Myanmar Centre for Responsible Business

Supplement to MCRB's Briefing Paper on Biodiversity, Human Rights and Business

Biodiversity in Myanmar, including Protected Areas and Key Biodiversity Areas

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+95 1 512613 info@myanmar-responsiblebusiness.org www.mcrb.org.mm

This Supplement to MCRB's Briefing Paper on Biodiversity, Human Rights and Business in Myanmar gives further information about the biodiversity of Myanmar, its Protected Area (PA) Network and other Key Biodiversity Areas (KBA), which are critically important to protecting biodiversity and the ecosystem services they provide. It is structured as follows:

A. Ecoregions

B. Protected Areas of Myanmar and other Areas of Global Significance, including an overview of coverage representativeness, financing, governance, enforcement and social implications of protected area expansion

C. Important Designations for Biodiversity Not Yet Protected (tentative World Heritage Sites and Key Biodiversity Areas (KBAs) in Myanmar)

D. Main Ecosystems/Habitats of Myanmar, covering forests, limestone karst, freshwater ecosystems, wetlands, marine habitats and species

Almost all of Myanmar lies within the Indo-Burma Biodiversity Hotspot, one of 35 global hotspots that support high levels of biodiversity and endemism.[1] The Indo-Burma hotspot ranks in the top 10 hotspots globally for irreplaceability and in the top five for threats. Myanmar supports an extraordinary array of ecosystems, with mountains, permanent snow and glaciers, extensive forests, major rivers, a large river delta, a dry plateau, a long coastline with offshore islands, and valuable coastal and marine habitats.

A. Ecoregions

Myanmar has 14 major ecoregions, or relatively large areas of land or water which each contain characteristic, geographically distinct assemblages of plants and animals (see ***Map 1***).[2] More than half the country is covered by 3 of the 14 ecoregions - Irrawaddy moist deciduous forest (20.6%), Northern Indochina subtropical forest (20.5%) and Mizoram-Manipur-Kachin rain forests (10.5%). Overall, 8 of the forest ecoregions (and 72% of Myanmar's forest areas) were classified as either vulnerable or critically endangered some years ago. In this context, the 4 ecoregions classed as ***vulnerable*** (61%) are likely to become endangered unless the factors threatening their survival improve. The 4 ecoregions classed as ***Critically endangered*** (11%) are facing an extremely high risk of extinction, as these habitats are extremely fragmented and continue to decline in area and quality. Less than 1% of these ecoregions are within Protected Areas.

B. Protected Areas of Myanmar and other Areas of Global Significance

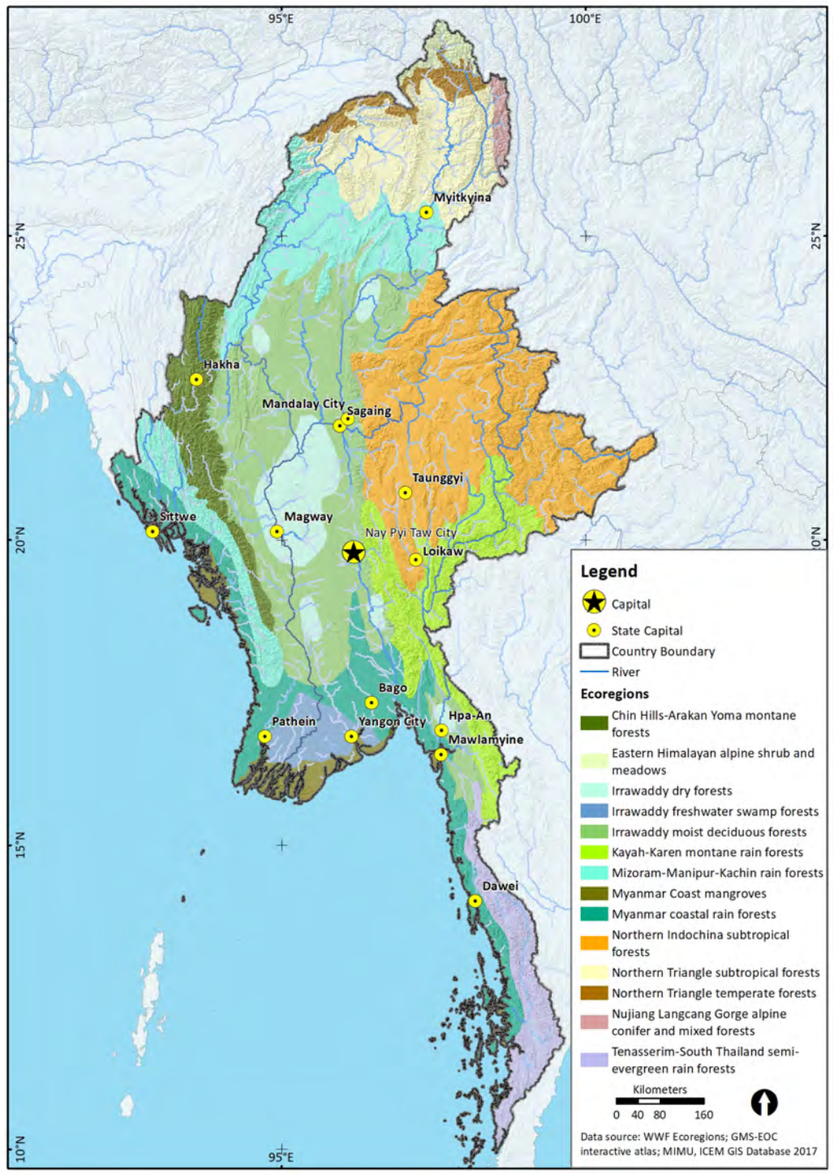
Protected Areas are one of the most important tools for biodiversity conservation, safeguarding ecosystems services and preserving cultural landscapes. As of 2018, Myanmar has 42 Protected Areas (see ***Map 2***).[3] Seven of the Protected Areas are ASEAN Heritage Parks (AHPs) recognised for their biodiversity value within ASEAN countries; and five are Ramsar Sites (wetlands of international importance).

1 Mittermeier, R. et al. (2004). Hotspots Revisited: Earth's Biologically Richest and Most Endangered Ecoregions. Mexico City: CEMEX

2 IFC (2017a). Baseline Report - Strategic Environmental Assessment of the Hydropower Sector in Myanmar, International Finance Corporation, Washington, D.C, Ministry of Electricity and Energy (MOEE), Ministry of Natural Resources and Environmental Conservation (MONREC).

3 Forest Department (2017). *Biodiversity Conservation in Myanmar, an overview*. The Republic of the Union of Myanmar, Ministry of Natural Resources and Environmental Conservation.

Map 1: Ecoregions of Myanmar



Source: Kh IFC (2017a). Baseline Report - Strategic Environmental Assessment of the Hydropower Sector in Myanmar, International Finance Corporation, Washington, D.C, Ministry of Electricity and Energy (MOEE), Ministry of Natural Resources and Environmental Conservation (MONREC).

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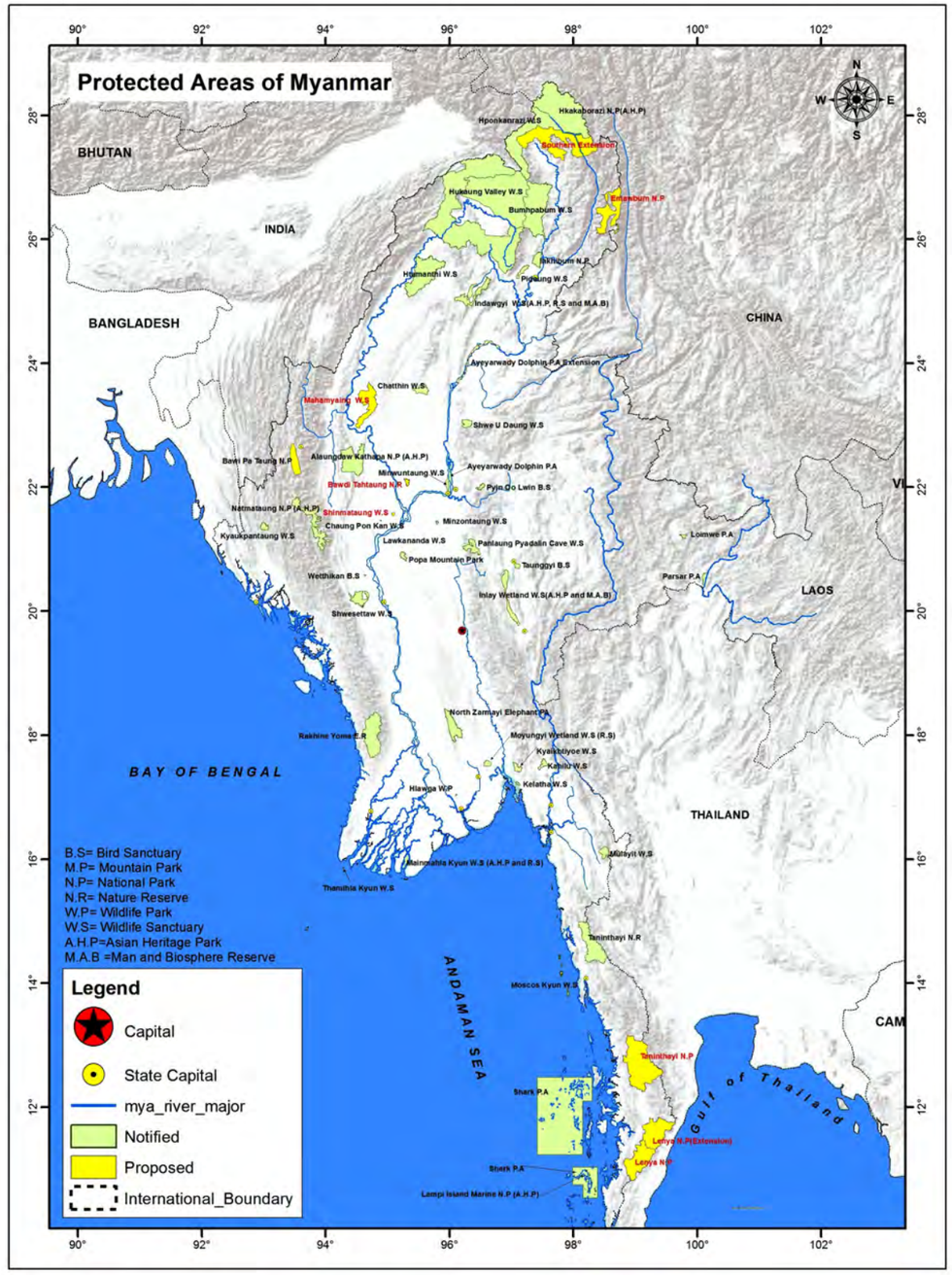
Map 2: Protected Areas of Myanmar



