

**National Biodiversity Strategy
and Action Plan 2015-2020**

Final Draft



The Republic of the Union of Myanmar
Ministry of Environmental Conservation and Forestry

NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN
(2015-2020)

Prepared by

FOREST DEPARTMENT, CONSULTED BY INTERNATIONAL UNION FOR
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Preface

Biodiversity underpins a range of ecosystem services, which are central for the sustainable development of human being. In addition, biodiversity is the integral part of the stability of climate. The Republic of the Union of Myanmar is proud of its biodiversity richness and of the way Myanmar have managed this resource for centuries. However, biodiversity is losing due to several means such as unsustainable land use practices, unplanned and uncoordinated development, and loss of biodiversity leads to degradation and deterioration of ecosystem services. Consequently, we are facing several challenges such as climate change, water scarcity, decline of agricultural productivity, insecure energy, and so on, and that are threatening life support system. In 2011, the National Biodiversity Strategy and Action Plan was developed, and the Government of the Republic of Myanmar adopted it.

The 2011 NBSAP served as the national guiding framework for biodiversity conservation, management and utilization in a sustainable manner, we have made some progresses in biodiversity conservation. However, **it is now time** to revise the 2011 NBSAP under the given country's continued population increase, rapid industrialization, increased consumption of and demand for natural resources for food production and trade, and increased energy consumption.

In this context, NBSAP (2015-2020) is prepared to provide a strategic framework for the conservation of Myanmar's biodiversity to address new and emerging challenges under the political, economic and social reform in Myanmar, as well as to take into account the new opportunities, and also to align with CBD's Strategic Plan for Biodiversity 2011-2020 and Aichi Biodiversity Targets.

NBSAP (2015-2020) provides a comprehensive account of the country's biodiversity; identifies the threats to biodiversity; describes the key efforts, achievements and gaps in the management of biodiversity; presents strategic approaches, theme-specific strategies and associated priorities for actions; and outlines the implementation arrangement. The strategies and priority actions take into consideration of the national needs in terms of conservation, sustainable use of its components and equitable sharing of benefits. The strategy will be implemented in collaboration and partnership with all relevant stakeholders. I believe that the document like this will attract the attention of both national stakeholders as well as of the global community.

H.E. U Win Tun
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Ministry of Environmental Conservation and Forestry
Chairman, Environmental Conservation Committee
The Republic of the Union of Myanmar

Executive Summary

[REQUEST TO IUCN]

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Acronyms and Abbreviations

AAC	Annual Allowable Cut
ABS	Access and Benefits Sharing
ACB	ASEAN Centre for Biodiversity
ADB	Asia Development
ASAP	Asian Species Action Partnership
ASEAN-WEN	ASEAN Wildlife Enforcement Network
BANCA	Biodiversity and Nature Conservation Association
BBOP	Business and Biodiversity Offset Programme
BET	Business Ecosystems Training
BIOFIN	Biodiversity Finance Initiative
BOBLME	Bay of Bengal Large Marine Ecosystem
CAS	California Academy of Sciences
CBD	Convention on Biological Diversity
CFIs	Community Forestry Instructions
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CFiUGs	Community Fishery User Groups
CR	Critically Endangered
DAR	Department of Agricultural Research
DD	Data Deficient
DMDF	Dry Mixed Deciduous Forest
DOF	Department of Fisheries
DZGD	Dry Zone Greening Department
ECC	Environmental Conservation Committee
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
EIA	Environmental Impact Assessment
EISAs	Environmental and Social Impact Assessments
EITI	Extractive Industries Transparency Initiative
EN	Endangered

Eps	The Equator Principles
ETIS	Elephant Trade Information System
FD	Forest Department
FDI	Foreign Direct Investment
FFI	Fauna & Flora International
FoW	Friends of Wildlife
FPIC	Free, Prior, and Informed Consent
FRI	Forest Research Institute
GAD	General Administration Department
GDP	Gross Domestic Product
GEF	Global Environment Fund
GFW	Global Forest Watch
GMS	Greater Mekong Subregion
GPFLR	Global Partnership on Forest and Landscape Restoration
HCVF	High conservation value forest
IAS	Invasive Alien Species
IBCAS	Institute of Botany, Chinese Academy of Sciences
ICCAs	Indigenous and Community Conserved Areas
IRRI	International Rice Research Institute
ITPGR	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
Izs	Development at industrial zones
KBAs	Key Biodiversity Areas
LMMA	Locally-Managed Marine Areas
MBK	Makino Botanical Garden
MEAs	multilateral environmental agreements
METT	Management Effectiveness Tracking Tool
MFF	Mangroves For the Future
MIC	Myanmar Investment Commission
MIKE	Monitoring the Illegal Killing of Elephants

MLFRD	Ministry of Livestock, Fisheries and Rural Development Ministry of Mining
MNPED	Ministry of National Planning and Economic Development
MOAI	Ministry of Agriculture and Irrigation
MOECAF	Ministry of Environmental Conservation and Forestry
MOEd	Ministry of Education
MOHA	Ministry of Home Affairs
MOT	Ministry of Transport
MRTV	Myanmar Radio and Television
MSY	Maximum Sustained Yield
MTE	Myanmar Timber Enterprise
NBC	National Committee on Biodiversity
NBSAP	National Biodiversity Strategies and Action Plan
NCNPP	Nature Conservation National Park Project
NECC	National Environmental Conservation Committee
NEQG	National Environmental Quality (Emissions) Guidelines
NEQS	National Environmental Quality Standards
NIBR	National Institute of Biological Resources
NMFC	Northern Mountain Forest Complex
NSDS	National Sustainable Development Strategy
NTFP	Non-Timber Forest Products
NWCD	Nature and Wildlife Conservation Division
PAs	Protected Areas
PES	Payments for Ecosystem Services
PFE	Permanent Forest Estate
PGR	plant genetic resources
Ramsar Convention	Convention on Wetlands of International Importance especially as Waterfowl Habitat
REDD+	Reducing Emissions from Deforestation and Forest Degradation-plus
SEA	Sectoral Strategic Environmental Assessments
SEZ	Special Economic Zones
SIA	Social Impact Assessment

SLRD	Settlement and Land Records Department
SMART	The Spatial Monitoring and Reporting Tool
TSA	Turtle Survival Alliance
UF	Unclassified Forest
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNDRIP	UN Declaration on the Rights of Indigenous People
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VU	Vulnerable
WCS	Wildlife Conservation Society
WHC	World Heritage Convention
WHS	World Heritage Site
XTBG	Xishuangbanna Tropical Botanical Garden

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Chapter 1 Introduction

1.1 A brief back ground

Myanmar is the largest country in mainland South-east Asia with a land area of 676,577 km², bordered by Bangladesh and India to the northwest, the People's Republic of China to the northeast and the Lao People's Democratic Republic and Thailand to the southeast. The Bay of Bengal and Andaman Sea lie to the south and west. More than 40% of the Myanmar is mountainous. Prominent mountain chains include the Eastern Himalayan, Chin Hills, Western Plateau, Bago Yoma, Eastern Plateau and Taninthayi Range. There are many rivers in Myanmar, and the most important are Ayeyawady, Thanlwin, Chindwin, Sittoung and Kaladan. There are three seasons in Myanmar: wet (from mid-May to mid-October), cold (from early November to late February) and dry (from March to mid-May). Nevertheless, temperature, precipitation and humidity are relatively varied from one region to another, for example, the coastal regions receive about 5,000 mm of rain annually while central Myanmar receives only 500-750 mm of rain (Figure 1).

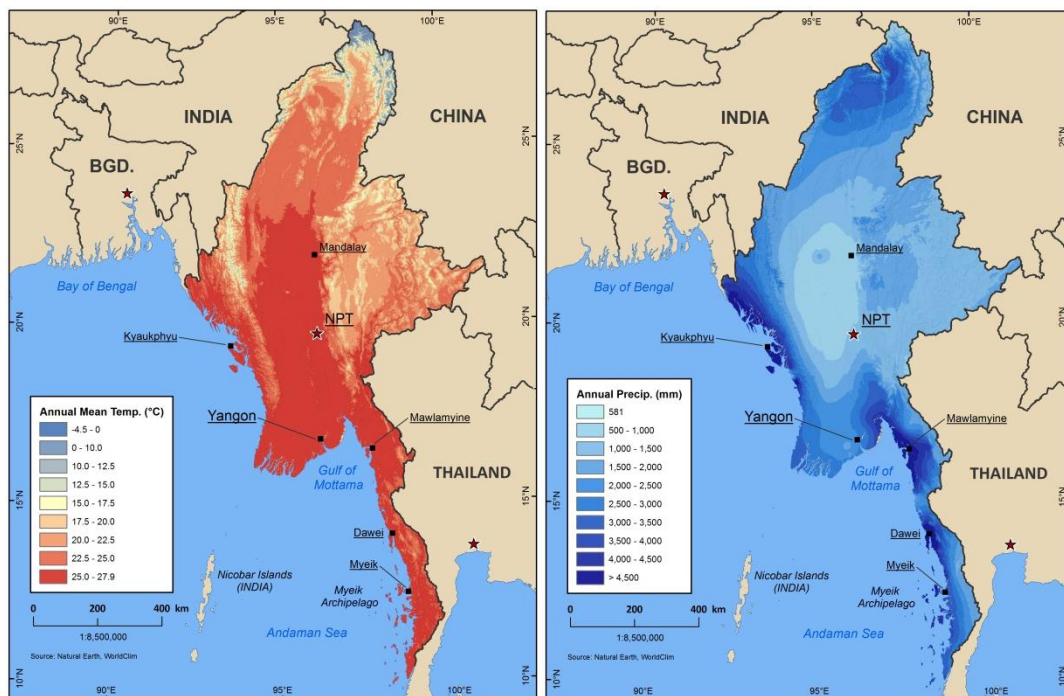


Figure 1. Annual Mean Temperature and Annual Precipitation of Myanmar.

The diverse topography, rivers, and varying climatic conditions, create numerous different ecosystems and support an incredibly wide range of associated species.

1.2 Biodiversity Conservation History of Myanmar

All forest land is owned by the State and is legally classified as either reserved forests, protected public forests, protected areas or unclassified forests. So far more than 20 million ha of forest area (approximately 30% of the country's total land area) are classified as protected areas (i.e.,

conservation areas), reserved forests (i.e. production forests), or protected public forests (local natural resource supply areas) (Table 1).

Conservation of natural resources has been a feature of government policy in Myanmar for nearly a century. The first protected area was established in 1920, and timber harvests were managed following long term management plans for much of Myanmar's early history. Modern conservation efforts are rooted in the early 1980s. Between 1981 and 1984, the Nature Conservation National Park Project (NCNPP) was launched under the joint implementation of the United Nations Development Program (UNDP) and the government of Myanmar. During the NCNPP, the Ministry of Environmental Conservation and Forestry (MOECAF) established the Nature and Wildlife Conservation Division (NWCD), which is responsible for nature conservation and PAs. Since then, the establishment of PAs has increased. Until 1996 protected areas covered <1 % of the total land with areas ranging in size from 0.47 km² to 2,150 km². Starting in the mid-1990s, establishment of protected areas shifted from a focus on protection of certain species and habitats to protection of entire landscapes and ecosystems. 15 new protected areas ranging in size from 23 km² to 11,022 km² were added between 1996 and 2014 (Figure 2).

Table 1. Forest areas classified as Reserved Forest, Protected Public Forest and Protected Areas.

Category	Area (km ²)	Per cent of total land area
Reserved Forests	120,236.19*	18.00
Protected Public Forests	47,492.01*	6.05
Protected Areas	38,906.52	5.75
Total	206,634.72	29.80

* Source: Planning and Statistics Division, FD, July 2014

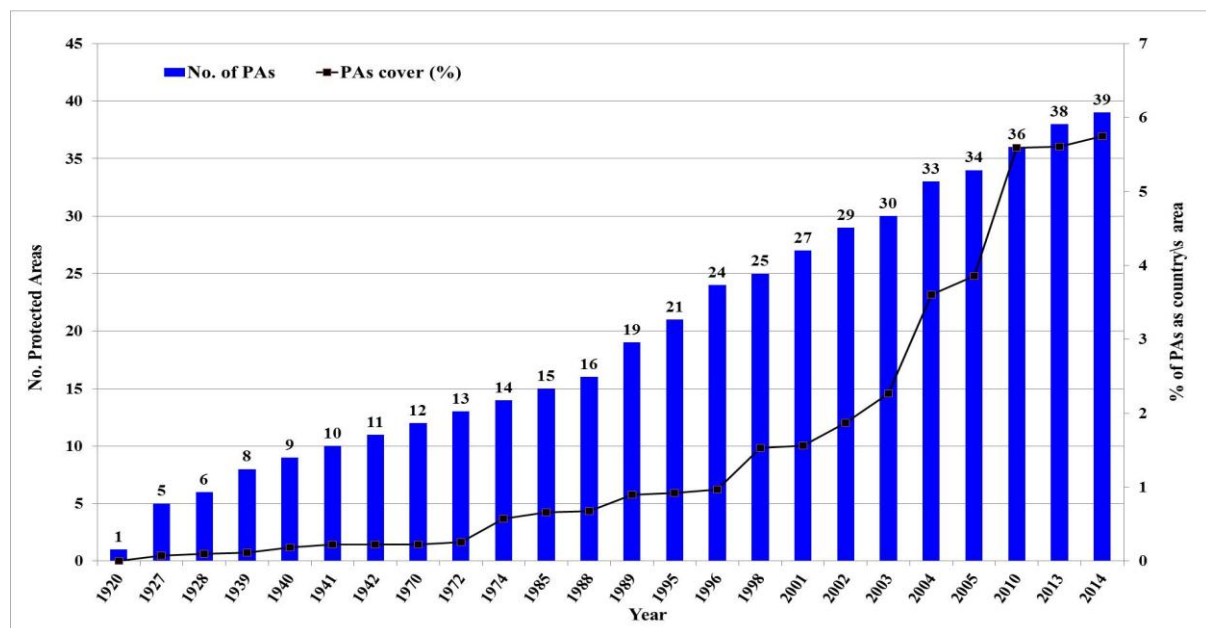


Figure 2. Cumulative area protected between 1920 and 2014.

Among the 39 PAs, seven PAs have been recognized as ASEAN Heritage Parks (AHPs) (Figure 3). The seven AHPs are Hkakaborazi National Park, Indawgyi Lake Wildlife Sanctuary, Alaungdaw Kathapa National Park, Inlay Lake Wildlife Sanctuary, Meinmahla Kyun Wildlife Sanctuary, Lampi Marine National Park and Natmataung National Park.

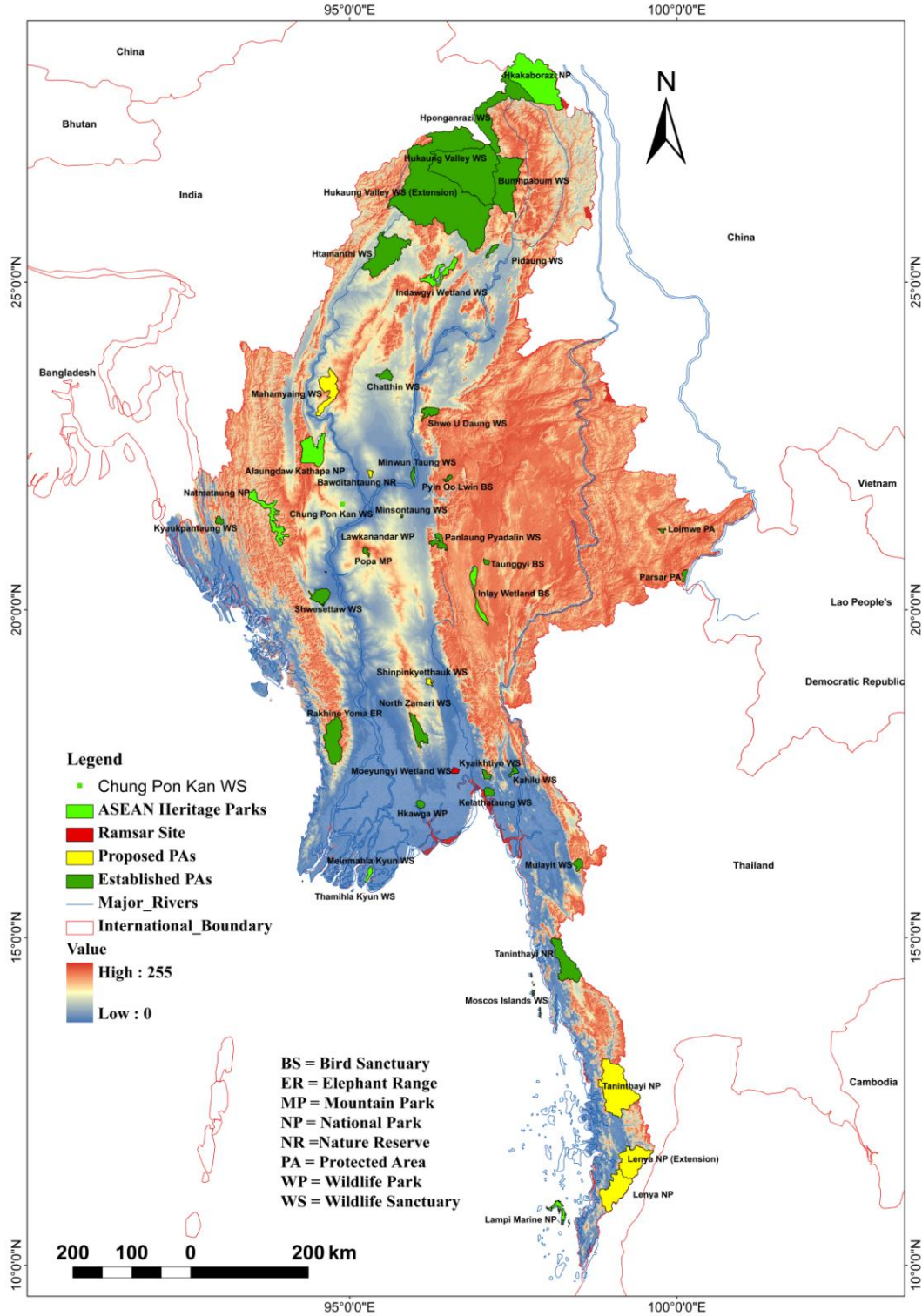


Figure 3. Location of Protected Areas and ASEAN Heritage Sites in Myanmar.

Chapter 2 Biodiversity Status and Trends in Myanmar

2.1 Overview of Biodiversity of Myanmar

2.1.1 Ecosystem diversity

Forest Ecosystem

Forests constitute the dominant ecosystem in Myanmar, with 45 per cent of the country classified as forest (FRA 2015). Further, as a result of variance in the altitudinal range, with corresponding variation in climatic conditions, the country supports a wide range of forest types and vegetation zones. Broadly speaking, forests in Myanmar can be categorized into the types shown in Figure 4. Moreover, one of the largest pure bamboo stands of the world is occurred in the Rakhine State, and it extends over 7,770 km².

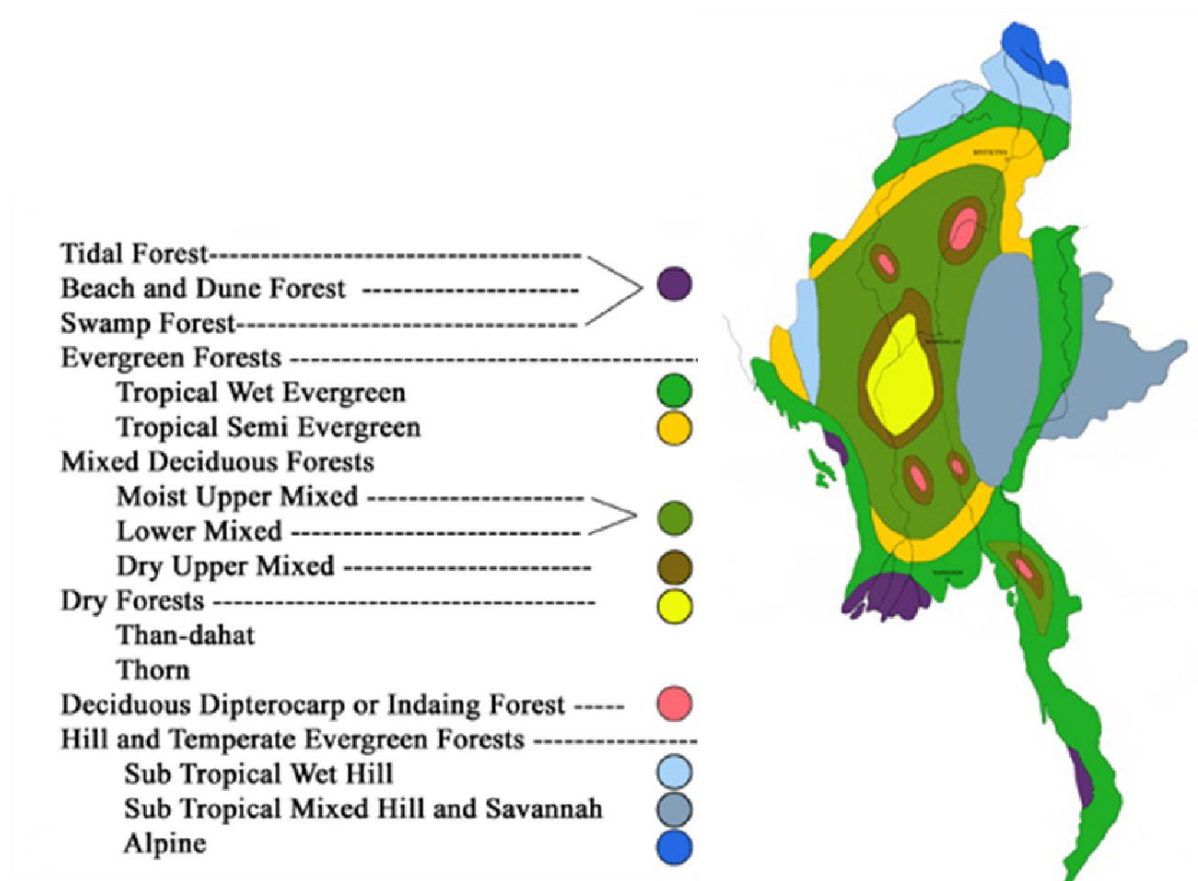


Figure 4. Major Vegetation Types of Myanmar. (Adopted from a Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar, Kress et al. 2003).

Fresh Water Ecosystem

Myanmar supports a diversity of freshwater ecosystems, from fast-flowing mountain streams to wide, slow-flowing lowland rivers, as well as lakes and other non-flowing wetlands.

Rivers

Myanmar is endowed with tremendous inland water resources in the form of rivers, streams, and springs. These major rivers are shown in Figure 5.



Figure 5. Map showing major rivers of Myanmar. (GIS data are available from Myanmar Information Management Unit-MIMU).

Major rivers include the 1,800 km-long Ayeyarwady River which arises from the confluence of the N'mai Kha and Mali Kha Rivers. The Chindwin River, with headwaters in the north western hills, is the main tributary of the Ayeyarwady. The Sittaung River starts in the hills southeast of Mandalay, and

the Thanlwin River, the last undammed river, races through deep gorges in the Shan Plateau. The Kaladan River is formed by tributaries discharging from the Arakan Mountains.

Lakes

There are large numbers of small and medium-sized lakes spread across the country. Glacial lakes in the north are crucial sources of freshwater.



Several lakes within urban areas play crucial role in fresh water support and recreation as well. The most famous inland lakes are Inlay Lake on the Shan plateau, renowned for its floating agricultural islands and leg-rowers, and Indawgyi Lake, located in the country's north, between the Ayeyawady and Chindwin Rivers.

Coastal and Marine Ecosystem

Myanmar has a large marine territory. The coastline stretches from the Naaf River, the dividing line between Bangladesh and Myanmar, to Kawthoung (Victoria Point) at the border with Thailand, 2,831 km to the south (Figure 6). Along the southern coastline the Myeik Archipelago characterized by more than 800 islands. The continental shelf covers 225,000 km², and the Exclusive Economic Zone covers 486,000 km². Coastal areas also include half a million hectares of brackish and freshwater swampland that provides essential ecological habitat for spawning and as a nursery and feeding ground for aquatic organism like fish, prawns and other aquatic fauna and flora of economic and ecological importance. Mangrove is one of the most widespread habitats in coastal regions, particularly near estuaries in Rakhine State, Taninthayi Region and Ayeyawady Region. Other coastal habitats include intertidal mud and sand flats, which are very important for migratory water birds, as

well as sand dunes and beach forest. The Gulf of Mottama is one of the largest intertidal mud flat areas of the world and is thought to be key for the survival of the critically endangered spoon-billed sandpiper.

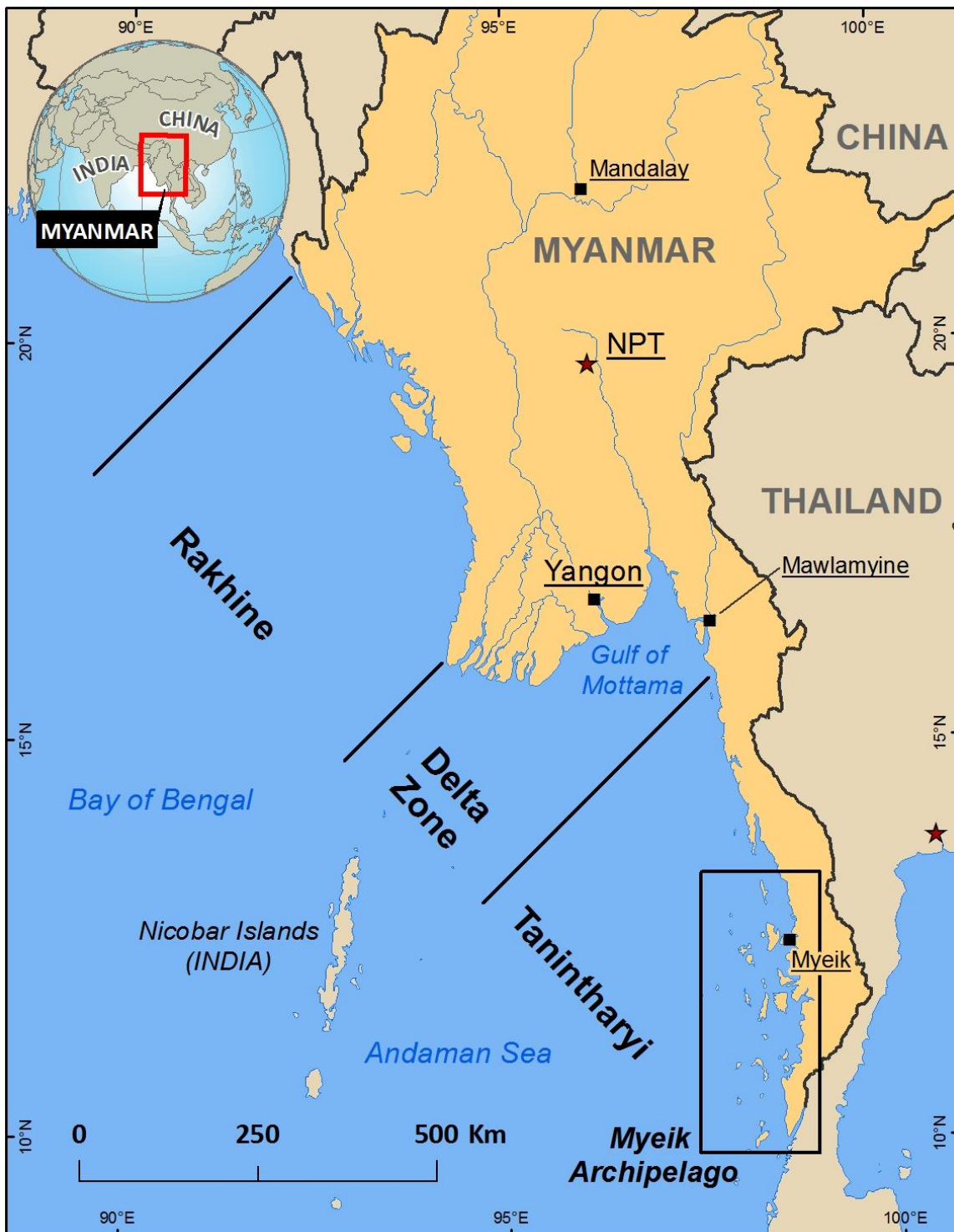


Figure 6. Map Showing Coastal Area of Myanmar.

Mountain Ecosystem

Forty-two per cent of Myanmar is mountainous areas are one of the most important landscapes in terms of biological, cultural, traditional and ethnic diversity and identity (Figure 7). These areas are

also important for the country's economy, providing most of the freshwater for the country. In addition, three-quarters of the 132 Key Biodiversity Areas (KBAs) in Myanmar are located in mountainous areas, and these areas are home of several endemic and globally important species. In the far north, 5,881m Hkakaborazi with is the highest peak as well as is the only permanently snow-capped mountain in ASEAN countries.

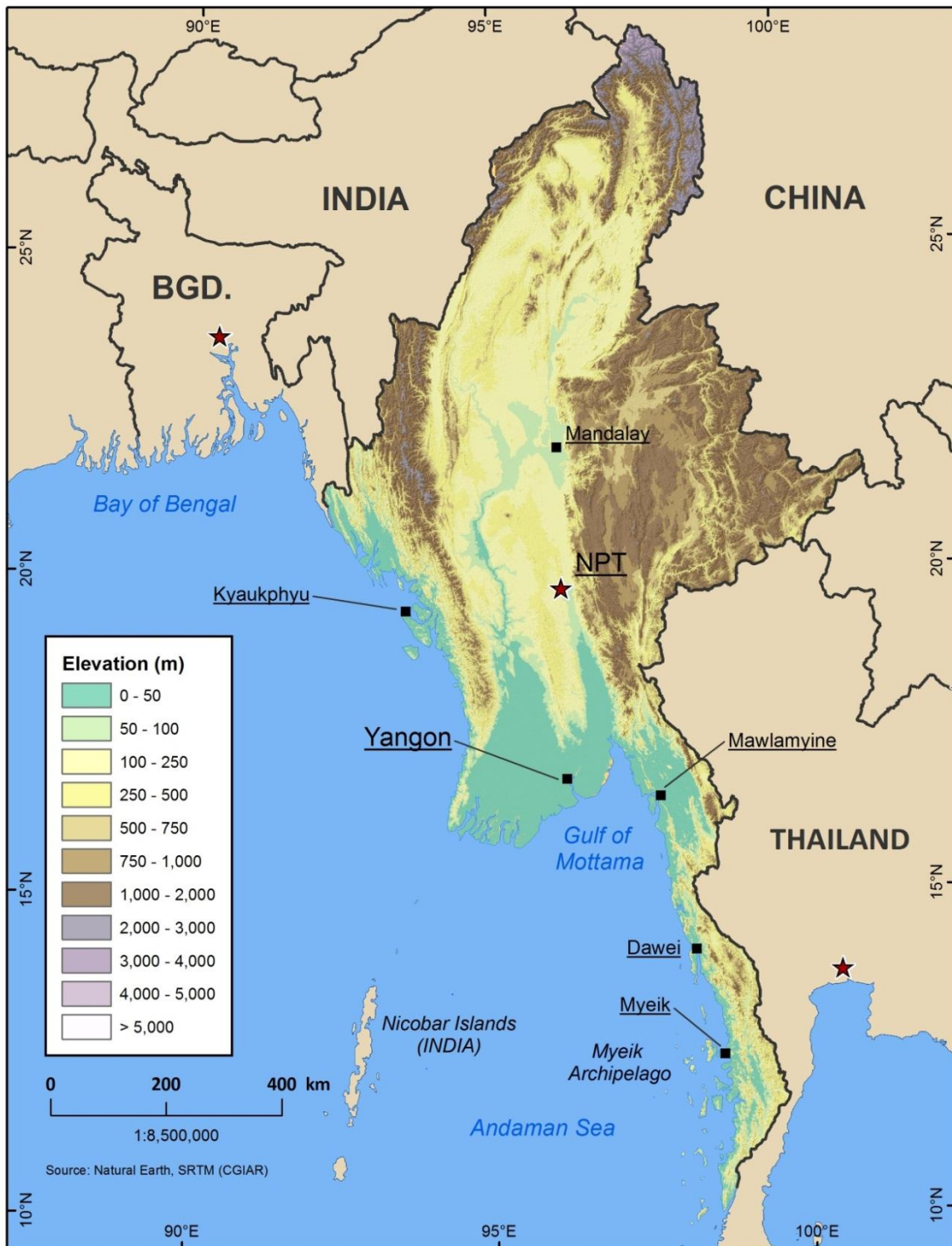


Figure 7. Elevation gradient of Myanmar.

