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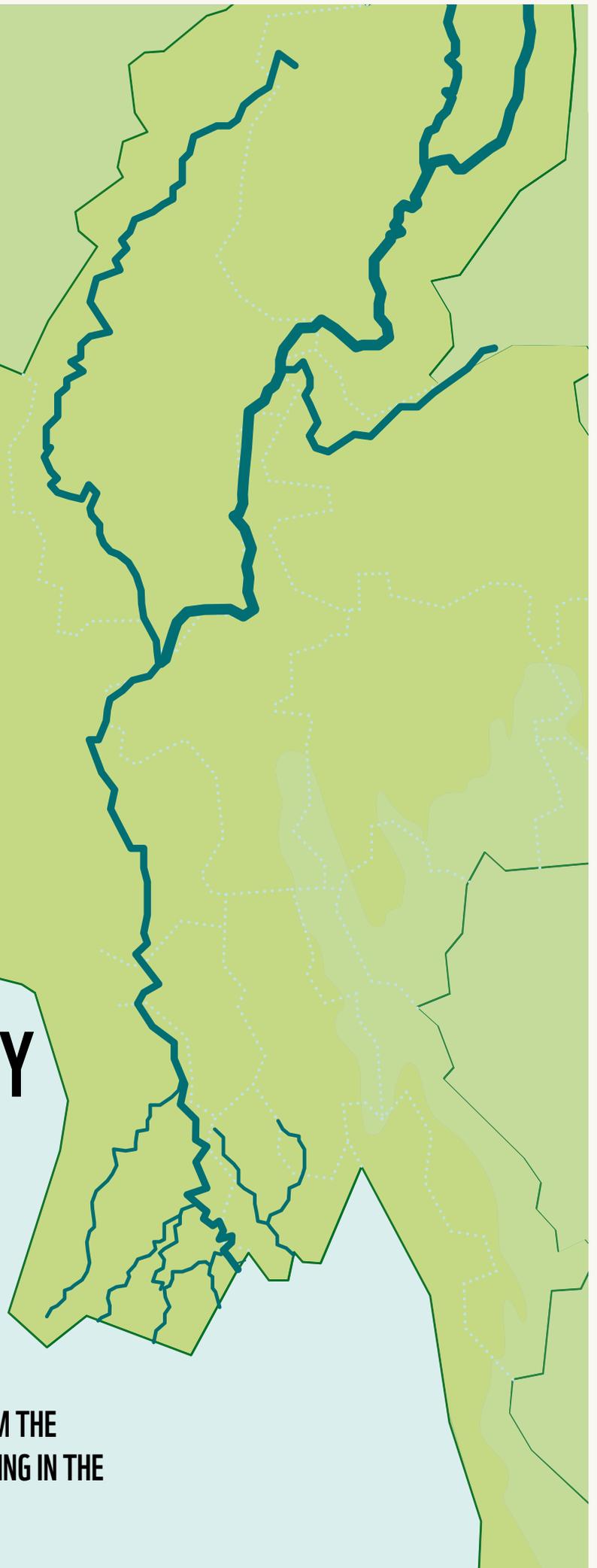
REPORT

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2018

THE AYEYARWADY RIVER AND THE ECONOMY OF MYANMAR

VOLUME 1: RISKS AND OPPORTUNITIES FROM THE
PERSPECTIVE OF PEOPLE LIVING AND WORKING IN THE
BASIN



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WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global Network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

INTRODUCTION

Myanmar's Ayeyarwady River is both unique and special. It is one of the largest free-flowing rivers in Southeast Asia. There is just one other river with this title, the Thanlwin or Salween River, which also traverses Myanmar's undulating landscapes.

Although the river is "free-flowing", it is not pristine. The Ayeyarwady is the engine of the Myanmar economy. It feeds the country's population with fish and rice, and enables goods to be transported to people up and down the river. Its waters are used to power turbines for electricity, while sand from its basin is a key component for infrastructure like houses, offices and roads.

This document attempts to identify different ways that the Ayeyarwady River is important to both Myanmar's economy and society. It also aims to highlight the importance of balanced development that will ensure the naturally functioning systems within the river continue to support growth and development, as they have for hundreds of years. It is a culmination of perspectives and inputs from stakeholders along the river regarding their perceived risks and opportunities.