Source: WCS, Protected Areas, 2017.

There is one marine park. Myanmar has no World Heritage Sites (WHS), but several Protected Areas have been put forward to the WHC committee for consideration (See ***Map 2*** for the full list of Protected Areas)[4].

Coverage

The current Protected Area network covers considerably less than the Aichi Target of 17% of total land area (see ***Box 1***) and the global average of 14.8%. Myanmar's 42 Protected Areas extend over 52,946 km^2 which represents 8.1% of the total land area of 653,080 km^2 (See Annex 1). However, this is an increase from the less than 1% afforded protection in 1996.

The most recent National Biodiversity Strategy and Action Plan (NBSAP, 2015-2020) proposes seven additional Protected Areas by 2021.[5] A more recent document written by the Ministry of Natural Resources and Environmental Conservation (MONREC) identifies ten (rather than seven) further sites occupying a further 1.4% of land.[6] Over the longer term, Myanmar's 30-year Forest Master Plan (2002-2031) established a target for Protected Areas to increase to 10%.

Expansion of the Protected Area network is desirable. However, unless there is budget and management on the ground, there is a risk that these will be little more than "paper parks", even if paper parks have some value.

BOX 1 - AICHI BIODIVERSITY TARGET 11 ON PROTECTED AREAS

At the tenth meeting of the CBD Conference of the Parties in 2010, in Nagoya, Aichi Prefecture, Japan, 20 Biodiversity Targets were agreed for 2011-2020 period. Target 11 relates to Protected Areas and states that "*By 2020, at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas, should be protected*". The areas conserved should be:

- Of **particular importance** for **biodiversity and ecosystem services**
- **Ecologically representative** – including at least 10% of each ecoregion within the country
- **Effectively and equitably managed** – with measures in place to ensure ecological integrity and the protection of species, habitats and ecosystem processes, with the full participation of indigenous and local communities, and such that costs and benefits of the areas are fairly shared.
- **Well-connected** – to the wider landscape or seascape using corridors and ecological networks to allow connectivity, adaptation to climate change, and the application of the ecosystem approach.

4 Map provided by WCS
5 MOECAF (2015). National Biodiversity Strategy and Action Plan (2015-2020) The Republic of the Union of Myanmar, Ministry of Environmental Conservation and Forestry
6 Forest Department (2017). *Biodiversity Conservation in Myanmar, an overview*. The Republic of the Union of Myanmar, Ministry of Natural Resources and Environmental Conservation

Myanmar's Protected Areas range in size from 0.5 km² (the Lawkananda Wildlife Sanctuary near Bagan) to 22,000 km² (Hukaung Valley Wildlife Sanctuary in the Northern Kachin State). Older Protected Areas tend to be smaller, whereas the more recent ones aim to protect entire landscapes in order to preserve species with large home ranges such as the Asian elephant and tiger, who require large areas of contiguous habitat for long-term survival.

Representativeness

In terms of representativeness, the network does not achieve the target of having at least 10% of each ecoregion represented. Due to the presence of a few large Protected Areas in Kachin and Sagaing, a number of ecoregions such as the Eastern Himalayan alpine shrub and meadows (96% in Protected Areas), Northern Triangle temperate and subtropical forests (36% in Protected Areas) are well represented. However, seven ecoregions have less than 1% or no protection (see ***Annex 1***), including 4 ecoregions classified as ***critically endangered***.

The lack of Marine Protected Areas (MPA) is a significant gap, with just a single Protected Area in the country (Lampi Marine National Park). Flora and Fauna International (FFI) has sponsored and co-sponsored a range of studies to expand the knowledge base and facilitate the development of a network of Marine Protected Areas in Myanmar, particularly in the Myeik Archipelago (see ***Map 3***)[7].

These studies add to the understanding of marine ecosystems in the area and provide a platform for the identification of priority sites for further conservation action. Three Locally Managed Marine Areas (LMMAs) are being set up in the Myeik Archipelago in addition to the Lampi Marine National Park. LMMAs tend to be largely or wholly managed at the local level by coastal communities and represent a traditional approach to community-based fisheries. It should be noted that LMMAs are a fisheries management tool and are not designed to conserve marine biodiversity per se.

Financing

Myanmar's Protected Area network is underfunded. Over the period 2010-2015, an average of $1.9 million a year or $43/km² was spent on Protected Areas.[8] Union funds contribute 41% of this figure (an average of $0.79 million a year) and externally-funded projects account for 59% ($1.1 million). Funding levels differ greatly between sites. A third of Protected Areas and 10% of the total area under protection have no budget at all. According to MONREC, in 2014/15 approximately $18.7 million of external funding was provided for a range of projects, a significant increase on previous years. However, it is not clear how much of that was spent on conservation activities and it should be noted that these external funds are not guaranteed annually. MONREC recognises the issue: target 20.1 of the NBSAP states that "by 2020, the funding available for biodiversity from all sources is increased by 50%".

Protected Areas generate little or no income (less than $17,000 in 2013/14) and there has previously been no system in place that would allow Protected Area revenues to be retained and reinvested in the Protected Area network. All earnings are submitted to the central treasury. This may change with the new Biodiversity and Conservation of Protected Areas Law (2018) which has a provision for the Director General (Forest Department, MONREC) to *"determine a system for Payment of Ecosystem Service derived from the ecosystems within a Protected Area"* but provides no further details on how this will be implemented.[9]

The private sector contributes a small amount to the Protected Area network but could play a greater role in the future. For example, as compensation for biodiversity impacts related to pipeline construction, the Tanintharyi Nature Reserve is funded by the Moatama Gas Transportation Company (TOTAL), the Tanintharyi Pipeline Company (Petronas) and PTT Exploration and Production. This is discussed in more detail in the main report. The Htoo Group of Companies (HGC) has a management contract with the Forest Department to run Hlawga Park, Pyin Oo Lwin Botanical Garden, Nay Pyi Taw, Yadanabon and Yangon Zoological Gardens.

The Wildlife Conservation Society (WCS) has explored a range of sustainable financing options for Protected Areas, including REDD+ payments, payments for ecosystem services (PES), compensation funds, offsets, user fees, voluntary levies and ecotourism. A Myanmar Ecotourism Policy and Management Strategy for Protected Areas has been produced and an ecotourism plan formulated for Lampi Marine National Park.[10]

Governance and Enforcement

Many Protected Areas lack staff, management plans and basic infrastructure. They consequently suffer from threats of encroachment, poaching and over-harvesting of non-timber forest products. There is a strong correlation between the threat status of Protected Areas and the prevalence of well-paid and trained staff who have access to resources to adequately patrol Protected Areas[11] and to develop community projects to minimise existing threats. Simply stated, the better the staff resources, the less threatened the Protected Areas.

Without objectives and plans, it is hard to assess management effectiveness. It is difficult to obtain accurate data on staffing, training, availability or status of management plans, park infrastructure and conservation outcomes. A review of information on existing and proposed Protected Areas was undertaken in 2011 by Istituto Oikos.[12] The report provides information on 43 existing and proposed sites and undertook rapid assessment surveys of 30 sites. The report concluded that although 20 Protected Areas had some kind of planning document, they were not comprehensive management plans. Staff at 70% of the surveyed Protected Areas stated that lack of budget and staff (both in numbers and quality) were the main constraints to the implementation of management actions. Patrolling, environmental education and wildlife surveys are implemented in approximately half of the surveyed Protected Areas. Shifting cultivation and/or permanent agricultural fields were also present inside a third of the sites they visited, resulting in forest degradation.

A quarter of Protected Areas included some form of community based natural resources management and community forestry in the areas surrounding the Protected Area, with a slightly higher percentage having outreach programs. Conflicts with local communities and armed groups were identified as the main obstacle to effective management in 15% of the sites visited. It should be emphasised, however, that even so called 'paper parks' can be important in conserving biodiversity.