Major mountain ranges in Myanmar are presented as below:

Eastern Himalayan Extension- Northern part of country comprised by the eastern extent of the Himalayan range

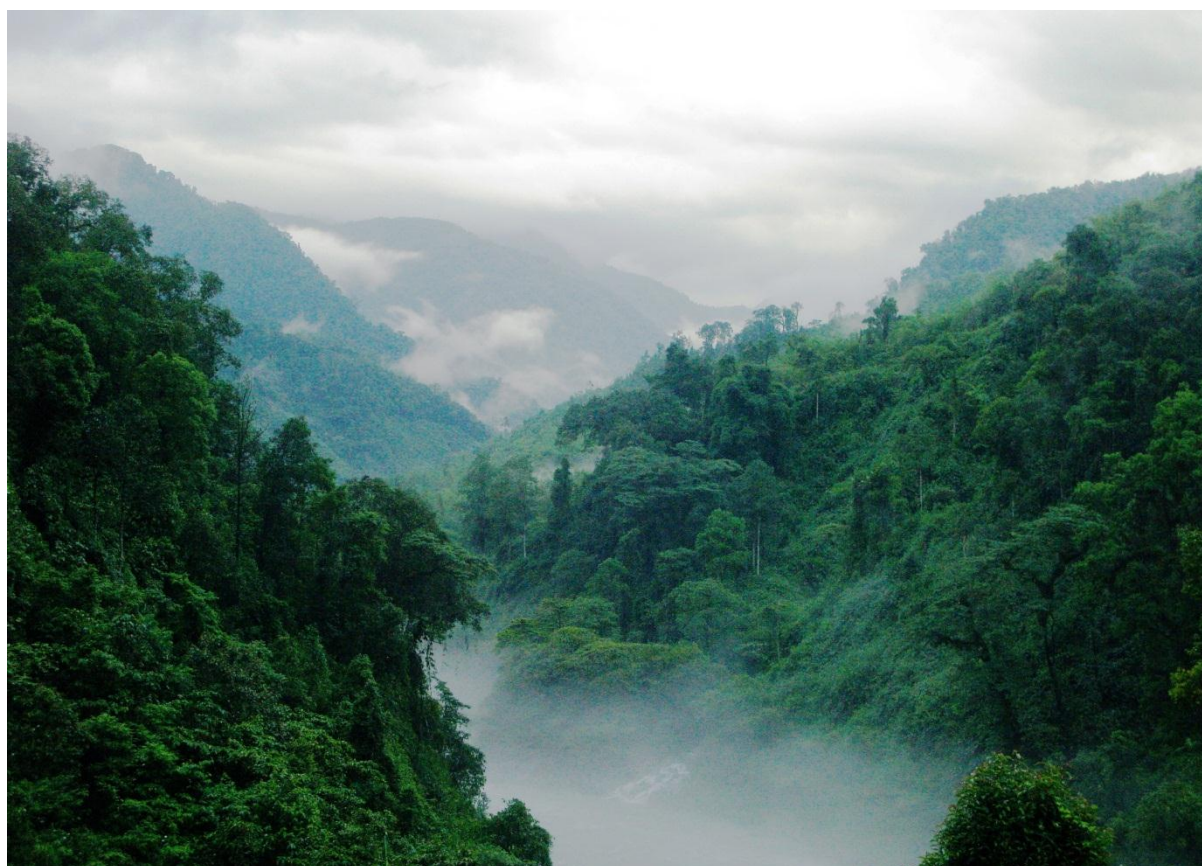
Chin Hills - Western part of Myanmar, extending to south of India

Western Plateau - Between the Ayeyawady River and Bay of Bengal

Bago Yoma - Between the Ayeyawady and Thanlwin Rivers

Eastern Plateau - North-east of country bordering with China, Laos and Thailand

Taninthayi Range - South of the country bordering with Thailand



Agricultural Ecosystem

Myanmar has eight major agro-ecological zones corresponding with topographical variation and climatic conditions (Table 2).

Table 2. Major Agro-ecological Zones of Myanmar (Adapted from FAO/WFP, 2009).

Name	Geographical description	Administrative units	Main agricultural practices
A. Bago, Kachin River-side Land	Upper Delta, Kachin plain, flat plain along the side of river Ayeyawady and Sittaung, moderate	Ayeyawady Region, Kachin State, Sagaing Region, Mandalay Region and Bago Region.	Rice, pulses, oilseeds, sugarcane, tobacco and Kaing/Kyun cultivation

Name	Geographical description	Administrative units	Main agricultural practices
	rainfall (1000 - 2500 mm).		
B. Central Dry Zone	Central dry zone, rainfall less than 1000 mm, highest temperature in summer, flat plain, some areas with uneven topography.	Magway Region, Mandalay Region, and Sagaing Region.	Upland crops, oilseeds, pulses, rice, cotton, irrigated agriculture and Kaing/ Kyun cultivation
C. Delta and Coastal Lowland	Delta, lowland and mouth of rivers in coastal area, heavy rainfall (more than 2500 mm).	Ayeyawady Region, Yangon Region, Bago Region, Mon State, Kahyin State, Taninthayi Region and Rakhine State.	Rice, pulses, oilseeds and nipa palm
D. Kachin and Coastal Upland	Mountainous, slope land, heavy rainfall (more than 2500 mm).	Kachin State, Rakhine State, Taninthayi Region, Mon State, Kayin State, Kayah State, Yangon Region and Bago Region.	Orchard, plantation crops, fruit trees and upland agriculture
E. North, East and West Hills	Hilly areas, uneven topography, moderate to heavy rainfall, slope land	Kachin State, Chin State, and Shan State.	Upland crops, shifting cultivation and fruit trees
F. Upper, Lower Myanmar and Shan Plain	Plain, upper and lower parts outside of central dry zone, plateau.	Sagaing Region, Kachin State, Shan State, Bago Region, Magway Region, Mandalay Region and Yangon Region.	Upland crops, oilseeds, pulses, vegetable and wheat

2.1.2 Species Diversity

Wild species diversity

Plants

Because of the very wide variations in latitude, altitude and climate within the country, Myanmar supports a high diversity of habitats, and is extremely rich in plant species. The country is located at the convergence of four major floristic regions: the Indian, Malesian (Sundaic), Sino-Himalayan and Indochinese. To date, more than 18,000 plant species have been recorded in Myanmar. The flora of Myanmar consists of over 800 orchid species, 80 bamboo species and more than 800 medicinal plant species. However, there are huge research and information gaps for several species groups such as lichens, and fungi. On-going collaborative botanical exploration and research between Wildlife Conservation Society (WCS) from the USA, National Institute of Biological Resources (NIBR) from the Republic of Korea, Institute of Botany, Chinese Academy of Sciences (IBCAS) from the People's Republic of China, Xishuangbanna Tropical Botanical Garden (XTBG) from People's Republic of China, and Makino Botanical Garden (MBK) from Japan may identify more new plant species,

including endemic species, to Myanmar's flora checklists. Enhanced coordination of these efforts is required.

There are 61 globally threatened plant species known to occur in Myanmar; 16 species are assessed as Critically Endangered (CR), 24 as Endangered (EN) and 21 as Vulnerable (VU) (Table 3). *Dipterocarpaceae* (*Dipterocarpus* spp., *Hopea* spp., *Shorea* spp., etc.) is the most threatened plant family. The main threats to plant species in Myanmar are overexploitation by legal and illegal logging, habitat loss, degradation and fragmentation from expansion of commercial plantations and unsustainable land uses such as mining, shifting cultivation with short fallow periods and road expansion (WCS 2013). Reports indicate that rose wood species (Padauk, *Pterocarpus macrocarpus* and Tamalan, *Dalbergia oliveri*) and orchids are the plant species most commonly illegally trafficked in Myanmar.

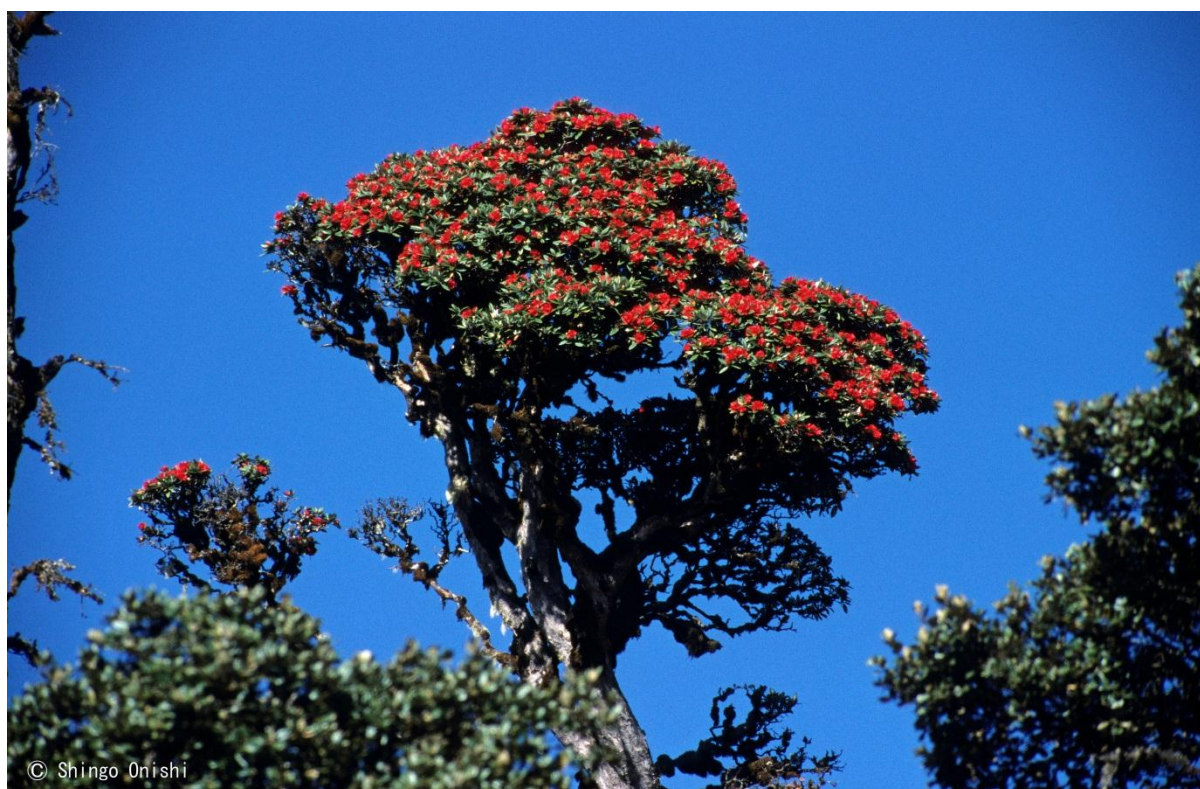


Table 3. Plant Species Found in Myanmar on the IUCN Red List of Threatened Species.

No	Scientific Name	Common Name	Category
1	<i>Anisoptera scaphula</i>		CR
2	<i>Dipterocarpus baudii</i>		CR
3	<i>Dipterocarpus dyeri</i>		CR
4	<i>Dipterocarpus gracilis</i>		CR
5	<i>Dipterocarpus grandiflorus</i>		CR
6	<i>Dipterocarpus kerrii</i>		CR
7	<i>Dipterocarpus turbinatus</i>		CR
8	<i>Hopea apiculata</i>		CR
9	<i>Hopea helferi</i>		CR

No	Scientific Name	Common Name	Category
10	<i>Hopea sangal</i>		CR
11	<i>Magnolia gustavii</i>		CR
12	<i>Nardostachys jatamansi</i>		CR
13	<i>Parashorea stellata</i>	White Seraya	CR
14	<i>Shorea farinosa</i>		CR
15	<i>Sonneratia griffithii</i>		CR
16	<i>Vatica lanceaefolia</i>		CR
17	<i>Azelia xylocarpa</i>		EN
18	<i>Anisoptera costata</i>		EN
19	<i>Cleidiocarpon laurinum</i>		EN
20	<i>Cypripedium lichiangense</i>	The Lijiang Cypripedium	EN
21	<i>Dalbergia oliveri</i>		EN
22	<i>Dipterocarpus alatus</i>		EN
23	<i>Dipterocarpus costatus</i>		EN
24	<i>Heritiera fomes</i>		EN
25	<i>Hopea ferrea</i>		EN
26	<i>Illicium griffithii</i>		EN
27	<i>Magnolia rostrata</i>		EN
28	<i>Paphiopedilum areeanum</i>		EN
29	<i>Paphiopedilum bellatulum</i>	Enchanting Paphiopedilum	EN
30	<i>Paphiopedilum charlesworthii</i>	Charlesworth Paphiopedilum	EN
31	<i>Paphiopedilum concolor</i>	One Colored Paphiopedilum	EN
32	<i>Paphiopedilum insigne</i>	Splendid Paphiopedilum	EN
33	<i>Paphiopedilum parishii</i>	Parish's Paphiopedilum	EN
34	<i>Paphiopedilum spicerianum</i>	Spicer's Paphiopedilum	EN
35	<i>Paphiopedilum wardii</i>	Ward's Paphiopedilum	EN
36	<i>Shorea gratissima</i>		EN
37	<i>Shorea henryana</i>	White Meranti	EN
38	<i>Shorea roxburghii</i>	White Meranti	EN
39	<i>Taxus wallichiana</i>	East Himalayan Yew, Himalayan Yew	EN
40	<i>Vatica cinerea</i>		EN
41	<i>Aquilaria malaccensis</i>	Agarwood, Aloewood, Eaglewood, Lign-aloes	VU
42	<i>Burretiodendron esquirolii</i>		VU
43	<i>Cayratia pedata</i>		VU
44	<i>Cephalotaxus mannii</i>	Mann's Yew Plum	VU
45	<i>Cleidiocarpon cavaleriei</i>		VU
46	<i>Curcuma candida</i>		VU
47	<i>Cycas pectinata</i>		VU
48	<i>Cycas siamensis</i>		VU
49	<i>Dipterocarpus retusus</i>		VU
50	<i>Eleiotis rottleri</i>		VU
51	<i>Halophila beccarii</i>	Ocean Turf Grass, Species code: Hb	VU
52	<i>Hopea griffithii</i>		VU

No	Scientific Name	Common Name	Category
53	<i>Hopea odorata</i>		VU
54	<i>Intsia bijuga</i>	Borneo Teak, Moluccan Ironwood	VU
55	<i>Magnolia nitida</i>		VU
56	<i>Paphiopedilum hirsutissimum</i>	Shaggy Paphiopedilum	VU
57	<i>Paphiopedilum villosum</i>	Villose Paphiopedilum	VU
58	<i>Picea brachytyla</i>	Sargent's Spruce	VU
59	<i>Picea farreri</i>	Farrer's Spruce	VU
60	<i>Pterocarpus indicus</i>	Amboyna Wood, Burmese Rosewood, Red Sandalwood	VU
61	<i>Taiwania cryptomerioides</i>	Coffin Tree, Taiwan Cedar, Taiwania	VU

Source: The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on **10 August 2015**.

Mammals

Nearly 300 mammal species have been recorded in Myanmar, but a number of these have not been sighted in recent years, including the Sumatran rhinoceros (*Dicerorhinus sumatrensis*), Javan rhinoceros (*Rhinoceros sondaicus*) and Indian water buffalo (*Bubalus arnee*). Myanmar is home to the western hoolock gibbon (*Hoolock hoolock*), eastern hoolock gibbon (*Hoolock leuconedys*) and Myanmar snub-nosed monkey *Rhinopithecus strykeri*, discovered in the mountains near the Chinese border in north eastern Kachin State in 2010.

There are 47 globally threatened mammal species in Myanmar; five Critically Endangered species, 17 Endangered and 25 Vulnerable (Table 4).



Two large mammals, the Asian elephant (*Elephas maximus*) and tiger (*Panthera tigris*) are threatened mainly due to illegal trafficking and their populations are thought to be decreasing. On the other hand, camera trap surveys have shown that Htamathi Wildlife Sanctuary, and Proposed Taninthayi, Lenya and Lenya (extension) National Parks are home to a considerable number of tigers and prey species, as well as the Asian elephant. Black musk deer (*Moschus fuscus*), sun bear (*Helarctos malayans*), Malayan pangolin (*Manis javanica*) and Chinese pangolin (*Manis pentadactyla*) are also severely threatened by illegal trafficking.

The population of the Irrawaddy dolphin (*Orcaella brevirostris*) has been decreasing mainly due to destructive fishing and the death was high in 2014. Sightings of another large aquatic mammal, the dugong (*Dugong dugon*), are relatively few, and mainly reported in the Myeik Archipelago.

Myanmar is also home of five endemic mammal species such as Anthony's pipistrelle (*Hypsugo anthonyi*), Joffre's pipistrelle (*Hypsugo joffrei*), Myanmar pipistrelle (*Hypsugo lophurus*), Popa soft-furred Rat (*Millardia kathleenae*) and Eld's deer (*Rucervus eldii*).

Table 4. Mammal Species Found in Myanmar on the IUCN Red List of Threatened Species.

No	Scientific Name	Common Name	Category
1	<i>Dicerorhinus sumatrensis</i>	Sumatran Rhinoceros	CR
2	<i>Manis javanica</i>	Sunda Pangolin, Malayan Pangolin	CR
3	<i>Manis pentadactyla</i>	Chinese Pangolin	CR
4	<i>Rhinoceros sondaicus</i>	Javan Rhinoceros	CR
5	<i>Rhinopithecus strykeri</i>	Myanmar Snub-nosed Monkey	CR
6	<i>Balaenoptera musculus</i>	Blue Whale, Sibbold's Rorqual, Sulphur-bottom Whale, Pygmy Blue Whale	EN
7	<i>Bos javanicus</i>	Banteng, Tembadau	EN
8	<i>Bubalus arnee</i>	Asian Buffalo, Asiatic Buffalo, Indian Buffalo, Indian Water Buffalo, Water Buffalo, Wild Asian Buffalo, Wild Water Buffalo	EN
9	<i>Cuon alpinus</i>	Dhole, Red Dog, Indian Wild Dog, Asiatic Wild Dog	EN
10	<i>Elephas maximus</i>	Asian Elephant, Indian Elephant	EN
11	<i>Hapalomys longicaudatus</i>	Greater Marmoset Rat, Marmoset Rat	EN
12	<i>Hoolock hoolock</i>	Western Hoolock Gibbon, Hoolock Gibbon, Western Hoolock	EN
13	<i>Hylobates lar</i>	Lar Gibbon, White-handed Gibbon, Common Gibbon	EN
14	<i>Lutra sumatrana</i>	Hairy-nosed Otter	EN
15	<i>Moschus fuscus</i>	Black Musk Deer, Dusky Musk Deer	EN
16	<i>Panthera tigris</i>	Tiger	EN
17	<i>Prionailurus viverrinus</i>	Fishing Cat	EN
18	<i>Rucervus eldii</i>	Eld's Deer, Thamin, Brow-antlered Deer	EN
19	<i>Tapirus indicus</i>	Asian Tapir, Indian Tapir, Malayan Tapir, Malay Tapir	EN
20	<i>Trachypithecus germaini</i>	Indochinese Lutung, Germain's Langur, Germain's Silver Langur, Indochinese Silvered Langur	EN
21	<i>Trachypithecus phayrei</i>	Phayre's Leaf-monkey, Phayre's Leaf Monkey, Phayre's Langur	EN
22	<i>Trachypithecus</i>	Shortridge's Langur, Shortridge's Capped Langur	EN

No	Scientific Name	Common Name	Category
	<i>shortridgei</i>		
23	<i>Ailurus fulgens</i>	Red Panda, Lesser Panda, Red Cat-bear	VU
24	<i>Aonyx cinereus</i>	Asian Small-clawed Otter, Small-clawed Otter, Oriental Small-clawed Otter	VU
25	<i>Arctictis binturong</i>	Binturong, Bearcat	VU
26	<i>Bos gaurus</i>	Gaur, Indian Bison	VU
27	<i>Budorcas taxicolor</i>	Takin	VU
28	<i>Craseonycteris thonglongyai</i>	Hog-nosed Bat, Bumblebee Bat, Kitti's Hog-nosed Bat	VU
29	<i>Helarctos malayanus</i>	Sun Bear, Malayan Sun Bear	VU
30	<i>Hemigalus derbyanus</i>	Banded Civet, Banded Palm Civet	VU
31	<i>Hoolock leuconedys</i>	Eastern Hoolock Gibbon, Eastern Hoolock	VU
32	<i>Lutrogale perspicillata</i>	Smooth-coated Otter, Indian Smooth-coated Otter	VU
33	<i>Macaca arctoides</i>	Stump-tailed Macaque, Stumptail Macaque, Bear Macaque	VU
34	<i>Macaca leonina</i>	Northern Pig-tailed Macaque, Northern Pigtail Macaque	VU
35	<i>Naemorhedus baileyi</i>	Red Goral	VU
36	<i>Naemorhedus griseus</i>	Chinese Goral, Grey Long-tailed Goral	VU
37	<i>Neofelis nebulosa</i>	Clouded Leopard	VU
38	<i>Neophocaena phocaenoides</i>	Indo-Pacific Finless Porpoise	VU
39	<i>Nycticebus bengalensis</i>	Bengal Slow Loris, Bengal Loris, Northern Slow Loris	VU
40	<i>Orcaella brevirostris</i>	Irrawaddy Dolphin, Snubfin Dolphin	VU
41	<i>Pardofelis marmorata</i>	Marbled Cat	VU
42	<i>Petinomys setosus</i>	Temminck's Flying Squirrel	VU
43	<i>Petinomys vordermanni</i>	Vordermann's Flying Squirrel	VU
44	<i>Rusa unicolor</i>	Sambar, Sambar Deer	VU
45	<i>Trachypithecus pileatus</i>	Capped Langur, Capped Leaf Monkey, Capped Monkey, Bonneted Langur	VU
46	<i>Ursus thibetanus</i>	Asiatic Black Bear, Himalayan Black Bear	VU
47	<i>Viverra zibetha</i>	Large-spotted Civet	VU

Source: The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on 10 August 2015.

Avifauna

Myanmar is recognized as being one of the countries with the greatest diversity of bird species in South-east Asia, with 1,096 avifauna species recorded, including 6 endemic species and 46 bird species listed on the IUCN Red List of Threatened species.

Bird species: endemic to Myanmar are Jerdon's minivet (*Pericrocotus albifrons*), hooded treepie (*Crypsirina cucullata*), Burmese bush lark (*Mirafra microptera*), Burmese bushtit (*Aegithalos sharpie*), white-throated babbler (*Turdoides gularis*) and white-browed nuthatch (*Sitta victoriae*).

Some of the Myanmar's avifauna species have not been recorded for decades, however, field surveys also often record species which have not been seen for decades; for example Jerdon's babbler

(*Chrysomma altirostre*), which was rediscovered in grassland near Yangon in 2014, the first record in 73 years.



Of the 45 globally threatened bird species in Myanmar, eight are listed as Critically Endangered (Table 5). Myanmar is home of important populations of five critically endangered species. These include the white-bellied heron (*Ardea insignis*), spoon-billed sandpiper (*Eurynorhynchus pygmeus*), white-rumped vulture (*Gyps bengalensis*), slender-billed vulture (*Gyps tenuirostris*) and red-headed vulture (*Sarcogyps calvus*). Myanmar is home to the bulk of the world's population of Gurney's pitta (*Pitta gurneyi*), an endangered species, which, outside of Myanmar, is only known from very small populations in southern Thailand.

Table 5. Bird Species Found in Myanmar on the IUCN Red List of Threatened Species.

No	Scientific Name	Common Name	Category
1	<i>Ardea insignis</i>	White-bellied Heron, Imperial Heron	CR
2	<i>Aythya baeri</i>	Baer's Pochard	CR
3	<i>Calidris pygmaea</i>	Spoon-billed Sandpiper, Spoonbill Sandpiper	CR
4	<i>Gyps bengalensis</i>	White-rumped Vulture, Asian White-backed Vulture, White-backed Vulture, Oriental White-backed Vulture	CR
5	<i>Gyps tenuirostris</i>	Slender-billed Vulture	CR
6	<i>Pseudibis davisoni</i>	White-shouldered Ibis, Black Ibis	CR
7	<i>Rhodonessa caryophyllacea</i>	Pink-headed Duck	CR
8	<i>Sarcogyps calvus</i>	Red-headed Vulture, Indian Black Vulture, Pondicherry Vulture	CR
9	<i>Asarcornis scutulata</i>	White-winged Duck, White-winged Wood Duck	EN
10	<i>Ciconia stormi</i>	Storm's Stork	EN

No	Scientific Name	Common Name	Category
11	<i>Emberiza aureola</i>	Yellow-breasted Bunting	EN
12	<i>Heliopais personatus</i>	Masked Finfoot, Asian Finfoot	EN
13	<i>Leptoptilos dubius</i>	Greater Adjutant	EN
14	<i>Mergus squamatus</i>	Scaly-sided Merganser, Chinese Merganser	EN
15	<i>Pavo muticus</i>	Green Peafowl, Green-necked Peafowl	EN
16	<i>Pitta gurneyi</i>	Gurney's Pitta	EN
17	<i>Sitta magna</i>	Giant Nuthatch	EN
18	<i>Sitta victoriae</i>	White-browed Nuthatch	EN
19	<i>Sterna acuticauda</i>	Black-bellied Tern	EN
20	<i>Tringa guttifer</i>	Spotted Greenshank, Nordmann's Greenshank, Nordmann's Greenshank	EN
21	<i>Aceros nipalensis</i>	Rufous-necked Hornbill, Rufous-cheeked Hornbill	VU
22	<i>Antigone antigone</i>	Sarus Crane	VU
23	<i>Aquila heliaca</i>	Eastern Imperial Eagle, Imperial Eagle, Asian Imperial Eagle	VU
24	<i>Arborophila charltonii</i>	Chestnut-necklaced Partridge, Scaly-breasted Partridge, Chestnut-breasted Tree-partridge	VU
25	<i>Calidris tenuirostris</i>	Great Knot	VU
26	<i>Chrysomma altirostre</i>	Jerdon's Babbler	VU
27	<i>Ciconia episcopus</i>	Asian Woollyneck, Woolly-necked Stork	VU
28	<i>Clanga clanga</i>	Greater Spotted Eagle, Spotted Eagle	VU
29	<i>Clanga hastata</i>	Indian Spotted Eagle	VU
30	<i>Columba punicea</i>	Pale-capped Pigeon, Purple Wood-pigeon	VU
31	<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle, Pallas's Fish Eagle, Band-tailed Fish-eagle, Pallas's Sea-Eagle	VU
32	<i>Leptoptilos javanicus</i>	Lesser Adjutant	VU
33	<i>Lophophorus sclateri</i>	Sclater's Monal, Crestless Monal	VU
34	<i>Megapodius nicobariensis</i>	Nicobar Scrubfowl, Nicobar Scrubfowl	VU
35	<i>Mulleripicus pulverulentus</i>	Great Slaty Woodpecker	VU
36	<i>Nisaetus nanus</i>	Wallace's Hawk-eagle, Wallace's Hawk-Eagle	VU
37	<i>Otus sagittatus</i>	White-fronted Scops-owl, White-fronted Scops-Owl, White-fronted Scops Owl	VU
38	<i>Pycnonotus zeylanicus</i>	Straw-headed Bulbul, Straw-crowned Bulbul	VU
39	<i>Rhyticeros subruficollis</i>	Plain-pouched Hornbill	VU
40	<i>Rynchops albicollis</i>	Indian Skimmer	VU
41	<i>Sitta formosa</i>	Beautiful Nuthatch	VU
42	<i>Stachyris oglei</i>	Snowy-throated Babbler, Austen's Babbler	VU
43	<i>Tragopan blythii</i>	Blyth's Tragopan, Grey-bellied Tragopan	VU
44	<i>Treron capellei</i>	Large Green-pigeon, Large Green Pigeon, Large Green-Pigeon	VU
45	<i>Turdus feae</i>	Grey-sided Thrush	VU

Source: The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on **10 August 2015**.



Herpetofauna

A herpetofauna survey, jointly conducted between 1999 and 2010 by the Forest Department (FD) and California Academy of Sciences (CAS), USA, revealed that Myanmar supports a very high diversity of reptile and amphibian species. The number of reptile and amphibian species recorded in Myanmar is presented in Table (6).

Table 6. Numbers of Reptile and Amphibian Species Recorded in Myanmar.

Group	Species	No.	Group	Species	No.
Reptile	Snakes	172	Amphibian	Frogs and toads	116
	Lizards	87		Caecilians	2
	Turtles and tortoises	32		Salamanders	1
	Crocodiles	4			
Total		291			119

21 reptile species and 3 amphibian species endemic to Myanmar () have been recorded, including Burmese frog-faced softshell turtle (*Chitra vandijki*), Myanmar star tortoise (*Geochelone platynota*), Rakhine forest turtle (*Heosemys depressa*), Burmese roofed turtle (*Batagur trivittata*), Myanmar flapshell turtle (*Lissemys scutata*), Burmese-eyed turtle (*Morenia ocellata*) and Burmese peacock softshell turtle (*Nilssonina formosa*).

On-going analysis of survey data from the FD-CAS Herpetofauna survey continues to identify new species. At the same time, some species, such as *Geochelone platynota*, *Batagur trivittata* and *Crocodylus siamensis*, are nearly extinct in the wild, while the status of several species including *Manouria emys*, *Manouria impressa*, *Batagur baska*, Gharial crocodile (*Gavialis gangeticus*), *Crocodylus palustris*, and *Tomistoma schlegelii* remains poorly known (WCS 2013).

Invertebrates

Invertebrates are one of the least studied taxa in Myanmar. A joint study by FD and Smithsonian Institution identified 1,197 butterflies in Myanmar (Kinyon 2004), about 12% of the global total, which makes Myanmar the fifth richest country in the world in terms of butterfly diversity. This also includes six of the rarest known butterfly species in the world (Table 7). Other invertebrate species such as insect, beetle, bee and spider are largely unknown.

Table 7. Rare Butterfly Species Found in Myanmar.

No	Common Name	Scientific Name
1	The Apollo	<i>Parnassius imperator</i>
2	The Common Birdwing	<i>Troides helena cerberus</i>
3	The Golden Birdwing	<i>Troides aeacus praecox</i>
4	The Bhutan Glory	<i>Bhutanitis ledderdalei lidderdalei</i>
5	The Kaiser	<i>Teinopalpus imprrialis</i>
6	The White Edge Baron White-edged Blue Baron	<i>Euthalia phemius phemius</i> (<i>Euthalia phemius</i>)

Freshwater Fish

The freshwater fish fauna of Myanmar is one of the least studied in Southeast Asia (Kullander *et al.* 2004). Nevertheless, Myanmar is already known to be rich in freshwater fish species, with 520 species recorded, including a number of endemic species (Fish Database, <http://www.fishbase.org/search.php>, country profile). Recent studies conducted by FD and Fauna & Flora International (FFI) revealed some species new to science (*Lepidocephalichthys* spp., *Acanthocobitis* spp. and *Physoschistura* spp. from Indawgyi Lake). Freshwater endemic fish species in Myanmar are presented in Table 8. One of the notable areas for endemic freshwater fish in Myanmar is Inlay Lake which supports 9 endemic fish species in 3 endemic genera (WWF; http://www.wwf.panda.org/about_our_earth/ecoregions/lake_inle.cfm).

Table 8. Endemic Freshwater Fish Species in Myanmar.

No.	Species	No.	Species	No.	Species
1	<i>Akysis pictus</i>	21	<i>Garra poecilura</i>	41	<i>Neolissochilus blythii</i>
2	<i>Akysis prashadi</i>	22	<i>Garra propulvinus</i>	42	<i>Neolissochilus compressus</i>
3	<i>Caragobius burmanicus</i>	23	<i>Garra rakhinica</i>	43	<i>Neolissochilus stevensonii</i>
4	<i>Chaca burmensis</i>	24	<i>Garra spilota</i>	44	<i>Olyra burmanica</i>
5	<i>Channa harcourtbutleri</i>	25	<i>Garra vittatula</i>	45	<i>Osteochilus sondhii</i>
6	<i>Clupisoma prateri</i>	26	<i>Gonialosa modesta</i>	46	<i>Parasphaerichthys ocellatus</i>
7	<i>Cyprinus intha</i>	27	<i>Gonialosa whiteheadi</i>	47	<i>Physoschistura brunneana</i>
8	<i>Danio choprae</i>	28	<i>Gudusia variegata</i>	48	<i>Physoschistura rivulicola</i>
9	<i>Danio erythromicron</i>	29	<i>Hemibagrus peguensis</i>	49	<i>Physoschistura shanensis</i>
10	<i>Danio nigrofasciatus</i>	30	<i>Hemibagrus variegatus</i>	50	<i>Proeutropiichthys macropthalmos</i>

No.	Species	No.	Species	No.	Species
11	<i>Devario auropurpureus</i>	31	<i>Homaloptera rupicola</i>	51	<i>Pseudolaguvia tuberculata</i>
12	<i>Devario sondhii</i>	32	<i>Ilisha novacula</i>	52	<i>Puntius burmanicus</i>
13	<i>Devario spinosus</i>	33	<i>Labeo stolizkae</i>	53	<i>Sawbwa resplendens</i>
14	<i>Esomus ahli</i>	34	<i>Macrognathus caudiocellatus</i>	54	<i>Schistura acuticephalus</i>
15	<i>Esomus altus</i>	35	<i>Mastacembelus oatesii</i>	55	<i>Sicamugil hamiltonii</i>
16	<i>Exostoma berdmorei</i>	36	<i>Microdevario gatesi</i>	56	<i>Toxotes blythii</i>
17	<i>Exostoma stuarti</i>	37	<i>Microphis dunckeri</i>	57	<i>Trichogaster labiosa</i>
18	<i>Garra flavatra</i>	38	<i>Microrasbora rubescens</i>	58	<i>Yunnanilus brevis</i>
19	<i>Garra gravelyi</i>	39	<i>Mystus leucophasis</i>		
20	<i>Garra nigricollis</i>	40	<i>Mystus rufescens</i>		

Marine fauna

Myanmar has a long coastline and large marine territory. Its marine resources play an important role in the country's development. However, species diversity of coastal and marine ecosystems is largely unknown. The initial result of a marine ecosystem survey by the Research Vessel RV Fridtjof Nansen conducted from November–December 2013 indicated that the maximum sustained yield (MSY) in Myanmar's marine territory has been significantly reduced compared to the MSY calculated in the early 1980s. The recorded marine diversity of Myanmar is presented in Table 9. With the exception of the marine fish species, the majority of the data is collected from the Myeik Archipelago.

