupation located in the northwest part of Wallacea.

Because of its tropical climate, its numerous islands, and complex geological history, Wallacea has high biodiversity, with numerous species found nowhere else in the world. Its total number of species is estimated at 11,400 and holds a high probability of undiscovered species due to the area's isolation and inaccessibility.

Table 9.4.1 Diversity and Endemism in Wallacea

Taxonomic Group	Species	Endemic Species	Percent Endemism	Endemic Species (samples)
Plants	10,000	1,500	15.0%	
Mammals	222	127	57.2%	babirusa, anoa, tarsiers, kuskus, sulawesi palm civet, celebes black macaque etc.
Birds	647	262	40.5%	maleo, matinan flycatcher, white-tipped monarch, taliabu masked-owl, sulawesi red-knobbed hornbill etc.
Reptiles	222	99	44.6%	calamorbabium, rabdion, cyclotyphlops etc.
Amphibians	48	33	68.8%	sulawesi toad, green frog, common green turtle etc.
Freshwater Fishes	250	50	20.0%	halfbeak, goby, oryzia etc.
	11,389	2,071	18.2%	

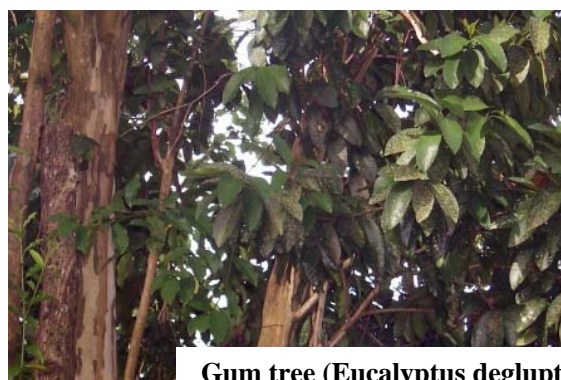


Threat Categories: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; EW = Extinct in the Wild

Endemism: Single = endemic to one hotspot; Multiple = not endemic to any one hotspot, but to the combined area of two or more hotspots

1) Plants

Although the flora in this island region is not well known, it is estimated that there are about 10,000 species of vascular plants, with roughly 1,500 endemic species and at least 12 endemic genera. There are about 500 endemic species on Sulawesi with a 5 percent endemism.



Gum tree (*Eucalyptus deglupta*)

2) Birds

There are about 650 regularly occurring bird species in Wallacea, roughly 262 (about 40 %) of which are endemic. There are also 29 endemic genera. As a testimony to the diversity and endemism of Wallacea, 10 endemic bird areas (EBAs) have been identified within the territory by BirdLife International.

Among the island groups, Sulawesi has the largest number of fauna, with 356 species, including 96 endemic species. About 50 bird species are threatened with extinction.

Among the threatened species is the maleo (*Macrocephalon maleo*, EN) a chicken-like bird unique to the island and known for its behavior of building mounds (including dummy mounds) in which to bury their eggs. After hatching the young birds come out of the mound already feathered in adult plumage.



3) Mammals

More than 125 of Wallace's 220-plus mammal species are found nowhere else in the world. If endemism is recalculated to exclude more than 125 species of bats (because they disperse easily), the level of mammal endemism in Wallacea still results in an astonishing 88 percent.

One of the most unusual mammals in Sulawesi is the babirusa (*Babirusa babirusa*, VU), a protected pig-like mammal whose name in Bahasa Indonesia literally means "pig-deer." One of its attributes is the male's long curving tusks that penetrates its upper lip.



Another famous protected mammal is the anoa, or dwarf buffaloes, which is endemic to the forests of Sulawesi. The two species of anoa—the lowland anoa (*Bubalus depressicornis*, EN) and the mountain anoa (*Bubalus quarlesi*, EN)—can be found in the conservation areas, national parks, and forests of Sulawesi.



A number of endemic primates can also be found in Sulawesi which have at least seven species of endemic macaques and at least five species of endemic tarsiers. The Celebes black Macaque is seriously threatened with extinction among Sulawesi's endemic macaques species. There is also the unique spectral tarsiers which are tiny, goggle-eyed creatures that resemble mammalian tree frogs more than monkeys. They live in various conservation areas and national parks.