7 Map provided by FFI Myanmar Programme
8 Emerton, L. et al. (2015). Sustainable financing for Protected Areas. Yangon, Wildlife Conservation Society
9 See the Biodiversity and Conservation of Protected Areas Law (2018). The Republic of the Union of Myanmar, Union Parliament Law No. 12
10 MOECAF (2015). Myanmar Ecotourism Policy and Management Strategy for Protected Areas. The Republic of the Union of Myanmar, Ministry of Environmental Conservation and Forestry.
11 Tranquilli, S. et al. (2014) Protected Areas in Tropical Africa: Assessing Threats and Conservation Activities. PLOS One
12 Istituto Oikos and BANCA (2011).Myanmar Protected Areas: Context, Current Status and Challenges. Milano, Italy

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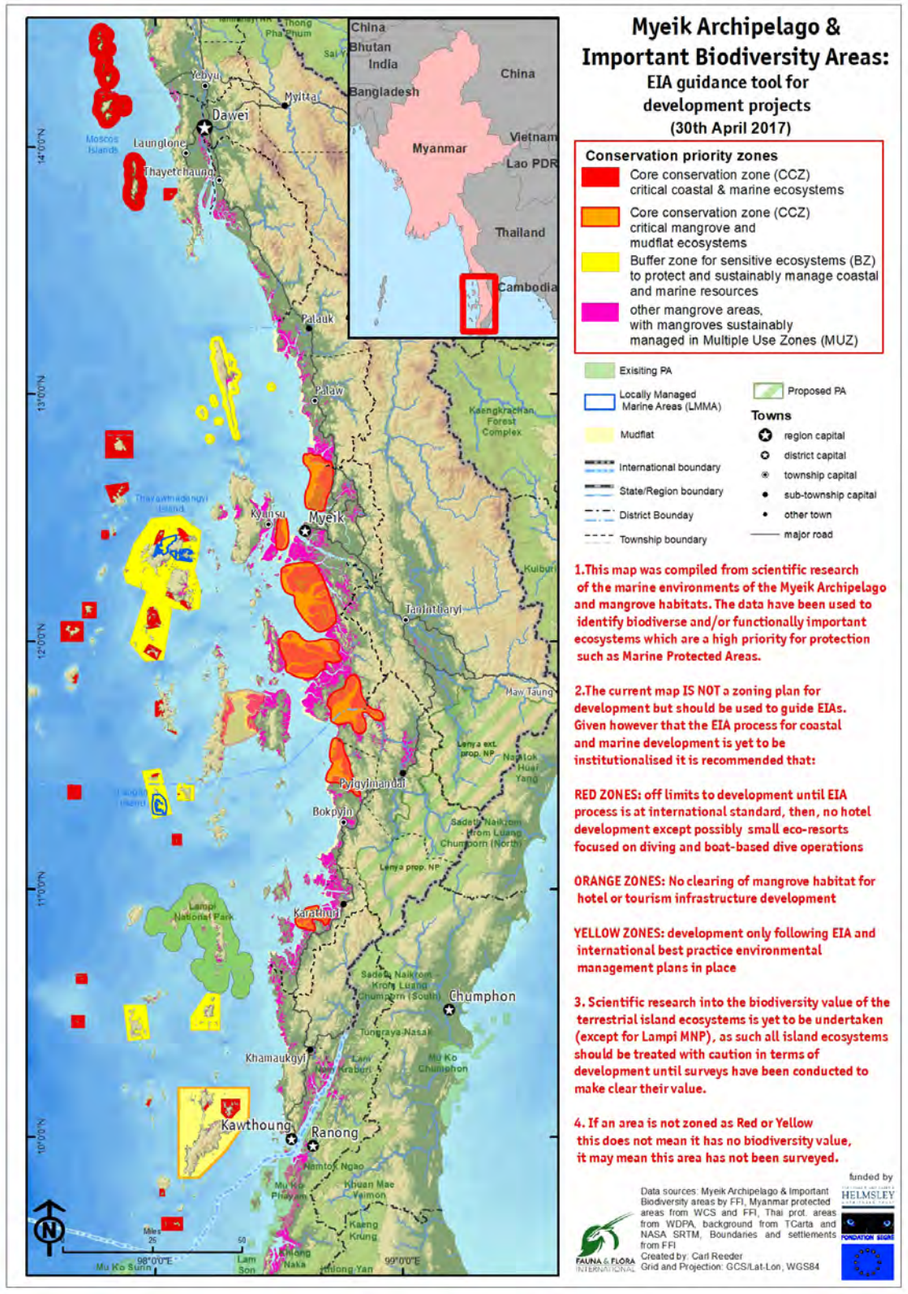
Map 3: Important Biodiversity Areas of the Myeik Archipelago



Source: Fauna & Flora International Myanmar Programme (2017).

This largely relates to the maintenance of habitats rather than species of conservation concern.

MONREC recognises the issue around governance: the NBSAP Target 11.3 requires that "*by 2020, the management effectiveness of Myanmar's Protected Area system has significantly improved, with 15 Protected Areas implementing SMART [Spatial Monitoring and Reporting Tool], at least 5 Protected Areas implementing management plans, and local communities involved in management activities in at least 5 Protected Areas*".

Management plans have been developed for one proposed Protected Area (Tanintharyi Nature Reserve) and one existing protected Area (Lampi Marine National Park). A further four are being developed (Indawgyi, Alaungdaw Kathapa, Natmataung and Meinma-hla-kyun) and planning is in place for seven others (Hkakaborazi, Hukaung, Htamanthi, Chatthin, Popa, Shwesettaw, Moeyingyi). Lampi Marine National Park is managed by MONREC with assistance from Istituto Oikos. A comprehensive management plan has been completed that outlines a vision and objectives for the park together with management activities, zoning, and community outreach to improve conservation and community livelihoods. There is also an accompanying ecotourism plan as the park does not currently financially benefit from tourism activity within the Park.[13] Following a tender, the Natural Conservation and Wildlife Division (NCWD) of MONREC approved the development of an eco-resort on Wa Ale Island in the Lampi Marine National Park scheduled to open in late 2018.[14]

Social Implications of Protected Area Expansion

Although the global and local benefits of biodiversity and ecosystem services are well recognised, some of the costs of Protected Areas have historically been borne by local people. There is widespread acceptance that conservation policy should, at the very least, do no harm, and where possible should contribute to poverty alleviation.[15] Tensions between the need to protect high value habitats whilst ensuring the rights of local communities are exemplified by local protests regarding the proposed expansion of Mt. Hkakabo Razi National Park in October 2017. The social implications of any new Protected Area should be thoroughly assessed to ensure respect for full participation and customary rights. Threats to existing Protected Areas are likely to continue due to dependence by communities on these natural resources - hence the need for clearly defined and well-managed buffer zones that meet the requirements of surrounding communities.

The new Biodiversity and Conservation of Protected Areas Law (2018) does stipulate a greater role for local communities. The Law recognises "Community Protected Areas" as a category of protected area and requires the Forest Department to provide "*technical coordination and support for management of Community Protected Areas*". The Law also permits the Director General (Forest Department, MONREC) to allow co-management in collaboration with the local communities and defines buffer zones for the socio-economic development of local communities.[16] It is likely that the new by-laws (2019) will further clarify management rights for local communities and allow more community involvement.

13 Instituto Oikos (2015). Lampi Marine National Park Ecotourism Plan: 2015-2018
14 See the Lampi Marine National Park (2018), Nature and Wildlife Conservation Division of Myanmar Forest Department
15 CBD (2008). Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet. Secretariat of the Convention on Biological Diversity, Montreal, Technical Series no. 36
16 See the Biodiversity and Conservation of Protected Areas Law (2018). The Republic of the Union of Myanmar, Union Parliament Law No. 12