Table 9. Marine Diversity in Myanmar.

No.	Marine diversity	Number	No.	Marine diversity	Number
1	Phytoplankton	136	6	Gastropods (molluscs)	50
2	Zooplankton	150	7	Bivalves (molluscs)	41
3	Meroplankton	47	8	Crab (crustacean)	42
4	Sea grass	11	9	Coral reef	132
5	Seaweed	38	10	Marine fish	578

Domestic Biodiversity

Crops

Plants play a vital role for the survival of human society. Plant genetic resources provide enormous potential for food security, biofuel and biopharmaceutical production. More than 60 different crops are grown in the country and they can be grouped into seven categories as follows (Myint 1989):

- Cereals – Rice, wheat, maize and millet.
- Oil seeds – Groundnut, sesame, sunflower and mustard.
- Pulses– Black gram, green gram, butter bean, red bean, pigeon pea, chickpea, cowpea and soybean, etc...
- Industrial crops – Cotton, sugar cane, tobacco, rubber and jute.
- Culinary crops – Potato, onion, chilli, vegetables and spices.
- Plantation crops – Tea, coffee, coconut, banana, oil palm, toddy palm and other fruits.
- Other crops – other crops that are not listed in the above groups.

Inter- and intraspecific genetic variations are also observed among crops sown nationwide, especially for rice, maize, sorghum, millet, sesame, groundnut, ginger, turmeric, custard apple, okra, chilli, pepper, tomato, citrus, water melon, mango, jack-fruit, banana and medicinal plants (Tun and Than 1995).

Myanmar is also home to important crop species such as rice, mango, banana and sugarcane. Wild relatives and local landraces of these cultivated crops are also found in Myanmar. According to genetic, geographical and molecular studies, Myanmar is believed to be in the center of diversity of cultivated rice, *O. sativa indica* (Londo *et al.* 2006, quoted in DAR 2011). Several wild legume species related to cultivated mung bean, black gram and azuki bean are distributed in different ecosystems of Myanmar, including coastal sandy soils, lime stone hills and high lands of Shan state (Tun and Yamaguchi 2007). These wild legume species could provide useful genes for legume crop improvement of Myanmar. Moreover, several lesser used plant species are grown and used by diverse ethnic groups in Myanmar.

Recognizing the great value of plant genetic resources (PGR) and the increasing threat of the loss of plant genetic diversity from their natural habitats and farm lands, the Seed Bank of Ministry of Agriculture and Irrigation (MOAI) has made efforts to collect and conserve the agro biodiversity of Myanmar. Currently, Seed Bank is conserving more than 12,000 accessions of important crops of Myanmar (Table 10).

Table 10. Plant Genetic Resources Conserved by the Myanmar Seed Bank.

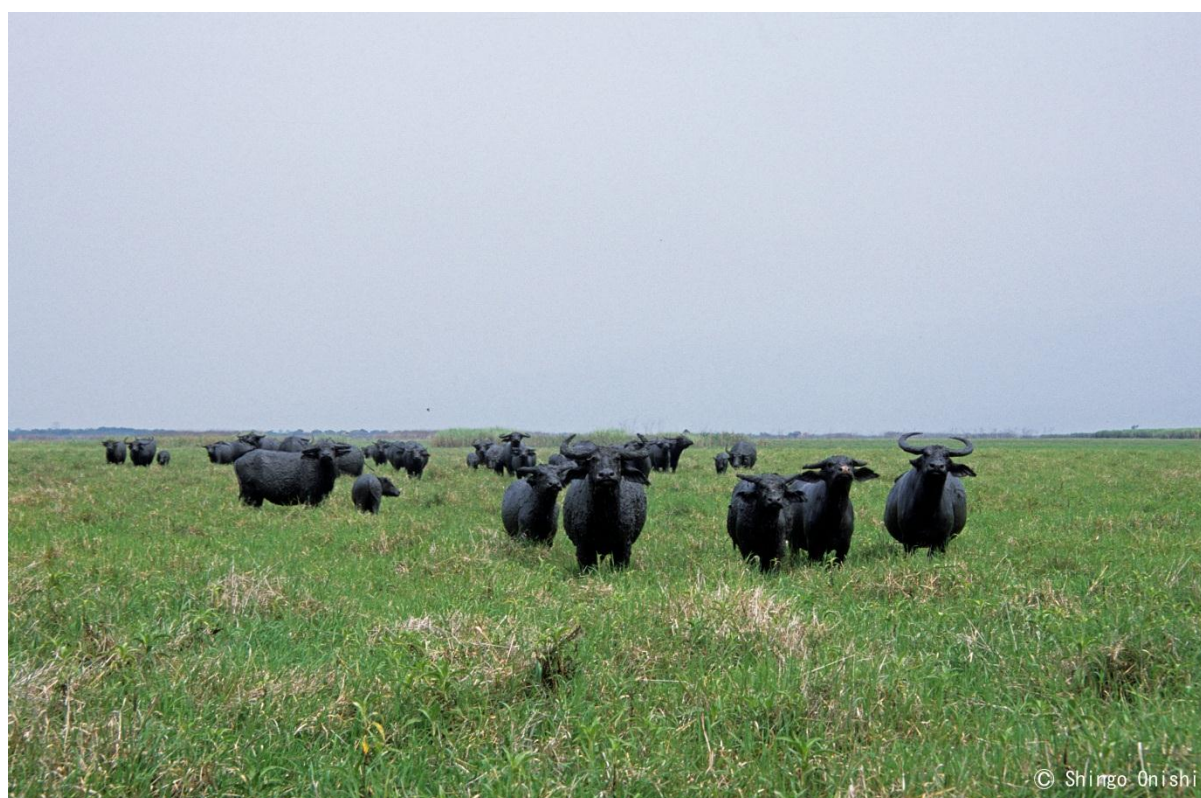
No.	Crop species	Number of accessions	No.	Crop species	Number of accessions
1	Rice	7,367	12	Maize	100
2	Wild rice	184	13	Wheat	1,607
3	Black gram	128	14	Sorghum	219
4	Chick pea	617	15	Millet	123
5	Pigeon pea	143	16	Sesame	37
6	Green gram	189	17	Groundnut	665
7	Cow pea	181	18	Niger	1
8	Soybean	80	19	Safflower	1
9	Lima bean	66	20	Jute	42
10	Kidney bean	69	21	Vegetables	109
11	Wild Vigna spp.	101	Total		12,029

Livestock

The genetic variations of livestock in Myanmar are still largely unknown. Some livestock breeds are common across the country but some are much more localized. For example, Mithun (*Bos frontalis*) is bred only in Chin State. Mithun is also known as the “Cattle of Hilly Regions”, and it plays an important role in the day to day socio-economic life of the local tribal population, but has been gradually decreasing due to pressure for meat production. To respond to this situation, the Department of Animal Biotechnology of Kyauk Se Technical University initiated systematic Mithun breeding. Myanmar Myin (horse) and Inbinwa chicken are considered at risk because of a population decrease nationwide (LBVD 2011). The major livestock breeds in Myanmar are presented in Table 11.

Table 11. Major Livestock Breeds in Myanmar.

No.	Species	Scientific Name	Local Name	Region/Location
1	Cattle	<i>Bos indicus</i>	Pya Sein, Shwe Ni, Shan Nwa, Katonwa, Kyauk Phyu	Mandalay, Magway, Sagaing, Shan, Kayin, Rakhine
2	Mythun	<i>Bos frontalis</i>	Nwa Nauk	Chin
3	Buffalo	<i>Bubals bubals</i>	Myanmar Kywe, Shan Kywe	Ayeyawady, Sagaing, Shan
4	Horse	<i>Equus caballus</i>	Myanmar Myin, Shan Myin	Magway, Mandalay, Sagaing, Shan
5	Ass	<i>Equus asinus</i>	Myanmar Mye	Shan
6	Pig	<i>Sus domesticus</i>	Bo cake, Chin wet	Badoung, Akhar, Wet taung Magway, Mandalay, Sagaing, Shan
7	Sheep	<i>Ovis aries</i>	Myanmar Thoe, Karla Thoe	Magway, Mandalay, Sagaing
8	Goat	<i>Capra hircus</i>	Seik Ni/ Jade Ni/ Nyaung Oo/Htain San/ Hkway Seik	Magway, Mandalay, Sagaing , Rakhine
9	Chicken	<i>Gallus gallus</i>	Taik Kyet, Tainyin Kyet, Kyet Lada, Inbinwa Kyet	Wide spread
10	Turkey	<i>Meleagris gallopavo</i>	Kyet Sin	Wide spread
11	Duck	<i>Anas platyrbynchos</i>	Khayan Be, Taw Be	Wide spread
12	Duck, Muscovy	<i>Cairina Maschata</i>	Mandarli	Wide spread
13	Goose	<i>Anser cygnoides</i>	Ngan	Wide spread
14	Quail	<i>Coturnix spp</i>	Ngown	Wide spread



Invasive Alien Species

The information on the status of invasive alien species (IAS) is still incomplete for Myanmar. The impact of IAS has not been comprehensively assessed. However, some studies indicated some socio-economic and environmental problems are being faced due to IAS, for example, golden apple snail (*Pomacea canaliculata*) is a major threat to cultivated crops in Inlay Lake, pennisetum grass causes big problems in commercial teak plantations, and water hyacinth (*Eichhornia crassipes*) degrades river and wetland ecosystems.

Legislation and regulations to control and manage IAS are not yet available in Myanmar. Some legislation, such as the Forest Law (1992), Protection of Wildlife and Protected Areas Law (1994), and Plant Pest Quarantine Law (1993, amended in 2011) provide some regulations to control IAS, but these are not adequate to fully address IAS issues. At the same time, public awareness of IAS is relatively limited.

Some IAS were intentionally imported for research, forest restoration, food production, while some could be unintentionally introduced. The available information on IAS in Myanmar is presented in Table 12.

Table 12. Known IAS in Myanmar.

Species Name	Common Name	Type	Introduction	Habitat	Impact	Source
<i>Acacia auriculiformis</i>	Acacia, Aurisha	Tree	Intentional for Fuel & Pulp(forestry)	Road side, forest plantations,	Cause irritation and asthma from pollen, Easily broken by wind	NBSAP
<i>Acacia longifolia</i>	Long-leaved wattle	Shrub/ Tree	Intentional for forestry	Road side, plantation	Uncertain	GISD
<i>Acacia mangium</i>	Black wattle	Tree	Intentional for Fuel & Pulp(forestry)	Road side, plantation	Uncertain Easily broken by wind	GISD
<i>Achatina fulica</i>	Giant African snail	Snail	-	Uncertain	Nuisance, impacts crops, transmits parasites.	NBSAP
<i>Aedes aegypti</i>	Yellow fever mosquito	Insect	Unintentional	Uncertain	Uncertain	GISD
<i>Ageratum conyzoides</i>	Goat weed	Herb	Unintentional	Rice fields	Aggressive and competitive, rapid growth.	NBSAP
<i>Brontispa longissima</i>	Hispid palm leaf beetle	Insect	Ornamental palm tree from Indonesia	Uncertain	Palm mortality and stunting	GISD
<i>Chromolaena odorata</i>	Bitter bush	Shrub	Ornamental	Fallow lands, road sides, pasture, forest plantations	Skin irritation, asthma, and toxic to animals. Displaces native vegetation species.	NBSAP GISD

Species Name	Common Name	Type	Introduction	Habitat	Impact	Source
<i>Clarias gariepinus</i>	African cat fish	Fish	Intentional for food production	Water reservoirs, lakes	Ecosystem engineer, reduces water clarity and destroys other aquatic organisms.	NBSAP GISD
<i>Ctenopharyngodon idella</i>	Grass carp	Fish	Intentional for food production	Water reservoirs, lakes	Ecosystem engineer, eliminating vegetation from water systems, parasite vector.	NBSAP GISD
<i>Cyprinus carpio</i>	Carp	Fish	Intentional for food production	Water reservoirs, lakes, mangroves	Ecosystem engineer, reduces water clarity, destroys and uproots aquatic vegetation.	NBSAP GISD
<i>Echinochloa crus-galli</i>	Barnyard grass	Grass	Unintentional	Rice fields	Yield reduction, and toxic to animals.	NBSAP
<i>Eichhornia crassipes</i>	Water hyacinth	Aquatic weed	Aesthetic/ Ornamental	Lakes, ponds, creek - water bodies	Clogs and dries up waterways.	NBSAP GISD
<i>Eucalyptus</i> sp.	Eucalypt	Tree	Forestry	Plantations and roadsides, open space	Aggressive and competitive, allelopathic suppresses native species and plantation species).	
<i>Hyptis suaveolens</i>	Bush tea	Shrub	-	Plantation, road sides, pastures, dry lands	Causes asthma, and damage to arable lands.	NBSAP
<i>Imperata cylindrical</i>	Blady grass, Congo grass	Grass	Cosmopolitan distribution	Plantation, pasture, dry lands	Inhibits natural regeneration of forests and highly flammable.	NBSAP GISD
<i>Lantana camara</i>	Lantana	Shrub	Intentional for ornament	Plantation, pasture, urban	Poisonous to cattle, understory competitor, and displaces native species.	NBSAP
<i>Leucaena leucocephala</i>	Leucaena	Tree	Intentional for fuel wood	Plantations, gardens, open spaces	Displacing native species.	NBSAP GISD
<i>Limnocharis flava</i>	Limnocharis	Aquatic weed	Ornamental	All water bodies	Choking and desiccation of water bodies.	GISD

Species Name	Common Name	Type	Introduction	Habitat	Impact	Source
<i>Mikania micrantha</i>	Mile-a-minute weed, Chinese creeper, American rope	Climber	Ornamental Accidental from India	Forest and plantations	Smothers other plants, and competes for water and nutrients.	NBSAP
<i>Mimosa diplotricha</i>	Giant sensitive plant	Small shrub	Ornamental Accidental	Forest plantations, agricultural fields, undisturbed area	Thorny, spreads rapidly, smothers vegetation	NBSAP Forest Research Institute
<i>Mimosa pigra</i>	Giant sensitive tree	Tree/shrub	Accidental	All water bodies, waterlogged agricultural fields	Rapid spread and suppression of other vegetation	Forest Research Institute
<i>Oreochromis spp.</i>	Tilapia	Fish	Intentional for food production	Water reservoirs, lakes	Declining culturally valued native fish species, and the alteration of natural benthic communities.	NBSAP GISD
<i>Paspalum conjugatum</i>	Buffalo grass	Grass	Forage	Rice fields and disturbed areas	Aggressive and competitive	NBSAP
<i>Pennisetum spp.</i>	Mission grass	Grass	Intentional for pasture	Forest and rubber plantations	Aggressive and competitive, and inhibits growth of plantation trees.	NBSAP
<i>Pomacea canaliculata</i>	Golden apple snail	Snail	Unintentional	Paddy field, Floating farm	Poses major threat to rice production.	NBSAP
<i>Prosopis juliflora</i>	Mesquite	Shrub/Tree	Intentional for shade, fodder and dry zone greening	Dry land, pasture	Very aggressive in displacing native vegetation. Its poisonous thorns can injure livestock and people.	NBSAP GISD
<i>Rattus exulans</i>	Pacific rat	Mammal	Unintentional	Many habitats	Consumes native fauna, flora and agricultural products.	GISD
<i>Solenopsis geminate</i>	Fire ant	Insect	Unintentional Trade & transport	Host on big trees	Displacement of native invertebrates and crop damage.	GISD

Species Name	Common Name	Type	Introduction	Habitat	Impact	Source
<i>Sorghum halepense</i>	Johnson grass	Grass	-	Disturbed areas, including agricultural land	Aggressive and competitive, and inhibits growth of native species.	NBSAP
<i>Teredo spp.</i>	Ship worm, Marine borer	Marine worm	Moving	Sea, Mangrove area	Decays wood, timber and destroys bridges.	NBSAP VI Table 8
<i>Trogoderma granarium</i>	Khapra beetle	Insect	Unintentional	Stored foods	Degradation of stored grains	GISD
<i>Varroa jacobsoii</i>	Parasitic bee mite	Mite	Parasitic	Bees	Impacts native and economically significant species	NBSAP VI Text



Chapter 3 Policy, Legal Framework and Institutions for Biodiversity Conservation

3.1 Policy and Legal Framework

The Constitution of the Republic of the Union of Myanmar (2008) sets a clear policy direction on environmental conservation. Article 45 of the Constitution states that “The Union shall protect and conserve the natural environment.” and Article 390 states that “Every citizen has the duty to assist the Union in carrying out the following matters:

- (a) preservation and safeguarding of cultural heritage;
- (b) environmental conservation;
- (c) striving for development of human resources;
- (d) protection and preservation of public property.”

Myanmar has a number of policies and regulations to safeguard the environment as summarised below:

National Environment Policy, 1994, aims to integrate environmental considerations into the development process to enhance the quality of life of all citizens and states that environmental protection should always be the primary objective of development.

Forest Policy, 1995, ensures that Myanmar's forest resources and biodiversity are managed sustainably to provide a wide range of social, economic and environmental benefits, and aims to maintain 30 per cent of the country's total land area under Reserved Forests and Public Protected Forest and 5 per cent of country's total land area as Protected Areas. [30-year National Forestry Sector Master Plan (2001/02 to 2030/31) prepared in year 2000, increased the coverage of PAs to be 10 per cent of country's total land area.]

Myanmar Agenda 21, 1997, is a blue print for all natural resource management and environmental conservation work and the pursuit of the activities contribute to biodiversity conservation throughout the country.

National sustainable development strategy, 2009, supports the goals of sustainable management of natural resources, integrated economic development and sustainable social development.

The legislation mainly concerned with the natural resources and biodiversity are as presented below:

- Law Relating to Aquaculture, 1989
- Pesticide Law, 1990
- Freshwater Fisheries Law, 1991
- Forest Law, 1992
- Law Relating to Fishing Rights of Foreign Fishing Vessels, 1989, and amended in 1993
- Myanmar Marine Fisheries Law, 1990, and amended in 1993
- Myanmar Mines Law, 1994
- Protection of Wildlife and Protected Areas Law, 1994
- Fertilizer Law, 2002

- Plant Pest Quarantine Law, 1993 and amended in 2011
- Seed Law, 2011
- Conservation of Water Resources and River Law, 2006
- Environmental Conservation Law, 2012

3.2 Existing Institutional Arrangement

Ministry of Environmental Conservation and Forestry (MOECAF), formed from the Ministry of Forestry in September 2011, is the focal ministry for environmental and biodiversity related matters. The Forest Department (FD), Environmental Conservation Department (ECD) and Dry Zone Greening Department (DZGD) under MOECAF are focal organizations of three Rio Conventions: Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC) and United Nations Convention to Combat Desertification (UNCCD), respectively.

The other key Ministries involved in conservation, management and utilization of natural resources and biodiversity are:

- Ministry of Agriculture and Irrigation
- Ministry of Livestock, Fisheries and Rural Development
- Ministry of Science and Technology
- Ministry of National Planning and Economic Development
- Ministry of Mines
- Ministry of Health

Furthermore, a goal has been set by the Government of the Republic of the Union of to achieve harmony and balance between economic development and environmental conservation across multiple sectors via the coordination efforts of the Environmental Conservation Committee (ECC). In 2011, the ECC was initially formed as National Environmental Conservation Committee (NECC), and it was reformed as ECC in 2014. ECC is chaired by the Union Minister from the Ministry of Environmental Conservation and Forestry, and its members include Deputy Ministers from related ministries.

There are five working committees (WC) under the ECC:

- Policy, Law, Rules, Procedures and Quality Standard
- Industry Planning, Urban and Rural
- Natural Resource and Cultural Heritage Conservation
- Climate Change Adaptation and Mitigation
- Environmental Education and Awareness Raising.

ECC also has Special Task Forces (STF) as presented below:

- Land Use
- Rivers, Streams and Wetlands
- Industrial Projects, Large Industries and Urban and Rural Areas
- Environmental Policy, Law and Procedures

- Environmental Education and Awareness; and Climate Change.

3.3 International Cooperation for Biodiversity Conservation

To fulfil strong commitment on sustainable natural resources, ecosystems and biodiversity conservation, management and utilization, Myanmar is party to several regional and international environment agreements, treaties and protocols (Table 13).

Table 13. International and Regional Environmental Agreements, Treaties and Protocols signed by Myanmar.

No.	Agreements/Treaties/ Protocols	Date of Signature/ Ratification/Acceded
Regional		
1.	Plant Protection Agreement for the Southeast Asia and the Pacific Region	4-11-1959
2.	ASEAN Agreement on the Conservation of Nature and Natural Resources	16-10-1997
3.	ASEAN Agreement on Transboundary Haze Pollution	13-3-2003
International		
4.	United Nations Framework Convention on Climate Change (UNFCCC)	25-11-1994
5.	Convention on Biological Diversity (CBD)	25-11-1994
6.	International Tropical Timber Agreement (ITTA)	31-1-1996
7.	Vienna Convention for the Protection of the Ozone Layer	24-11-1993
8.	Montreal Protocol on Substances that Deplete the Ozone Layer	24-11-1993
9.	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	24-11-1993
10.	The Convention for the Protection of the World Culture and Natural Heritage	29-4-1994
11.	United Nations Convention to Combat Desertification (UNCCD)	2-1-1997
12.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	13-6-1997
13.	Cartagena Protocol on Biosafety	11-5-2001
14.	Kyoto Protocol to the Convention on Climate Change	13-8-2003
15.	Stockholm Convention on Persistent Organic Pollutants (POPs)	18-4-2004
16.	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity	9-1-2014

Chapter 4 National Biodiversity Strategies and Action Plans

4.1 Review of the past NBSAP

Myanmar's first NBSAP was developed in 2011, and it was adopted by the government of the Republic of the Union of Myanmar. NBSAP is a national-level framework for guiding effective management and utilization, and has been disseminated to relevant organizations. One of the limitations of the first NBSAP was the data that were not updated, and mainly from the sources published in 2000-2003. In addition, the data gap was significant for freshwater and marine ecosystems. Though Myanmar NBSAP did not directly link with the Strategic Plan for Biodiversity 2011–2020 and its' 2020 Biodiversity Targets or Aichi Biodiversity Targets, several activities under the NBSAP also contribute to the Aichi targets. However, national targets and measurable indicators were missing in the previous NBSAP.



4.2 Process of developing the updated NBSAP

The preparation of NBSAP (2015-2020) mainly based on the driver, pressure, state, impact and response (DPSIR) model. The baseline information and data used for the NBSAP preparation were provided by government departments, I/NGOs, and academic institutions, as well as obtained from the national and regional reports of biodiversity projects. Issues related to biodiversity and ecosystems were identified and prioritized through the consultations at the central level, as well as at State and Region levels, and they were considered in setting national targets liking with global targets. Consultations on national targets and indicators were conducted with central government departments, I/NGOs, research institutes and academic institutions. The NBSAP (2015-2020) draft was shared to international organizations to get their feedbacks and comments. The revised NBSAP (2015-2020) was adopted by the Government of the Republic of the Union of Myanmar as the national guiding

document on to conserve, manage and use biodiversity for the economic, environmental and social wellbeing of the present and future generations of Myanmar.

4.3 Vision

Conservation, management and utilization of biodiversity in sustainable manner for sound and resilient ecosystems and national posterity.

4.4 Mission

By 2020, biodiversity is valued, effectively conserved, sustainably used, and appropriately mainstreamed to ensure the continuous flow of ecosystem goods and services for the economic, environmental and social wellbeing of the present and future generations.

4.5 Strategies and National Targets

The Strategic Plan for Biodiversity 2011–2020 adopted by the CBD COP includes 20 targets for 2015 or 2020 (the "Aichi Biodiversity Targets"), organized under five strategic goals. The goals and targets comprise both: (i) aspirations for achievement at the global level; and (ii) a flexible framework for the establishment of national or regional targets. The development of National Targets is intended to be guided by this flexible framework, taking into account national needs and priorities, while also bearing in mind national contributions to the achievement of the global targets. The Aichi Targets, and associated strategic goals, are outlined below.

Strategic goal A. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic goal B. Reduce the direct pressures on biodiversity and promote sustainable use

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have

no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic goal C. Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11: By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic goal E. Enhance implementation through participatory planning, knowledge management and capacity building

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

4.6 Targets, Indicators and Action Plans

4.6.1 Aichi Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Myanmar's Fifth National Report, submitted to the CBD in 2014, identified that limited grassroots support for conservation and undervaluation of ecosystem services and biodiversity are among the major threats to biodiversity. Building on the diverse range of knowledge held by local communities, government staff, and citizens could help increase this support and facilitate attainment of the remaining national biodiversity targets. However, increasing awareness without addressing underlying drivers will not necessarily lead to enhanced biodiversity conservation outcomes.

In order to improve outcomes, awareness raising must be approached in a strategic context that identifies key audiences, leverages existing knowledge, and acknowledges other incentives that influence actions. The focus should be on targeted efforts to couple outreach and awareness raising with a **change in behaviour** of select groups.

It is important to note that 'awareness raising' should be seen not as a top down education of the ignorant, but as an exchange of what different groups understand and value about the natural environment. In addition, although awareness of the values of biodiversity must ultimately be raised among the greater Myanmar population, a first step should be to focus on a representative selection of stakeholders, partners, and appropriate communication channels. In Myanmar, these key audiences include political decision-makers, line department staff, communities in and around key biodiversity areas, educational institutions, the private sector and media.

Making relevant information on the value of biodiversity and potential policy linkages available to **decision-makers** (e.g., national and state/region parliamentarians) could quickly help raise awareness

in a group with outside influence on the future of Myanmar's environment. Many parliamentarians and government staff may not be familiar with the value of biodiversity or appropriate ways to maintain and enhance this as Myanmar develops. Increasing the awareness of decision-makers would be an effective way to build support for enhanced biodiversity conservation at the highest levels. To this end, a series of short **briefing documents** should be prepared for parliamentarians and senior government staff on the importance and value of biodiversity and the potential to use nature-based solutions to address challenges related to food security, disaster risk reduction, and climate change. Studies that demonstrate the true economic value of a select number of high-profile ecosystems, such as mangrove forests, should also be undertaken and shared.

The staff of **line agencies** may already possess significant knowledge, but could benefit from inter-departmental communication to share their expertise in a specific sector, as well as enhance awareness of new fields. As the focal point for the Convention on Biological Diversity (CBD), the Forest Department (FD) could serve as a coordinating agency, helping to actively develop and expand extension services, materials, and host meetings to bring together various line agencies to discuss and learn about biodiversity in Myanmar.

Local communities in and around key biodiversity areas and protected areas are a key group to involve in outreach and knowledge sharing activities. These communities often have the best understanding of the value of biodiversity in these areas and are well-placed to share this knowledge, as well as work with government and NGOs to implement appropriate management regimes. Improved co-operation and knowledge sharing between FD and NWCD staff and local communities would facilitate and improve biodiversity conservation programs. In particular, the current rule requiring government staff to have at least a secondary-level education complicates recruiting local community members to participate in activities that would benefit from local knowledge and help raise awareness of activities that affect biodiversity, such as PA management, within communities. Relaxation of this rule, perhaps by establishing a "community ranger" job class, would increase community participation and knowledge exchange.

Greater cooperation between FD and local NGOs with experience in community engagement would further facilitate these activities. Opportunities to link biodiversity conservation goals with the **cultural norms and belief systems** of local communities should also be identified.

Incorporation of the value of biodiversity and the environment into the **educational system** at all levels is fundamental to building support for conservation. Biodiversity is covered in curricula at select universities, but this could be expanded. Curricula addressing biodiversity values should also be expanded at the primary and secondary levels, as well as through non-traditional education. Public education is a key management activity at many protected areas. Between 2009 and 2013 the FD conducted 296 educational activities for local communities. One way to expand similar opportunities to other areas, including urban areas, would be to form nature clubs. These clubs could increase understanding and appreciation of nature and provide a supplement to official school curricula. They could also be used to help promote civic engagement around local environmental stewardship by promoting campaigns to plant trees, collect waste, and raise awareness about biodiversity. A similar role is also played by religious groups that have environmental outreach and education as part of their community outreach activities.

The **private sector** is poised to become an increasingly important audience to involve in biodiversity conservation. Making the connection between business operations and biodiversity represents a massive opportunity. By working with business leaders and investors to understand their incentives

and communicate the value of biodiversity and ecosystem services to their operations a strong business case can be made for conservation. This could build on tools such as a national biodiversity information repository and natural capital accounting systems (see Target 2).

The **media** can help raise awareness of biodiversity across all sectors. As of 2014, Myanmar Radio and Television (MRTV) has played an educational series about forests and broadcast 39 radio segments on the value of the environment. Organising targeted training for journalists and media representatives would increase quality media coverage, and raise awareness, of threats and opportunities for biodiversity conservation in a cost effective manner.

There are many potential benefits of an effective communication strategy to raise awareness in Myanmar about biodiversity conservation issues, such as national pride, community action, political support and improved funding. Public awareness programs in neighbouring countries have mobilized a broad spectrum of society, including politicians, journalists, lawyers, PA managers, the private sector, media, and the general public, to implement the sometimes substantial measures needed to conserve their most threatened wildlife. Increase awareness of biodiversity is an effective way to build similar broad-based support for conservation in Myanmar and is critical to achieving all of the remaining national Aichi Targets.

Table 14. National Targets and Priority Actions for Aichi Target 1.

Target and Action	Lead
Target 1.1: By 2018, awareness of biodiversity values in key decision makers and line agencies has been improved	
Action 1.1.1 Draft and disseminate briefing documents to national and state/region parliaments	MOECAF
Action 1.1.2 Establish national working group chaired by FD and state/region working groups to share information and communicate activities related to biodiversity and the natural environment	FD
Action 1.1.3 Strengthen capacity of MOECAF's outreach unit to communicate biodiversity values	MOECAF
Target 1.2: By 2018, the private sector has an enhanced understanding of the value of biodiversity and relation to business practices	
Action 1.2.1 Establish business and biodiversity industry trade group	Myanmar Centre for Responsible Business
Action 1.2.2 Offer Business Ecosystem Training (BET) to major private sector businesses investing in Myanmar	Myanmar Centre for Responsible Business
Target 1.3: By 2017, the media have an improved understanding of and capacity to communicate topics related to biodiversity	
Action 1.3.1 Hold media training events focused on environmental issues and reporting	FD (extension), media
Target 1.4: By 2020, local communities in and around protected areas have enhanced opportunities to share knowledge and participate in management activities	
Action 1.4.1 Increase number of annual outreach and extension activities with local communities living in and around protected areas	FD
Action 1.4.2 Explore opportunities for joint FD-community management in and around protected areas	FD
Action 1.4.3 Appoint well-known Myanmar artist as "biodiversity ambassador" to raise awareness of biodiversity values and share information with communities through art and entertainment	FD, Ministry of Culture
Target 1.5: By 2020, primary, secondary, and tertiary curricula have incorporated biodiversity values	
Action 1.5.1 Improve curricula covering biodiversity-related topics and integrate into educational activities	Ministry of Education (MOEd)
Action 1.5.2 Establish biodiversity conservation programs at a select number of leading universities	MOEd
Action 1.5.3 Translate and make available key existing biodiversity references in Myanmar language	FD

4.6.2 Aichi Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems

Myanmar is undergoing a rapid political and economic transition that presents both opportunities and threats to biodiversity. The ADB (2012) concluded that "Myanmar's current growth pattern is placing huge pressure on its environment and, if continued, will certainly be unsustainable given the country's

continued population increase, expected rapid industrialization, increased consumption of and demand for natural resources for food production and trade, and increased energy consumption."

Myanmar can benefit from the many lessons of its neighbours' development experiences, especially to avoid the social instability and environmental degradation they have experienced. Despite the region's spectacular economic performance, poverty persists along with harmful environmental impacts. Thus, Myanmar's long-term development agenda would benefit from placing environmental sustainability at its core. Myanmar can capitalize on its "late mover advantage" by incorporating international experience and best practice into new legislation. From an environmental perspective, the Equator Principles, environmental impact assessments (EIA), biodiversity valuation, and natural capital accounting are among the array of policy tools and international standards that can support more efficient, effective, and equitable use of natural resources.

The Equator Principles (EPs) are a risk management framework for determining, assessing, and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. To date, 80 financial institutions in 35 countries, including the Industrial Bank of China, have officially adopted the EPs. In total, these institutions account for over 70% of international project finance debt in emerging markets. As foreign direct investment (FDI) grows in Myanmar, the EPs could help improve social and environmental performance of these funds by requiring higher standards than would otherwise be followed.

The International Association for Impact Assessment defines an **Environmental Impact Assessment** (EIA) as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made." EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather require decision makers to account for environmental values in their decisions and to justify these in light of detailed environmental studies and public comments on the potential environmental impacts. With ADB support, MOECAAF has drafted an EIA Procedure. The EIA legislation will be completed by the end of 2015, and an additional Social Impact Assessment (SIA) component will be finalized in the next 1–2 years. The SIA should eventually be broadened to include a range of social issues including health impacts and conflicts. However, the capacity to carry out even in-depth EIA reviews as investment pours into the country may be strained, as the volume of applicants and the complexity of the work make substantial demands on staff. Given the rapid development Myanmar is experiencing, an effective EIA system should be made fully operational by 2018.