The Sulawesi palm civet (*Macrogalidia musschenbroekii*, VU), which as the name suggests can only be found in Sulawesi, belongs to about 25 species of ranging rodents.

Unfortunately, about a third of endemic mammals in this hotspot are threatened with extinction.

4) Freshwater Fishes

Nearly all of the more than 300 freshwater fish species can be found in Wallacea and about 75 of these species are endemic. On the island of Sulawesi alone, there are nearly 70 known fish species, about three-quarters of which are endemic. Malili Lakes in South Sulawesi have at least 15 endemic and beautiful telmatherinid fishes. They include three endemic *Oryzias*, two endemic halfbeaks, and seven endemic gobies.

Aside from being living testaments to Sulawesi's rich and wonderful biodiversity, these unique species should bring national and international attention to the area to help promote their protection and improve the development of the local people and communities.

The key will be finding a balance in how to safeguard its rich biological diversity, the traditional way of life of its communities, and yet allowing sustainable development and an improved access to basic services such as health care, education, and transport. The peoples and communities of Sulawesi Island will be the key stakeholders in the conservation of its natural reserves and the development of Sulawesi Island as a whole.

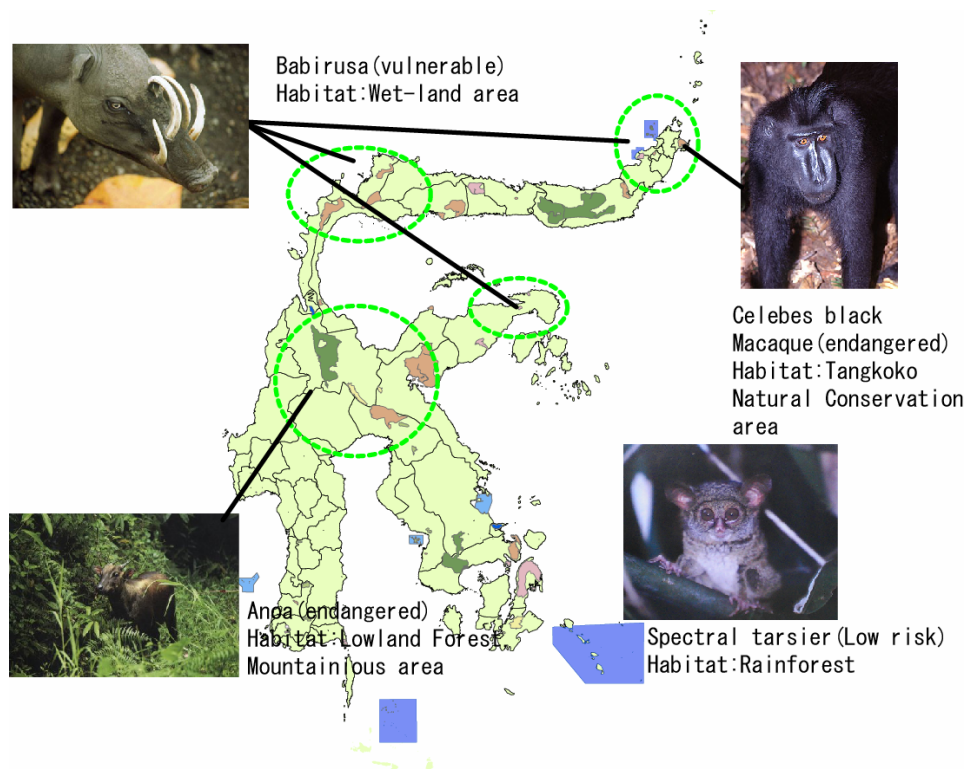


Figure 9.4.4 Selected Indicator Species of Mammals

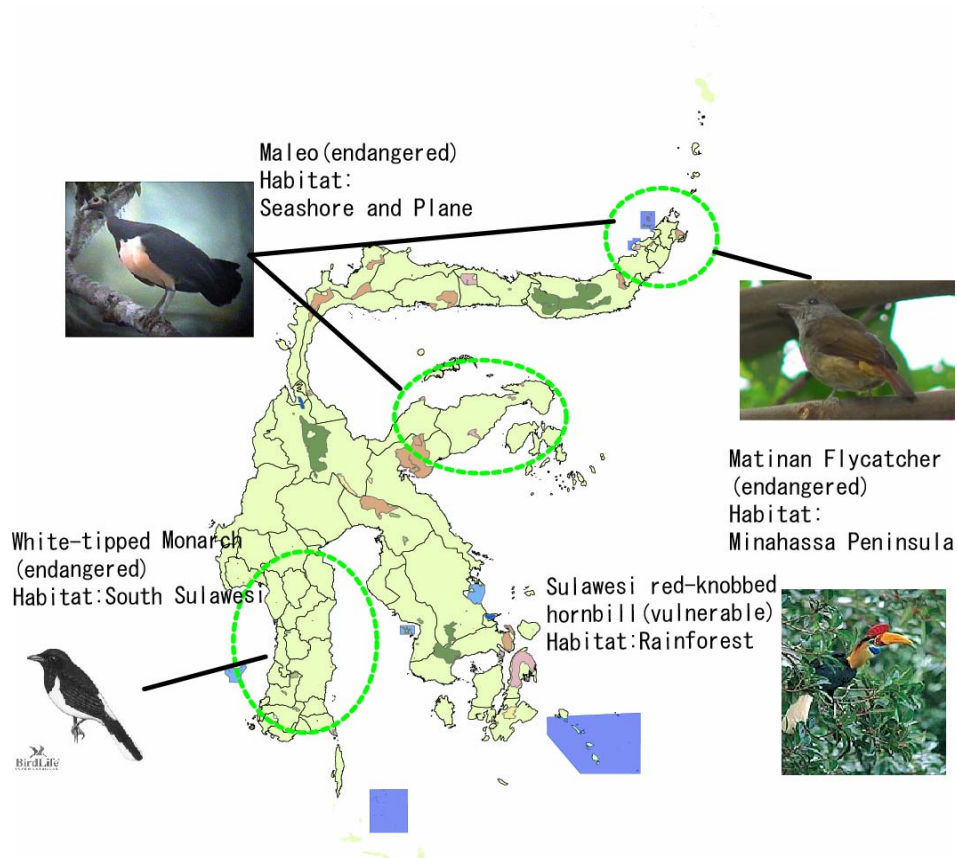


Figure 9.4.5 Selected Indicator Species of Birds

(3) Coral Reefs around Sulawesi Island

The essential coral reefs scattered around Sulawesi Island are shown in Figure 9.4.6. Coral reefs are useful in the preservation of the area's marine biodiversity and fishery production. In addition, they are a favorable and vital tourism resource.