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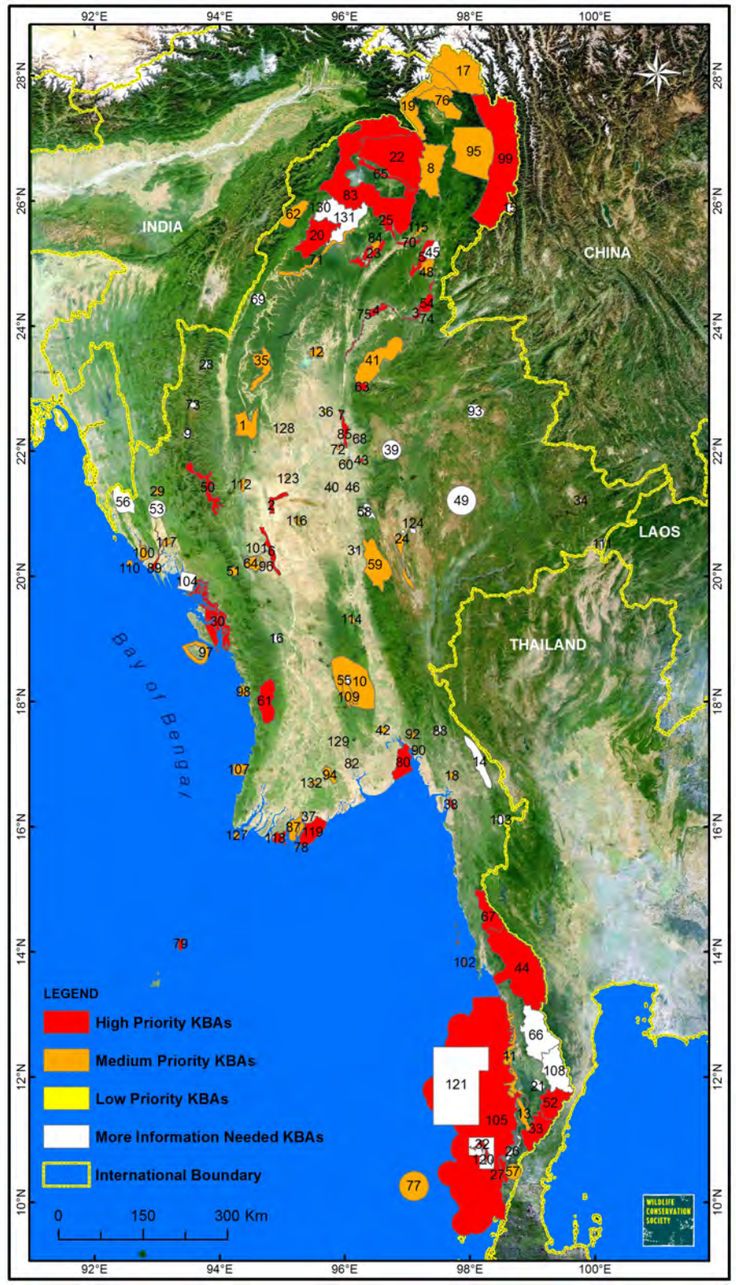
Map 4: Key Biodiversity Areas



Source: WCS, Key Biodiversity Areas, 2013.

Myanmar has a number of conservation initiatives involving local communities, including community monitoring of Protected Areas using Spatial Monitoring and Reporting Tool (SMART), which is a conservation tool to allow them to monitor, evaluate and improve the effectiveness of conservation management. There are also community-run forests and locally managed marine areas are in Myanmar.

C. Important Designations for Biodiversity Not Yet Protected

Tentative World Heritage Sites

Myanmar signed the World Heritage Convention (The Convention for the Protection of the World Culture and Natural Heritage) in 1994. World Heritage Sites are officially recognised by the UN as having unique cultural, historical, scientific or some other form of significance, and they are legally protected by international treaties. States are encouraged to submit a tentative list of sites they consider to be of outstanding universal value for inscription on the World Heritage List.

Seven sites of importance for biodiversity have been proposed to the World Heritage Committee for consideration.[17] These include: the Ayeyarwady River Corridor, home to the critically endangered sub-population of freshwater dolphin; the Hukaung Valley Wildlife Sanctuary, one of Asia's largest intact floodplains; the Indawgyi Lake Wildlife Sanctuary, one of the largest lakes in continental Southeast Asia, supporting restricted range freshwater species and large flocks of migrating birds; the Myeik Archipelago; the Nat Ma Taung National Park with a diversity of Himalayan flora including a rich variety of orchids; the Northern Mountain Forest Complex (Hkakabo Razi and Hponkan Razi National Parks) covering intact forests spanning nearly 5,000 metres of elevation gain; and the Tanintharyi Forest Corridor, one of the largest remaining lowland evergreen forests in Southeast Asia. Out of these, Nat Ma Taung National Park, Indawgyi Lake Wildlife Sanctuary and Hakaborazi National Park were evaluated for their suitability for the UNESCO World Heritage Site National tentative list, but neither Nat Ma Taung nor Indawgyi fulfilled the integrity and management criteria.

Key Biodiversity Areas (KBAs)

KBA sites are of global significance for biodiversity and are identified using standardized criteria. They represent the most important sites for biodiversity conservation worldwide.[18] Myanmar has 132 KBAs. In Myanmar, KBAs (see ***Map 4***)[19] have no legal standing as an official form of land tenure except where they overlap with formally established Protected Areas. Of these 132 KBAs, 35 are existing Protected Areas and a further six are proposed Protected Areas, but the majority have no legal status. Nevertheless, KBA designation assists countries in identifying priority areas for future conservation efforts and protection; and supports development planning by highlighting the value of areas so that impacts on biodiversity can be avoided. KBAs are also being increasingly being targeted as potential areas for offset sites. Currently, KBAs cover 17% of the country.

Three-quarters of the KBAs are located in the north and in Tanintharyi Region encompassing the Myeik Archipelago. The first national natural capital assessment for Myanmar showed that there

17 For details see https://www.mmbiztoday.com/articles/myanmar-natural-sites-identified-top-priorities-world-heritage-nomination

18 See IUCN (2016). A Global Standard for the Identification of Key Biodiversity Areas, Version 1.0. First edition. Gland, Switzerland: IUCN

19 Map provided by WCS

is an overlap between KBAs and important ecosystems. This shows that KBAs have value for the ecosystem service benefits they provide, in addition to their value for biodiversity conservation.[20]

D. Main Ecosystems/Habitats of Myanmar

Forests

Aside from the provisioning ecosystem services they provide, such as non-timber forest products, charcoal, medicines and construction material, forests ecosystems are a carbon sink and also stabilise soils. By slowing water flow due to increased infiltration, forests help regulate the seasonal flow of water downstream and recharge sources of groundwater, which supports baseflow in streams. People living downstream benefit from increased stream flows during the dry season, thereby improving access to water for drinking, irrigation, freshwater fisheries etc. By impeding the loss of soils, forests help to maintain the functioning of dam and reservoir infrastructure.

Forest constitutes the dominant vegetation type in Myanmar (see ***Table 1***).[21] The total area of forest is 290,410 km^2 - which is 43% of the total land area.[22] However only half of this is described as closed forest, whereas the other half is 'open' or 'degraded'. Myanmar ranks in the top three countries globally in terms of the amount of forest lost between 2010 and 2015. The total area of forest lost was 5460 km^2, equivalent to a rate of loss of 1.8%/year.[23]

Rainfall and elevation strongly influence the distribution of different vegetation types. Tropical lowland evergreen rain forest occurs largely in the south in Tanintharyi and the southern Bago Yoma. In the east, north and west there is tropical hill evergreen rain forest (often without dipterocarp species) and temperate rain forest; semi-evergreen rain forest borders the arid central plain particularly in southern Bago Yoma. Myanmar has two types of teak forest: wet deciduous forest present in Northern Tanintharyi, Bago Yoma, Bhamo and Mogok; and dry deciduous forest which occurs in northern Bago Yoma, Chindwin, western Pakokku and the Shwebo Hills. Some coniferous forests occur above 1200m on dry slopes, particularly in Shan and Chin states, whereas oak and rhododendron occur on the wetter slopes. Extensive bracken and bamboo brakes also occur in Myanmar. Mountain grassland is present, particularly on the Shan plateau, Chin Hills, Rakhine Yoma, and the Northeastern slopes. Indaing forest occurs in small patches along dry ridges of Bago Yoma.

Along the Rakhine, Ayeyarwady and Tanintharyi coasts, tidal forests occur in river estuaries, lagoons, tidal creeks and along low islands. Such woodlands are characterised by mangrove and other coastal trees. Beach and dune forests also grow above the high tide line, consisting of palms, hibiscus, casuarinas and other tree varieties. Dry forest occurs where rainfall is usually less than 400mm a year and support xerophytic types of vegetation such as semi-desert Euphorbia scrub and Acacia thorn type scrub forests.

Limestone Karst

Karst is a special type of landscape that is formed by the dissolution of soluble rocks, such as limestone and dolomite. Karst formations are found in a number of regions including Tanintharyi Region, Kayin State, Shan State, and Kachin State.[24] The importance of Karst from a biodiversity perspective relates to the fact that some of the species that are found there have very restricted ranges, some confined to a single cave or peak. This is particularly the case for some invertebrates such as molluscs. Nineteen new species of gecko have recently been found in Karst habitats in Myanmar.[25]

TABLE 1: FOREST COVER IN MYANMAR BY VEGETATION TYPE

FOREST TYPES	% OF FOREST AREAS
Mixed Deciduous Forest	38
Hill and Temperate Evergreen Forest	25
Tropical Evergreen Forest	16
Dry Forest	10
Deciduous Dipterocarp (Indaing) Forest	5
Tidal Forest, Beach and Dune Forest, Swamp Forest	4
Fallow Land	2

Freshwater Ecosystems, Wetlands & Species

Myanmar supports a diverse range of freshwater ecosystems including large river systems and lakes that are not only important for biodiversity, but also have cultural and economic value. Myanmar has eight major river catchments: The Ayeyarwady, Chindwin, Thanlwin, Sittaung, Myit Ma Hka and Bago, several shorter rivers from the Rakhine Yoma and Chin Hills and the Tanintharyi coastal region.[26] In terms of lakes, the most notable are Inle Lake and one of the largest lakes in Asia, Indawgyi Lake.