WHAT MAKES THE AYEYARWADY RIVER UNIQUE?

A BIG RIVER

- Length **2170 km**
- Area **413,710km²**
- **91%** lies in Myanmar, 5% in China, 4% in India

THE BASIN

- The ARB (Ayeeyarwady River Basin) is the **largest** and **most economically significant** river in Myanmar
- It covers **61%** of the country's landmass.
- **5** of Myanmar's largest cities are in the basin

THIS HUGE RIVER COVERS AN AREA **10% LARGER THAN GERMANY**

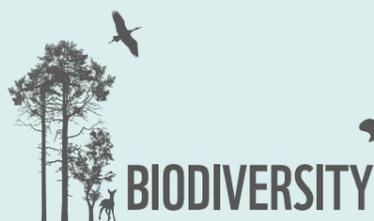
34 MILLION PEOPLE LIVE IN THE RIVER'S BASIN



PEOPLE



- The basin is **home to 66% of Myanmar's population** (34 million people)
- On average, there is **79 people per km²** living in the basin
- The majority of these people live in the Ayeeyarwady's **agricultural heartlands**, the **dry zone** and **the delta** - particularly in Yangon and Mandalay



BIODIVERSITY

- One of the **most biologically diverse** regions in the world
- around **1,400 mammal, bird and reptile species**
- **More than 100** of these species are globally threatened
- **388** identified **species of fish**
- **50%** of these fish **endemic** to the Ayeeyarwady River
- Each time the river is surveyed, **new species are discovered**

NEW SPECIES ARE DISCOVERED EVERY TIME THE RIVER IS SURVEYED

SERVICES PROVIDED BY THE RIVER CONTRIBUTE **2-6 BILLION USD TO MYANMAR'S ECONOMY EVERY YEAR**



MYANMAR'S LARGEST CITIES ARE IN THE AYEYARWADY BASIN

 Monywa 182,000	 Mandalay 1.2 million
 Patheingyi 237,000	 Yangon 5 million
 NayPyiDaw 0.9 million	