As the investment framework for Myanmar is developed, the implementing rules and regulations for integrating the procedures for obtaining prior approval from MOECAAF, permission from the Myanmar Investment Commission (MIC), permission from state and regional government, and assessment and monitoring of sector-specific environmental regulations must be further developed, harmonized, and streamlined. Environmental values should be incorporated into the cost-benefit analyses that MIC (and other relevant institutions) conduct when reviewing proposed investments.

The EIA procedures, capacity building, and implementing rules should be monitored for effectiveness and revised based on early experiences. The current procedure requires MOECAAF to form an EIA Report Review Body, which comprises experts from relevant government departments, technical organizations, and civil society to review and provide comments and recommendations on EIA. The inclusion of civil society and technical organisations could help improve transparency of the review

process. Additional resources are necessary to ensure that EIAs are effectively reviewed and to avoid unacceptable environmental or social impacts, and in this context, ECD should find a way to support the EIA review team by the help of international organizations.

The Business and Biodiversity Offset Programme (BBOP) is another tool to assess and avoid or minimize impacts from development. BBOP advocates strict adherence to a mitigation hierarchy, i.e. avoids, minimize, mitigate and, as a last resort, compensate, in development planning and assessment. This process ensures that biodiversity values are appropriately considered at all stages development project planning. A regularly updated national database for biodiversity assessment could be used to for reference and to screen targets against. This would help companies investing in Myanmar assess what biodiversity values are potentially present in an area, permitting avoidance and minimization measures to be applied at lower costs during the early stages of development planning and through the EIA process. This would in turn avoid expensive and controversial offsetting processes. Compensatory measures such as biodiversity offsets should be viewed as a "last resort", after all other reasonable measures have been taken, first to avoid and minimize the impact of a development project, then to restore biodiversity on-site. The goal of biodiversity offsets is to achieve no net loss, and preferably a net gain, of biodiversity with respect to species composition, habitat structure, ecosystem function and people's use of and cultural values associated with biodiversity in a specific area. When no other reasonable options are available this no net loss requirement should be strictly followed and not seen as an option to pay for loss of biodiversity.

An approach to improve the social and environmental performance of business is the **Extractive Industries Transparency Initiative** (EITI). Established in 2003 to strengthen the transparency of government and company accounting and reporting systems, inform public debate, and enhance trust between stakeholders, EITI is a global standard to promote open and accountable management of natural resources. While EITI compliance applies to only oil and gas and mining, its principles can be applied to other extractive sectors. EITI is being implemented by a multi-stakeholder group of government, private sector, and civil society representatives. Current implementation goals include improving EITI awareness at the state/region level. Myanmar is an EITI Candidate Country, and has a national target to be certified as EITI compliant by 2017. If Myanmar were to meet all requirements and become an EITI Compliant Country, it would send a strong signal to domestic and international businesses that the country will apply the highest social and environmental standards in the extractive industry sector.

Improved integration of environmental considerations in planning processes by individuals, the private sector, and government decision-makers can be supported through biodiversity valuation. Biodiversity valuation estimates the economic value of biodiversity, including species, ecosystems and landscapes—facilitating interpretation of biodiversity values by decision makers more familiar with economic planning than the environment—and allowing incorporation of biodiversity values into cost-benefit analysis processes for assessment of development actions or conservation projects. Biodiversity valuation may also be used as a tool to raise awareness of the importance of natural ecosystems amongst communities and decision makers. Without biodiversity valuation, environmental values and ecosystem services are often undervalued or ignored in planning processes, leading to high environmental costs. In order to assist in the incorporation of biodiversity values into development planning, a **systematic valuation approach** should be applied to ecosystems, based on the approach already applied to forest ecosystem services in Myanmar.

Gross Domestic Product (GDP) looks at only one part of economic performance—income—but says nothing about the underlying wealth and assets. For example, when a country exploits its minerals, it

generates income, but depletes its wealth. The same holds true for over-exploiting fisheries or degrading water resources. These declining assets are not included in estimations of GDP. Wealth accounting, including **natural capital accounting** (stock of natural assets such as water, minerals, and living organisms), is needed to sustain growth based on the accumulation and sound management of a portfolio of assets. These assets include manufactured capital, natural capital, and human and social capital.

A major limitation of GDP is the poor representation of natural capital. Forestry is an example: timber resources are counted in national accounts but the other services provided by forests, such as carbon sequestration and air filtration, are ignored. GDP is the market value of all final goods and services produced in a country in a given time period, and it is an economic estimator and one of the indicators of economic growth. However, GDP can give misleading signals about the economic performance and well-being of a country. As a result, ecosystems are deteriorating worldwide, and with them, the capacity to support human wellbeing and sustainable economic growth. In order to more fully assess sustainability and economic performance, Myanmar should consider natural capital together with human capital and financial capital as a critical asset to be included in long-term development planning.

The government has expressed support for more accurate valuation of natural capital. At the fourth GMS Environment Ministers’ Meeting in Nay Pyi Taw in January 2015, the six GMS governments pledged to intensify efforts to protect and enhance natural assets—including forests, wetlands, and water bodies. The Joint Ministerial Statement noted: “natural capital/resources lie at the heart of economic development, underpins inclusive and sustainable development and sustains the livelihoods and well-being of all people in the GMS, especially the rural poor... future prosperity of the GMS will depend on timely and effective investments [in natural capital/resources].” There are currently substantial opportunities for Myanmar to build on the experiences of other countries in the region to institutionalize natural resource accounting natural capital accounting procedures into national accounts.

Table 15. National Targets and Priority Actions for Aichi Target 2.

Target and Action	Lead
Target 2.1: By 2018, Myanmar has made a formal commitment to natural capital accounting and has taken significant steps to integrate the value of biodiversity and ecosystem services into its national accounts	
Action 2.1.1 Take steps to formalize natural capital accounting	MOECAAF
Action 2.1.2 Implement necessary steps to become an EITI Compliant Country	MOM
Target 2.2: By 2018, significant steps have been taken to incorporate biodiversity and ecosystem services into state/region land use plans	
Action 2.2.1 Identify and start to work with at least two states/regions on incorporating biodiversity into integrated land use plans	MNPED
Action 2.2.2 Prepare non-binding guidelines for incorporating biodiversity into land use plans and key sectors in at least two states/regions and provide capacity training to increase their use	MNPED
Target 2.3: By 2018, the government has significantly enhanced its capacity to review, assess, monitor, and enforce EIAs	
Action 2.3.1 Review and approve EIA Procedure Laws and revise Rules to ensure they incorporate international best practice and require independent party EIAs for all projects with an anticipated environmental impact	ECD
Action 2.3.2 Establish and hold annual EIA training course for staff responsible for EIA review, monitoring, and enforcement	ECD

Target and Action	Lead
Action 2.3.3 Design and establish a national biodiversity database using the latest land cover, habitat, and species data	MOECAF, MLFRD, MOAI

4.6.3 Aichi Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions

Incentives arise from the interaction of different sectoral and national policies, institutional frameworks, governance systems, and market forces that together produce conditions that undermine or encourage sustainable use of natural resources. Incentives can also be direct monetary subsidies, such as subsidies for agrochemicals or energy, which can result in overconsumption and increase negative environmental impacts. In contrast, policies such as improving land tenure for local communities, establishing Payments for Ecosystem Services (PES) programs and developing community conservation agreements can provide direct incentives to promote conservation.

Tenure systems, including customary rights and access rights to natural resources, play a fundamental role in shaping incentives and disincentives for sustainable resource management. Tenure systems determine who has the right to manage resources, including terrestrial, marine/freshwater, and minerals, and who can benefit from their use. Securing tenure for local communities creates strong incentives for sustainable management, while insecure and open access tenure promotes rapid extraction for short-term gain.

The objectives of Myanmar's National Land Use Policy are to promote sustainable land use management, protect cultural areas, the environment, and natural resources for the public good, strengthen land tenure security for the livelihood security of people in rural and urban areas, recognize and protect customary land tenure rights and procedures, develop a transparent, fair, and independent dispute resolution mechanism, and to promote responsible investment to support equitable environmental development. The policy includes participatory mapping of land use and land use planning at the district level, to be integrated with state, region, and national level planning. It includes guidelines on changes in land use for government and private purposes, dispute resolution mechanisms, and research and monitoring priorities. The policy also recognizes customary tenure, including rotational and shifting taungya, which is essential to support tenure security and environmental sustainability in upland systems. Recognizing customary tenure also enhances ICCAs and other conservation approaches that benefit from local ownership and traditional knowledge. The establishment of PAs and PFE on customary land can create an open access resource out of what had previously been a managed commons, incentivizing short term resource extraction. In lands currently classified as vacant, fallow, and virgin, customary tenure recognition would help secure tenure of local users and protect against outside concessions.

Incentives are by-products of **plans and targets in other sectors**, including agricultural production targets and energy and mining sectors development plans. Strategic assessment and design of incentives can help to achieve these national goals while minimizing their impact on the environment. Agriculture targets provide a good example. While the 2011 NBSAP and the National Sustainable Development Strategy prioritize increasing yields on existing agricultural land to meet cultivation

targets instead of expanding agricultural land, the current legal framework on land and agriculture provides stronger incentives for expanding land than for increasing yields, efficiency, quality, or profitability of existing agricultural land.

Strengthening the legal framework for communities to benefit from the sustainable management of forests would better incentivize forest preservation and restoration when undertaken with clearly defined and secure tenure. The community forestry instruction is in the process of being revised to allow sustainable commercial use of products from community forests. It is also the first step to a legal pathway for community-managed sustainable timber harvesting. The revision of the Forest Law to allow communities to harvest and sell high-value commercial trees that are currently restricted to government harvest would further strengthen this incentive by making forest management more profitable for communities. The allocation of fishing licenses directly to fishermen's associations similarly provides access and exclusion rights, potentially giving direct users an incentive to manage fisheries for the longer term.

Persistent debt and other social conditions can cancel out incentives to sustainably manage resources, and the dynamics created by **debt relations** should be considered in design of natural resource and conservation programs. Agricultural development programs that increase reliance on high input cash crops increases the vulnerability of farmers to fall into debt, which can drive unsustainable resource extraction and land use conversion for short term income. Increased landlessness can also push farmers onto increasingly marginal land and drive forest degradation. Safeguards for contract farming and fishing, and programs to reduce vulnerability and increase the resilience of these groups, can help to reduce rural debt and create an enabling environment for positive conservation incentives. Examples of these programs include addressing land tenure systems, support for low-input agricultural commodities, formation of cooperatives and associations to increase bargaining power, and provision of microcredit for rural farmers. The National Sustainable Development Goals may be an appropriate forum to develop a national target on rural debt, which would complement the national biodiversity targets.

Subsidies in the agricultural, energy or transport sectors may be applied in order to stimulate investment in those sectors or as poverty reduction policies. While popular, poorly designed or blanket subsidies can be an inefficient and ineffective strategy for stimulating investment or reducing poverty. Such subsidies can result in overconsumption and waste. While targeted subsidies for fertilizer mixes and other agricultural inputs can contribute to the public good, subsidies in many countries have encouraged excessive application of urea and agrochemicals, with serious repercussions for ecosystems, agricultural production, and human health. Energy consumption for the poor is relatively inelastic, and while targeted subsidies may provide a public purpose, blanket fossil fuel subsidies, risk deplete government budgets to subsidize wealthier businesses and have little effect on poverty reduction.

The Myanmar Investment Commission, MOECA, and relevant line ministries at national and regional levels should consider how **direct incentives for investment** will impact biodiversity, as well as create a national investment framework that produces incentives for preserving natural capital and minimizes outsized environmental impacts. This includes mainstreaming natural capital accounting into cost-benefit analyses for approving investments, creating a transparent process by which investors are encouraged and obligated to follow national environmental standards, and encouraging corporate social responsibility. Incentives to encourage technology transfer can help to minimize the environmental impact of developing industries in Myanmar.

PES and direct payments for conservation are emerging tools to provide **direct incentives for conservation**. These tools are typically mediated through NGOs and are intended to directly compensate local communities for protecting biodiversity and ecosystem function and compensate for direct losses and opportunity costs of restricted use of resources. PES schemes are most effective when the beneficiaries (users) can be clearly identified and made to pay for ecosystem services, for example, a hydroelectric company would be the beneficiary (user) of, and pay for, ecosystem services provided by a forested watershed area that reduces reservoir siltation and therefore lowers the cost of producing electricity. Less direct incentives include coupling conservation activities with projects to improve livelihoods, including improved access to healthcare and education. These development supports can also serve as compensation for reduced access to resources.

The actions recommended to achieve the Aichi Biodiversity Targets will require the **revision of annual work plans** to reflect new projects and priorities, including EIA review, community forestry, forest restoration, and increased time spent working with civil society and communities. Staff time must be allocated for consultation processes in order for consultations to be meaningful and effective. The national community forestry target provides a good example, as township and district forestry officials currently do not have time in their annual work plans to develop management plans with communities or process applications for CF certification. Once annual targets are developed for CF coverage, the work necessary to achieve these targets can be included in annual work plans. Targets and actions should also be incorporated into job descriptions and TORs to ensure a shared understanding of changing roles and responsibilities.

Mechanisms to recognize and reward Forest Department officers who make a strong positive contribution to national biodiversity targets would create institutional incentives for staff to work towards national biodiversity targets. Including time spent working with communities in participatory processes and consultations should be recognized in performance evaluations and considered an important part of relevant job descriptions.

Table 16. National Targets and Priority Actions for Aichi Target 3.

Target and Action	Lead
Target 3.1: By 2020, the national legal framework on tenure encourages conservation and sustainable management	
Action 3.1.1 Finalize a National Land Use Policy and Land Law that strengthen smallholder and customary tenure rights	MOECAAF
Action 3.1.2 Develop implementing rules and regulations that recognize customary tenure of land, freshwater, and marine resources, including communal tenure and rotational and fallow taungya	MOECAAF, MNPED, MOAI, MOHA
Action 3.1.3 Mainstream conservation into district level land use plans, and provide technical support to districts	FD
Action 3.1.4 Mainstream conservation into national land use planning and improve coordination of ministries in allocating new concessions	MOECAAF
Target 3.2: By 2020, positive incentives are established for the sustainable use of nature	
Action 3.2.1 Commission a comprehensive review of laws, rules and other relevant incentives affecting biodiversity in Myanmar	MOECAAF
Action 3.2.2 Amend the Forest Law and Community Forestry Instructions to enable sustainable, market-led community forestry and allow for joint management	FD
Action 3.2.3 Amend the fisheries legislation to create legal support for LMMAs, Community Fishery User Groups (CFiUGs) and locally-managed freshwater fisheries, and grant legal right for community users to	DoF

Action 3.2.4	exclude outsiders from their fishing grounds Establish community conservation agreements with communities in and around protected area buffer zones to provide incentives for conservation and compensation for restricted access	FD
Target 3.3:	By 2018, line department annual work plans are revised to enable and encourage staff to implement actions to achieve national Biodiversity Targets	
Action 3.3.1	Incorporate actions required to meet national Biodiversity Targets into job descriptions, TORs, and annual work plans	Line Departments
Action 3.3.2	Create positive incentives through performance appraisal and recognition of staff who make substantial contributions to the achievement of national Biodiversity Targets	Line Departments
Action 3.3.3	Provide training for staff on skills linked to their work plans, responsibilities, and the national Biodiversity Targets, including on community consultation and outreach, EIA, and natural capital accounting	Line Departments

4.6.4 Aichi Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits

The CBD defines sustainable use as the “use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations”. The sustainability of primary production and subsistence activities (such as fisheries, agriculture, and forest products) are addressed elsewhere in the Myanmar NBSAP. This target focuses on sustainable production and consumption relating to the mining and energy industries.

The ecological footprint of Myanmar, as calculated by the Global Footprint Network in 2011, was approximately 75% of the estimated biological capacity for Myanmar, indicating that current levels of development are sustainable, relative to neighbouring countries whose ecological footprints have exceeded their biological capacity, making them dependent on external resources. In Myanmar, the increased use of natural resources is recognized as being necessary to drive economic development. However, rapid expansion and potential for exploitation of natural resources for short term gain means that there is potential for large inefficiencies in use of natural resources, resulting in an unnecessarily large increase in the ecological footprint, and a high risk that natural ecosystems critical for supporting livelihoods and biodiversity will be degraded, reducing natural biological capacity. To deliver long term economic development, the sustainable use of natural resources must be a fundamental principle of development planning. For Myanmar, the challenge will be to increase resource use efficiency in line with development to minimize the ecological footprint and protect and improve biological capacity to ensure that the ecological footprint does not exceed biological capacity.

In 2009, with UNEP support, the government prepared a National Sustainable Development Strategy (NSDS), which outlined eleven goals and associated actions to be implemented within 5- and 10-year timeframes for the sustainable management of natural resources. A number of critical actions identified in this plan, such as enacting an Environmental Conservation Law (ECL), and developing an Environmental Impact Assessment Procedure have been completed or are near completion. A review of progress toward implementing the actions identified in the NSDS would permit assessment of the progress the government has made toward sustainable development.

There are many opportunities for Myanmar to strengthen integration of sustainability principles into all development projects, by strengthening internal government processes, learning from international experience, and engaging the private sector. The ECL has established special task forces for the following sectors to provide advice on environmental sustainability and the green economy: Land use; rivers, streams and wetlands; industrial projects, large industries and urban and rural areas; and environmental policy, law, and procedures. These taskforces must be given the authority to provide advice on development projects in order to ensure that the impacts on sustainability of natural resources are avoided, minimized, or mitigated.

The UNEP-led Green Economy Initiative recognizes the necessity of development for improved human well-being and social equity in developing countries such as Myanmar, and aims to facilitate this development while significantly reducing environmental risks and ecological scarcities. Forums to establish dialogue between individual specialists, government agencies, and the private sector on green economy have led to the development of key actions required for more sustainable economic development in different sectors. Further engagement of local and international business is key and can be encouraged through training programs such as Business Ecosystems Training (BET) and development of business plans for biodiversity. Green Economy analysis has also been applied to demonstrate the economic value of protecting biodiversity in relation to the development of the road through the Dawna-Tenasserim Landscape between Thailand and Myanmar.

There is growing public concern in Myanmar that many large-scale mining and energy projects currently being developed or planned are driven by short term private economic interests, with sustainability issues and external costs being overlooked or undervalued. Relatively unregulated expansion of the mining sector in Myanmar, for example, has been recognized as a significant threat to biodiversity. Mining projects have a range of impacts such as reduced agricultural productivity, soil and water contamination, fragmentation and destruction of natural habitat, providing access to remote areas, all of which degrade natural resources, and are often not adequately considered when assessing the value of a mining project.

Energy reform is one of the big challenges relating to sustainability in Myanmar. Domestic electricity use in Myanmar is low with, less than 30% of the population having access to electricity. With ADB support, the government is preparing a long term energy policy that will guide development of the energy sector. This is an opportunity to maximize the sustainability of both energy supply and demand by adopting an appropriate mix of energy production strategies, including renewables, off-grid system and, improving incentives for technology transfer. The development of Myanmar's hydropower potential is likely to be an important component of the Energy Policy. Regional experience shows clearly that if undertaken without appropriately planning, large scale hydropower development can severely harm fish production, food security, and fish diversity.

Sectoral Strategic Environmental Assessments (SEA) are recommended by the World Bank and UNEP to assess cumulative impacts of industries which have the potential to have large scale cumulative impacts on biodiversity, and should consider existing, planned and potential developments. SEAs can identify critical areas in which development is not appropriate, and identify thresholds of impacts on biodiversity and natural resources required to ensure that cumulative development impacts occur within safe ecological limits. This information would support the development of industry guidelines, and form the basis for subsequent assessment of the impacts of individual projects. A sectoral SEA of existing and potential mining operations, and of all planned hydropower development to assess cumulative impacts would permit the development of guidelines to ensure that biodiversity impacts are avoided and mitigated in the development of this industry. The

World Bank is funding the Ayeyawady Integrated River Basin Management Project, which includes preparation of a river basin management plan for the Ayeyawady River. This plan could provide the framework for undertaking an SEA which attempts to optimize the trade-offs between power, biodiversity, and food security.

Box 1 Hydropower in Myanmar

Currently, 74% of power in Myanmar is supplied by hydropower. Surging demand for electricity mean that Myanmar will have to greatly increase its power production in the coming years. Although coal and natural gas power plants have been proposed, additional hydropower dams will also make up part of this increase in generation capacity. In 2011, one of the largest dams proposed for Myanmar, the Myitsone, was temporarily suspended, citing environmental and community concerns. However, 19 other dams have already been constructed, and the ADB counts another 59 hydropower schemes as being under consideration (although the exact status of these is unknown). As of 2013, Myanmar had 2,780 MW of hydropower capacity, or roughly 2.7% of the total potential hydropower generation capacity estimated for the four largest rivers in Myanmar. This same year, six dams were proposed for the Thanlwin River alone, which would add 15,000 MW of capacity to Myanmar's power grid. Such dams can offer relatively clean power, but also impact riverine ecosystem services and the communities that depend on them. Dams can alter hydrological flow regimes, block fish migration, and disrupt upstream and downstream food chains, potentially disrupting extensive fisheries and agricultural systems. The benefits of these hydropower projects must be balanced against external costs, such as loss of agricultural productivity, fisheries, forest resources and biodiversity values, which may not be explicitly quantified, along with the need to maintain critical ecosystem services and the rights of local residents to make use of natural resources.

Reducing energy wastage and improving efficiency of distribution networks should be addressed in the energy policy and will help minimize the sector's environmental impacts. Methods to achieve this include upgrading transmission technology and designing efficient distribution networks through adoption of diverse strategies including off-grid solutions for remote communities. Similarly, requiring the consideration of energy consumption in urban planning, and reducing dependence on non-sustainable energy sources such as charcoal derived from natural forests would reduce energy consumption and the associated impact on biodiversity. Increasing domestic supply and distribution of energy sources such as natural gas could help reduce pressure on natural forests and provide a cleaner alternative to coal. The removal of perverse incentives such as energy subsidies which encourage resource over-use and waste would also make a significant contribution to reducing energy consumption and wastage.

Considering sustainability in future urban development is an important strategy to improve the sustainability of resource consumption. Sustainability planning in urban development can deliver significant dividends in the form of improved energy efficiency for individuals, the private sector and the government, and also significantly reduce waste production. In Myanmar, priorities for urban development planning include providing access to efficient cooking fuel sources, ensuring climate appropriate building design, treating sewage, and developing appropriate waste and construction material recycling systems.

Table 17. National Targets and Priority Actions for Aichi Target 4.

Target and Action		Lead
Target 4.1.	By 2020, SEA conducted and guidelines prepared for mining and hydropower sectors	
Action 4.1.1	Conduct a SEA, in line with international best practice, of major mining and hydropower projects	ECD
Action 4.1.2	Conduct a SEA, in line with international best practice, of small-scale mining projects and establish inter-ministerial working group to address impacts	MOM
Action 4.1.3	Develop guidelines for the mining and hydropower sectors based on SEA recommendations	ECD, MOM, MOE
Action 4.1.4	Organize an industry workshop to identify roles of government, NGOs, and private sector in improving mining industry operations	MOM
Target 4.2:	By 2020, sustainable production and consumption of natural resources is mainstreamed in development planning	
Action 4.2.1	Require that Biodiversity Action Plans be prepared for any new large scale resource extraction or power generation project	ECD
Action 4.2.2	Develop the authority and capacity of taskforces established by the 2012 Environmental Conservation Law to advise on the sustainability of developments and development plans, particularly through consideration of impacts on biodiversity	ECD
Action 4.2.3	Establish and incentivize energy production technology transfer programme, with a focus on enhancing efficiency	MOE
Action 4.2.4	Establish government green procurement programme and targets	MNPED

4.6.5 Aichi Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced

Stretching from sea level to 5,881 meters and from 9 to 28 degrees north, Myanmar encompasses a **wide range of habitats** encompassing alpine and sub-alpine in the far north, low to moderate elevation forest and mountain ranges running along the eastern and western borders, a central dry zone, several large freshwater lakes and river systems, and extensive deltaic, coastal, and offshore marine areas. These diverse habitats and ecosystems form the basis of Myanmar's economy, culture, and biodiversity. Forests make up an important part of many of these ecosystems, but have been severely impacted in recent decades.

The Smithsonian Institution reports a loss of 12,000 sq km of forest of all types between 1990 and 2000. Global Forest Watch (GFW) reports a loss of 15,000 sq km of forest between 2001 and 2012, indicating an **acceleration of forest loss**, peaking at 2,162 sq km in 2009. Over half the loss occurred in Kachin and Shan States and Sagaing and Taninthayi Regions. Two of the most threatened, economically valuable, and biologically important forest types are dry deciduous and mangrove forests.

Myanmar holds 125,000 sq km of **dry mixed deciduous forest (DMDF)**, half of the total in Southeast Asia. Restricted to lowland areas with strongly seasonal rainfall and found in isolated patches or as modified fragments within a human-dominated landscape, DMDF is one of the least protected forest types in the tropics. Within Myanmar, relatively large areas remain in Sagaing Region, Shan and Rakhine States. At present, only 2% of Myanmar's DMDF is legally protected (compared to about 40% in Thailand and Cambodia). DMDF is characterized by exceptionally high

diversity and endemism, and historically by an abundance of elephants, tigers, rhinos, and other large, wide-ranging mammals.

Because DMDF is discontinuous and seasonally drops its leaves, it is hard to map accurately. Nevertheless, a Smithsonian Institution-led study of forest cover change between 1990 and 2000 estimated that DMDF was being lost at a rate of 0.7%/year, over twice the national average of general forest loss. Because of human pressure on DMDF, there are few opportunities for establishing large, strictly protected areas. **However, in 2013 a small Indigenous and Community Conserved Area (ICCA) was established in Magwe Region.** Because the ICCA was initiated locally and had strong community support, it was quickly approved by MOECA. This model could be replicated across areas of DMDF and, if done so at sufficient scale, could increase habitat connectivity.

Myanmar has the third largest area of **mangroves** in Southeast Asia (after Indonesia and Malaysia). A 2014 NASA study showed a significant decline in mangrove cover between 2000 and 2013, particularly in Rakhine State and Ayeyawady Region (Table 18).

Table 18. Mangrove Cover Changes between 2000 and 2013.

Area	Mangrove Cover (sq km)		Mangrove loss (2000-2013) (sq km)	Annual Loss (sq km)	Rate
	2000	2013			
Rakhine State	1,734	1,470	-264	-20.31	-1.17%
Ayeyawady Region	818	462	-356	-27.38	-3.35%
Taninthayi Region	2,075	2,040	-35	-2.69	-0.13%
Total	6,627	5,985	-655	-50.38	-0.76%

The extensive mangrove clearing was a major factor behind the loss of life caused by cyclones Nargis (2008) and Giri (2011) and the collapse of the shrimp sector in northern Rakhine State. Cyclone Nargis led to a large number of NGO-led mangrove reforestation efforts in the Ayeyawady Delta, but mangroves continue to decline in both extent and quality. Less than 1% of mangroves are legally protected and there is growing pressure on the 137 sq km Meinmahla Kyun Wildlife Sanctuary, the largest area of intact mangroves in the delta, for fuelwood and charcoal production. In areas of Malaysia and the Philippines, **sustainable harvesting regimes** have been in place for decades that allow for mangrove cutting in ways that do not threaten the integrity of the forest. Myanmar needs to practise this sustainable use approach. Myanmar recently became a member country of Mangroves For the Future (MFF), a project that has been successful in protecting coastal regions, providing alternative livelihoods, and conserving mangroves throughout the region. As this project expands in Myanmar it could be a key tool in protecting the remaining mangroves along Myanmar's coast, and in helping reduce vulnerability to future natural disasters.

In Myanmar, forest clearing for the **expansion of commercial agriculture** is now the leading cause of deforestation. While this process has been occurring for many decades, the current rate of forest conversion is unprecedented. While official figures indicate that 16 square km of concessions were issued for oil palm and rubber plantations in 2013/2014. Furthermore, this excludes concessions allocated by regional, military, and or non-state authorities, so the total number could be higher. The laws, regulations, and procedures by which these concessions are allocated, especially those involving degazetting of forest reserves or those located within forest reserves, are spread across numerous uncoordinated jurisdictions and the use of legal loopholes, special permits, and exemptions is common.

In the forestry sector itself, promising new reforms are underway, but so far have focused only on FD-managed timber estates. The remaining natural forests in the country's resource-rich, ethnic minority areas remain outside of any effective forest management and are highly vulnerable to extensive logging and forest conversion. The FD is in the process of reforming itself into a well-governed and accountable agency. However, the transfer of forests under FD's jurisdiction into agribusiness concessions under the authority of other ministries presents new institutional and policy challenges.

With no reversal of policy, the decline in the extent and quality of Myanmar's forests will continue to accelerate. The most urgent need is to redefine the **permanent forest estate** (PFE) under FD jurisdiction, recognizing that large areas of forest are now under permanent agriculture or plantations or other concessions, and many high conservation value forests outside of FD jurisdiction need to be preserved. Given competition with agricultural land use and, particularly in Sagaing Region, mining, the PFE should be re-assessed.

The FD needs to put in place measures that break the deforestation sequence that starts with the removal of larger trees by commercial operators, then less valuable species for domestic construction and fuelwood, and ends with the conversion of degraded forest to plantations and/or small-scale cultivation. Large-scale **forest restoration** is needed, a task that the FD is unable to accomplish alone. New approaches are required whereby local communities and the FD work together to protect and replant forests and prevent forest degradation. Many forests are exhausted after decades of over-extraction and need to be closed for at least 10 years.

Timber harvesting and processing capacity must be kept at appropriately low, sustainable levels to allow the exhausted forests to recover both ecologically and commercially. Domestic wood needs must be supplied through a legal and regulated system, not ad hoc as at present. Sustainable forest management must be applied to the currently 'unclassed forests' rather than using them to augment declining timber yields from the PFE without regard to their condition.

Community forestry has had a generally positive experience in Myanmar but the model has focused on small areas and is cumbersome to negotiate. Progress has been slow: approximately 80,000 hectares of forest have been brought under formal community management since the Community Forestry Instructions were issued in 1995. The National Forestry Master Plan sets a target of 980,000 hectares of community forest established by 2030. To contribute to a national PFE restoration program, the process needs to be simplified and scaled up and, crucially, communities need to be assured a fair share of the benefits. For example, communities could be responsible for designing forest management plans, establishing nurseries, planting native species, and protecting the forest in cooperation with FD. In exchange they would have the right to collect fuelwood and construction timber within agreed sustainable levels, and if consent to harvesting, would receive an equitable proportion of the timber revenue. This approach would be compatible with REDD+ and the Bonn Challenge, a global program launched in 2011 to restore 150 million hectares of the world's deforested and degraded lands by 2020. This approach could be accelerated by working with NGOs, such as the Center for People and Forests (RECOFTC), which are well-placed to support and scale-up community forestry projects.

Myanmar is very well endowed with coastal and freshwater **wetlands**. In 2001-2003, wetland surveys were conducted in the Central Dry Zone, along the Ayeyawady River, in Shan State, and in Kachin State. Ninety-nine wetland sites were surveyed, including 19 that were assessed as globally significant. The results were published in 2004. The same year Myanmar joined the Ramsar Convention and nominated its first and only Ramsar site: Moeyungyi Wetland Sanctuary, a 100 sq km

man-made wetland near Yangon. Indawgyi Lake has been submitted as Myanmar's second Ramsar site and there is interest in nominating parts of the Gulf of Mottama, which is home to Southeast Asia's largest intertidal mudflats and is essential for the survival of the Critically Endangered Spoon-billed sandpiper (*Eurynorhynchus pygmeus*).

Despite their importance for both biodiversity and livelihoods, Myanmar has no wetland management strategy. As the basis of such a strategy, the 2004 wetlands inventory would need to be updated and expanded to include more information on fish diversity and to fill geographic gaps, notably Shan State, Rakhine State, Taninthayi Region, and the upper Chindwin River.

Table 19. National Targets and Priority Actions for Aichi Target 5.