Few ichthyological (fish) surveys have been undertaken in Myanmar, so data is limited. However, a 2017 Strategic Environmental Assessment of the hydropower sector[27] includes a lot of valuable

20 See WWF (2016) Natural Connections: How natural capital supports Myanmar's people and economy
21 Kress, J. et al. (2003). A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar. Smithsonian Institution
22 FAO (2015) Myanmar Forest Resource Assessment. Food and Agriculture Organisation, Rome
23 FAO (2016) Global Forest Resources Assessment How are the world's forests changing? Food and Agriculture Organisation, Rome
24 MOECAF (2015). National Biodiversity Strategy and Action Plan (2015-2020).
25 See the Mongabay. Myanmar caves yield up 19 new gecko species. 11-10-2017
26 IFC (2017) Draft baseline of the Strategic Environmental Assessment (SEA) of the hydropower sector in Myanmar: Baseline Assessment, Chapter 4, Biodiversity.
27 IFC (2017). Strategic Environmental Assessment of the Hydro Sector in Myanmar: Baseline Assessment, Chapter

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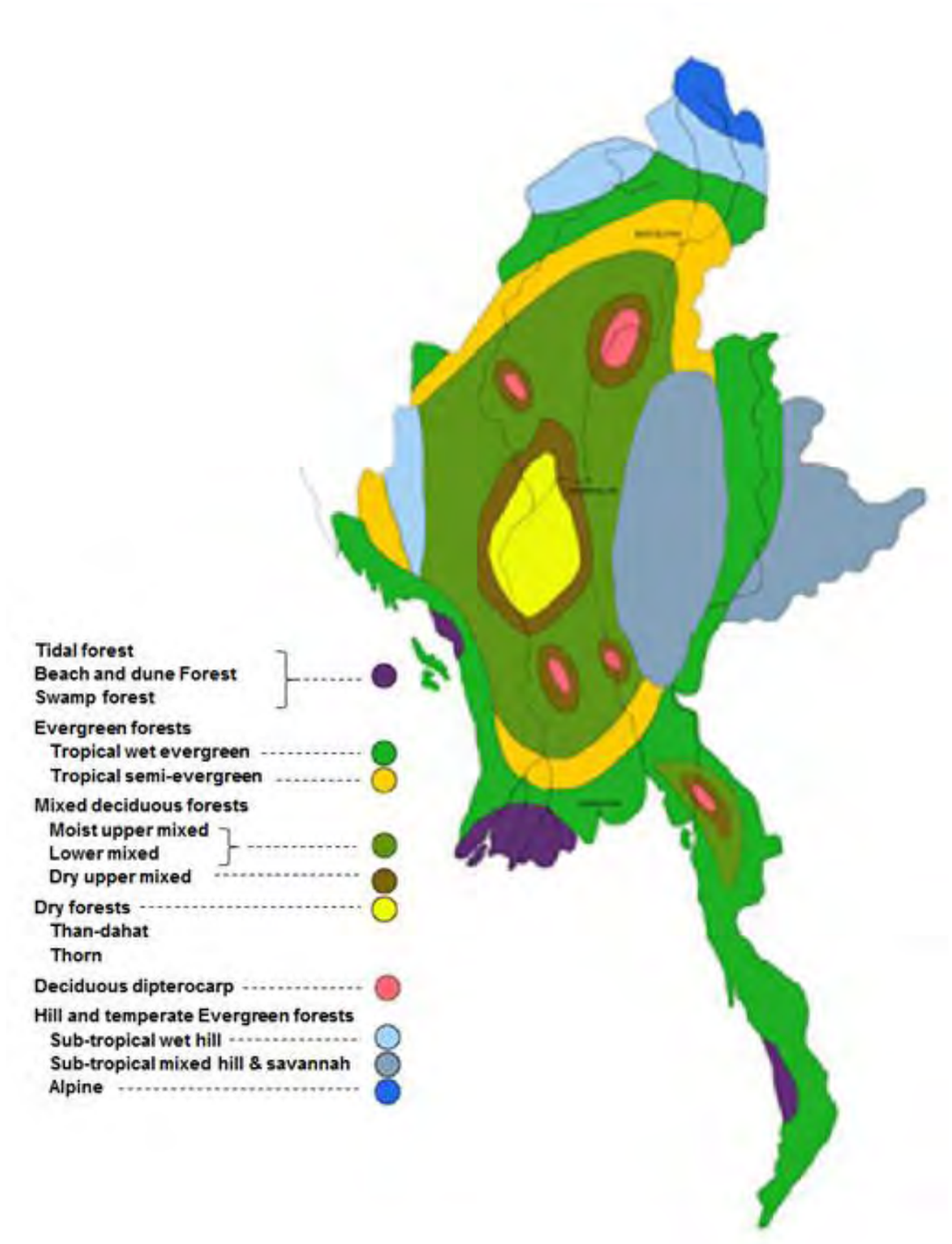
Map 5: Major Vegetation Types of Myanmar



Source: Kress, J. et.al (2013) A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar. Smithsonian Institution

information on freshwater ecology. In addition to summarising the aquatic ecology and fisheries baseline of the different catchments, the report identifies stretches of river that are particularly sensitive from an ecological perspective using a range of criteria. These include rarity of river class, presence of confluences (which are important locations for mixing of biodiversity and for migrations), reaches flowing through karst limestone, presence of restricted range and threatened species and the presence of wetland or Ramsar sites. These are presented in ***Map 6***[28].

One of the more valuable stretches is the Ayeyarwady River Corridor (ARC), which has been proposed as a World Heritage Site. It stretches from north of Mandalay to Bhamo and supports the Critically Endangered (CR[29]) freshwater subpopulation of the Irrawaddy Dolphin, other threatened birds and turtles such as Northern River Terrapin (CR) and the Burmese Eyed Turtle (VU), and the White-bellied Heron (CR) and valuable riparian habitat. The southernmost segment is already the Irrawaddy Dolphin Protected Area (PA). The World Bank is funding the Ayeyarwady Integrated River Basin Management Project, which aims to strengthen the government's ability to sustainably manage the Ayeyarwady River by developing water resources management institutions and enabling informed decisions about future investments in developing the river. In the Tanintharyi river catchment, where until recently few surveys of aquatic biodiversity had been carried out, recent surveys identified 103 species, of which 7 are endemic and 9 potentially new to science and unnamed.

Field surveys of bird species found at 8 sites including intertidal mudflats, mangroves, sandy beaches, near coastal forest habitats and rocky islands were undertaken in 2008-2013 along Myanmar's coastline.[30] This identified 80 species of water birds, including 39 species of waders, 12 gulls and terns, 11 duck and geese, and 7 heron and egrets. This included 10 globally threatened species (such as the Spoon-billed Sandpiper (CR) and Nordmann's Greenshank (EN). Myanmar ratified the Ramsar Convention on Wetlands of International Importance in 2005 and, as of 2017, has five Ramsar sites.

The Indawgyi Lake Ramsar Site in Kachin State is the largest freshwater lake in Myanmar. It is also a proposed World Heritage Site supporting 20,000 migratory and resident water birds. Ten of the bird species present are globally threatened and the lake is also home to several restricted range fish and turtle species, including the Burmese Peacock Turtle. The Moyingyi Wetland Wildlife Sanctuary and the Meinmahla Kyun Wildlife Sanctuary in the Ayeyarwady Delta are both Ramsar sites.[31]

The former provides habitat for 20,000 migratory water birds, including the globally threatened

5, Fisheries and Aquatic Ecology.

28 IFC (2017a). Baseline Report - Strategic Environmental Assessment of the Hydropower Sector in Myanmar, International Finance Corporation, Washington, D.C, Ministry of Electricity and Energy (MOEE), Ministry of Natural Resources and Environmental Conservation (MONREC).

29 The IUCN Red List classifies species based on criteria such as rate of decline, population size, area of distribution, and degree of population and distribution fragmentation. The main classes in this section are: Critically endangered (CR) applies to species with an extremely high risk of extinction in the wild; Endangered (EN) applies to species with a high risk of extinction in the wild; Vulnerable (VU) applies to species with a high risk of endangerment in the wild; Near threatened (NT) applies to species likely to become endangered in the near future; and Least concern (LC) applies to species at low risk that are widespread and abundant.