There are 3 national marine parks and 2 nature recreational marine parks on Sulawesi Island.



Figure 9.4.6 Location of Coral Reefs Around Sulawesi Island

(4) Conservation Areas in Sulawesi Island

Among key international ecological conventions, the United Nations' Convention on Biological Diversity, Convention on International Trade in Endangered Species of Wild Fauna and Flora: CITES, and Ramsar Convention on Wetlands are ratified by the Indonesian government.

Conservation areas in Indonesia are categorized into six classifications and are described as follows:

Table 9.4.2 Classifications of Conservation Areas in Indonesia

Classification	Definition
Nature Reserve	Most important area for the preservation and conservation of biodiversity; with rare species of flora and fauna; to be placed under strict management, operation, control, and protection.
Wildlife Reserve	Important area for the preservation and conservation of biodiversity; with rare species of flora and fauna; to be placed under strict management, operation, control, and protection.
National Park	Important area for the preservation and conservation of biodiversity; with rare species of flora and fauna; can be used by the public as recreational area.
Nature Recreational Park	Area of relatively lower importance for the preservation and conservation of biodiversity; with rare species of flora and fauna; can be used by the public for recreation.
Hunting Game Reserve	Area of low importance for the preservation and conservation of biodiversity; with rare species of flora and fauna; hunting of specific animals (boars, deer, some fishes) is allowed.
Grand Forest Park	Needed to protect reservoirs.