UNIQUE NATURAL DYNAMICS

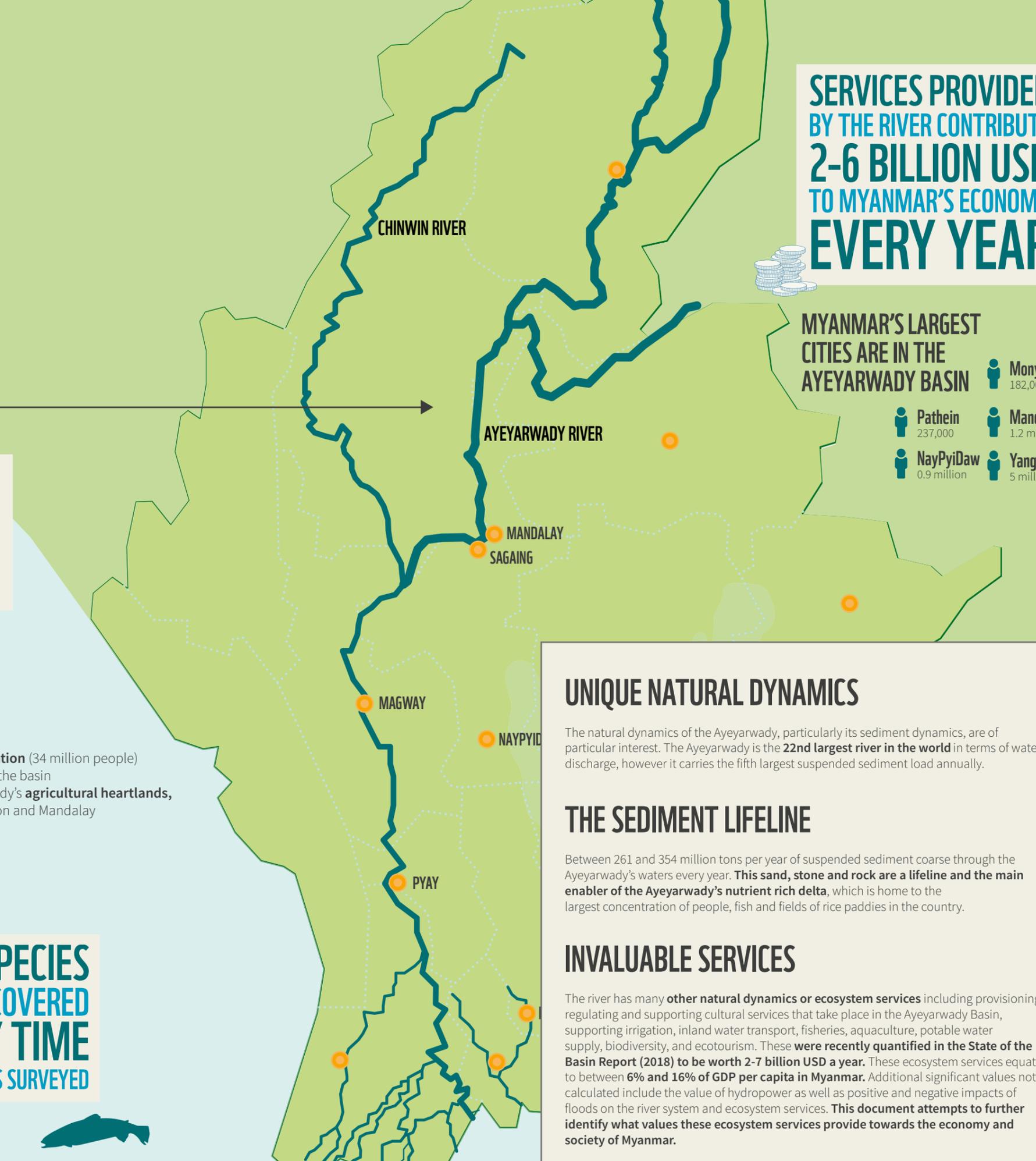
The natural dynamics of the Ayeeyarwady, particularly its sediment dynamics, are of particular interest. The Ayeeyarwady is the **22nd largest river in the world** in terms of water discharge, however it carries the fifth largest suspended sediment load annually.

THE SEDIMENT LIFELINE

Between 261 and 354 million tons per year of suspended sediment coarse through the Ayeeyarwady's waters every year. **This sand, stone and rock are a lifeline and the main enabler of the Ayeeyarwady's nutrient rich delta**, which is home to the largest concentration of people, fish and fields of rice paddies in the country.

INVALUABLE SERVICES

The river has many **other natural dynamics or ecosystem services** including provisioning, regulating and supporting cultural services that take place in the Ayeeyarwady Basin, supporting irrigation, inland water transport, fisheries, aquaculture, potable water supply, biodiversity, and ecotourism. These **were recently quantified in the State of the Basin Report (2018) to be worth 2-7 billion USD a year**. These ecosystem services equate to between **6% and 16% of GDP per capita in Myanmar**. Additional significant values not calculated include the value of hydropower as well as positive and negative impacts of floods on the river system and ecosystem services. **This document attempts to further identify what values these ecosystem services provide towards the economy and society of Myanmar.**



A CONNECTED AYEYARWADY

Interdependency of sectors and sub-basins with the Ayeyarwady River

The Ayeyarwady is at the heart of many activities in Myanmar. In each of its sub basins, a unique set of needs and risks is associated with the river. As part of the WWF-funded Ayeyarwady River in the Economy Project, a series of workshops were held in each of these sub basins (upper, Chindwin, middle, lower and delta) to identify the goods and services provided by the river, but also to identify how these demands are putting the river at risk, and ultimately the sectors themselves, which depend on a healthy Ayeyarwady.

30 participants attended each workshop. They represented a diversity of backgrounds; academia, government, private sector and civil society. They identified the goods and services provided to their sub basins that depend on their stretch of river. These include provisioning services such as water for irrigation, regulating services such as flood recession ponds for fish spawning, supporting services such as safe habitats for biodiversity, and cultural services for tourism, as well as spiritual sites along the basin.