Target and Action	Lead
Target 5.1: By 2020, the area of DMDF and low-elevation evergreen forest under sustainable management has increased	
Action 5.1.1 Establish ICCAs, CF, and/or PAs in priority DMDF and low-elevation evergreen areas to improve sustainable management	FD
Target 5.2: By 2020, the rate of mangrove loss has decreased to less than 0.25% annually	
Action 5.2.1 Draft and begin to implement a national mangrove action plan, including CF and LMMAs	FD
Target 5.3: By 2018, the PFE will have been re-assessed	
Action 5.3.1 Assess the status of forest cover in the PFE (i.e. Reserved Forest, Protected Public Forest and Protected Areas) and unclassified forest areas for potential inclusion in PFE and areas of PFE overlapping with agricultural concessions	FD
Action 5.3.2 Update Geographic Information System (GIS) database showing PFE	FD, GAD
Target 5.4: By 2020, forest area under community management has been expanded to cover at least 130,000 ha	
Action 5.4.1 Expand community forestry to cover at least 130,000 ha	FD
Action 5.4.2 Review and amend Community Forestry Instructions (CFIs) (1995)	FD
Target 5.5: By 2020, all wetland areas surveyed and prioritized for conservation value	
Action 5.5.1 Update national wetlands inventory	FD, I/NGOs
Action 5.5.2 Nominate three additional Ramsar sites to Ramsar Secretariat	FD
Action 5.5.3 Implement Ramsar Convention activities	FD, I/NGOs
Action 5.5.4 Establish community-based participatory monitoring and management programme in Ramsar sites and potential Ramsar wetlands	FD, I/NGOs
Target 5.6: By 2020, implement REDD+ Readiness Road Map	
Action 5.6.1 Develop REDD+ strategy and safeguards	FD and REDD+ Task Force
Action 5.6.2 Implement REDD+ Readiness Road Map	FD and REDD+ Task Force
Action 5.6.3 Pilot REDD+ activities	FD and REDD+
Target 5.7: By 2018, effective mechanism on combating illegal logging has been put in place	
Action 5.7.1 Establish national-level mechanism for combating illegal logging	FD
Action 5.7.2 Improve budget allocation for combating illegal logging	FD
Target 5.8: By 2020, negotiation phase to sign Forest Law Enforcement Governance and Trade (FLEGT) Voluntary Partnership Agreement (VPA) a FLEGT VPA has been conducted	
Action 5.8.1 Preparing FLEGT process	FD
Action 5.8.2 Forming FLEGT Taskforce in consist of relevant organizations	FD

Target and Action		Lead
Action 5.8.3	Integrate the tasks of FLEGT in annual work plan of concerned organization	FD
Action 5.8.4	Amending Law, procedures and rules to support the implementation of FLEGT	FD

4.6.6 Aichi Target 6: By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits

The **fisheries** sector is the second largest food producing sector after agriculture and is a very important source of food security and employment. The seafood sector alone employs 3-4 million people directly and focuses primarily on the export market. Freshwater fisheries are mostly for domestic consumption. The majority of data relating to fisheries relate primarily to marine fisheries, as estimating the yield and sustainability of freshwater fisheries in Myanmar is difficult to establish, as fish catch is consumed domestically and the fisheries are highly dispersed. Between 1995 and 2010, the value of Myanmar's fisheries increased rapidly to about US\$500 million, primarily due to increased effort, as measured by the number of both subsistence and commercial boats and fishers. However, since 2010 there has been a **sharp decline** in total catch and quality of fish harvested. Anecdotal reports suggest that fish and shrimp harvests have fallen by as much as 90% over the past 10 years, a decline that has affected both capture fisheries and aquaculture.

Myanmar has impressive freshwater capture fisheries, utilized primarily for domestic consumption, associated with the Ayeyawady, Chindwin, Sittaung and Thalwin Rivers, encompassing a total aquatic resource area of approximately eight million ha of permanent and seasonal water bodies. In addition, the Department of Fisheries (DOF) estimates that there is an additional six million ha of floodplains. Myanmar potentially has an inland fishery greatly exceeding that of any single national part of the Mekong River basin, and quite feasibly rivals that of the lower Mekong Basin in its entirety. There are also great similarities in the fisheries of the Ayeyawady and Mekong and Myanmar presents a fascinating opportunity to compare statistics and experiences between these regions,

Inland capture fisheries are divided into two main categories, lease-able fisheries and open fisheries. Lease-able fisheries establish private plots, traditionally auctioned every year, on floodplains where fish are captured in private traps designed to capture fish migrating off floodplains at the beginning of river drawdown. Open fisheries relate to all other areas and include all types of fishing operations. The right to fish in these areas is licensed by DOF, and all fishing gears require a license, although in general licenses for small scale fishing for subsistence are not enforced, with licensing focusing on commercial fishing operations. Threats to inland capture fisheries have not been extensively investigated and are likely to relate primarily to unsustainable harvesting practices and pollution of key water bodies. DOF has recently extended leasing periods at some lease-able fisheries to 9 years to try to encourage long-term sustainable practices and improve management of these fisheries.

The Bay of Bengal Large Marine Ecosystem Project (BOBLME) national report on sustainable management of the coastal and marine areas identifies key existing and emerging threats to coastal and marine fisheries in Myanmar. The greatest threat to marine fisheries is **unsustainable harvesting**, both legal and illegal. The major factors behind the decline in coastal fisheries include the

use of intensive and destructive fishing gear, little respect for seasonal closures, local and foreign trawlers illegally entering near-shore areas, and loss of mangroves, sea grass, coral reefs, and other ecosystems essential for the survival of fish at different stages in their life cycle. The **shrimp sector** has been particularly hard hit. In northern Rakhine State, the area of shrimp farming increased from 34,000 hectares in 2001, to 63,000 hectares in 2005, and to 45,000 hectares by 2010. Meanwhile, productivity declined from 200 kg/hectare/year to less than 20 kg/hectare/year, likely the result of clearing mangroves, which provide a natural nursery habitat for shrimp larvae.

This situation was confirmed by the Norwegian marine research vessel RV Fridtjof Nansen, which returned to Myanmar after a 30-year gap to survey 145 locations across its Exclusive Economic Zone. The preliminary results show that there have been dramatic declines in fish populations with the biomass of pelagic (open ocean) and demersal (which live on or near the ocean bottom) fish **declining by 90% and 60%**, respectively, since the previous survey in 1980. This decline is almost certainly the result of massive overfishing. The DOF is the government agency primarily responsible for enforcing fisheries legislation. DOF faces the difficult task of enforcing laws in, as well as collecting revenues from, poorly serviced, isolated fishing communities. One of its primary activities is issuing fishing licenses, which may be issued to the highest bidder, rather than based on long term fisheries management. This precludes community participation and since the licenses are often re-auctioned to several operators, increases pressure on fish stocks.

To address illegal and unregulated fishing, DOF has established 13 checkpoints for in-shore fishing vessels (within 10 nautical miles of the shoreline). There has been little action, however, to address illegal fishing by off-shore vessels. Effective action off-shore would require cooperation with the navy, which has the most effective marine enforcement capacity in Myanmar. A new threat, which could massively impact future harvests, is that **juvenile fish**, which were previously of no commercial value, will be harvested using fine trawl nets and sold as feed to aquaculture farms in Thailand, and within Myanmar as the domestic market further develops.

Lessons from other countries in the region (e.g., Philippines) show that when fishing communities are given more responsibility and authority for managing their local fisheries, either alone (**community-based management**) or in cooperation with government (**co-management**), compliance with rules and regulations increases, leading to more sustainable fishing practices. Regional experience also shows that when communities are given more control over their resources, they tend to take better care of them and invest their own time and effort in protecting them.

The laws governing fisheries are the Law Relating to the Fishing Rights of Foreign Fishing Vessels (1989, amended in 1993), Aquaculture Fisheries Law (1989), Myanmar Marine Fisheries Law (1990, amended in 1993) and Freshwater Fisheries Law (1991). Drafted with minimal public consultation, these laws were not tailored to local conditions and have proved ineffective at halting the decline in fish stocks. In response, the Rakhine State parliament approved a **Freshwater Fisheries Law** in September 2014. The key insight of the law (which also covers coastal fisheries) is that the principal solutions to sustainable fisheries are not technical, but rather are driven by governance. Building on regional experience, the law allows the formation of community fisheries committees and the negotiation of co-management agreements. The Rakhine fisheries law and partnership could serve as models for other states/regions in Myanmar embarking on similar reforms.

Similar laws could help address pressures on freshwater fisheries in other areas of the country, such as in Inlay Lake and the Ayeyawady River. In the Ayeyawady electrofishing has emerged as a major threat, decimating fisheries as well as impacting species that depend on them, such as the Critically

Endangered Irrawaddy Dolphin. Inlay Lake is another fishing hotspot, home to nine endemic fish species and several snails, but is threatened by a range of impacts, primarily from surrounding terrestrial activities.

Currently, few coastal or marine areas are formerly protected. This is a gap that could be addressed through enhanced management and through the creation of additional protected areas (see Target 11). Although a shark protection area has been created in the Myeik Archipelago, and additional crab protection areas have been established, these do not appear to be enforced as no-fishing zones and in practice have little conservation value. Key coastal fisheries habitat such as coral reefs have also been heavily impacted by illegal fishing activities including trawling and blast (dynamite) fishing.

Trawlers illegally entering the 10-mile near-coastal exclusion zone are a major threat to coastal fisheries. Trawling with fine nets for small fish in coastal areas is known to be a significant driver of the depletion of coastal fisheries, as it rapidly depletes commercial fish stocks by removing immature fish and destroying aquatic habitats which are important nurseries for commercially important fish species. Illegal trawling in coastal areas consequently has severe long-term economic costs and often results in conflict with local fishers. Enforcement of the coastal exclusion zone for these trawlers is critical for the sustainability of marine fisheries in Myanmar. In this case, there may be an opportunity to engage the **Myanmar Fisheries Federation** to encourage its members, many of whom are spending more and more time and effort to catch fewer and fewer fish, to respect the law in their own long-term interests. This is a complex case to make and will require pressure from all levels of government, bodies such as the Rakhine Fisheries Partnership, and media.

Table 18. National Targets and Priority Actions for Aichi Target 6.

Target and Action	Lead
Target 6.1: By 2020, states/regions have approved laws allowing for community and/or co-managed fisheries	
Action 6.1.1 Support approval of laws allow for community and/or co-managed fisheries in six additional states/regions	DOF
Action 6.1.2 Register 400 additional CFiUGs and explore further capacity development, including through partnerships	DOF, Universities
Action 6.1.3 Expand area under CFiUG management to cover 10,000 hectares through establishment of locally-managed fishery management zones	DOF
Action 6.1.4 Develop guidelines for sustainable management of CFiUG and provide support to communities in following the guidelines	DOF, I/NGOs
Action 6.1.5 Implement sustainable aquaculture technology transfer programme	DOF
Target 6.2: By 2020, total commercial marine catch reduced to more sustainable levels	
Action 6.2.1 Develop sustainable, ecosystem-based fishery management plan for the Myeik Archipelago	DOF
Action 6.2.2 Establish a network of NFZ to protect key spawning sites, as part of an ecosystem-based fishery management planning process	DOF
Action 6.2.3 Establish a joint enforcement task group to control Illegal, Unreported, and Unregulated (IUU) fishing in MPAs, NFZs, and during closed season	DOF, MOECAAF, Navy
Action 6.2.4 Enhance education and outreach to publicize information on seasonal/site closures and gear restrictions	DOF, Media
Action 6.2.5 Develop alternative livelihood pilot projects for select communities during seasonal closures	DOF, I/NGOs



4.6.7 Aichi Target 7: By 2020 areas under agriculture, aquaculture, and forestry are managed sustainably, ensuring conservation of biodiversity

The agriculture, aquaculture, and forestry sectors are dominant in Myanmar, currently providing the vast majority of employment, and a significant proportion of export earnings. Agriculture alone accounts for 36% of output (UNDP 2011a), two-thirds of the country's employment, and 25-30% of exports by value. An abundance of land, water, and low-cost labour contribute to the output of the sector and drive its contribution to the economy. Furthermore, Myanmar's agriculture sector is relatively untapped: only a fifth of the country's total land area is used for crop production and only 18.5% of this is irrigated. The same numbers for Thailand are 42% and 29% and for Vietnam are 34% and 42%. Enhancing agricultural productivity and access to food is also important to enhance food security for the growing population in Myanmar. Agricultural exports can be an important source of foreign exchange earnings in the early stage of transition.

Functional ecosystems, including forests, are fundamental for the continued viability of agricultural systems. Forests help to maintain hydrological and soil systems that are essential to agricultural production. Proximity to forests increases pollination and yields of some crops, while the birds and bats and insects found in greater numbers near forests help to control pests.

Cultivated landscapes in turn play essential role in biodiversity conservation. Agricultural systems, including agroforestry and silvo-pastoral systems, connect forest fragments by providing corridors for the dispersal and migration of species. Agricultural lands can also support high biodiversity themselves – some shifting cultivation systems and agroforests rival nearby forests in biodiversity and the number of species of potential conservation concern found within.

The integration of conservation and agriculture in multi-functional landscapes, with policies that affirm smallholder farmers as the backbone of agricultural production, is essential for achieving the goals of agricultural growth, poverty reduction, and biodiversity conservation. This integration plays out over multiple scales depending on local realities of tenure and crop needs, from the landscape level to the sustainable management of farms and forests. Models can be found in traditional management systems as well as modern precision agriculture techniques.

Smallholder farmers are the backbone of Myanmar's agricultural sector and are together the country's largest investors in agriculture. Agricultural policies should support these farmers' security and profitability, while minimizing environmental impact where possible. Support for post-harvest processing technology can increase product quality and profitability. Decreasing post-harvest spoilage and improving food transport, including cold-chains, can increase the efficiency of farms by minimizing waste.

Certification schemes, including organic certification, can provide incentives for sustainable agriculture and improving food and farmer safety. Farmers' organizations and cooperatives can minimize the cost of certification and provide bargaining power and other economies of scale to members. Extension programs currently include Integrated Pest Management, and farmer extension services supporting IPM, organic farming, and other sustainable farming methods should hold trainings more frequently and reach more farmers.

In the 1950s, Myanmar was the world's leading **rice** exporter. However, 30 years of central planning saw a collapse in production. Since economic reforms started in the late 1980s, rice production has more than doubled, the result of an expansion in paddy area and increased yields. The production of pulses, Myanmar's second most valuable crop, has undergone even more dramatic increases in production, area, and yields (Table 21) (Myanmar Agriculture in Brief 2013, MOAI) .

Table 21. Rice and Beans Cultivated Areas and Productions.

Crop	2009/10	2010/11	2011/12	2012/13	2013/14
Rice					
Area ('000 hectares)	8,067	8,047	7,593	7,241	TBC
Production ('000 tons)	32,681	32,579	29,010	27,704	TBC
Productivity (tons/hectare)	4.06	4.07	3.83	3.84	TBC
Pulses					
Area ('000 hectares)	4,383	4,501	4,417	4,449	4,534
Production ('000 tons)	5,584	5,896	5,506	5,800	6,004
Productivity (tons/hectare)	1.27	1.31	1.25	1.30	1.32

Traditionally, rice in Myanmar has followed low-intensity cultivation practices, taking advantage of the natural monsoon cycle to provide water and high nutrient silt carried with floods. At 5 kg NPK/ha, fertilizer use in Myanmar is very low and has fallen by 75% since 1995. There is therefore scope to increase productivity and production.

The government has stated a goal of transitioning to a shorter crop cycle to increase exports. Regional experience shows that such "hyper intensification" is a serious threat to both biodiversity and rice production. This risk is exemplified in the Mekong Delta in Vietnam where starting in the 1990s the government built high dikes (or polders) to allow the production of three rice crops per year, instead of the traditional 1-2 crops per year. The consequences of the three rice crop policy have been significant: massive increase in use of fertilizer and pesticides to compensate for the sediment and nutrient delivery provided by the annual flood pulse of the Mekong), increased flooding downstream

(because of constriction of the floodplain by the high dikes), loss of capture fisheries (because the high dikes function as mini-dams and block fish migration and recruitment), health hazards (because of the unregulated use of pesticides), and poverty (because farmers are trapped into growing low-value rice and have to use more and more fertilizer to maintain yields). The region's governments often regard rice as "white gold" and see rice exports as a way to prosperity. But Vietnam's experience shows that while construction companies and state-owned enterprises with an effective monopoly on rice exports have benefited, farmers and the environment have suffered.

Integrating aquaculture and animal husbandry with rice cultivation can improve rural nutrition, diversify income, reduce the use of pesticides and herbicides, and increase the efficiency of nitrogen uptake. Labor and water availability are constraints to these integrated farming systems, which also increase on-farm biodiversity and can provide habitat for water birds. Seasonal rotation between salt-adapted rice and brackish water aquaculture may be viable adaptations to paddy salinization and sea-level rise in coastal areas.

Climate change adaptation and mitigation should be mainstreamed into agricultural and rural development strategies to improve sustainability. Examples would include accounting for sea level rise in projections of rice production, helping farmers adapt to changing weather patterns in the Dry Zone and the Delta, and conducting research on resilient crop varieties, including local landraces.

By regional standards, **aquaculture** is small but has grown rapidly. The area of aquaculture, predominantly freshwater fish ponds and shrimp farms, expanded from 12,300 hectares in 1991 to 181,600 hectares in 2013, and production rose from 6,400 tons to 944,800 tons over the same period, partly in response to declining marine catches. This expansion is expected to continue with the continued decline of wild catch, increased investment, and better access to foreign markets. The Myanmar Fisheries Federation has identified aquaculture as an investment priority, particularly for tilapia and other fast-maturing species.

Over half of the aquaculture area, 92,400 hectares, consists of **shrimp** farms. As in many countries, these have had a devastating impact on mangroves, particularly in Rakhine State and the Ayeyawady Delta. The impact in northern **Rakhine State** has been particularly severe. Starting around the year 2000, large areas of mangroves were cleared to construct ponds, which removed the vital environmental goods and services that mangroves provide: including nursery areas (food and shelter) for juvenile shrimp, crabs and fish, both inside and outside the ponds; and protection against storms. Because of this mangrove loss, the natural recruitment of shrimp declined sharply and the coastal population became more vulnerable to storms such as Cyclone Giri, which struck in 2010 and killed 157 and left 70,000 homeless.

Yields have fallen so low that nationally shrimp exports decreased from 240,000 tonnes in 2005 to 190,000 in 2011. Meanwhile, global shrimp demand and prices have been rising steadily and there is a growing consumer preference for farmed shrimp that have been produced in environmentally friendly ways. Recovery of the shrimp sector, and the opportunity to participate in new export markets, would require **restoring mangroves** over 40,000 hectares of abandoned shrimp ponds. This would need multi-million dollar investments in pond management, hatcheries, landscaping to re-establish the tidal hydrology, and natural and assisted mangrove regeneration. Such investment could be driven by international institutions such as the World Bank, in partnership with government, local organizations, and multi-stakeholder platforms such as the Rakhine Fisheries Partnership.

Aquaculture expansion and investment often causes privatization of previously common resources and risks increasing vulnerability of small scale fishermen and gleaners. Disputes between fishermen and aquaculture investors have been documented in both freshwater and coastal areas of Myanmar. Policy on granting aquaculture concessions and permits should develop recognizing customary use, community management, and sustainable management, so that aquaculture investment does not fuel “water grabs” that mirror ongoing conflict over land concessions

Integration of aquaculture with mangroves or rice paddy could mitigate competition over competing coastal resources. Silvo-aquaculture systems have been piloted in communities in the Delta to maintain mangrove cover. Research on mola fish production in rice paddy has been facilitated by the Department of Fisheries and World Fish.

Increasing the sustainability of the **forestry** sector is addressed in Target 15 and to a lesser extent Target 5. However, this topic is also highly relevant to, and affected by, agriculture. After decades of over-harvesting, virtually all of Myanmar's accessible forests have been logged out and are at risk of conversion to plantations or crops. In these areas, the forests need to be restored through collaboration between community and the FD that provides real incentives for protection and/or sustainable use. The last large areas of commercially valuable forest are in northern Myanmar and in the Taninthayi Region, which holds the largest remaining tracts of **lowland wet evergreen forest** in the biologically-rich transition zone between the Indochinese, and Sundaic biogeographical regions. The confluence of these biogeographic regions supports a unique assemblage of species, including the endemic Gurney's Pitta and other globally threatened species, such as tigers and Malayan tapirs. Their lowland topography, one of the attributes that makes them so valuable for biodiversity, also renders them extremely vulnerable to logging, land speculation, hunting, and the expansion of agriculture, especially rubber and oil palm plantations.

A national target for edible oil production has led to the allocation of large **palm oil** concessions with a target of nearly 3,000 sq km of oil palm by 2030. Some concessions overlap with the proposed Lenya National Park and Lenya National Park Extension. Most concessions have not yet been cleared, providing an opportunity for strategic planning of the sector in order to minimize environmental impact, particularly in areas of global conservation importance like Lenya National Park and its extension, which are on Myanmar's World Heritage Tentative List. Oil Palm concessions should not be granted in High Conservation Value Forest areas according to international industry standards.

Table 19. National Targets and Priority Actions for Aichi Target 7.

Target and Action		Lead
Target 7.1:	By 2020, sustainable management has been implemented in 10% of rice paddy area	
Action 7.1.1	Develop sustainable rice cultivation guidelines and implement across 10% of rice cultivation area	MOAI
Action 7.1.2	Hold agricultural extension events to train farmers in sustainable rice cultivation techniques and certification	MOAI
Target 7.2:	By 2020, 5% of fish and shrimp aquaculture follows international best practices for sustainable management	
Action 7.2.1	Establish extension programme for sustainable aquaculture management	DOF
Action 7.2.2	Develop pilot shrimp aquaculture projects meeting international certification standards for sustainable aquaculture and food safety export standards	DOF
Action 7.2.3	Develop alternatives to fish feed for domestic aquaculture, including soy-based feed	DOF



4.6.8 Aichi Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity

Despite having relatively low levels of pollution compared to many other countries in Asia, Myanmar faces increasing threats to ecosystem function and biodiversity from pollution. The draft Myanmar State of the Environment Report identifies significant pollution issues including toxic wastes from small and large-scale mining, release of untreated industrial waste, release of untreated sewage, inadequate disposal of solid urban waste and excessive use of agrochemicals.

Research on the impacts of pollution on ecosystems and biodiversity in Myanmar is currently limited. Known pollution impacts on ecosystem function and biodiversity relate primarily to the contamination and eutrophication of sensitive aquatic ecosystems and include: threats to the Irrawaddy Dolphin resulting from bioaccumulation of mercury released by extensive gold panning and mining in the upper reaches of the Ayeyawady and Chindwin Rivers; declines in native invertebrate fauna and fish in Inlay Lake caused by excessive fertilizer and pesticide use on floating tomato gardens; eutrophication and sedimentation of rivers and other water bodies caused by release of untreated sewage as well as nutrient and sediment releases from large scale deforestation. Research conducted by the Smithsonian Institute indicates rapid and extensive expansion of mining in the Sagaing Region, which is likely to have significant implications for pollution discharges, and similar expansion is likely to be occurring elsewhere in Myanmar.

A number of chemicals used for veterinary purposes, as pesticides, and as fuel additives are known to have catastrophic impacts on ecosystems and are unregulated in Myanmar, although the extent to which these chemicals are used is not known. Accumulation of organochlorines (typically used as pesticides) is known to threaten raptors, veterinary use of diclofenac severely affects populations of vultures, and, in addition to widely recognized impacts on human health, lead pollution resulting from the continued use of tetraethyl lead in fuel causes toxicity in plants, destroys natural communities of

micro-organisms and can bioaccumulate to toxic levels in animals. Regulation of such chemicals, consistent with international environmental standards, is a priority to minimize impacts on biodiversity.

A review of sources and types of pollution that have a high risk of threatening sensitive ecosystems or leading to biodiversity loss is a high priority for understanding and ultimately reducing the existing effects of pollution on biodiversity in Myanmar. Monitoring of pollution levels and impacts on biodiversity in high risk environments is important to inform the development of management strategies, and also to provide a basis for assessing the potential impacts of proposed developments. The establishment of a community water quality monitoring network would permit cost-effective basic water quality monitoring to be implemented over large areas. Such a monitoring program would enable identification of waterways where ecosystems are threatened and potentially allow point sources of pollution to be identified.

Rapidly accelerating development following recent political and economic reforms is likely to significantly increase the threat to ecosystems and biodiversity from pollution. Sewage and solid urban waste will increase due to growing urban populations and consumption; industrial pollution will rise due to rapid growth in industrial development, particularly around special economic zones; mining waste will increase due to increased access to mineral resources by large corporations; and agrochemical use will increase due to improved availability.

Development at industrial zones (IZs) and Special Economic Zones (SEZ) such as Dawei, Thilawa, and Kyaukpyu has significant potential to outpace the capacity to assess environmental impacts and apply appropriate environmental standards (Figure 8). The experience at some special industrial zones elsewhere in Asia indicates that these areas have a high risk of severe long-term pollution problems leading to impacts to human health, degradation of local ecosystems, and loss of biodiversity, and may be vulnerable to a race-to-the-bottom scenario where IZs compete for clients by providing lower environmental compliance costs and hence lower environmental standards. Good environmental planning, including an effective Environmental Impact Assessment (EIA) process, transparent monitoring and consistent enforcement of environmental standards are critical to managing the impacts of pollution on ecosystems and biodiversity.

The rapid economic growth is occurring in the context of low levels of regulation of industrial and urban pollution, and limited capacity to apply or enforce environmental standards. Provisions relevant to the management and control of pollution are dispersed throughout different legislation and authority is divided between different government bodies. This lack of centralization reduces capacity to identify regulating authorities, reduces transparency of pollution control regulation, impedes the development of capacity to adequately address pollution impacts and undermines accountability of regulatory bodies. Even where requirements for wastewater or air pollution management are imposed, the required environmental standards may not be specified, such that standards are often dependent on regulator discretion, limiting effectiveness. Challenges relating to management of urban waste relate primarily to the lack of infrastructure and capacity. In order to adequately meet the needs of a growing urban population, and address the already substantial problems of urban wastewater and solid waste pollution, Myanmar will need to build public and private sector capacity, and clarify responsibility for managing and monitoring urban waste.



Figure 8. Industrial Zones and Special Economic Zones in Myanmar.

The main law responsible for the assessment of future development is the Environmental Conservation Law enacted in 2012. This law gives MOECAF the authority to plan environmental management at national and regional levels and to plan, prevent, control and reduce environmental impacts. It also provides the basis for EIA/SIAs, establishes national environmental standards for industry, provides the basis for a "polluter pays" model of penalties and specifies that MOECAF should implement a comprehensive monitoring system for key sources of pollution. As EIA

Procedures are applied and refined, the next five years provides a critical opportunity to ensure that consideration of the potential impacts of pollution on biodiversity is integrated into the EIA Procedure and enforce compliance with conditions in order to ensure that pollution emissions from large scale developments are maintained within acceptable environmental levels.

MOECAF is in the process of finalizing National Environmental Quality (Emissions) Guidelines (NEQG) which apply international standards to define recommended limits for noise and vibration, air emissions and effluent discharges. The guidelines will be applied as an interim measure while National Environmental Quality Standards (NEQS) are developed during the next few years. The next five years therefore also provide a critical opportunity to ensure that the NEQG are effectively implemented to avoid environmentally damaging pollution and to ensure that the NEQS incorporates consideration of potential biodiversity impacts in setting emissions thresholds.

Table 203. National Targets and Priority Actions for Aichi Target 8.

Target and Action	Lead
Target 8.1: By 2020, understanding of the extent and severity of pollution in Myanmar and its impacts on biodiversity is significantly enhanced	
Action 8.1.1 Undertake a desktop study of existing pollution issues in Myanmar and compile a priority list of ecosystems and species at risk	ECD
Action 8.1.2 Undertake targeted field research to determine the condition of sensitive ecosystems (such as rivers and lakes) at particular risk of being impacted by pollution (e.g. near industrial sites and mining) and for which only limited information is currently available	ECD
Target 8.2: By 2017, the EIA Procedure, NEQG, and NEQS include adequate provisions to ensure protection of biodiversity and ecosystem services	
Action 8.2.1 Ensure draft EIA Procedure and NEQS are reviewed by independent biodiversity experts	MOECAF, MOST
Action 8.2.2 Conduct training on the potential impacts of pollution on biodiversity to ensure that the regulators responsible for review of EIA documentation and application of NEQG or NEQS have adequate understanding of biodiversity to assess the potential impacts of development	
Target 8.3: By 2020, a water pollution monitoring network involving both government and local communities is operational at three critical freshwater sites and at existing or proposed SEZs	
Action 8.3.1 Establish and enhance network of water pollution monitoring stations around Inlay Lake, Indawgyi Lake, and along the Ayeyawady River (particularly stretches frequented by the Irrawaddy Dolphin)	MOECAF
Action 8.3.2 Develop a community-based water quality monitoring program and provide training to support the development of a community water monitoring network	MOECAF
Action 8.3.3 Undertake water quality monitoring of water bodies within or adjacent to SEZs and with the participation of local communities	MOECAF
Target 8.4: By 2020, water quality in Inlay Lake has stabilized and has begun to show signs of improvement	
Action 8.4.1 Prioritize implementation of the Inlay Lake Conservation 5-Year Action Plan (2015-2016 to 2019-2020)	MOECAF
Action 8.4.2 Assist floating vegetable farmers in Inlay Lake to adopt ecologically-friendly practices that minimize the use of agrochemicals	MOAI
Target 8.5: By 2020, the sale and use of fuel additives, agrochemicals and veterinary drugs that are known to have significant negative impacts on biodiversity and ecosystem services are effectively controlled and, where appropriate, banned	
Action 8.5.1 Undertake a desktop study of known, internationally recognized,	MOECAF

Action 8.5.2	environmentally damaging chemicals to identify regulation gaps Regulate use of organochlorines and ban the veterinary use of diclofenac and other non-steroidal anti-inflammatory drugs known to kill vultures	MOECAAF
Action 8.5.3	Ban use of tetraethyl lead as a fuel additive banned in Myanmar	MOECAAF, MOT



4.6.9 Aichi Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment

Under the Convention on Biological Diversity, an Invasive Alien Species (IAS) is defined as a “species whose introduction and/or spread threaten biological diversity”. IAS refer to any non-native species which, when introduced, can transform the structure and composition of ecosystems, either natural or man-made, by excluding native or desirable species either directly or indirectly. IAS may belong to any of the major groups of organisms, including vertebrates, invertebrates, plants, fungi and microorganisms. IAS have the potential to have catastrophic adverse impacts on the economy and the environment. Potential costs include not only direct expenses relating to management, but also indirect costs to both market and non-market values such as increased unemployment, damaged goods and equipment, loss of agricultural, forestry and aquaculture industries, water contamination, environmental degradation, loss of biodiversity, increased rates and severity of natural disasters and disease epidemics. Effectively addressing IAS can require natural resource managers to invest substantial resources in management operations and restoring ecosystems in order to reproduce their goods and services.

Limited information is available on the presence or impacts of IAS in Myanmar, as research on the identification of invasive species or the quantification of the impacts of invasive species is scarce. A review of information currently available, including the 2011 NBSAP and the Global Invasive Species Database, identifies 33 IAS occurring in Myanmar (Table 12). Several socio-economic and environmental problems caused by IAS have already been identified in Myanmar: golden apple snail (*Pomacea canaliculata*) is a major threat to cultivated crops in Inlay Lake; Pennisetum grass (*Pennisetum sp.*) suppresses commercial teak plantings, inhibits natural regeneration and increases

fire risk; and water hyacinth (*Eichhornia crassipes*) degrades rivers and wetlands, threatening natural ecosystems and fisheries.

Further information is required to identify emerging IAS problems, identify ecosystems most threatened by IAS and assess environmental or socio-economic impacts. This information would allow the prioritization of the allocation of resources to IAS management. Early identification of IAS allows the targeting of resources and control or eradication may be undertaken at significantly lower costs than would be required to manage the IAS once established. Currently, the capacity to undertake research on IAS is limited, and obtaining the resources and skilled staff to conduct research is likely to be a challenge. Providing relevant IAS training to biological science students could be one strategy for developing the future capacity to undertake IAS research.

While many IAS are already established in Myanmar, the potential for trans-boundary movement of new IAS into Myanmar is high along land borders shared with neighbouring countries such as India, Bangladesh, China, Laos and Thailand. New IAS also have the potential to be introduced into Myanmar by water and air transport. IAS may be introduced unintentionally by migrants, tourists or through the transport of cargo or movement of pets, plant parts, seeds and residues, or introduced intentionally, for example for research, medicine, ornamental purposes, agricultural, forestry, biological control or industrial purposes. Due to institutional and political challenges, in many areas the potential for the Government of Myanmar to effectively regulate transboundary movement within the next five years may be limited. Identifying key threats, building the capacity of relevant authorities and providing appropriate information to authorities and communities is likely to be a realistic approach to managing the risk of the transboundary introduction of IAS in the short term.

Legislation and regulations relating to the control and management of IAS have not yet been enacted in Myanmar. Some legislation, such as the Forest Law (1992), the Protection of Wildlife and Protected Areas Law (1994), and the Plant Pest Quarantine Law (1993, amended in 2011) provide some regulations to control IAS, but these are not adequate to address the threat of environmental and economic damage caused by IAS. Development of targeted legislation relating to controlling the introduction, movement and management of IAS, as well as the strengthening of quarantine laws and enforcement, will be an important long-term component of the management of IAS in Myanmar.

A low awareness of IAS and their potential environmental and socioeconomic impacts amongst communities, land managers and government authorities in Myanmar is likely to be a key impediment to the identification and management of IAS. Increasing the awareness of IAS amongst communities and land managers, and providing accessible information relating to the identification and threats of IAS, will be important strategies for gaining support for IAS management and to increase community involvement in reporting of IAS. The capacity of land managers and governments to effectively manage IAS is also limited, due to the absence of a coordinating agency, limited availability of information, restricted resources and limited staff capacity. Identifying the roles of different stakeholders and assigning responsibility for the coordination of IAS management to a single agency would develop the ability of Myanmar to efficiently and effectively control existing and emerging IAS threats.

In order to best utilize resources and minimize environmental and economic costs of IAS in the long term, Myanmar requires an effective and coordinated National IAS Action Plan. Myanmar can utilize existing resources produced by national IAS programs in neighbouring countries and international Organizations such as the Global Invasive Species Programme. Regionally focused publications produced by the Global Invasive Species Program such as “*Tropical Asia Invaded. The growing*

danger of invasive alien species”, “*Prevention and Management of Invasive Alien Species: Proceedings of a workshop on Forging Cooperation throughout South and Southeast Asia*” and “*Invasive alien species: A toolkit of best prevention and management practices*” contain resources directly relevant to the development of a National IAS Action Plan and management of IAS known to occur in Myanmar.