Permitted and prohibited activities in each conservation area are shown in Table 9.4.3.

The most critical area is the nature reserve, and in Sulawesi Island there are 18 regions which are nominated as such. The second priority area is the wildlife reserve, and Sulawesi has 16 wildlife reserves. Notwithstanding the prohibitions in the activities in these reserves and the use of their resources, the people in and around the conservation areas often hunt and kill endemic or protected species. They also collect rare flora or consume other edible flora species.

Detailed data on conservation areas in Sulawesi Island are in Table 9.4.4.

Table 9.4.3 Permitted and Prohibited Activities in Conservation Areas in Indonesia

Conservation Area Activities	Nature Reserve	Wildlife Reserve	National Park	Nature Recreational Park	Hunting Game Reserve	Grand Forest Park
Cultivation of edible crops	x	x	x	x	x	x
Cultivation of fruit trees	x	x	x	○	○	○
Migration	x	x	x	x	x	x
Commercial cutting	x	x	x	x	x	x
Gathering of useful plants and firewoods	x	○	x	x	x	○
Hunting	x	x	x	x	○	○
Fishery	x	x	○	x	○	○
Camping	x	○	○	○	○	○
Gathering for research	x	△	△	△	△	△
Management and preservation for ecosystem	x	○	○	○	○	○
Transfusion and replantation of internal species	x	○	○	○	○	○
Gathering of wisteria and bamboo	x	x	x	△	x	x
Development for mineral resources	x	△	△	△	△	△
Management and preservation for wild animals and plants	x	○	○	○	○	○
Entry of tourists	x	○	○	○	○	○
Migration and replantation of extraneous species	x	x	x	x	x	○