They were also asked to identify how these sectors providing goods and services are impacting upon the river system, creating risks for the stretch of river in their region.

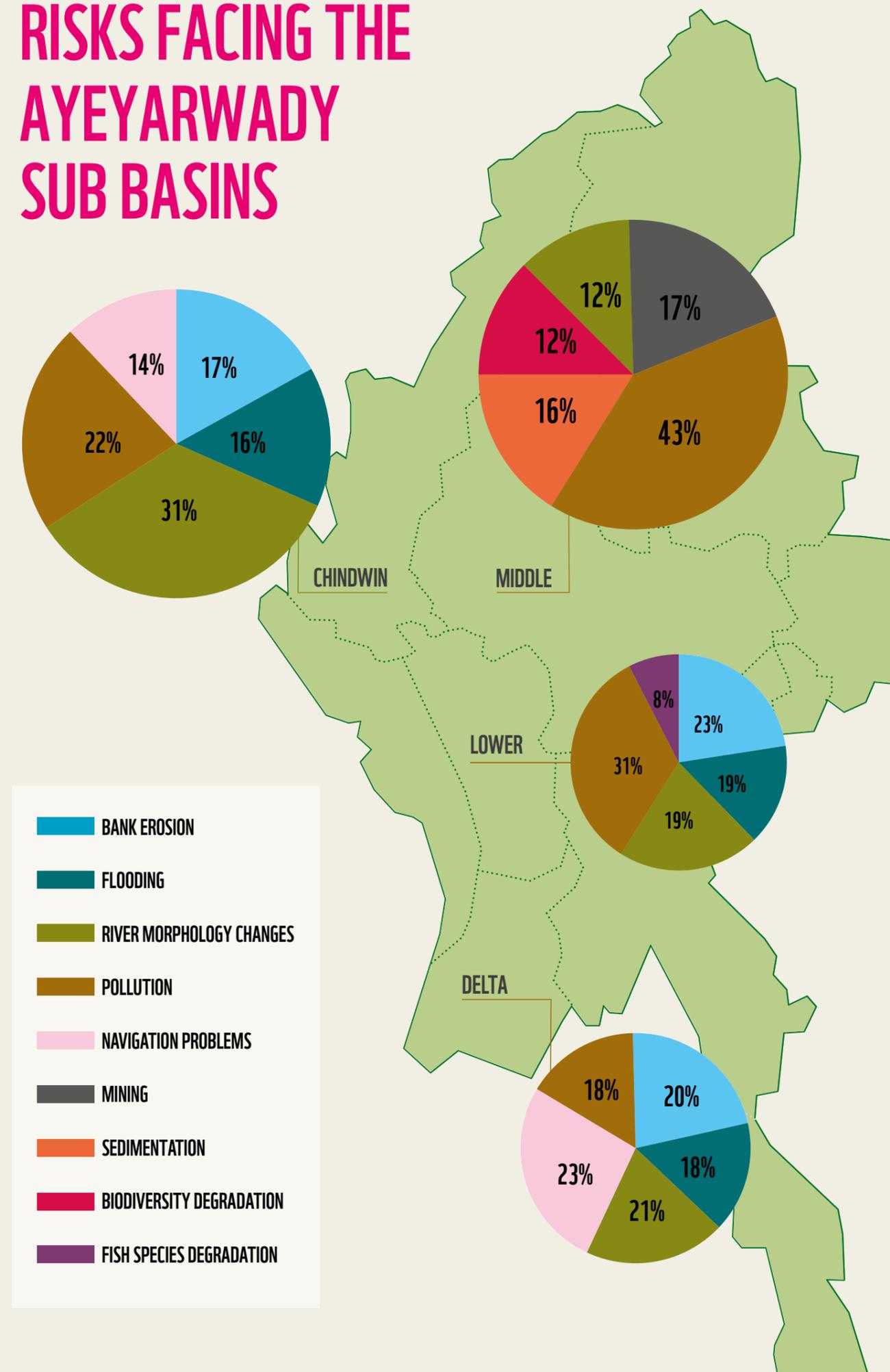
The top risks identified in each sub-basin are shown in the following figure. These include flooding, mining, bank erosion, pollution, sedimentation, navigation challenges, river morphology changes, and fish species degradation.