Table 24. National Targets and Priority Actions for Aichi Target 9.

Target and Action	Lead
Target 9.1: By 2019, a National IAS Action Plan has been developed and formally approved by Government, and is under active implementation with the support of civil society, local communities, the private sector and the international community	
Action 9.1.1 Establish an IAS Unit within the Forest Department, to help coordinate the activities of government, the private sector and non-governmental organizations.	FD
Action 9.1.2 Based on desk research, targeted surveys and stakeholder consultations, identify those IAS that should be prioritized for prevention, control and eradication.	FRI, MOAI, Universities
Action 9.1.3 Identify the measures required to strengthen controls on potential transboundary movement of IAS	FRI
Action 9.1.4 Identify the priority capacity building needs of land managers and government authorities, in relation to IAS identification, prevention and management.	FD
Action 9.1.5 Prepare a ten-year National IAS Action Plan, through a participatory process involving government, civil society and the private sector.	FD, MOAI



4.6.10 Aichi Target 10: By 2015 the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning

Understanding of the **marine realm** in Myanmar is a major gap, but important to address for the conservation of biodiversity in the country. Important marine ecosystems in Myanmar identified by the BOBLME national report on sustainable management of coastal and marine resources are mangrove forests (addressed in Target 5), coral reefs, and sea grass and seaweed beds. Of these, coral reefs are the most vulnerable to climate change and ocean acidification.

Coral reefs in Myanmar are calculated to cover approximately 187,000 ha in the Myeik Archipelago, the Rakhine Coast, and to restricted areas in the Ayeyawady Coastal Zone. The Myeik Archipelago, which extends for over 300 km north to south and comprises over 800 islands, is the most important area in Myanmar for hard and soft corals (Figure 9). Elsewhere, along the Rakhine Coast, coral reefs are reported to be less developed and consist of small patches found on rocky substrates. Reef formation in the Ayeyawady coastal zone is restricted to the Coco and Preparis islands where there is no influence of river runoff. Coral reefs support high biodiversity and provide many ecosystem services which support small scale and commercial fisheries and growing tourism opportunities. Coral reefs also provide critical disaster reduction services by providing a buffer between the marine environment and coastlines. Coral reefs are one of the ecosystems most vulnerable to climate change, as indicated by the catastrophic mass coral bleaching event in the Andaman Sea in 2010, which greatly affected the integrity of coral reefs across the region.

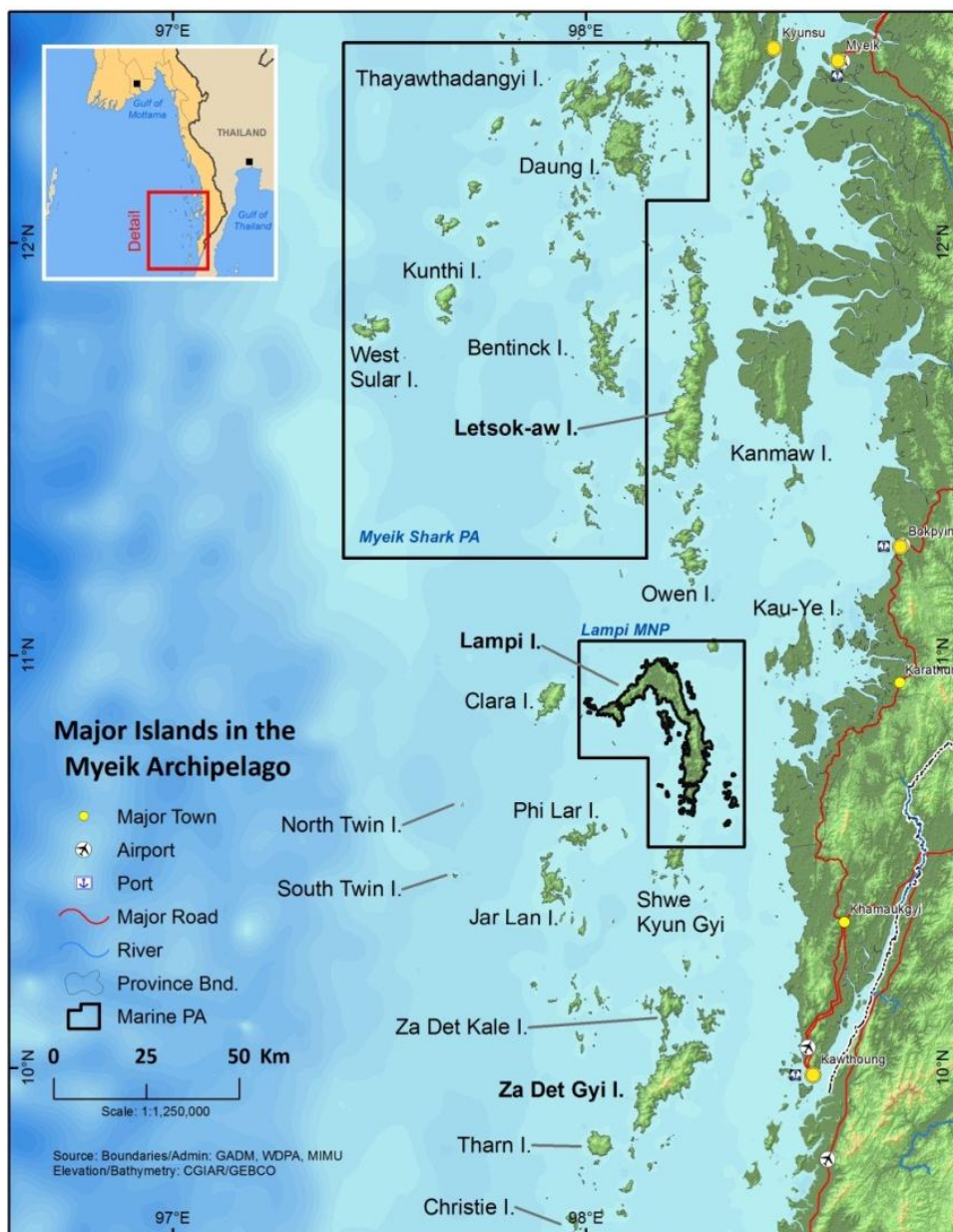


Figure 9. Map showing Myeik Archipelago.

Coral community composition and health in the Myeik Archipelago was poorly known until recently. However, from 2013-2015, comprehensive literature reviews and field-based ecological assessments were carried out to assess coral reef condition and to establish biodiversity baselines in a variety of sites throughout the Archipelago. In 2014-15, IUCN, FFI, and Prince of Songkla University (PSU) carried out four surveys of the Myeik Archipelago. Corals identified during these surveys included two species listed as Endangered on the IUCN Red List, as well as 36 species listed as Vulnerable and 4 species listed as Data Deficient. The BOBLME Rapid Ecological Assessment of the southern Myeik Archipelago indicated that many reefs have less than 10% live hard coral cover, and are dominated by corallimorphs and algae growing on dead coral and rubble. In the northern Archipelago, conditions appear to be better with hard corals making up 33% of coral cover on average and up to 80% in some areas.

While identifying high levels of diversity, these studies suggest that Myanmar's coral reef area has declined by over 56% in recent decades due to destructive fishing practices (i.e. blast fishing, near-shore trawling and light lure fishing), overfishing, unregulated marine resource extraction (e.g. sea cucumbers and clams) and mass coral bleaching. The latest survey in the Myeik Archipelago also revealed the absence of sharks, large pelagic species and other large fish for which the area was once known. This is a clear sign of an overharvested fish stock and is confirmed by a comprehensive fisheries survey in 2013 that showed the biomass of pelagic and demersal fishes has declined by up to 90% and 60%, respectively, since the previous survey in 1980. Reducing the multiple anthropogenic stresses and building reef resilience should be one of the main priorities for the Government of Myanmar to ensure sustainability of marine and coastal resources.

Sea grass and seaweed beds have not been studied in detail in Myanmar. Sea grass beds are a productive and valuable resource which provide habitats and food supply for many commercially valuable species of fish, shrimps and cephalopods as well as species of high conservation importance such as dugong and sea turtles. Sea grass beds provide a range of services such as coastal stabilization, filtration and nutrient cycling. They also provide the sheltered habitats which are crucial feeding, spawning and nursery grounds for economically important species. Their primary commercial value lies in this role as essential forage and habitat for lucrative commercial fish species. The Rakhine and the Taninthayi coastal regions support the greatest diversity of tropical marine seaweed. While studies on the seaweed flora of each coastal region are incomplete, the 122 genera and 307 species of seaweeds from Myanmar have been reported. These seaweed ecosystems are likely to be important nursery, shelter and foraging resources for many coastal fish species, and seaweeds are also eaten as vegetables or used as a source of agar extraction. In order to better target design of protected areas and management strategies to conserve these ecosystems, research is required to determine the extent and condition of sea grass beds, along with vulnerability and ecosystem service assessments to determine the main threats and socio-economic roles of these ecosystems.

Under the Myanmar Marine Fisheries Law, the DOF has banned fishing gear known to be destructive to the environment and marine resources, including pair trawling, push-net electric fishing and fishing using poisons, chemicals or explosives (Myanmar Marine Fisheries Law 1990, amended in 1993). In addition, trawling is banned within 10 nautical miles of the coastline. Law enforcement is very limited, however, due to lack of capacity, low incentives to patrol, and few enforcement officers. The existing legal framework and enforcement system will need to be reviewed and upgraded in order to permit enforcement of regulations essential for protecting marine ecosystems and associated fisheries. A review of the existing legal framework for existing Marine Protected Areas and the role of all relevant and responsible agencies across government sectors should be undertaken. In order to

improve capacity for enforcement of fisheries regulations, professional law enforcement agencies with adequate resourcing, possibly including the Navy, should be involved in controlling illegal fishing practices. International cooperation among enforcement agencies, especially with Thailand, is likely to be critical to improve law enforcement effectiveness. An information-based patrol system like SMART could be applied to create transparency and flow of information for effective law enforcement. These actions are linked with target 11.3, improving management effectiveness of Myanmar's PA system.

Although some protected areas with marine coverage have been established, there is a substantial gap of representation of marine ecosystems, especially coral reefs. The existing Marine Protected Areas such as Lampi Marine National Park (under the Forest Department) and the shark protected areas (under the Department of Fisheries) have neither effective management nor sufficient protection for coral reefs. There is therefore an urgent need to expand the system of marine protected areas and to enhance their connectivity and management to build the ecological resilience of reefs in the Myeik Archipelago. High priority sites for protection, including coral reef, sea grass and seaweed ecosystems, along with associated terrestrial ecosystems, should be identified as a first step.

Once high priority sites for protection have been identified, the ecological and socio-economic role of these sites should be assessed in order to develop the most appropriate strategies to ensure sustainable protection of these sites. In some cases, co-operative management models such as Locally Managed Marine Areas (LMMAs) may be appropriate. Establishment of LMMAs has the potential to manage anthropogenic pressures and protect key ecosystems while supporting local communities and alleviating poverty through facilitating co-management between local communities and local government and strengthening community tenure over traditional resource areas. Developing the legal and institutional framework and capacity for LMMAs will be an important initial stage. A pilot project to develop the capacity for establishing LMMAs in coral ecosystems in Taninthayi Division was implemented by FFI in 2013, and this and similar efforts could be expanded in other areas. Sustainable reef-based tourism should be investigated and piloted as a way to sustainably finance such MPA or LMMA operation. The Myeik Archipelago is on Myanmar's natural World Heritage tentative list. If eventually designated as a World Heritage Site, the potential for such tourism could greatly increase.

Establishment of a central focal point responsible for managing data and co-coordinating research and monitoring of marine ecosystems would facilitate developing an understanding of the condition, trends in, and threats to marine ecosystems in Myanmar. Mawlymine University is one of the few universities in Myanmar to offer a degree in Marine Science. Enhancing its capacity as the soon-to-be national centre for marine excellence will help coordinate research, monitoring, and data organization. This investment is important for long-term development of in-country technical expertise in sustainable marine resource management.

Table 25. National Targets and Priority Actions for Aichi Target 10.

Target and Action	Lead
Target 10.1: By 2020, 30 per cent of Myanmar's coral reefs conserved within marine protected areas, including locally-managed marine areas and other area-based conservation measures	
Action 10.1.1 Carry out detailed feasibility assessments and public consultations at priority sites for establishing new marine protected areas.	FD, DOF
Action 10.1.2 Enhance the capacity of the Mawlymine University as the	Universities

Action 10.1.3	national centre for marine excellence Establish a national coordination body to manage overlapping jurisdiction and coordinate activities	DOF, FD, Navy
Target 10.2:	By 2018, destructive fishing practices in coral reef areas banned and effectively enforced	
Action 10.2.1	Develop an effective interagency law enforcement system for the marine environment and ensure adequate resources, funding and incentives	DOF, Navy
Action 10.2.2	Confiscate gear and issue appropriate fines engaging in illegal and destructive fishing practices	DOF, Navy

4.6.11 Aichi Target 11: By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes

To date, Myanmar has designated 39 protected areas covering 38,906 sq km, 5.75% of Myanmar's land area. Seven additional areas have been proposed, which would cover a further 1.09%. Myanmar's 30 year National Forestry Master Plan set the national target for protected area coverage at 10% of total land area by 2030. Aichi Target 11 recognizes a variety of protection types, reflecting the diversity of conservation tools and approaches used internationally, and the diversity of conservation practices found in customary cultural practices. In Myanmar, these traditional practices include sacred forests, caves, lakes, and rivers, watershed protection forests, and traditional controls on hunting and fishing.

A key step for establishing an ecologically representative and effectively, equitably managed PA system is the adoption of management models that can recognize sustainable use and recognize co-management and community management. The IUCN governance types and management categories provide a framework for diversifying management options that can be adapted to local context. Currently, Myanmar's PA law only recognizes one PA management type (IUCN Category II), and one PA governance type (management by government). Recognizing co-management, community conserved areas, and sustainable use will require revisions and modifications of both policy and practice.

Of the 132 terrestrial and coastal Key Biodiversity Areas that were identified in 2012 (and which cover 65,304 km², about 10% of land area), only 35 are in-part included within protected areas. As currently under-surveyed regions and taxa receive more attention, additional KBAs are likely to be identified. Gap analyses of protected area coverage indicate that a few large protected areas, particularly in Kachin State and Sagaing Region, contribute disproportionately to national PA coverage. An assessment of ecoregion coverage also indicates which ecosystems are disproportionately well-represented, and which are under-represented. The following table shows that 9 of the 14 **WWF ecoregions** found in Myanmar are significantly over or underrepresented in the PA system (Table 26).

Table 26. Coverage of PAs for ecoregions of Myanmar.

Ecoregion	Protected Over represented	Currently Proposed additions
Eastern Himalayan alpine shrub and meadow	96%	Inkhine Bum National Park
Northern Triangle subtropical forest	36%	None
Under represented		
Coastal mangroves	0.92%	None
Northern Indochina subtropical forest	0.90%	None
Kayah-Karen montane rain forest	0.60%	<i>Represented the Wildlife Sanctuaries designated by the KNU</i>
Irrawaddy dry forest	0.45%	Mahamyaing Wildlife Sanctuary
Coastal rainforest	0.44%	None
Irrawaddy freshwater swamp forest	0.04%	Incorporate small areas into Yangon urban development plans
Nujiang Langcang Gorge alpine conifer and mixed forest	0.00%	Imawbum National Park

Most globally threatened **mammal species** in northern Myanmar are found within existing PAs, exceptions being the Myanmar Snub-nosed Monkey (CR), Tufted Deer (NT), and Chinese goral (VU), all of which are found in far-eastern Kachin State. This gap could be filled by the establishment of Imawbum Wildlife Sanctuary. Several Sundaic mammal species in southern Myanmar, including the Banded Langur (NT), Dusky Langur (NT), and Banded Civet (VU) are not found inside existing PAs. Of the 37 globally threatened **bird species** that are found outside of PAs (out of 132 globally threatened bird species found nationally), the largest unprotected group are Sundaic species. This gap could be filled by the establishment of Taninthayi National Park, Lenya National Park, and Lenya National Park Extension, which together form a discontinuous Taninthayi Forest Corridor (TFC).

In **phase 1**, several species-focused PAs could be established: Mahamyaing Wildlife Sanctuary (home to 25% of the global population of the Eastern Hoolock Gibbon), Lenya National Park (Asian Elephant, Tiger, Tapir) and Inkhine Bum National Park (Hoolock Gibbon and Gaur) (Table 27). In **phase 2**, the new PAs would include Taninthayi National Park and Lenya National Park Extension of TFC and Pan Thi Taung National Park in Kayah State where there is no protected area.

Imawbum National Park is the only known site of the Myanmar Snub-nosed Monkey. This site, along with the Southern Extension (SE) of Hkakaborazi National Park and Za Loon Taung Protected Area of Sagaing Region would be established in **phase 3**. The SE covers sub-tropical forest in the 900-1,500 m elevation range and is characterized by very high bird and plant diversity and endemism.

Establishment of new PAs should be carried out with public participation and approval, respecting customary tenure and striving to build feelings of local ownership. The current PA establishment procedure provides a framework for continued improvement of these processes.

Table 27. Plan of PAs Establishment in Myanmar up to 2020-2021.

Phase	Name	Area (sq km)	Sub-total (sq km)	Coverage (%)	Cumulative Coverage (%)
	39 existing PAs	38,906	38,906	5.75	5.75
1	Lenya National Park	1,766	3,246	0.48	6.23
	Mahamyaing Wildlife Sanctuary	1,180			
	Inkhine Bum National Park	300			
2	Taninthayi National Park	2,590	4,223	0.62	6.85
	Lenya National Park (extension)	1,399			
	Pan Thi Taung National Park	234			
3	Imawbum National Park	1,563	6,557	0.97	7.82
	Za Loon Taung Protected Area	216			
	Hkakaborazi National Park SE	4,778			
	Total	52,932	52,932	7.82	

Several ecoregions, notably the Irrawaddy freshwater swamp forest, coastal mangroves, coastal rain forest, and Northern Indochina subtropical forest are heavily impacted by human activities and are highly fragmented. Community-based management, including ICCAs and community forests, may be particularly effective in these fragmented areas, as well as in intact areas in other regions of the country. In both cases the value for securing ecosystem services and local community livelihoods will likely be significant. In more impacted areas, the emphasis should be on community control, sustainable use, and natural regeneration, rather than strict protection. In areas with more intact forests, ICCAs could provide protection without the need for a more formal, centrally-managed PA. Multiple legal tools can help to recognize ICCAs at the national, state and regional, and district levels, including revisions to implementing rules and regulations and integration into land use planning at all levels. ICCAs could be identified through participatory mapping processes and drafting of district level land use plans as described in the National Land Use Policy. Some kinds of ICCA may be recognized through community forestry certification. In other countries, ICCAs also include customary tenure areas and indigenous reserves. Establishment of a customary land type classification would greatly improve recognition and protection of ICCAs.

Effective management of protected areas is an essential component of Target 11. There are currently serious deficiencies in national capacity for PA management, including budgeting, staffing, equipment and capacity to implement collaborative management approaches. The global standard for measuring PA management effectiveness is the Management Effectiveness Tracking Tool (METT). Developed by the GEF, METT is intended to report progress regarding management effectiveness of a PA in terms of context, planning, inputs, processes, outputs, and outcomes. The completion of a METT by all PAs is a crucial first step in identifying the strengths and weaknesses of each site, and determining what steps should be taken in order to improve management quality. Another useful tool for assessing management effectiveness is the IUCN-WCPA Management Effectiveness Evaluation Framework.

Co-management, an internationally-recognized IUCN governance type, provides models for including communities in PA management, in order to increase management effectiveness and support community-based approaches to sustainable livelihoods. The Protection of Wildlife and Protected Areas Rules (2002) established the ability to designate buffer zones within protected areas. Buffer

zones should be established using participatory mapping and community-based natural resource management approaches developed in collaboration with communities living within and surrounding protected areas. Co-management, community conservation agreements, and participatory mapping and monitoring can help to reduce conflict between PAs and communities, ensure that livelihood needs are met, and provide a framework for benefit-sharing from PA designation.

To address unsustainable use, including hunting, whether for subsistence or trade, local authorities and PA managers need to be encouraged and rewarded to proactively engage local communities living in and around protected areas. This means including community engagement in their job description. To engage successfully, natural resource managers need to collaborate with social scientists and NGOs who can work with local communities over an extended period of time to facilitate collaboration and mutual understanding.

The **Spatial Monitoring and Reporting Tool (SMART)** is the standard tool for measuring, evaluating, and improving the effectiveness of wildlife law enforcement patrols and site-based conservation activities. It is intended to be used by PA managers to plan, evaluate, and implement activities. WCS is working with NWCD to implement SMART in a small number of PAs. Expanding SMART to all major PAs would be an effective way of improving management effectiveness.

The 20 PAs under NWCD management have an average annual budget of about US\$55,000; seven of these receive less than US\$30,000 per year. By comparison, some large PAs in Thailand have annual budgets close to US\$1 million. It is not realistic to expect a dramatic increase in funding for PAs in Myanmar before 2020. However, existing funds could be used more effectively. This requires ensuring that **PA budgets are linked to conservation priorities** through systematic management planning and NWCD oversight. In addition to funding gaps, there is a critical need for increased staffing, equipment, and capacity development to support implementation of international best practices for PA management.

Marine Protected Areas remain a large gap in Myanmar's protected areas system. To date, one national park (Lampi Island Marine National Park), three Wildlife Sanctuaries, two shark protected areas, and three crab protection areas have been established. The shark and crab protected areas were designated by the Department of Fisheries, which can establish special management zones. Lampi Island Marine National Park includes terrestrial areas and marine areas two nautical miles from the lowest tide areas from most islands within the park and other parts of the marine environment surrounding Lampi Island Marine National Park are designated as a shark protection area. Lampi is being used to pilot marine conservation management tools. Crab protection areas cover 207 ha with little management. In total, MPAs in Myanmar currently cover approximately 13,650 sq km (2.6% of Myanmar's Exclusive Economic Zone), and leave important fisheries and coral reef areas unprotected. New Marine Protected Areas are urgently needed to protect Myanmar's coastal ecosystems, particularly of coral reef ecosystems in the Myeik Archipelago, and ensure the sustainability of Myanmar's fisheries.

Myanmar joined the World Heritage Convention in 1994 but has only one **World Heritage Site (WHS)**, Pyu Ancient Cities, which was inscribed as a cultural site in 2014. Despite its size and biological richness, Myanmar has no natural WHS. In 2014, seven natural sites were added to the WHS Tentative List (TL): Ayeyawady River Corridor, Hukaung Valley Wildlife Sanctuary, Indawgyi Lake Wildlife Sanctuary, Myeik Archipelago, Natmataung National Park, the Taninthayi Forest Corridor, and the Northern Mountain Forest Complex (NMFC, comprising Hkakaborazi National Park and the Southern Extension (SE), Hponkanrazi Wildlife Sanctuary, and planned Imawbum

Wildlife Sanctuary; the SE is considered essential to the successful nomination of NMFC because it contains a forest type that has disappeared from the adjacent Three Parallel Rivers WHS in China). Seven PAs are currently recognized as ASEAN heritage parks for their exceptional regional conservation value. Myanmar joined the Ramsar Convention in 2004 but has only one **Ramsar site**, Moeyungyi Wetland Sanctuary, which was designated in 2004. Indawgyi Lake Wildlife Sanctuary has been nominated as a Ramsar Site. Some initiatives are on-going to nominate parts of the Gulf of Mottama as a Ramsar Site, but consultations with stakeholders, particularly local communities are required. Recognition of Ramsar wise-use principles in management in both policy and practice is essential for the successful management of these areas, which are under significant human use. The integration between ecosystems and traditional livelihoods at Inlay Lake is recognized by the listing of Inlay Lake as a UNESCO man and biosphere reserve in 2015.

Global experience shows that international labels such as WHS and Ramsar build national pride and attract international attention to the need to conserve the site, make the site subject to international scrutiny that can help protect against inappropriate development; create national and international partnerships that facilitate access to technical assistance; and bring tourists to the site with accompanying economic benefits.

Table 218. National Targets and Priority Actions for Aichi Target 11.

Target and Action	Lead
Target 11.1: By 2020, 8% of Myanmar’s land area is conserved within PAs, including ICCAs	
Action 11.1.1 Approve proposed Lenya National Park, Lenya National Park Extension, Mahamyang Wildlife Sanctuary and Inkhine Bum National Park	FD
Action 11.1.2 Establish Taninthayi National Park, Pan The Taung National Park	FD
Action 11.1.3 Establish Hkakaborazi National Park SE, Imawbum National Park and Za Loon Taung Protected Area	FD
Target 11.2: IUCN governance categories and management categories are recognized in policy and practice	
Action 11.2.1 Conduct a review of opportunities for recognizing governance and management diversity, including ICCAs, within the current legal and governance framework, including forests, fisheries, protected area categories, and other area-based conservation approaches	FD
Action 11.2.2 Recognize additional governance types and management categories using appropriate legal tools, including amendments of laws and revisions of implementing rules and regulations	FD
Target 11.3: By 2020, the management effectiveness of Myanmar’s PA system has significantly improved, with 15 PAs implementing SMART, 5 to 10 PAs implementing management plans, and local communities are involved in management activities in at least 5 to 10 PAs.	
Action 11.3.1 Complete METT survey in 20 protected areas	FD
Action 11.3.2 Implement SMART in 15 protected areas	FD
Action 11.3.3 Implement management plan addressing conservation priorities and investment in 5 to 10 protected areas	FD
Action 11.3.4 Designate buffer zones through a participatory process in select protected areas	FD, I/NGOs
Action 11.3.5 Implement pilot projects in 5 to 10 protected areas involving local communities in management, including patrolling and biodiversity surveys	FD, I/NGOs
Target 11.4: By 2020, Myanmar’s sites of premier conservation value are recognized by relevant international designations, through the designation of one natural World Heritage Site, three additional Ramsar Sites, and one Biosphere Reserve	
Action 11.4.1 Nominate a natural site for inclusion on the UNESCO World Heritage	FD

Target and Action	Lead
list	
Action 11.4.2 Nominate additional Ramsar sites	FD
Action 11.4.3 Nominate at least one additional Biosphere Reserve	FD
Target 11.5: By 2020, a Marine Spatial Plan with nested Marine Protected Areas is prepared for the Myeik Archipelago	
Action 11.5.1 Pilot marine spatial planning by developing a spatial plan for the Myeik Archipelago through a multi-stakeholder process	DOF
Action 11.5.2 Establish at least one additional MPA that can – together with Lampi National Park – serve as a model and pilot for future marine PA management	DOF, FD

4.6.12 Aichi Target 12: By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained

As a result of its size, 2,100-km latitudinal range, and diversity of topography and habitats from the eastern extremity of the Himalayas in the far north to the Sundaic forests in the far south, Myanmar is home to a rich diversity of species, including many endemics. Due in part to the historically slow pace of economic development, Myanmar has experienced significantly lower rates of deforestation and habitat loss than in neighbouring countries. But many species have been virtually extirpated (e.g., tiger) or pushed to the brink of extinction (e.g., several species of freshwater turtle) by hunting for subsistence and, increasingly, illegal trade. Rapid economic growth triggered by political and economic reforms since 2010 will put further pressure on Myanmar's habitats and species—but also provide resources and opportunities to save them.

If efforts to protect nationally and globally threatened species are not significantly improved in the near future, then it is very likely that Myanmar will experience the same pattern of species extirpations and extinctions that has been seen elsewhere in the region. The IUCN Red List of Threatened Species has assessed 3,849 species in Myanmar, 715 of which are globally threatened or Data Deficient (DD) (Table 29). The high percentage of DD species reflects the fact that a crucial limiting factor is a lack of up-to-date information on distribution and population status, as some parts of the country have not been surveyed for decades (see Target 19).

Table 29. Species of Myanmar under IUCN RedList.

Global Status		Animals		Plants		Total	
	Critically Endangered (CR)	22	3%	14	18%	36	5%
Globally Threatened	Endangered (EN)	59	9%	15	20%	74	10%
	Vulnerable (VU)	157	25%	18	24%	175	24%
Data Deficient (DD)		401	63%	29	38%	430	60%
Total		639		76		715	

Functionally important species are species which play key functional roles in the function of an ecosystem, such as soil engineering, seed dispersal, pollination or, in the case of top predators, regulation of herbivore numbers. Loss of these species can result in fundamental phase shifts in ecosystems, often resulting in cascade effects of local extinctions, or irreversible environmental damage. Although not necessarily currently threatened, such species may warrant additional conservation priority, as their conservation can avoid subsequent species loss resulting from ecosystem change.

To determine conservation priorities, species can be grouped under three categories:

1. important species for *in situ* conservation action (**Type A**) (Table 30):
 - Endemic and near-endemic species.
 - Globally threatened species for which Myanmar is or may become an important country (as populations decline elsewhere in the region).
 - Additional priority species identified by the Asian Species Action Partnership (ASAP), an interagency coalition formed to address extinction risk among the most threatened non-marine vertebrates in Southeast Asia.
2. Tortoises and freshwater turtles that are either the focus of or in urgent need of *ex situ* conservation action and re-introduction efforts (**Type B**) (Table 31).
3. Wide-ranging species of national priority and species with very fragmented populations (**Type C**) (Table 32).

Table 30. Type A: Selected vertebrate species in need of *in-situ* conservation action (Sub-type A1: Endemics/Near-endemics, n = 12).

Common name	Scientific name	Global Status
Myanmar snub-nosed monkey	<i>Rhinopithecus strykeri</i>	CR
Irrawaddy dolphin (Ayeyawady River sub-population)	<i>Orcaella brevirostris</i>	CR
Joffre's pipistrelle	<i>Pipistrellus joffrei</i>	DD
Anthony's pipistrelle	<i>Hypsugo anthonyi</i>	DD
Spoon-billed sandpiper	<i>Eurynorhynchus pygmeus</i>	CR
White-bellied heron	<i>Ardea insignis</i>	CR
White-browed nuthatch	<i>Sitta victoriaeaeis</i>	EN
Gurney's pitta	<i>Pitta gurneyi</i>	EN
Burmese eyed turtle	<i>Morenia ocellata</i>	VU
Burmese peacock softshell	<i>Nilssonina formosa</i>	EN
Burmese narrow-headed softshell turtle	<i>Chitra vandijki</i>	NE*
Burmese flapshell turtle	<i>Lissemys scutata</i>	DD

*NE = Not Evaluated

Of the Sub-type A1 species, few are currently the focus of dedicated *in situ* conservation efforts. FFI supports protection of the Myanmar snub-nosed monkey in Kachin State. WCS supports protection of the isolated sub-population of the Irrawaddy dolphin between Mingun and Bhamo. The Biodiversity and Nature Conservation Association (BANCA) support protection of the spoon-billed sandpiper in its wintering grounds in the Gulf of Mottama. In December 2014, ASAP and Synchronicity Earth held a conservation-planning workshop for the white-bellied heron and developed an action-oriented species conservation strategy, which is currently under development.

Table 30-a. Sub-type A2: Species for which Myanmar is or may become an important range country, n = 29.

Common name	Scientific name	Global Status	Common name	Scientific name	Global Status
Shortridge's langur	<i>Trachypithecus shortridgei</i>	EN	Greater adjutant	<i>Leptoptilos dubius</i>	EN
Western Hoolock gibbon	<i>Hoolock hoolock</i>	EN	Lesser adjutant	<i>Leptoptilos javanicus</i>	VU
Sunda	<i>Manis javanica</i>	CR	Sarus crane	<i>Grus antigone</i>	VU

Common name	Scientific name	Global Status	Common name	Scientific name	Global Status
pangolin					
Chinese pangolin	<i>Manis</i>	CR	Indian skimmer	<i>Rynchops albicollis</i>	VU
Black musk deer	<i>pentadactyla</i> <i>Moschus fuscus</i>	EN	Black-bellied tern	<i>Sterna acuticaudaonce</i>	EN
Asian small-clawed otter	<i>Aonyx cinerea</i>	VU	Jerdon's babbler	<i>Chrysomma altirostre</i>	VU
Smooth-coated otter	<i>Lutrogale perspicillata</i>	VU	Northern river terrapin	<i>Batagur baska</i>	CR
Hairy-nosed otter	<i>Lutra sumatranais</i>	EN	Big-headed turtle	<i>Platysternon megacephalum</i>	EN
Dugong	<i>Dugong dugon</i>	VU	Toli shad	<i>Tenualosa toli</i>	CR
White-rumped vulture	<i>Gyps bengalensis</i>	CR	Green sawfish	<i>Pristis zijsron</i>	CR
Slender-billed vulture	<i>Gyps tenuirostris</i>	CR	Large-tooth sawfish	<i>Pristis pristis</i>	CR
Red-headed vulture	<i>Sarcogyps calvus</i>	CR	Dwarf sawfish	<i>Pristis clavata</i>	EN
White-winged duck	<i>Cairina scutulata</i>	EN	Narrow sawfish	<i>Anoxypristis cuspidata</i>	EN
Masked finfoot	<i>Heliopais personatus</i>	EN	Chinese coffin tree	<i>Taiwania cryptomerioides</i>	VU
Green peafowl	<i>Pavo muticus</i>	EN			

Of the Sub-type A2 species, very few are the focus of dedicated *in situ* conservation. Although there are on-going programs in parts of the home ranges of Shortridge's langur and western hoolock gibbon, there is a need for more directed conservation action. The Turtle Survival Alliance (TSA) has been working at various sites on conservation of the Northern river terrapin and other tortoises and freshwater turtles. Friends of Wildlife (FOW) is conducting a small-scale initiative in Kachin and Shan States on conservation of vultures.