30 Zöckler, C. et al. (2014). The importance of the Myanmar coast for water birds. Stilt 66(2014):37-51

31 See Ramsar (2017). Annotated List of Wetlands of International Importance - Myanmar. Ramsar Sites Information Service

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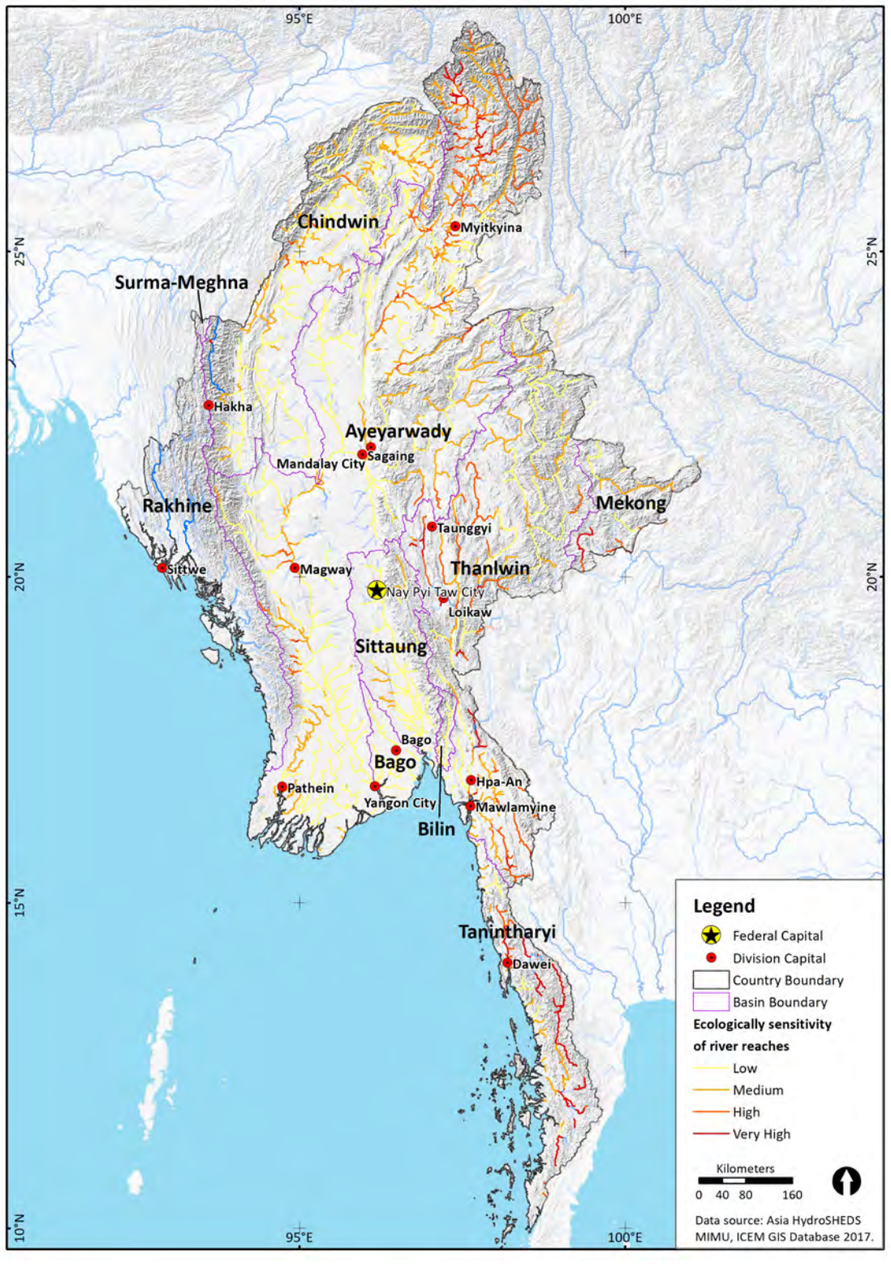
Map 6: Ecologically Sensitive Reaches of River Basin in Myanmar



Source: IFC (2017a). Baseline Report - Strategic Environmental Assessment of the Hydropower Sector in Myanmar, International Finance Corporation, Washington, D.C, Ministry of Electricity and Energy (MOEE), Ministry of Natural Resources and Environmental Conservation (MONREC).

Burmese Eyed Turtle (VU), and more than 1% of the regional population of the Northern Pintail (Anas acuta). The Gulf of Mottama Ramsar Site was designated in May 2017. This 45,000ha site is situated at the mouth of the Sittaung River and is habitat for 150,000 migratory birds. It is one of the most important wintering areas for the Spoon-billed Sandpiper (CR), supporting half the global population. The site also supports the livelihoods of tens of thousands of fisher people.

Inle Lake was designated as a Man and Biosphere Reserve (MAB) in 2015 and became a Ramsar Site in 2018. The Lake is important for biodiversity by virtue of its restricted range snails (gastropods) and fish,[32] with a total of 13 species restricted to the lake or very near the lake. However, Inle Lake is also suffering a range of impacts from pollution, sedimentation, agriculture, tourism development and deforestation within the catchment.

Inland Fisheries

Myanmar has no reliable fisheries statistical system to assess inland fisheries capture. However, Myanmar's freshwater fisheries are estimated to be the largest in Southeast Asia with 1.5 million tonnes of freshwater fish caught in 2015. This represents 28% of the total national fish production and provides job opportunities to 1.5 million people.[33] Inland fisheries are divided into leasable fisheries and open fisheries. Leasable fisheries establish private plots auctioned annually by the Department of Fisheries (DOF) and are mainly fishing grounds on floodplains that are fished through the erection of barrage fences around the lease area with fish collected in various collection pens or traps. Open fisheries include all other types of fishing operations and require licences from the DOF. In practice however, licenses for small-scale fisheries are not enforced. Threats appear to relate primarily to unsustainable harvesting of fish, and pollution.

Marine Habitats & Species

Myanmar has a large marine territory. The coastline stretches from the Naf River, the dividing line between Bangladesh and Myanmar, to Kawthaung at the border with Thailand. Along the southern coastline the Myeik Archipelago is made up of more than 800 islands. Many are covered by lowland wet evergreen forest and are associated with coral reef, mangrove and seagrass. Other coastal habitats include intertidal mud and sand flats, which are important for migratory water birds (e.g. the Gulf of Mottama as mentioned above). Seagrasses are mainly found in Rakhine and Tanintharyi marine areas, although they are absent from the Ayeyarwaddy Delta because of high turbidity.

The Myanmar Marine Biodiversity Atlas[34] illustrates the current state of marine resources in Myanmar through spatial information and lays a foundation for future marine spatial planning (MSP) and conservation activities. FFI has written a Blueprint for a network of Marine Protected Areas in the Myeik Archipelago which identifies areas that should be protected, as currently there is currently only one marine national park, Lampi Island Marine National Park; two shark Protected Areas; and three small crab Protected Areas. The National Biodiversity Strategy and Action Plan (2015- 2020) aims to protect 15% of the coral reefs in Myanmar by 2020.

Coastal habitats are important for provisioning ecosystem services and as a source of livelihoods.

32 Kano, Y. et al. (2016). Dataset of fishes in and around Inle Lake, an ancient lake of Myanmar, with DNA barcoding, photo images and CT/3D models. Biodiversity Data Journal. 2016;(4):e10539.
33 Myanmar Fisheries Partnership: Improving Freshwater Fisheries Management in Myanmar
34 Birch et al (2016) The Myanmar Marine Biodiversity Atlas (Edition 1)

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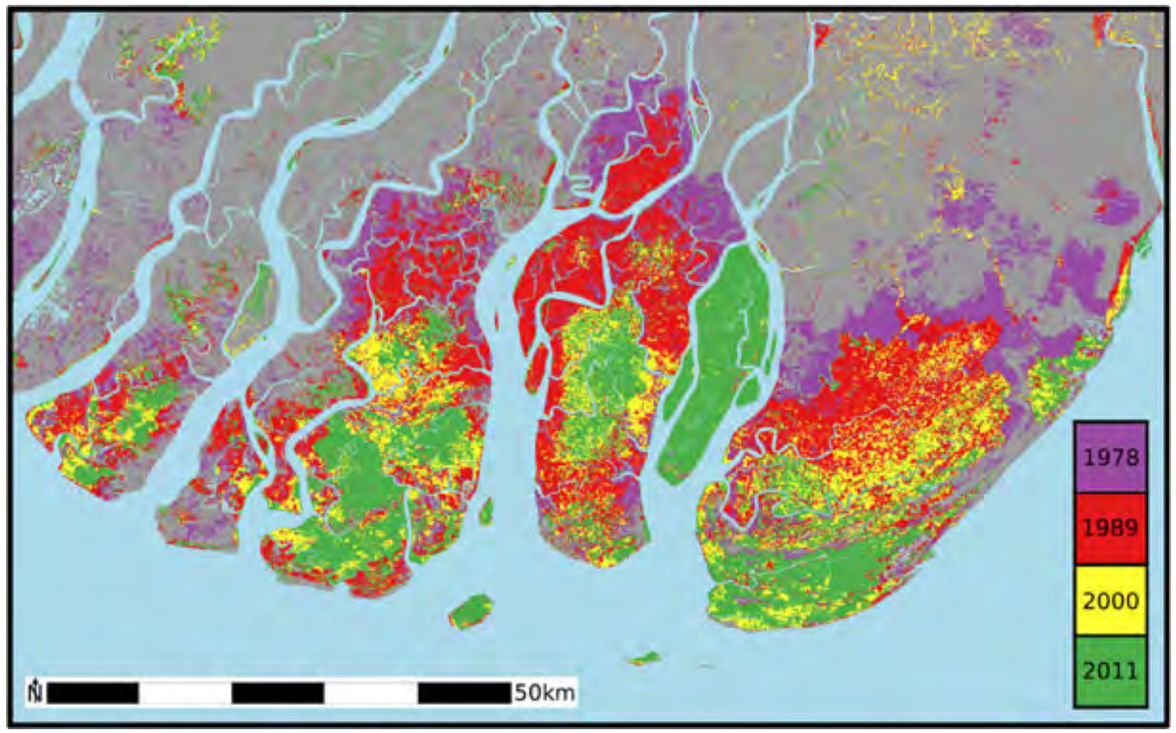
In addition, coastal habitats – especially mangroves, but also seagrass beds and coral reefs – reduce the exposure of coastlines to erosion and inundation by decreasing the strength of wind- and wave-generated currents and stabilising sediments protecting coastal populations, property and infrastructure from storms. They also provide nursery grounds for many commercially important fish species. Seagrass beds also store significant amounts of carbon, as do mangroves and coral reefs. Mangroves and reefs also store significant levels of carbon.