Resource : Field Report of UNDP/FAO National Park Development Project INS/78/061

Remarks ○: Permission
 △: Particular Privilege
 x: Prohibition

Table 9.4.4 Data on Conservation Areas in Sulawesi Island

Classification	No.	Conservation Area Name	Area (ha)	Province Name
Nature Reserve (Cagar Alam)	1	Tnagkoko Batu Angus	3,196	North Sulawesi Province
	2	Gunung Dua Saudara	4,299	North Sulawesi Province
	3	Gunung Lokon	100	North Sulawesi Province
	4	Gunung Ambang	8,638	North Sulawesi Province
	5	Tangale	113	Gorontalo Province
	6	Mas Popaya Raja	160	Gorontalo Province
	7	Panua	45,000	Gorontalo Province
	8	Tanung Api	4,246	Central Sulawesi Province
	9	Morowali	225,000	Central Sulawesi Province
	10	Pangi Binanga	6,000	Central Sulawesi Province
	11	Pegunungan Faruhumpenai	90,000	South Sulawesi Province
	12	Kalaena	110	South Sulawesi Province
	13	Ponda-Ponda	80	South Sulawesi Province
	14	Bulu Saraung	5,690	South Sulawesi Province
	15	Bantimurung	1,000	South Sulawesi Province
	16	Karaenta	1,000	South Sulawesi Province
	17	Lamedae	500	Southeast Sulawesi Province
	18	Napabalano	9	Southeast Sulawesi Province
		Sub-Total	395,141	
Wildlife Reserve (Suaka Margasatwa)	1	Nantu	31,215	North Sulawesi Province
	2	Gunung Manebbu-Nembu	6,500	North Sulawesi Province
	3	Karangkelang Utara dan Selatan	21,400	Gorontalo Province
	4	Pinjam/Tanjung Mantop	1,613	Central Sulawesi Province
	5	Dolongan	463	Central Sulawesi Province
	6	Pati-Patai	198	Central Sulawesi Province
	7	Lombuyan 1 & 2	3,665	Central Sulawesi Province
	8	Bangkiriang	12,500	Central Sulawesi Province
	9	Lampoko Mampie	2,000	West Sulawesi Province
	10	Komara	3,390	South Sulawesi Province
	11	Bonto Bahari	4,000	South Sulawesi Province
	12	Tanjung Peropa	38,000	Southeast Sulawesi Province
	13	Tanjung Amelengo	850	Southeast Sulawesi Province
	14	Tanjung Batikolo	5,500	Southeast Sulawesi Province
	15	Buton Utara	82,000	Southeast Sulawesi Province
		Sub-Total	213,293	
National Park (Taman Nasional)	1	Bunaken (Marine)	89,065	North Sulawesi Province
	2	Bogani Nani Wartabone	287,115	North Sulawesi/Gorontalo Province
	3	Lore Lindu	229,000	Central Sulawesi Province
	4	Taka Bonerate (Marine)	530,765	South Sulawesi Province
	5	Rawa Aopa Watumohai	105,194	Southeast Sulawesi Province
	6	Kepulauan Wkatobi (Marine)	1,390,000	Southeast Sulawesi Province
		Sub-Total	2,631,139	
Nature Recreational Park (Taman Wisata Alam)	1	Batu Angus	635	North Sulawesi Province
	2	Batu Putih	615	North Sulawesi Province
	3	Air Terjun Wera	250	Central Sulawesi Province
	4	Danau Matano	30,000	South Sulawesi Province
	5	Danau Towuti	65,000	South Sulawesi Province
	6	Nanggala 3	500	South Sulawesi Province
	7	Sidrap	500	South Sulawesi Province
	8	Lejja	1,265	South Sulawesi Province
	9	Cani Sirenrang	3,125	South Sulawesi Province
	10	Kepulauan Kapoposang	50,000	South Sulawesi Province
	11	Bantimurung	18	South Sulawesi Province
	12	Goa Patunuang	1,500	South Sulawesi Province
	13	Malino	3,500	South Sulawesi Province
	14	Mangolo	5,200	Southeast Sulawesi Province
	15	Tirita Rimba	500	Southeast Sulawesi Province
	16	Teluk Lasolo	81,800	Southeast Sulawesi Province
		Sub-Total	244,408	
Hunting Game Reserve (Taman Buru)	1	Landusa Tomata	5,000	Central Sulawesi Province
	2	Komara	4,610	South Sulawesi Province
		Sub-Total	9,610	
Grand Forest Park (Taman Hutan Raya)	1	Palu	8,100	Central Sulawesi Province
	2	Murhum	8,146	South Sulawesi Province
		Sub-Total	16,246	
		Total	3,509,837	

(5) Basic Data and Regional Development Plans

As much as possible, the JICA Study Team will collect the following information as part of the additional preliminary survey data.

Table 9.4.5 Information to be Collected

Type	Name	Source
Basic	Meteorology	Each Province
Plan	Natural Conservation Provincial Plan	Each Province
	Provincial Agricultural Plan	Each Province
	Provincial Fishery Plan	Each Province
	Provincial Electrification Plan	Each Province
	Provincial Commercial and Information Plan	Each Province
	Provincial Industrial and Mining Plan	Each Province
	Provincial Education Plan	Each Province
	Provincial Public Health Plan	Each Province
	Provincial Tourism Plan	Each Province
Environment	Habitat Map of Selected RDB Species	Forest Dep. of Each Province
	Pollution data	BAPEDALDA of Each Province
Social	Ethnic group maps	Each Province
	Cultural heritage	Each Province

9.4.2 Final Identification of Evaluation Items and Indices

After collecting all relevant data and information, the evaluation items and indices will be finalized in order to conduct a multicriteria analysis.

Through the workshop held last 6 March, 2007, the importance of social evaluation items, such as education, health, and poverty reduction, was highlighted. It has been widely accepted that improvements in roads have significant effects on poverty reduction at the household, village, and community levels because they improve access to a wide range of infrastructures such as health care, education facilities, and the availability of information and communications. There are empirical evidences that also show that a reliable transport system is particularly important in enabling women to participate in social and economic activities outside their communities. The evaluation items and indices will be finalized taking these factors into account.

9.4.3 Subsequent Activities for the SEA

After a clear-cut information on the proposed Master Plan is provided, subsequent activities for the strategic environmental assessment will include as the following: (1) finalization of evaluation items, (2) impact assessment, (3) conduct of the multicriteria analysis, (4) preparation of mitigation plan, and, (5) preparation of the SEA report.