Table 30-b. Sub-type A3: Additional priority species identified by IUCN SSC/ASAP, n = 5.

Common name	Scientific name	Global Status
Irrawaddy River shark	<i>Glyphis siamensis</i>	CR
Baer's pochard	<i>Aythya baeri</i>	CR
Pink-headed duck	<i>Rhodonessa caryophyllacea</i>	CR
Largetooth sawfish	<i>Pristis microdon</i>	CR
No common name	<i>Puntius compressiformis</i>	CR

The Irrawaddy river shark is only known from a single museum specimen described in 1896. The pink-headed duck has not been observed since 1949 despite several surveys led by Birdlife International in the early 2000s.

Table 31. Type B: Tortoises and freshwater turtles which are the focus of/in need of *ex-situ* conservation and re-introduction efforts.

Common name	Scientific name	Global Status
Burmese star tortoise	<i>Geochelone platynota</i>	CR
Burmese roofed turtle	<i>Batagur trivittata</i>	EN
Northern river terrapin	<i>Batagur baska</i>	CR
Arakan forest Turtle	<i>Heosemys depressa</i>	CR

Myanmar supports globally significant diversity of tortoises and freshwater turtles, with almost 10% of the total global diversity. 28 species of tortoises and freshwater turtle have been recorded, of which seven are endemic. Key threats to their survival include overharvesting for subsistence and trade (primarily to China), habitat destruction (particularly the conversion of nesting beaches to agricultural land, and inundation following hydropower development), and four species are recognized as critically endangered or endangered on the IUCH Red List of Threatened Species.

Table 32. Type C: Landscape species of national importance and species with very fragmented distributions.

Common name	Scientific name	Global Status
Asian elephant	<i>Elephas maximus</i>	EN
Tiger	<i>Panthera tigris</i>	EN
Hog deer	<i>Axis porcinus</i>	EN
Fishing cat	<i>Prionailurus viverrinus</i>	EN
Banteng	<i>Bos javanicus</i>	EN
Eld's deer	<i>Rucervus eldii</i>	EN
Gaur	<i>Bos gaurus</i>	VU

There are believed to be 4,000-5,000 wild **Asian elephants** in Myanmar (and about 6,000 in captivity) but little reliable information exists about population distribution, status, and trends. In addition to the Rakhine Yoma Elephant Range, the North Zamari Wildlife Sanctuary has been established specifically to protect the species. Myanmar has a long history of capturing wild elephants for use in low-impact teak logging. Driven in part by low reproductive rates and high mortality among the captive population, capture is now the leading threat to the wild population. But as logging practices become increasingly mechanized, wild-caught elephants are now being trafficked into Thailand for use in the tourism industry and their ivory is being trafficked into China. As agriculture and human populations expand, human-elephant conflict, including revenge-killings of elephants, is increasingly common, particularly in the Bago Yoma. NWCD reports data on elephant killings to CITES Monitoring the Illegal Killing of Elephants (MIKE) and on ivory seizures to CITES Elephant Trade Information System (ETIS).

Historically wide-spread in Myanmar, **tiger** are now restricted to small populations in Htmanthi and Hukaung Valley Wildlife Sanctuaries (both close to the border with India), and Taninthayi (bordering Thailand's Western Forest Complex, which is home to about 200 tigers). Its survival in Myanmar is inextricably linked to intensive protection in Htmanthi and Hukaung, the creation of three protected areas in the Taninthayi Forest Corridor (see Target 11), and greater transboundary cooperation, particularly with Thailand.

Several other globally threatened species are found in Myanmar with **very fragmented populations**, often falling outside of the protected area network. For these species, for wide-ranging species, landscape level planning that improves connectivity between forest fragments is essential. Land use planning from the national level to the District level should produce landscape level forest connectivity for the conservation of these species.

In addition to the terrestrial vertebrates described above, Myanmar is home to globally significant but poorly known populations of herpetofauna, invertebrates, plants, marine species and other taxa, many of whom likely warrant urgent conservation investment. For several of these groups, identification of conservation priorities is impeded by the lack of baseline data currently available.

The trade in **endangered wildlife** is one of the greatest threats to biodiversity in Myanmar. As commercially valuable wildlife have been wiped out in neighbouring countries, Myanmar has increasingly become a source of wildlife products. Particularly vulnerable are the country's endemic species, especially freshwater turtles and tortoises. By monitoring wildlife products in Mong La in Shan State since 2006, TRAFFIC has documented the significant trade in elephants, Asiatic bears, sun bears, tigers, leopards, snow leopards, cloud leopards, turtles, tortoises, and pangolins from Myanmar to its neighbours. In Mong La, Tachilek, and other border markets, there is essentially no enforcement of Myanmar's wildlife protection laws.

Ultimately, demand reduction is needed to reduce the impact of hunting and trading. But in the meantime, **intensive protection** of key populations and greater **international cooperation**, especially the disruption of transboundary wildlife trade networks, are urgently needed. NGO-supported patrols in a few protected areas and participation in the ASEAN Wildlife Enforcement Network (WEN) are steps in the right direction but are clearly insufficient to address the threat. Effective action requires a whole of government approach that combines intelligence gathering, public engagement, targeted law enforcement, and other measures to prevent, detect, and suppress wildlife crimes. Livelihood programs are important to ensure that individuals and communities that rely on the illegal wildlife trade are provided with alternative sources of income.

Table 33. National Targets and Priority Actions for Aichi Target 12.

Target and Action	Lead
Target 12.1: By 2020, the conservation status of priority, globally threatened species in Myanmar has improved	
Action 12.1.1 Identify priority species for research and conservation actions, including from poorly described taxa, and develop preliminary species action plans	FD
Action 12.1.2 Expand programs to establish assurance colonies, captive breeding and wild release programs of threatened tortoises and freshwater turtles	FD
Action 12.1.3 Integrate the consideration of connectivity for wide-ranging species and species with very fragmented distributions in to local, regional and national landscape planning	FD
Target 12.2: By 2020, substantially reduce illegal wildlife trade in Myanmar	
Action 12.2.1 Fully implement and enforce the requirements of the CITES Convention through national legislation.	FD
Action 12.2.2 Build the capacity of law enforcement authorities to enforce wildlife trafficking regulations through involvement in ASEAN-WEN	FD
Action 12.2.4 In co-operation with TRAFFIC, implement alternative livelihood programs to reduce the dependence of key communities on the wildlife trade	FD, TRAFFIC

Target and Action	Lead
Target 12.3: By 2020, National Red List assessments of key taxa have been substantially increased, with a particular focus on endemic species	
Action 12.3.1 Conduct Red List assessments for key taxa, with a focus on endemic species	FD, I/NGOs
Action 12.3.2 Hold capacity building workshops on application of Red List criteria and categories for enhancing conservation outcomes	FD, I/NGOs

4.6.13 Aichi Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity

Preserving the genetic diversity of cultivated plants, landraces, and crop wild relatives is essential for food security, climate change adaptation, and the maintenance of cultural traditions linked with the cultivation and consumption of traditional crops, foods, and medicines.

Myanmar's wealth of traditional landraces and crop varieties has been maintained in some areas, while in other regions it is increasingly under threat. Areas of traditional diversity include the wild rice and traditional landraces in Ngawchang Hka valley in Kachin state. In other areas, hybrid crops from one seed source have replaced traditional varieties as farmers become more heavily involved in the cash crop economy. Increased commercialization of agriculture and seeds and the increase in cash cropping on both smallholder farms and plantations will reduce the genetic diversity of cultivated crops.

Although the majority of seeds used in Myanmar are produced by farmers, the current legislative framework and extension service both focus on promoting the use of commercial seeds. This demonstrates a current policy gap in agricultural programs and incentives to preserve on-farm genetic diversity. Myanmar's draft national seed policy recognizes the rights of farmers to "use, exchange, share or sell their farm-saved seed," a critically important provision to protect the rights of farmers to cultivate diverse landraces and participate in seed saver networks and exchanges. Any future seed laws and Intellectual Property Rights legislation should reaffirm this policy.

Establishing domestic and international markets for Myanmar crop varieties, including mangoes and rice, creates stronger demand for some important local varieties and can create business opportunities for farmers. The Ministry of Science and Technology is currently developing a law that would allow Myanmar to confer Geographical Indication status on specialty agricultural products, potentially including teas, thanaka, lotus root cloth, and high quality teak. The Department of Agricultural Research (DAR) plans to focus on development of 10-15 varieties of certified rice seeds and the promotion of a market for Myanmar-specific rice varieties, and has suggested the creation of a high-quality rice variety for export. While these strategies could promote specific varieties unique to Myanmar, they also create disincentives to maintain crop diversity as one variety becomes more valuable on the export market.

Loss of habitat for crop wild relatives is also a threat to agrobiodiversity, caused by expansion of monoculture crops and other land use changes. Hotspots of crop wild relatives should be identified throughout the country in collaboration with civil society, including farmer's networks, in order to document their diversity and direct efforts for collaborative research and preservation.

There is no substitute for on-farm maintenance of genetic diversity and crop diversity. Much of the agricultural diversity in Myanmar is maintained by traditional farming practices, including rotational and fallow taungya, which maintains diverse crop varieties and non-timber forest products. The recognition of communal tenure is essential for the continued cultivation of these species in diverse fields, forests, and fallows.

Collaborative research between the DAR with university researchers, farmer groups, and NGOs is necessary to document and research local landraces, identify hotspots for crop wild relatives, and develop a national strategy and action plan to direct resources. This research can also help the National Seed Bank identify priority areas for collection for ex-situ conservation.

The establishment of seed saver networks is essential for the maintenance of crop diversity. Exchanges of seeds and crop knowledge on a larger scale, modeled after the ongoing Food Seed and Culture Fair also play an important role. At these Fairs, farmers who had lost their traditional landraces from adoption of cash cropping have found them anew and brought them back to their communities.

The DAR maintains the Myanmar Seed Bank in Yezin and has over 20,000 accessions in short and medium term storage. The Myanmar Seed Bank works to inventory and conserve crop landraces through participatory field surveys, facilitating group discussions, and increasing the number and diversity of their accessions. Rice germplasm has been the focus of this collection. The Seed Bank has exchanged seeds with the International Rice Research Institute (IRRI) and has stored accessions of over 7,000 germplasms of 18 crops with the seed banks of Korea, Japan, and Thailand. Conservation of medicinal plants has also been identified as a priority and plants are being conserved by the seed bank and through the establishment of medicinal gardens for conservation and public awareness.

Increasing the number and diversity – both in crop type and region – that is preserved in the national seedbank has been identified as a priority by the national Seed Bank. Partnerships between the Department of Agricultural Research and other relevant government departments (including the Department of Medicinal Plants and Botany Departments at Universities), along with collaboration with NGOs, farmers groups, and seed saver networks would enable increased documentation of agrobiodiversity and greater diversity and scope of accessions for ex-situ conservation.

Conservation of traditional livestock breeds and their genetic diversity can follow a similar framework. Collaborative research with livestock owners, the private sector, national and international research institutions, and NGOs working on rural livelihood improvement can strengthen the scale and impact of ex-situ livestock research and conservation.

Myanmar is a signatory to the Cartagena Protocol on Biosafety to the Convention on Biodiversity, and consequently has committed to ensure that a precautionary approach is applied protect biological diversity from the potential risks posed by [living modified organisms](#), such as herbicide resistant rice, resulting from modern biotechnology. Developing the capacity to identify and manage living modified organisms, whether imported accidentally or intentionally, is required to comply with the Cartagena Protocol and protect the genetic diversity of local landraces and wild crop relatives. The process for establishing a policy on biosafety in Myanmar has been stalled after a policy was drafted, and should be renewed.

Table 34. National Targets and Priority Actions for Aichi Target 13.

Target and Action	Lead
Target 13.1: By 2020, priorities for the conservation of Plant Genetic Resources (PGR) have been identified and are addressed by programs to promote in-situ conservation a	
Action 13.1.1 Conduct collaborative research to identify national priorities for conservation of genetic diversity of cultivated crops including underutilized crops, medicinal plants, and forest products	MOAI
Action 13.1.2 Establish seed saver networks and village seed banks in regions where traditional crop varieties are under greatest threat	MOAI
Action 13.1.3 Conduct collaborative research between MOAI and farmers groups, extension agents, and farmer field schools for documentation and breeding of traditional crop varieties	MOAI
Action 13.1.4 Ensure that the Intellectual Property Rights for traditional crop varieties are recognized and protected through implementation of the Nagoya Protocol and in the national legislative framework for seeds and intellectual property	MOAI
Action 13.1.5. Encourage incentives and programs to promote on-farm conservation of plant genetic diversity	MOAI
Target 13.2: By 2020, ex-situ conservation gaps have been addressed through collaborative research and collection programs	
Action 13.2.1 Establish a program of collaborative research and collection of biological material with seed networks, farmer organizations, village seed banks, and farmer field schools	MOAI
Action 13.2.2 Collect accessions from crops and regions for the National Seed Bank that have been identified as priorities in national gap analysis	MOAI
Action 13.2.3 Continue to expand collaboration with international research institutions and to further develop research programs with national universities	MOAI
Action 13.2.4 Upgrade National Seed Bank leading to establishment of national gene bank, using cryopreservation and DNA conservation techniques.	MOAI
Target 13.3: By 2020, a crop wild relative action plan has been initiated	
Action 13.3.1 Collaborative research conducted with universities, farmers groups, and civil society to identify centres of crop wild relative diversity throughout the country	MOAI
Action 13.3.2 Develop an action plan for conservation of crop wild relatives	MOAI, MOECAF
Target 13.4: By 2020, incentives and programs to conserve the genetic diversity of livestock are established to address current gaps	
Action 13.4.1 Collaborative research to identify priorities and opportunities for conservation of livestock genetic diversity and wild relatives, including preservation of tissue samples, both in-situ and ex-situ	MOAI

4.6.14 Aichi Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable

The population of Myanmar is highly dependent on natural resources and ecosystem services, with 66% of the population working in agriculture, and much of the remainder of the rural working

population involved in other resource-dependent activities such as fishing, mining, and forestry (FAO 2015). Poor and vulnerable members of society, including ethnic minorities and women, are especially dependent on the services provided by these ecosystems due to limited economic opportunities, concentration in more rural areas, and discrimination. The exploitation of such resources in an unsustainable manner will therefore disproportionately and negatively impact vulnerable members of society as well as the biodiversity that is key to providing these services. Target 14 is a broad, cross-sectoral target and achieving its sub-targets depends on the effective implementation of other national Aichi Targets (e.g., 3, 5, 7, 10, 11, 15, and 18). In order to more completely address ecosystem values it would be necessary to implement actions for all relevant ecosystems, policies, and beneficiaries. Due to the difficulty of such a task, this target focuses on four key ecosystem services and their associated values: freshwater, forest products, pollination, and coastal flood protection and fisheries.

This target can be divided into two complementary aspects and associated actions: (1) restoration and maintenance of ecosystem services; and (2) equitable access to benefits deriving from such services. Many of the bio-geophysical services provided by ecosystems are also covered under Targets 5 and 15. Equity issues are complex, and in many cases strongly correlated with gender, race, poverty, and access to resources. Examples of ecosystem services benefiting such vulnerable groups are included below (modified from Leadley *et al.* 2014) (Table 35).

Table 35. Examples of ecosystem services and associated values (modified from Leadley *et al.* 2014).

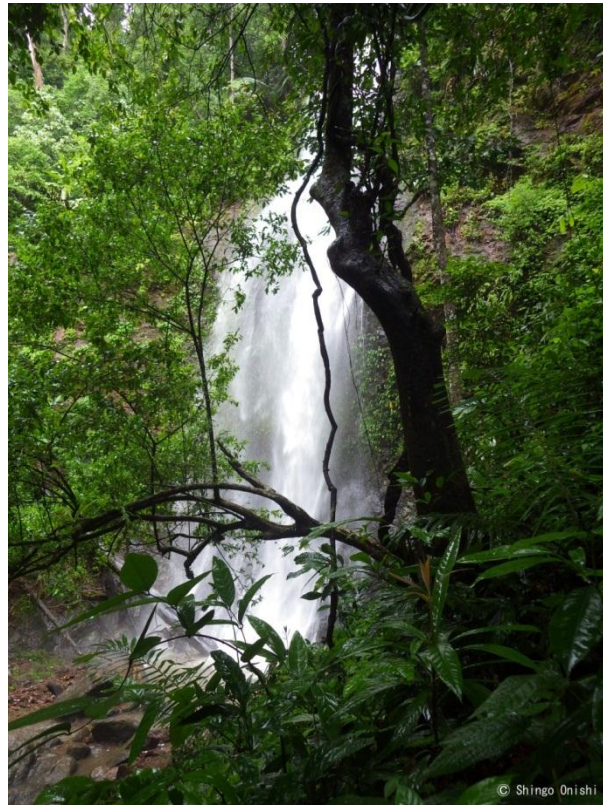
Service	Associated Ecosystem	Value
Water	Forested watersheds	Potable water, irrigation water
Fisheries	Inland/coastal water bodies, mangroves	Food security, protein, income security
Agriculture	Agro-ecological	Food security, income, preservation of traditional values and culture
Timber/fuelwood	Forest land	Timber for construction, fuelwood
NTFP and wild products	Terrestrial ecosystems	Plant and animals for food, income, medicine, materials
Medicine	Forests	Provision of traditional medicines
Ecotourism	Intact (aesthetic) landscapes	Income security
Cultural link	Numerous	Community health, identity, mental and spiritual health; other non-tangible values such as happiness
Soil fertility	Soil	Food, income
Disaster Risk Reduction	Coastal	Mitigation of flood/drought from storm events
Pollination	Agro-ecological and supporting ecosystems	Food security

Ecosystem services can broadly be classified in four categories. **Provisioning services** include production of resources such as crops, fish and livestock, and raw materials for construction and other needs, all of which directly depend on natural ecosystems. **Regulating services** include highly valuable functions such as climate regulation through the storage of carbon and control of local rainfall, and protection from disasters such as landslides and coastal storms, and are not measured in conventional markets. **Cultural** services are more difficult to measure, but are also highly valuable and include benefits such as cultural identity (which can maintain societal stability, mental health, and

other essential benefits) and ecotourism (through preservation of aesthetic values). **Supporting services** are not of direct benefit to people but are essential to the functioning of ecosystems and therefore indirectly responsible for all other services. Examples of supporting services are the formation of soils and the processes of plant growth.

The value of non-market ecosystem services can be difficult to quantify, with significant challenges associated with method and availability of information. Due to the challenges in quantifying many of the more subjective benefits, the focus is often on key provisioning services for which a market value can be more easily estimated, and as a consequence, many existing studies are likely to underestimate the value of ecosystem services.

One of the most valuable ecosystem services in Myanmar is the provision of **freshwater resources**. On average, Myanmar is a low water stress country, with the fifth highest per capita water availability in Asia and only 2.8% of the Total Renewable Water Resources consumed (Simmanee 2013). However, this masks over large regional and season differences. Rural, agricultural populations, which include most of Myanmar's ethnic minorities and poorest citizens, are dependent on watersheds to provide water for domestic use and irrigation. Agriculture is by far the largest user of water, consuming nearly 90% of water used for human use, significantly above the global average, however hydropower projects are also highly dependent on ecosystem services for reliable water flows and sediment management. Maintaining forested and intact watersheds is key to providing this water through filtration and moderation of flows throughout the year. Studies in other areas in the world make a clear case for the overwhelming economic value of safeguarding and restoring key watersheds, and this should be a goal for Myanmar as well. Potential tools include reforestation of degraded areas, enhanced agricultural cultivation techniques, and protection of upland and riparian areas. These activities could be funded through the expansion of a watershed protection fund, integration into agricultural extension activities, and in the long term, possibly by payments for ecosystem services.



Rivers and freshwater wetlands are important sources of ecological services, with potentially very high values. In addition to the agricultural and hydropower benefits provided by rivers, ecosystem services associated with rivers and wetlands include freshwater fisheries, harvested wild goods, transport, recreation and carbon storage. A study of Moeyungyi wetland in Bago estimated the site to provide a net annual benefit of US\$22 million (\$US2,200/ha/year) in ecosystem services, plus approximately US\$92 million in carbon storage functions. Despite their importance for both biodiversity and livelihoods, Myanmar has no wetlands strategy. Such a strategy should be developed and include a systematic assessment of the value of ecosystem services to facilitate incorporation into development planning. As the basis of such a strategy, the 2004 wetlands inventory would need to be updated and expanded to include more information on fish diversity and to fill geographic gaps, notably Rakhine State, Taninthayi Region, and the upper Chindwin River.

Forests support a wide range of ecosystem values including water provision (see above), supply of timber, meat from animals, and non-timber forest products (NTFP) such as medicinal plants. A systematic assessment of the values of services provided by forest ecosystems in Myanmar estimated that they generate more than US\$7 billion in goods and services every year (Emerton *et al.* 2013). Only 15% of this value is from timber and NTFPs, with the difference made up by contributions to other sectors and regulation services, such as global climate mitigation. In addition, forests provide a range of important resources for poor and vulnerable populations within Myanmar, and are also critical to preserving biodiversity.

The **pollination** of crops by insects and other animals supports food security and survival of plant species, and is especially critical for rural farmers. Pollinators include birds, beetles, rodents, and most importantly, bees (*Apis sp.*), which studies show can double the yield of some crops. There are no clear figures for the value of pollination in Myanmar, but if the global average of 9.5% of total crop value is used, it is likely to be a significant figure. In addition, the IUCN Red List Index (RLI) for other pollinators in Myanmar is declining, indicating faster relative population decreases and potential impacts to pollinated crop value. Considering that 58% of Myanmar's GDP is derived from agriculture, this is a worrying trend.

Coastal and marine ecosystems such as mangroves, intertidal mudflats, coral reefs, and sea grass can help mitigate **coastal flooding** and provide key **fisheries habitat** for many juvenile and adult fish species (see Target 10 for more information on coral reefs). The value of coastal protection services provided by mangroves in Myanmar has been clearly emphasized during storm events, such as Cyclone Nargis in 2008, when more than 140,000 people perished. Mangroves also provide a range of associated values and services, such as habitat for juvenile fish, carbon sequestration, and fuel wood. Research conducted by IUCN calculated that intertidal mudflats in Asia provide ecosystem services up to \$US38,000/ha/year, and mangroves in South-East Asia have been assessed as having a mean ecosystem service value of approximately \$US4,000/ha/year.

In order to incorporate consideration of ecosystem services into development planning, a **systematic valuation approach**, like that applied to forest ecosystems, should be applied to other ecosystems in Myanmar, particularly marine and freshwater environments for which ecosystem services potentially have very high indirect economic value. This will assist in ensuring that the true costs of development to communities are factored in to development planning through incorporation of ecosystem services into cost-benefit analyses, and also provide a basis for establishing payments for ecosystem services projects to support communities and create incentives to protect ecosystems.

Table 36. National Targets and Priority Actions for Aichi Target 14.

Target and Action	Lead
Target 14.1: By 2020, a National Ecosystem Assessment has been carried out, identifying the status, values and trends of Myanmar's key ecosystems and the services they provide	
Action 14.1.1 Quantify trends in the status of ecosystems and populations that provide key ecosystem services	MOECAAF
Action 14.1.2 Identify and map (using GIS) key ecosystem services through desktop analyses and participatory consultations involving multiple stakeholder groups, including ethnic minorities, women, and the poor and vulnerable	MOECAAF

4.6.15 Aichi Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification

Many of Myanmar's diverse range of ecosystems have, over more than 50 years of economic and political hardship, become degraded and require restoration. Forests are in particularly urgent need of action and have been selected as the focus of this target.

While average annual deforestation of 0.25% is relatively low, which is largely a function of the large areas of remote forest in southern and northern Myanmar, virtually all of Myanmar's more accessible forests are **shrinking rapidly in both extent and quality**. The latest satellite-derived data show that nation-wide, forest cover fell from 66.3% to 64.1% between 2001 and 2012. The reduction in forest quality is even more serious from a biodiversity and livelihoods perspective.

An indicator of forest quality is the **annual allowable cut (AAC)**, which the FD has prepared every 10 years based on detailed forest inventory for over a century. Under the national harvesting guidelines, only mature trees over the girth limit are to be selected and harvested, which in turn defines the AAC. The AAC for teak and other hardwoods fell from 39 million m³ in 1918 to 2 million m³ in 2010. The most important reason for this >90% reduction in AAC is overharvesting over many decades. Logging accelerated in the 1980s as harvesting levels became driven by politically-set revenue targets, not the silviculture-based AAC.

In 1988, a monopoly on teak harvesting was granted to **Myanmar Timber Enterprise (MTE)**. Founded in 1948, the State Timber Board, as its predecessor was known, was nationalized in 1963 and has since held a monopoly on teak exports. In border areas, starting in 1989, contracts were awarded to Thai logging companies. In Kachin State, Chinese companies negotiated informal logging rights with both the Tatmadaw and armed ethnic groups. FD has had little effective authority over these operations and has rarely been in a position to ensure that logging was sustainable.

FD classifies Myanmar's forests into three categories that together form the **Permanent Forest Estate (PFE)**, the forest that FD has gazetted through due legal process: Reserved Forest, which is the best quality and higher commercial value forest, in more remote areas, and where villagers have no harvesting rights; Protected Public Forest, which is of lower commercial value, more accessible, and where villagers have some harvesting rights; and Protected Areas. Technically, there should be no settlements inside the PFE, which in 2010, covered 29.25% of the land area.

FD also maps forest cover, which for 2010 shows that 22.90% and 25.60% of forested land is inside and outside of the PFE, respectively (Table 37). FD therefore only manages **47% of the total forest**

area; 53% is defined by FD as Unclassified Forest (UF), and by the Ministry of Agriculture and Irrigation as "virgin, fallow, and vacant land" and thus eligible for conversion to other uses (Figure 10).

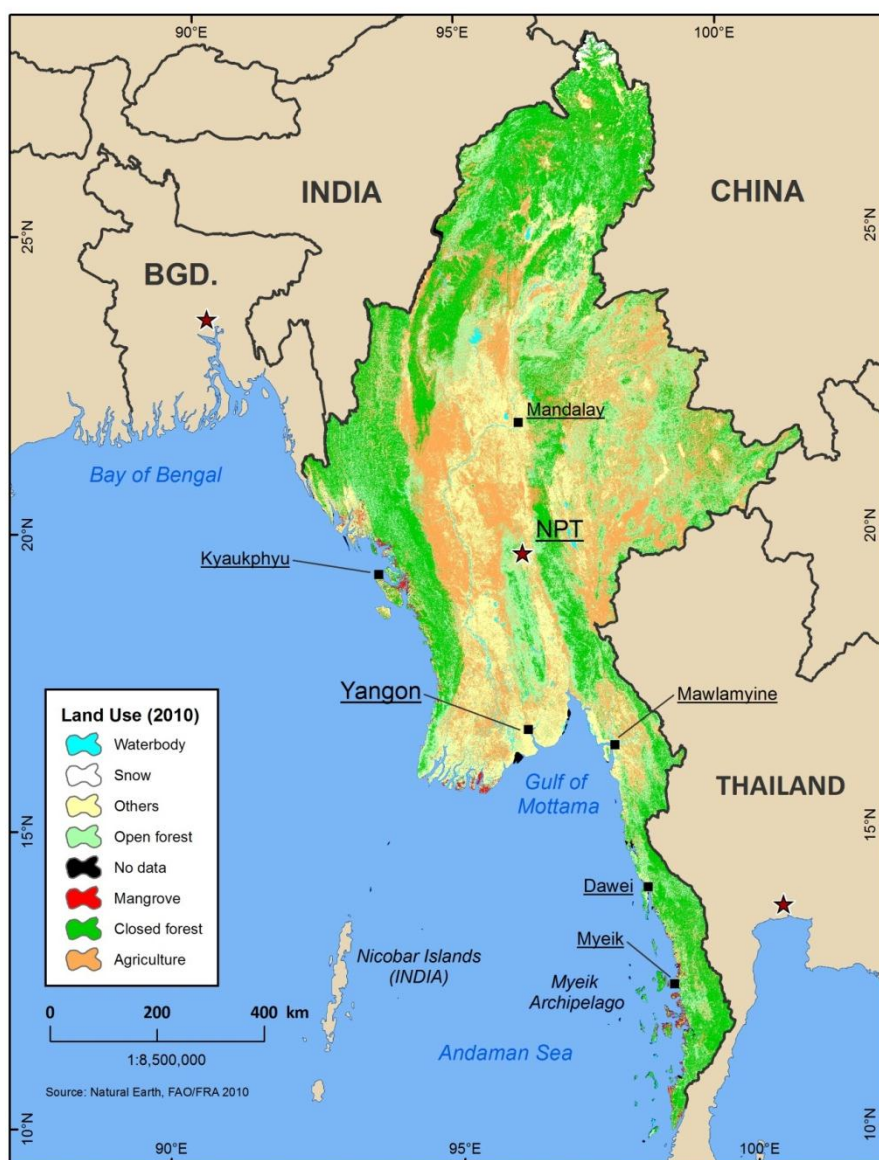


Figure 10. Forest Cover in Myanmar in 2010.

Table 37. PFE and forest cover under PFE.

FD administrative category	% of area	Land cover category	% of area
Reserved Forest	18.01	Forest within PFE	22.90
Protected Public Forest	6.05	Non forest within PFE	6.35
Protected Area	5.19	Other forest	25.60
Permanent Forest Estate	29.25	Other land (Unclassified Forest)	24.80
		Cultivable wasteland (secondary forest)	9.50
		Fallow (shifting cultivation)	0.60
		Net area sown (sedentary cultivation)	15.50
		Total	98.90

Around 2010, logging accelerated in anticipation of a log export ban that was finally introduced in 2014. From a commercial perspective, Myanmar's forests are now "**logged out**", as shown by the number of wood processing plants that are struggling to secure adequate high quality timber supplies and the gradual switch to processing lower quality plantation woods. Meanwhile, road building has opened up new areas of forest to logging and conversion.

One of the greatest threats to the remaining forest is organized clearing: for concessions to convert land to rubber, oil palm, betel nut and other agro-forestry plantations and also to a lesser extent the expansion of smallholder agriculture. Large areas of forest have now passed through a **degradation continuum** where they have been logged over so many times that conversion to plantation or agriculture, combined with substantial insecurity of tenure and in some cases conflict, is the likely next step.

Myanmar's forests are now at a **cross-roads**: will they continue to suffer continued degradation and loss or recover through a process of regeneration at a scale that can make a difference and in a way that is supported by local communities? The first outcome would resemble the situation in Cambodia and Laos where rapid deforestation and the granting of economic land concessions have been accompanied by frequent human rights abuses.

FD is committed to a path of forest recovery through greater community participation. But community forestry, its only administrative means of engaging local communities in forest management, has progressed so slowly since the Community Forestry Instructions (CFIs) were issued in 1995 that a **new policy model** is required that can rapidly expand public participation in forest restoration and protection over large areas.

In 2014, FD announced that it would legalize villages larger than 50 households inside the PFE and support the large-scale recognition of community forests. But there has been limited implementation of CF handover so far due to constraints of FD capacity and human resources. Community forestry has not generally been a good model for restoration due to the 30-year lease period, the reluctance to hand over any more than small areas of forest near villages, and the promotion of commercial species. Community forests are typically small, low biodiversity tree farms.

In Nepal, where over half the forest estate is under community management, it took decades of international support to build the necessary state and non-state capacity. But Myanmar cannot wait for decades. A **large scale forest restoration initiative** is needed, under FD leadership, that builds on and adapts successful models to the Myanmar context. The initiative would work with local communities for win-win outcomes that include improved land, tree and forest tenure security, guaranteed economic benefits in the short, medium, and long terms, and prioritization of wider ecosystem service benefits (e.g., biodiversity, hydrology, and carbon).

Under the CFI, about 80,000 hectares have been brought under community management, and most community forests are smaller than 100 hectares. To address the imminent threats to Myanmar's forests, a total of at least **1,000,000 hectares** need to be brought under some form of community management or FD co-management, which implies the allocation of much larger areas of forest. Some of this could be sustainably harvested and processed to meet local timber demand; most needs to be protected and allowed to regenerate naturally.

Such an initiative would have the following institutional, policy, and financial **elements**:

1. High conservation value forest (HCVF) within the UF (i.e., outside of FD control) must be gazetted into the PFE.
2. PFE must receive legal protection against conversion to large-scale commercial plantations.

3. CFI rules must be streamlined and adapted to cover much larger areas and barriers to registration must be removed.
4. FD must expand its role in forest restoration toward the provision of technical support for community participation.
5. FD may need presidential-level authority to prioritize these actions and overcome resistance from other quarters
6. Take advantage of initiatives such as the draft national land use policy, district-level land use planning, REDD+, and OneMap, all of which MOECAAF is leading.
7. Substantial donor funding would be needed to build capacity and to cover the transitional costs over the first 10-20 years.

A pilot to test this initiative should be carried out in an area that is well forested and relatively accessible such as southern Rakhine State or Bago Yoma. The social, political, and technical requirements are complex and the **Global Partnership on Forest and Landscape Restoration (GPFLR)**, which **works to restore degraded forests in ways that** deliver benefits to local communities and to nature, can assist. GPFLR is designed to help countries meet their international commitments on forests, including Aichi Target 15, REDD+ goal, and Rio+20 land degradation neutral goal. It has reached 59 million hectares of the Bonn Challenge target of restoring 150 million hectares of degraded forest by 2020.