Mangroves

There has been a significant decline in mangroves, particularly in Ayeyarwady region[35] but also in Rakhine. Almost all deforestation in the Ayeyarwady Delta has been for rice agriculture. Between 1978 and 2011, mangrove cover declined by 64.2%, an average rate of 3.1% per year, which is considerably higher than loss of other types of forest (see ***Map 7***). One of the few areas that remains forested is the Meinma-hla-kyun Wildlife Sanctuary Ramsar Site. Mangrove forests in Tanintharyi, especially on Lampi Island, are intact and in good condition.

Map 7: Mangrove Decline in Ayeyarwady Delta (1978-2011)



Source: Webb, E. et al. (2013). Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar

35 Webb, E. et al. (2013) Deforestation in the Ayeyarwady Delta and the conservation implications of an internationally-engaged Myanmar. Global Environmental Change 24 (2014) 321–333

Coral Reefs and Seagrass

Until recently, the coral reefs in Myanmar were poorly understood. Surveys undertaken in Myeik Archipelago in 2013 and 2015 as part of the BOBLME Project,[36] indicate that while several sites with good biodiversity still exist, the overall condition of most coral reefs is either Poor or Very Poor. It has declined due to overfishing (especially of high-value species such as sharks and grouper), destructive forms of fishing (such as dynamiting and the use of poisons), coastal development, sedimentation, marine-based pollution and live coral trade. Some reefs in the southern Archipelago have less than 10% live hard coral, suggesting that priority reefs should be protected as soon as possible.

Seagrass beds are productive and valuable resources that provide habitats and food for many species of fish and invertebrates as well as dugong. Their primary commercial value lies in this role as essential forage and habitat for lucrative commercial fisheries. Seagrass beds of varying sizes and species diversity can be found along the Rakhine and Tanintharyi coasts, especially around Lampi Island. There are also isolated patches in the northern part of the Myeik Archipelago. They support large numbers of marine fish and shrimp larvae. Seagrass is not present in the coastal zones off the Ayeyarwady Delta and Mon State.[37]

A workshop conducted by the Wildlife Conservation Society (WCS) in January 2012 with key stakeholders identified the coastal areas of southern Tanintharyi Region and a portion of the entire Rakhine Coast as important marine 'Conservation Corridors,[38] that encompass Protected Areas and link Key Biodiversity Areas (KBAs), and therefore should be conserved as a priority. This would allow for conservation planning in a manner that considers connectivity and resource impacts beyond the borders of nationally designated Protected Areas. The Myanmar Marine Biodiversity Atlas outlines the distribution of mangrove, seagrass and coral habitats within these corridors (see ***Map 8***)[39].

Marine Fauna

A number of highly threatened marine turtles are thought to still be present in Myanmar, including the hawksbill (CR), green (EN), Olive Ridley (VU), loggerhead turtle (CR, North East Indian Ocean subpopulation) and the leatherback (VU). However, the numbers of marine turtle are dropping significantly due to fishing activities, egg poaching, meat consumption and collection of carapaces, weak law enforcement, land utilisation of nesting sites and pollution. A recent paper[40] confirmed the existence of leatherback, green, and hawksbill turtles on Lampi Island. Dugong trails were observed on seagrass beds off Lampi and Nyaung Wee Islands of the Myeik Archipelago. Studies on cetaceans are limited and anecdotal. Commonly encountered cetacean species in Myanmar coastal waters include finless porpoises, Irrawaddy Indo-Pacific humpback and bottlenose, Pan Tropical spotted and spinner dolphins and the Irrawaddy dolphin.

36 BOBLME (2015). Rapid ecological assessment of the Myeik Archipelago, Myanmar – Cruise 2. BOBLME-2015-ECOLOGY-64
37 BOBLME (2004). National Report of Myanmar on the Sustainable Management of The Bay of Bengal Large Marine Ecosystem. GCP/RAS/179/WBG
38 Holmes, K. et al. (2014). Marine Conservation in Myanmar - The current knowledge of marine systems and recommendations for research and conservation. Yangon, WCS and MSAM.
39 Birch, F. et al. (2016). Myanmar Marine Biodiversity Atlas. University of Exeter, UK
40 Platt, S. et al. (2015). Marine Turtles and Estuarine Crocodiles in Lampi Marine National Park, Myanmar: A Conservation and Threat Assessment with Recommendations. Herpetological Review 46 (3): 319–327.

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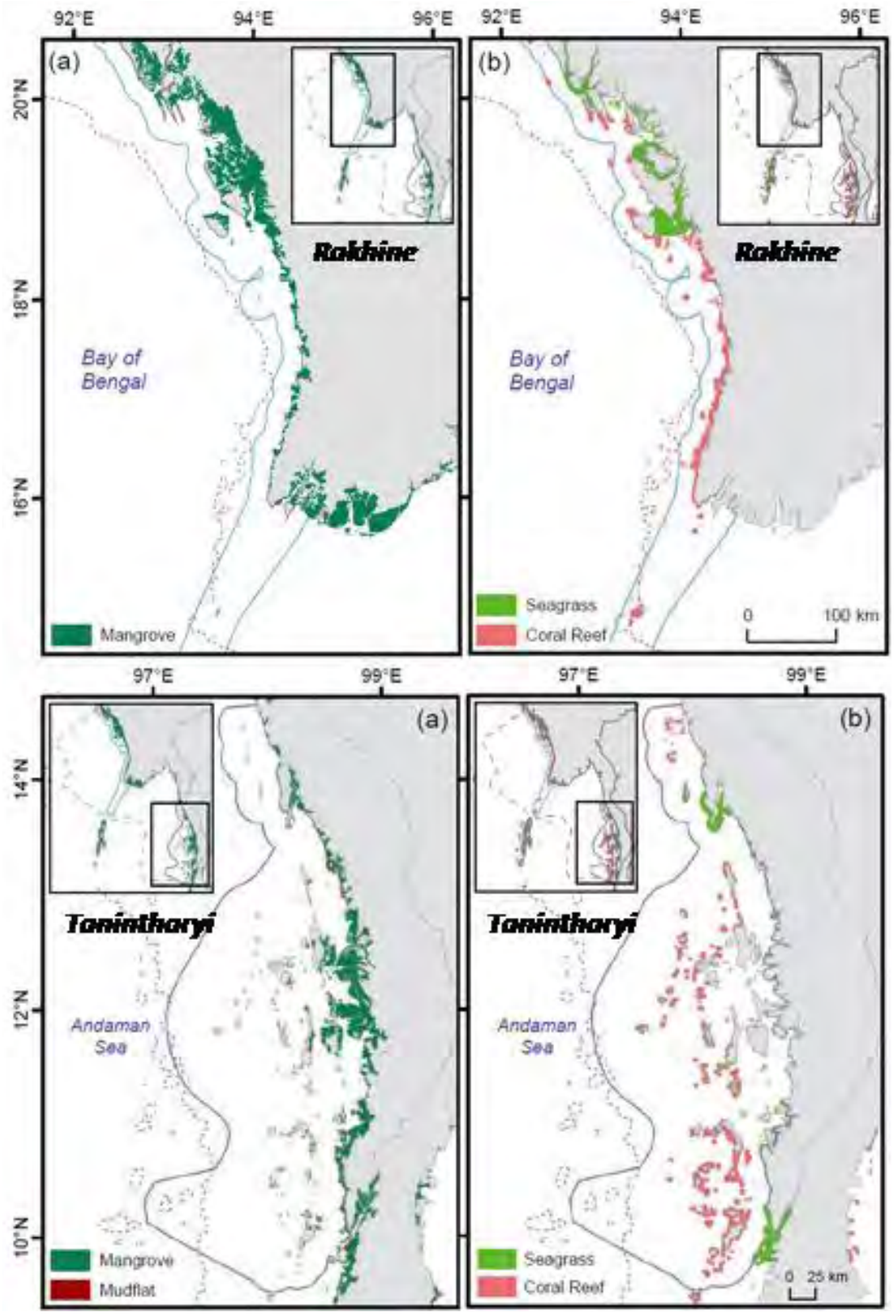
Map 8: Habitats of the Rakhine and Tanintharyi marine biodiversity corridors



Source: Birch, F.et al, (2016). Myanmar Marine Biodiversity Atlas

There is a lack of good scientific understanding of shark distributions in Myanmar's marine areas. Surveys undertaken as part of the BOBLME Project did not encounter a single shark.[41] The Myanmar government declared two shark 'no-take' areas covering 25% of the marine areas in 2004. The designation of the no-take shark zones was apparently ineffective due to a lack of outreach to fishermen and lack of enforcement. Due to the ineffectiveness of this first step, the Government declared a national moratorium on shark fishing in 2008. FFI's report[42] recommended it would be better to have stronger control covering smaller areas. Currently the Government is formulating a National Plan of Action for shark conservation.

Marine Fisheries

Myanmar's marine fisheries provide livelihood opportunities for many people through capture, processing and marketing. Some of the coastal fishing communities are among the most marginalized, poorest and vulnerable people in Myanmar society. However, the capacity of inshore fisheries to support fisheries-based livelihoods and make a significant contribution to the local economy is under some threat. Total marine catches are uncertain, but estimates range from 1.3 – 1.8 million tons/yr. The research vessel Dr Fridtjof Nansen[43] surveys in 1979/80 established a benchmark on the state of the Myanmar marine resources. In 1980-1983, the FAO estimated the maximum sustainable yield for Myanmar's marine fisheries to be about 1.05 million tonnes/year (for details see BOBLME, 2004). In 2013 and again in 2015, the Fridtjof Nansen expedition (within the framework of the FAO EAF-Nansen Project and BOBLME) conducted another survey on fish resources. The results of the 2013 survey showed that pelagic and demersal fish biomass had fallen by 90% and 70% respectively since 1980.

As a direct consequence of the survey – coupled with the likelihood that the total landing of marine fish will increase through better exploitation of resources – the Department of Fisheries (DOF) has increased their attention to sustainable management of fisheries. This includes measures such as implementing closed seasons, reducing the number of boats, banning foreign fishing vessels (all trawlers) and limiting the construction of local fishing vessels. However, DOF is very resource constrained and it will be difficult to adequately enforce these measures and monitor their impact on fish stocks.[44]

41 See BOBLME (2015). Final report - Strengthening existing marine reserves and shark conservation in Myanmar. BOBLME-2015-Ecology-21

42 Dearden, P. (2016). *Blueprint for a Network of Marine Protected Areas in the Myeik Archipelago*, Myanmar. Report No.39 of the Tanintharyi Conservation Programme. FFI, Yangon

43 The RV Dr Fridtjof Nansen is owned by the Norwegian Agency for Development Cooperation (NORAD). The vessel was built as part of the United Nations' (UN) Food and Agriculture Organization (FAO) project to help developing countries improve their fisheries management.

44 FAO Fishery and Aquaculture Country Profiles. Myanmar (2010). Country Profile Fact Sheets. In: FAO Fisheries and Aquaculture Department. Updated 2010.

ANNEX 1: LIST OF EXISTING PROTECTED AREAS IN MYANMAR

NO.	YEAR	NAME	AREA (KM²)	LOCATION	KEY SPECIES PROTECTED
1	1920	Taunggyi Bird Sanctuary	16.06	Shan State	Avifauna
2	1927	Pidaung Wildlife Sanctuary	122.07	Kachin State	Barking deer, Wildboar, Avifauna, Reptiles
3	1927	Shwe-U-Daung Wildlife Sanctuary	58.04 117.97	Mandalay Region Shan State	Elephant, Gaur, Banteng, Sambar, Serow, Macaque, Avifauna
4	1927	Pyin-Oo-Lwin Bird Sanctuary	127.25	Mandalay Region	Barking deer, Avifauna
5	1927	Moscos Islands Wildlife Sanctuary	49.18	Tanintharyi Region	Barking deer, Sambar, Water birds
6	1928	Kahilu Wildlife Sanctuary	160.55	Kayin State	Serow, Mouse deer, Hog deer
7	1939	Mulayit Wildlife Sanctuary	138.54	Kayin State	Barking deer, Wildboar, Macaque, Avifauna
8	1939	Wethtikan Bird Sanctuary	4.4	Magwe Region	Water birds
9	1940	Shwesettaw Wildlife Sanctuary	464.28	Magwe Region	Eld's deer, Sambar, Barking deer, Wild dog, Wildboar, Macaque, Avifauna
10	1941	Chatthin Wildlife Sanctuary	269.36	Sagaing Region	Eld's deer, Sambar, Barking deer
11	1942	Kelatha Wildlife Sanctuary	23.93	Mon State	Sambar, Barking deer, Wildboar, Avifauna
12	1970	Thamihla Kyun Wildlife Sanctuary	0.88	Ayeyarwady Region	Marine turtle, Water birds
13	1972	Minwuntaung Wildlife Sanctuary	205.88	Sagaing Region	Barking deer, Hog deer, Avifauna
14	1974	Htamanthi Wildlife Sanctuary	2150.73	Sagaing Region	Tiger, Leopard, Elephant, Gaur, Sambar, Wildboar, Barking deer, Bear, Macaque, Avifauna
15	1985	Inlay Wetland Bird Sanctuary	640.91	Shan State	Water birds, Migratory birds, Crane
16	1988	Moeyingyi Wetland Bird Sanctuary	103.6	Bago Region	Migratory birds
17	1989	Hlawga Park	6.24	Yangon Region	Sambar, Barking deer, Hog deer, Eld's deer, Macaque, Migratory birds
18	1989	Alaungdaw Kathapa National Park	1402.79	Sagaing Region	Tiger, Leopard, Elephant, Gaur, Sambar, Serow, Bear, Wildboar
19	1989	Popa Mountain Park	128.54	Mandalay Region	Barking deer, Wildboar, Dusk leaf monkey, Avifauna
20	1993	Meinmahla Kyun Wildlife Sanctuary	136.7	Ayeyarwady Region	Crocodiles, Sea birds
21	1995	Lawkananda Wildlife Sanctuary	0.47	Mandalay Region	Myanmar star tortoise, Eld's deer, Avifauna
22	1996	Lampi Island Marine National Park	204.84	Tanintharyi Region	Elephant, Pangolin, Macaque, Water birds, Coral reefs, Lesser mouse deer, Marine biotics
23	1996	Loimwe Protected Area	42.84	Shan State	Bear, Pangolin, Avifauna
24	1996	Parsar Protected Area	77.03	Shan State	Jungle fowl, Chinese pangolin, Avifauna
25	1998	Hkakaborazi National Park	3812.46	Kachin State	Takin, Musked deer, Red panda, Red goral, Leaf deer

NO.	YEAR	NAME	AREA (KM²)	LOCATION	KEY SPECIES PROTECTED
26	2001	Kyaikhtiyo Wildlife Sanctuary	156.23	Mon State	Goral, Gaur, Sambar, Barking deer, Macaque, Wildboar, Avifauna
27	2001	Minsontaung Wildlife Sanctuary	22.61	Mandalay Region	Barking deer, Rabbit, Myanmar star tortoise, Jackal, Wild cat, Snakes
28	2002	Rakhine Yoma Elephant Range	1755.7	Rakhine State	Elephant, Gaur, Leopard, Sambar, Barking deer, Jackal, Bear, Wildboar, Macaque, Avifauna
29	2002	Panlaung-Pyadalin Cave Wildlife Sanctuary	333.8	Shan State	Elephant, Leopard, Golden cat, Clouded leopard, Serow, Gibbon, Avifauna
30	2003	Hponkanrazi Wildlife Sanctuary	2703.95	Kachin State	Barking deer, Avifauna, Red Goral, Gibbon, Wild dogs, Mangooses
31	2004	Indawgyi Wetland Wildlife Sanctuary	814.99	Kachin State	Sambar, Serow, Goral, Water birds
32	2004	Hukaung Valley Wildlife Sanctuary	6371.37	Kachin State	Tiger, Elephant, Leopard, Gaur, Sambar, Bear, Wildboar, Serow
33	2004	Bumhpabum Wildlife Sanctuary	1854.43	Kachin State	Elephant, Leopard, Gaur, Serow, Clouded leopard, Jackal, Avifauna
34	2004	Shark Protected Area	1706 AND 11734	Tanintharyi Region	
35	2005	Tanintharyi Nature Reserve	1699.99	Tanintharyi Region	Tiger, Elephant, Tapir, Gurney's Pitta, Bear, Leopard, Avifauna
36	2005	Ayeyarwady Dolphin Protected Area	326	Mandalay Region	Ayeyarwady Dolphin
37	2010	Natmataung National Park	713.54	Chin State	Gaur, Serow, Goral, Barking deer, Leopard, Clouded leopard, Wildboar, White-browed Nuthatch, Avifauna
38	2010	Hukaung Valley Wildlife Sanctuary (extension)	4333.05 6669.22	Kachin State Sagaing Region	Tiger, Elephant, Leopard, Gaur, Sambar, Bear, Wildboar, Serow
39	2013	Kyauk Pan Taung Wildlife Sanctuary	130.61	Chin State	Seraw, Goral, Sambar, Lepoard, Clouded leopard, Wild cats, Barking deer, Wildboar
40	2013	Chungponkan Wildlife Sanctuary	2.2	Magwe Region	Myanmar golden deer, Rabbit, Wildcat, Jackal, Avifauna
41	2014	North Zamrari Wildlife Sanctuary	983.21	Bago Region	Elephant, Leopard, Clouded leopard, Gaur, Bear, Banteng, Avifauna
42	2017	Inkhaingbum National Park	300.52	Kachin State	Leopard, Gaur, Barking deer, Hog deer, Pangolin, Leaf deer, Red goral, Wild dog, Wild cats, Wild Boar, Bear, Avifauna, Snakes
		TOTAL AREA	**52946**		

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Myanmar Centre for
Responsible Business

ADDRESS:
6(a) Shin Saw Pu Road
Kayin Chan Ward, Ahlone Township, Yangon
Myanmar

P. +95 1 512613
E. info@myanmar-responsiblebusiness.org
www.mcrb.org.mm
www.myanmar-responsiblebusiness.org