Table 22. National Targets and Priority Actions for Aichi Target 15.

Target and Action	Lead
Target 15.1: By 2018, areas of High Value Conservation Forest (HCVF) in areas of Unclassified Forest (UF) mapped and continue to add to the PFE	
Action 15.1.1 Define and map HCVF within Myanmar	FD
Action 15.1.2 Incorporate HCVF areas into the PFE	FD
Target 15.2: By 2020, over 130,000 hectares of forest have been allocated to community or joint community management	
Action 15.2.1 Issue revised CFI or equivalent that increases incentives for conservation	FD
Target 15.3: By 2018, guidelines for a national forest regeneration programme that incorporates best international practice formally adopted by government and pilot project initiated	
Action 15.3.1 Draft and adopt government-endorsed national forest regeneration strategy	FD
Action 15.3.2 Implement pilot forest regeneration project	FD
Action 15.3.3 Explore opportunities for sustainable funding of restoration through REDD+ and establishment of other payments for ecological services schemes	FD
Action 15.3.4 Prepare guidelines for national forest regeneration programme taking into consideration economic, including the value of ecosystem services, and ecological aspects.	FD



4.6.16 Aichi Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation

The Nagoya protocol was adopted in Nagoya, Japan in 2010 and entered into force in October 2014. The Nagoya Protocol requires the implementation of a transparent legal framework to advance the fair and equitable sharing of benefits arising from the use of genetic resources. Fair and equitable benefits sharing is one of the three objectives of the Convention on Biological Diversity and is envisioned to create incentives to conserve and sustainably use biodiversity and to enhance the contribution of biodiversity to sustainable development. Each country must establish a legal framework for access and benefits sharing (ABS) for providers and users of genetic resources. The ABS framework protects owners of traditional knowledge associated with genetic resources, who must give consent for its use in research and share equitably in the resulting benefits.

Myanmar ratified the Nagoya Protocol on 9 January 2014. MOECAAF is the focal point for the Nagoya Protocol, and a road map for implementation is being developed with support from the ASEAN Centre for Biodiversity and in collaboration with relevant ministries, including the Ministry of Health for research on medicinal plants and the Department of Agricultural Research. The roadmap includes an assessment of the current national legal framework and needs for establishment of ABS. An assessment of capacity and training needs for implementation of ABS is also necessary. GEF funding is available to support these and other activities necessary to comply with the Nagoya Protocol.

Increased knowledge on genetic resources is necessary for implementation of ABS in Myanmar. Research on agricultural biodiversity is currently conducted on livestock, fisheries, crops, and traditional medicinal plants through various line departments, but funding and capacity limit the extent of these efforts. Partnership with farmers associations and civil society groups working to

document and maintain traditional knowledge can supplement government and university research programs.

A framework for the recognition and protection of indigenous knowledge is essential in order for communities to permit use of their traditional knowledge and resources for research and to receive benefits.

As Myanmar's national investment framework is developed and refined, ABS should be incorporated into investment rules and regulations as appropriate. ABS should also be reflected in Intellectual Property rights legislation and developed in reference to the Nagoya Protocol national roadmap.

Table 23. National Targets and Priority Actions for Aichi Target 16.

Target and Action	Lead
Target 16.1: By 2020, the Nagoya Protocol is under active implementation in Myanmar	
Action 16.1.1 Develop a National ABS Roadmap and Action Plan, which identifies the most relevant genetic resources, assesses the likely demand for these, and identifies the priorities for legislative development, awareness raising, and capacity development.	ECD
Action 16.1.2 Establish the Nagoya Protocol in the national legal framework	ECD
Action 16.1.3 Raise awareness amongst selected stakeholder groups within government, the private sector, international and national NGOs, and communities about the implications of the Nagoya Protocol, e.g. in relation to Free, Prior and Informed Consent (FPIC), Mutually Agreed Terms (MAT) and benefit sharing.	ECD MOAI
Action 16.1.4 Strengthen and continue the NISM-GPA	MOAI
Action 16.1.5 Conduct collaborative research on medicinal plants and crops and traditional knowledge of these resources under the framework of Nagoya Protocol	ECD, Universities
Action 16.1.6 Build capacity among key stakeholders to implement the provisions of the Nagoya Protocol, through the provision of targeted training, and the development of model ABS agreements and templates.	ECD, Universities
Action 16.1.7 Identify bio-prospecting opportunities for national and international partners interested in research and development, and launch at least one pilot demonstration project.	MOAI. MOECAF
Action 16.1.8 Translate <i>The Guide to the Nagoya Protocol</i> and other key references into Myanmar language.	ECD

4.6.17 Aichi Target 17: By 2015, each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan

National Biodiversity Strategies and Action Plans (NBSAPs) are the principal instruments for implementing the Convention on Biological Diversity (CBD) at the national level (Article 6). The CBD requires countries to prepare a NBSAP and to ensure that it is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity. To date, a total of 184 (95%) Parties have developed NBSAPs in line with Article 6. Myanmar submitted its first NBSAP in 2012. This revision builds on the NBSAP (2011) version by structuring it around the 20 **Aichi Biodiversity Targets** that were adopted at COP-10 in Nagoya in November 2010.

In addition to addressing international commitments under the CBD, the revised NBSAP will also assist Myanmar in meeting its own commitments to a development path that respects nature for its multiple environmental and cultural values. At this time of transition, the country needs a reference document that provides ambitious but realistic targets to be achieved by 2020. Some of these targets lie outside the traditional biodiversity conservation sector. They therefore challenge conventional ways of behaviour by requiring the building of alliances with non-traditional partners to address new threats and new opportunities.

Successful implementation of the NBSAP will require the involvement of many different government ministries and departments, as well as the engagement of civil society and the private sector. To this end, it will be important to ensure that the NBSAP is formally adopted by government as the nation's overarching framework for the conservation and sustainable use of biodiversity. There will also be a need to build awareness and support for the NBSAP amongst multiple stakeholders, and to create effective coordination, monitoring and evaluation mechanisms at multiple levels. State-level BSAPs that reflect regional and local priorities should also be considered, as mechanisms for promoting implementation at the sub-national level. The implementation plan for the NBSAP is provided in Chapter 5.

As the lead agency for biodiversity conservation in Myanmar, FD will have a central role to play in the implementation of the NBSAP. However, it faces a number of institutional and financial challenges that limit its ability to fulfil its mandate. Targets and indicators related to improved FD financing are given in Target 20. However, financial sustainability can only be achieved if there are strong and effective institutions for management and a solid framework for planning and implementing biodiversity conservation within which financial measures are embedded. In other words, and as regional experience clearly shows, conservation performance will only improve if adequate core funding is available, the broader political and economic environment is supportive, and the responsible agency is designed to make effective use of the funding it receives.

FD will therefore need to adopt a broad strategy that seeks to influence policies that lie outside its direct remit but nonetheless have important implications for biodiversity conservation. Within the context of this strategic redirection, FD would start to build alliances with non-traditional partners such as development NGOs, businesses, and parliamentarians; actively coordinate international support to maximize synergies and avoid duplication of effort; negotiate with state/region governments to ensure that conservation priorities are integrated into land use planning; encourage states/regions to issue laws that give them the authority to establish PAs including ICCAs; and make enhanced use of the media and other channels to make the case for increased state and non-state investment in biodiversity conservation.

This role of FD will become increasingly important as authority over natural resources and land use becomes decentralized to the states/regions. Regional experience shows that without strong central oversight, the local incentives for economic growth will dominate conservation concerns and that this can trigger a wave of deforestation and industrial pollution. In sum, FD should operate less as a manager of its partners and more as the conductor of an orchestra, organizing and leading partners to achieve what they cannot do alone.

Table 24. National Targets and Priority Actions for Aichi Target 17.

Target and Action	Lead
Target 17.1: By 2016, the NBSAP is adopted by Cabinet as the nation's over-arching policy framework for the conservation and sustainable use of biodiversity	
Action 17.1.1 Prepare the necessary briefing papers and formally submit the NBSAP to Cabinet for approval.	MOECAAF
Action 17.1.2 Develop mainstreaming and coordination strategy that recommends clear roles and responsibilities across national policy framework	MOECAAF
Target 17.2: By 2016, the institutional mechanisms to ensure effective implementation and monitoring of the NBSAP are in place and functioning effectively	
Action 17.2.1 Establish a National Steering Committee, to oversee and guide the implementation of the NBSAP.	MOECAAF/FD
Action 17.2.2 Create thematic working Groups composed of thematic specialists, to provide additional and more detailed expert advice on the implementation of specific targets within the NBSAP (e.g., on protected areas, invasive alien species, access and benefit sharing).	MOECAAF/FD
Action 17.2.3 Create an NBSAP Implementation Coordination Unit within MOECAAF.	MOECAAF/FD
Target 17.3: By 2020, state-level BSAPs have been under preparation in at least three States/Regions	
Action 17.3.1 Develop guidelines and principles for BSAP preparation, to ensure consistency of approach as well as integration with the NBSAP.	MOECAAF/FD
Action 17.3.2 Develop BSAPs in at least three states/regions, through a participatory process involving government, civil society, local communities, academia and the private sector.	MOECAAF/FD
Target 17.4: By 2017, the NBSAP enjoys broad support and understanding across government and other key stakeholder groups	
Action 17.4.1 Develop a series of high-level briefing packages on the NBSAP for senior policy and decision makers within government.	FD
Action 17.4.2 Develop and implement an NBSAP communications strategy and action plan, which identifies the key target audiences who need to be reached in order to ensure effective NBSAP implementation, the messages to be conveyed, and the communications tools and approaches to be used.	FD

4.6.18 Aichi Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Traditional knowledge and practices that contribute to conservation include the protection of sacred forests, lakes, rivers, and caves, taboos on hunting certain species, and the maintenance of watershed protection forests. Practices that contribute to sustainable use include hunting and fishing reduction during breeding seasons, no-take fishing zones and gear restrictions in spawning areas, rotational and fallows *taungya*, and indigenous silviculture and agroforestry techniques. Conservation tools to recognize and strengthen these traditional practices include recognition of customary tenure, co-

management of protected areas, Indigenous Reserves and Community Conservation Areas (ICCAs), and community forestry. Conservation projects should work with and be responsive to cultural traditions and beliefs about the environment. As a cross-cutting theme, traditional knowledge and customary practices can contribute to each of the other Aichi Biodiversity Targets.

The Convention on Biological Diversity (CBD), particularly Article 8(j) and 10(c), and the Aichi Biodiversity Targets, recognize the unique value of the knowledge and practices of traditional people and local communities for conservation, and directs parties to incorporate these values across the CBD's programme of work. The CBD provides guidelines and tools for Target 18 through the Working Group on Article 8(j), the Akwe: Kon guidelines for the conduct of impact assessments on traditional sacred sites, and the Tkariwaí:ri Code of Ethical Conduct on respecting cultural and intellectual heritage. The UN Declaration on the Rights of Indigenous People (UNDRIP) provides an international legal framework for implementation of Articles 8(j) and 10(c) through the recognition of indigenous rights, customary practices, and heritage. National policy should use the standards that give the highest level of protection to the rights of indigenous and ethnic minority groups.

The **recognition of customary tenure and traditional systems of governance** is fundamental to the promotion of traditional practices that benefit conservation and encourage sustainable use of resources. Sustainable shifting *taungya*, also called swidden or rotational agriculture, is a complex rotational agroforestry system that maintains the bulk of crop genetic diversity worldwide, includes secondary forest that can improve connectivity between forest fragments, produces a mosaic landscape with high species diversity, and is linked to the cultural and spiritual heritage and social relationships of indigenous people. Tenure security for the fallow stage of rotational agriculture is essential for the sustainability of the system and the tenure and livelihood security of uplands groups that practice it.

Indigenous Reserves and Community Conserved Areas (ICCAs) are diverse types of conservation areas managed by communities. ICCAs are recognized by IUCN as one of 4 governance types for protected areas, along with government management, co-management, and private management. Community conserved areas are increasingly recognized for their importance to conservation and their key role in the protection and sustainable use of terrestrial and marine resources. Establishment and formal recognition of these areas should take care to reinforce, and not to undermine, existing governance structures and customary management that promote sustainable use.

According to UNDRIP, conservation and development projects must consult affected communities and those communities have the right to give or withhold **Free, Prior, and Informed Consent (FPIC)**. This principle can be used to strengthen existing consultation processes, and is particularly relevant for the establishment of protected areas and the review of Environmental and Social Impact Assessments (EISAs). MOECAAF has already affirmed its support of FPIC and has begun to develop guidelines and build capacity for FPIC through implementation of the REDD+ Readiness Roadmap. The REDD+ Engagement and Safeguards Technical Working group has been tasked with developing FPIC guidelines for REDD+ projects. These guidelines can be used to incorporate FPIC into other conservation activities, particularly protected area establishment and governance. They can also be applied to review of EIA/SIAs by the Environmental Conservation Department (ECD). Training of responsible staff from the ECD on environmental and social standards should include FPIC as international best practice for consultation processes. Other Ministries whose work has significant impact on indigenous groups should also affirm and take steps to institutionalize FPIC in planning and implementation of projects. Incorporation of FPIC into EIA/SIAs can help to expose other sectors to FPIC principles and increase their adoption by government and the private sector.

Consultation occurs as part of the **protected area gazettement** process, in which communities have 90 days to submit land claims to be considered in the designation of protected area boundaries and buffer zones. These consultations can be strengthened with training of township-level Forest Department, GAD, and SLRD staff serving on the Preliminary Scrutiny Body on methods to facilitate community consultations and guidance on customary tenure recognition, by allocating time for consultations in staff work plans and budgets, and through development of outreach and educational material in local languages. The consultations for protected area gazettement, including the work of the Preliminary Scrutiny body, should be implemented in close collaboration with NWCD staff with expert training on national and international standards and tools for protected area management and governance. Co-management and community management should be used as tools to recognize and promote the sustainability of customary practices in accordance with Article 10(c).

Conservation activities, including establishment of protected areas, must be conflict-sensitive, especially as many current and proposed protected areas and Key Biodiversity Areas are in areas that are subject to overlapping and contested land claims. Upholding FPIC principles, pursuing rights-based approaches to conservation, and recognizing, protecting, and promoting traditional knowledge and customary practices in conservation projects are key components to solve conflict sensitivity.

Traditional knowledge of species classification and ranges, natural history, vegetation dynamics, and natural resource management make a substantial contribution to the mapping and understanding of biodiversity, as well as the management and monitoring of nature both within and outside of protected areas. This is reflected in the growing international appreciation for the role of traditional knowledge as an essential complement to scientific data to inform both technical management questions as well as cultural and ethical relationships to species and landscapes. Traditional knowledge should be reflected in park management plans, park co-management systems, mapping, and the designation of community conserved areas. Participatory mapping and monitoring are common tools to incorporate traditional knowledge into park management. Traditional knowledge and customs should also be included in park educational material. School curricula on the environment can incorporate traditional knowledge and youth organizations and customary institutions can facilitate inter-generational learning to maintain traditional knowledge.

Table 25. National Targets and Priority Actions for Aichi Target 18.

Target and Action	Lead
Target 18.1: By 2020, customary land use tenure systems has been recognized in Myanmar's legal framework and a mechanism for recognizing communal tenure is operational	
Action 18.1.1 Pass a National Land Use Policy that recognizes customary land use systems	MOECAF
Action 18.1.2 Develop implementing rules and regulations to allow registration of customary communal tenure	MOECAF
Action 18.1.3 Harmonize recognition of customary and communal tenure into relevant laws, dispute resolution mechanisms, and land use planning processes	MOECAF
Action 18.1.4 Begin to register communal land	MOECAF
Target 18.2: By 2020, Free, Prior, and Informed Consent (FPIC) principles are institutionalized in government, private sector, and donor programs	
Action 18.2.1 Prepare guidelines on FPIC for government use, including guidelines on consultation processes	MOECAF
Action 18.2.2 Ministries with significant potential impact on indigenous peoples and local communities affirm FPIC principles	MOECAF

Target and Action	Lead
Action 18.2.3 Incorporate FPIC principles into government and private sector work plans	MOECAF
Action 18.2.4 Train relevant staff on FPIC principles and consultation methods to increase awareness and capacity	MOECAF
Target 18.3: By 2020, traditional knowledge recognized, promoted, and protected through incorporated into education and conservation outreach education	
Action 18.3.1 Incorporate traditional knowledge, practices, and beliefs in Protected Area education materials	FD, I/NGOs
Action 18.3.2 Develop educational materials on traditional knowledge, practices, and beliefs for university coursework on forestry and conservation	FD, I/NGOs
Target 18.4: By 2020, Traditional knowledge, practices, and beliefs are recognized, protected, and promoted in formal and informal education	
Action 18.4.1 Include traditional environmental knowledge into the school curriculum	FD, I/NGOs
Action 18.4.2 Promote environmental awareness and engagement for youth groups	FD, I/NGOs

4.6.19 Aichi Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied

Relative to other parts of South-east Asia, the science base relating to biodiversity, and understanding of the consequences of loss, is low due to Myanmar's isolation from international investment and research. Key issues are the curation and accessibility of biodiversity data, meeting key gaps in biodiversity knowledge and the development of domestic expertise on biodiversity assessment and environmental planning.

Myanmar has benefited from over 20 years of survey work by WCS, the Smithsonian Institution, the California Academy of Sciences, and a number of other foreign organizations. These surveys provide the basis for the current state of biodiversity knowledge in Myanmar and include major geographic and thematic gaps. While large mammals, birds, and reptiles have been relatively well surveyed, much less attention has been paid to plants, freshwater fish, amphibians, invertebrates and other taxa. Large areas have been off-limits to field work because of security concerns. The IUCN Red List of Threatened Species can be used to infer how relatively poorly described Myanmar's fauna and flora are. The **total number of species** assessed in Myanmar (3,849) is significantly lower than in either Thailand (5,072) or Vietnam (4,407), despite that fact that Myanmar is one-third larger than Thailand and twice the size of Vietnam. With increased access, more projects are currently being implemented or planned by international environmental organizations to begin to address this information gap. In order to ensure that existing and future biodiversity data is available to be used by the Myanmar government and other stakeholders to inform development and conservation planning, a centralized repository for biodiversity assessments and ecological studies should be established.

There is a critical need to enhance data related to the conservation of **freshwater fish**. The last comprehensive assessment of Myanmar freshwater fauna dates back to the late 19th century with some additional surveys in Inlay and Indawgyi Lakes from 1910 to 1940. Since the year 2000 studies conducted by foreign scientists have generally focused on specific target species. In 2013, a FFI-led survey of Indawgyi Lake and surrounding mountain streams increased the number of known fish species from this, the best-known fish site in Myanmar, from 45 to about 72, which includes five undescribed species. A better understanding of freshwater fish is a priority because of the likely rapid development of **hydropower** (see Target 4). An understanding of freshwater fish distribution and ecology would permit Myanmar to develop hydropower projects which minimise the impacts on fish

diversity and food security, and avoid the significant but unnecessary costs resulting from loss of fisheries and agricultural production experienced by other countries in the region due to hydropower development.

Data on **forest cover change** is needed for a wide range of planning purposes. Having a well-documented, spatially explicit forest cover change database is critically important for conservation and development planning. By helping to make it widely accessible, for example, through a Clearing-House Mechanism web portal, MOECAAF could use this database to encourage a broader debate about forest cover management in Myanmar and as a resource for conservation and development planning.

Myanmar's isolation from the international community has had a serious impact on the quality of its higher education system, with many institutions requiring significant improvement to meet international academic standards. Reform of the **higher education** system is a national priority and in 2013 the education budget increased from US\$340 million to US\$740 million. However, the needs are extensive, covering physical infrastructure and IT, academic curriculum, improving the quality of instruction, university administration and governance reform, language training, skills development in research proposals and scientific writing, and international engagement. Despite the many challenges, small-scale interactions with universities will help not only to address a number of immediate needs, but also to create partnerships that can lay the groundwork for larger engagements. International NGOs can play a vital role in fostering these partnerships, including with advanced regional universities such as Chiang Mai University and Prince of Songkla University in Thailand. Development of partnerships with NGOs to run international master's program, as successfully implemented in the joint program between FFI and the Royal University of Phnom Penh, would facilitate the development of programs which meet international academic standards.

Table 26. National Targets and Priority Actions for Aichi Target 19.

Target and Action	Lead
Target 19.1: By 2016, a Clearing-House Mechanism web portal is established	
Action 19.1.1 Establish Clearing-House Mechanism and populate with relevant information	FD
Target 19.2: By 2020, a national forest cover change 2015-2020 database developed using international standard methods, and made publicly available online	
Action 19.2.1 Finalize national forest cover database and make publicly available online	FD, INGOs
Action 19.2.2 Hold regular GIS training courses for relevant staff	FD
Target 19.3: By 2020, leading Myanmar universities have established advanced diplomas and practical training in conservation and biodiversity-related fields and actively participate in biodiversity conservation projects	
Action 19.3.1 Establish master of science in conservation-related degree at leading university	Universities
Action 19.3.2 Identify and initiate opportunities for collaboration in curriculum development, student exchange and internships with foreign universities and international NGOs	Universities, I/NGOs
Action 19.3.3 Establish applied, field based, training course and certificate in PA management and conservation	Universities
Action 19.3.4 Invite contributions to and publish a Myanmar biodiversity research journal	Universities
Action 19.3.5 Undertake capacity building of university staff and students, including teacher training and scientific writing workshops	Universities

4.6.20 Aichi Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources (in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization) should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

Myanmar's PAs hold some of the country's most beautiful and outstanding natural and cultural landscapes. The PAs are important to sustain biodiversity and ecosystem services that underpin sustainable development, poverty reduction, climate stability and natural disasters reduction. Despite the importance of protected area network, there are still many challenges to managing these areas effectively. In particular protected area network has limited funding to support its effective management. Fortunately this is gradually changing over the past few years since the budgets for protected areas have been increasing, as well as external fundings have been increasing. However, adequate funding is still critical issue for the long term conservation of biodiversity in Myanmar. A national mobilization fund could help identify funding needs, mobilize funds, and coordinate and prioritize conservation activities. However, for now, much of the focus remains on protected areas.

Myanmar's PAs depend wholly on Union funds for their core budget, supplemented by externally-funded projects. Even though the law permits a variety of revenues to be generated from the use of PA lands and resources, there are currently no systems in place that would allow this income to be retained and reinvested in biodiversity conservation. All earnings must be remitted to the Union budget. Although "other accounts", which serve to absorb and manage all or a portion of own-source revenues, are held by other ministries and departments, no such arrangements exist for MOECAAF.

Over the last five years, an average of US\$1.9 million a year or US\$43/km² has been spent on PAs. Union funds contribute 41% of this figure (an average of US\$0.79 million a year) and externally-funded projects account for 59% (US\$1.1 million). When calculated on an area basis, levels of external funding and NWCD spending are similar (US\$25-26/km²/year). Self-generated revenues remain negligible (less than US\$17,000 in 2013/2014), both as a percentage of MOECAAF and FD earnings and in relation to PA management costs.

While the amount of public budget allocated to PAs has risen by around 50% in real terms over the last 5 years and externally-funded grants and projects have increased even more steeply (almost US\$20 million was committed last year), there remains a critical shortage of funds. Just over half of PAs have a dedicated budget or staff. Even those that receive regular funding are for the most part unable to cover the costs of core infrastructure, equipment, maintenance and running, and cannot afford to implement essential on-the-ground conservation activities.

It is possible to make a very rough approximation of funding gaps, using comparative data from other ASEAN countries and from global studies. Based on these figures, an annual budget of US\$130/km² is assumed for "basic" management, rising to US\$215 for "improved" management—three and five times as much, respectively, as current levels. Three staffing, management and funding scenarios are modelled for three possible sizes of PA networks (PAs that are currently actively managed by NWCD; the entire existing PA network; and an expanded system which incorporates all currently proposed PAs). The results indicate a funding gap ranging from just under US\$0.5 million a year to extend current staffing and expenditure levels across the entire existing PA network, up to a maximum of almost US\$9 million a year to achieve a fully-staffed, improved management and expanded PA network scenario.

Increased use of tools for the economic valuation of biodiversity and ecosystem services are likely to be needed to persuasively make the case for greater investment in biodiversity conservation. The economic case for greater state spending on forest conservation was made by Emerton *et al.* (2013), who estimated that forests generate over US\$7 billion in goods and services to the Myanmar economy every year and that 85% of the value of these goods and services comes from value-added to production in other sectors, domestic costs and damages avoided, and global costs and damages avoided. Only 15% came from timber and non-timber product harvesting, and continued forest degradation from these activities predicted to greatly undermine the value of ecosystem services provided, resulting in a net loss due to forest degradation. Yet in 2011, 80% of government spending on forestry went to Myanmar Timber Enterprises (MTE), the state logging enterprise, and only 20% to the rest of MOECAAF, mainly sectors responsible for services. The conclusion is clear that Myanmar could get a greater return on investment if it invested more in forest services.

One method to quantify the costs of biodiversity conservation and to leverage funding is through the Biodiversity Finance Initiative (BIOFIN). BIOFIN is program supported by the United Nations Development Program, and helps countries quantify conservation funding gaps and assisting countries prioritize and mobilize international funding. Specifically, the program can provide Myanmar with guidance on how to assess financial needs and how to mobilize the financial resources required to fully implement their revised NBSAPs, and thereby achieve the national targets.

Another important source is Global Environment Facility (GEF) fund, and under the GEF-6 which is from 2014 to 2018, Myanmar has been allocated US\$ 10.98 million for biodiversity. In addition, US\$ 16.95 million and US\$ 2.34 million for climate change and land degradation, respectively, and these are crucial for activities that supplement to biodiversity conservation. However, to optimize the use of available GEF funding, it is better to collaborate and coordinate among the relevant government organizations, GEF window agencies and GEF National Operational Focal Point of Myanmar.

Alternative funding sources and funding schemes can potentially contribute significantly to the budget available for environmental management and biodiversity conservation and research, either through traditional State-based funding, donor funding or through non-traditional funding arrangements. Establishment of trust funds can potentially provide a source of on-going funding for MOECAAF operations and implementation of actions. One option to secure sustainable on-going funding is to ensure that some revenues from visitor fees to national parks is allocated to the biodiversity management budget.

In the short term, recent political changes have increased opportunities to receive donor funding from sources such as the Global Environment Fund (GEF) and smaller contributions from NGO programs. Donor funding is available for limited periods, often requires a matching contribution, and cannot be considered to provide on-going funding for the regular function of MOECAAF. Donor funding and in-kind support from international donors is likely to be important for implementing one-off or intermittent actions, or actions with a high establishment cost, while donor funding coordinated by NGOs has the potential to increasingly support short-to-medium term biodiversity research and community development-based actions.

Alternative non-traditional and potentially non-government funding mechanisms that should be explored for securing sustainable funding include PES for watershed, carbon storage (i.e. REDD+), ecotourism, and building the capacity of communities and civil society such that local groups are better able to access and use conservation funding available both nationally and internationally.

Table 27. National Targets and Priority Actions for Aichi Target 20.

Target and Action	Lead
Target 20.1: By 2020, the funding available for biodiversity from all sources is increased by 50%	
Action 20.1.1 Develop a national resource mobilization strategy for biodiversity, in line with the CBD's Global Strategy for Resource Mobilization	MOECAAF
Action 20.1.2 Establish and fund conservation trust fund	MOECAAF, Donors
Action 20.1.3 Submit a formal request to UNDP for Myanmar to become a member of the Biodiversity Finance Initiative (BIOFIN)	MOECAAF
Target 20.2: By 2018, donor and partner funding for biodiversity is better coordinated and implemented	
Action 20.2.1 Form “GEF Coordination Team” and implement “National Portfolio Formulation Exercise” to optimize GEF funding.	MOECAAF
Action 20.2.2 Establish donor roundtable, led by MOECAAF	MOECAAF



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5. NBSAP Implementation Plan

5.1 National Coordination Structure

Efficient institutional mechanisms are needed for the effective implementation of biodiversity conservation as outlined in this NBSAP. Within the given socio-political situation of the country, a national level committee should be immediately formed to oversee the progress made in implementation of NBSAP activities.

The key gaps identified in the implementation of the past BAPs are the lack of ownership at the national, sectorial and local levels, coupled with poor coordination mechanism for fund mobilization and subsequent implementation.

The National Committee on Biodiversity (NBC), comprising high-level representation from the key sector, will guide the implementation of the NBSAP, in line with the obligations of CBD and other biodiversity-related regional and international conventions and treaties. As appropriate, the thematic sub-committees or working committee will be formed under NBC to implement the NBSAP (2015-2020) (Figure 11).

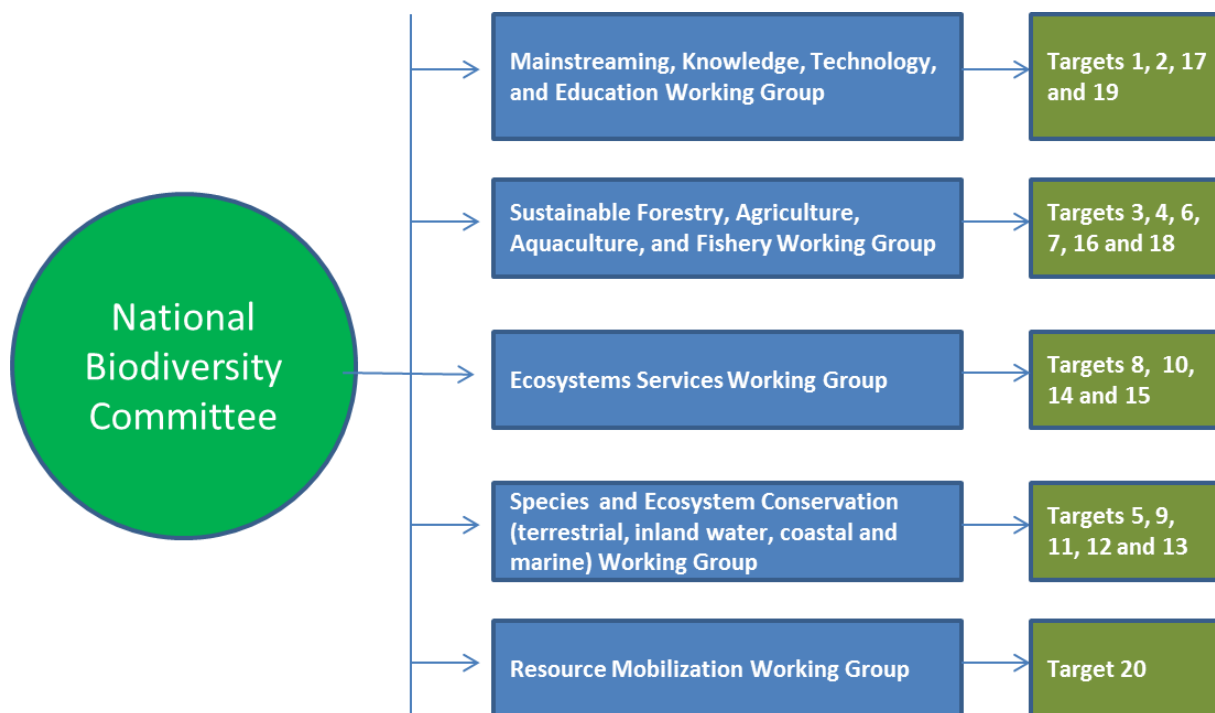


Figure 11. Institutional arrangement for the implementing NBSAP (2015-2020).

Communications strategy will be developed so that NBSAP (2015-2020) can be fully implemented through multi-stakeholder engagement. In addition, resource mobilization plan will be prepared to ensure the adequate resources for implementing NBSAP.

5.2 Capacity development approach for NBSAP implementation

One of the challenges for effective implementation of NBSAP is the limited capacity. In this NBSAP (2015-2020), the needs of capacity for different thematic areas are identified under the different national targets. Technology needs assessment will be conducted, and then Capacity development plan will be prepared for implementing NBSAP. The capacity development covers all the

stakeholders such as from the central government organizations to NGOs, CBOs, local government, as well as the communities.

5.3 Monitoring, Evaluation and reporting

The monitoring and evaluation on the implementation of NBSAP will be conducted by assessing progress of the national targets on an annual basis, using currently identified indicators, as well as additional ones if require. The results will be reported to the National Biodiversity Committee for necessary interventions for the successful achievement of the targets. It will also form a basis for national and international reporting obligations as well as national planning process. The Monitoring and evaluation protocol will be prepared within the first year after the adoption of the NBSAP.

5.4 Synergies between NBSAP and MEAs

Following recommendation on synergies among multilateral environmental agreements (MEAs), the NBSAP (2015-2020) supports the implementation of other biodiversity-related agreement such as CBD, UNFCCC, UNCCD, Convention on the Conservation of Migratory Species of Wild Animals (CMS), Convention on International Trade in Endangered Species of Wild Fauna and Flora (also known as the Washington Convention, CITES), Convention on Wetlands of International Importance especially as Waterfowl Habitat (also known as the Ramsar Convention), Convention Concerning the Protection of the World Cultural and Natural Heritage (also known as the World Heritage Convention, WHC) and International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR).

[REQUEST TO IUCN TO ADD SOME TEXTS HIGHLIGHTING HOW NBSAP (2015-2020) LINK TO BIODIVERSITY RELATED MEAS]

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