In addition to the individual risks identified within each localized sub-basin, there are also interlinked risks from up to downstream.

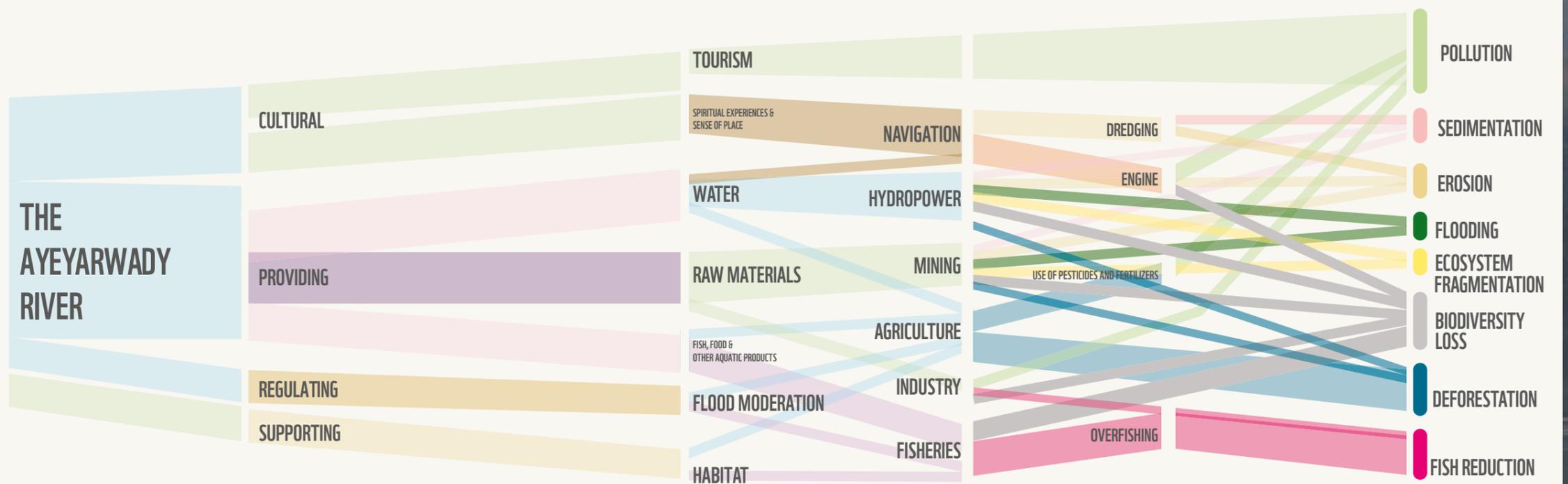
For instance, increased mining or deforestation in the upper catchment may shift the sediment dynamics downstream, causing bank erosion or sedimentation. As the Ayeyarwady flows through the country, hydropower dams trap sediment and may reduce the valuable ecosystem services provided to flood recession agriculture in its lower stretches. Because of this sedimentation the river widens and becomes more shallow, causing significant challenges for boats navigating the waters. The use of pesticides and fertilizers upstream also causes pollution for those using the river downstream. These are just a few of the ways that risks are transported geographically throughout the entire river basin.

It is of paramount importance that economic development plans taking place, especially in the upper reaches of the Ayeyarwady and its tributaries, take into account their impacts on the users downstream. This includes not only water availability and quality, but also the timing of flows and sediment dynamics. For instance, the flooding risks identified by stakeholders in the lower basin may be due to a sediment deficit in the upper reaches. This in turn limits the flow of sediment to the delta, contributing to its sinking. The lack of sediment may be due to a number of factors including regulation of flows from dams, the trapping of actual sediment from dams or perhaps the extraction of sediment for the construction sector. Individually these impacts may be small, but cumulatively they may result in a vulnerable delta, the home of the majority of Myanmar's population, infrastructure, and fish and rice production.

RISKS FACING THE AYEYARWADY SUB BASINS



HOW DO DIFFERENT SECTORS DEPEND ON THE AYEYARWADY?



AND WHAT ARE THE IMPACTS?



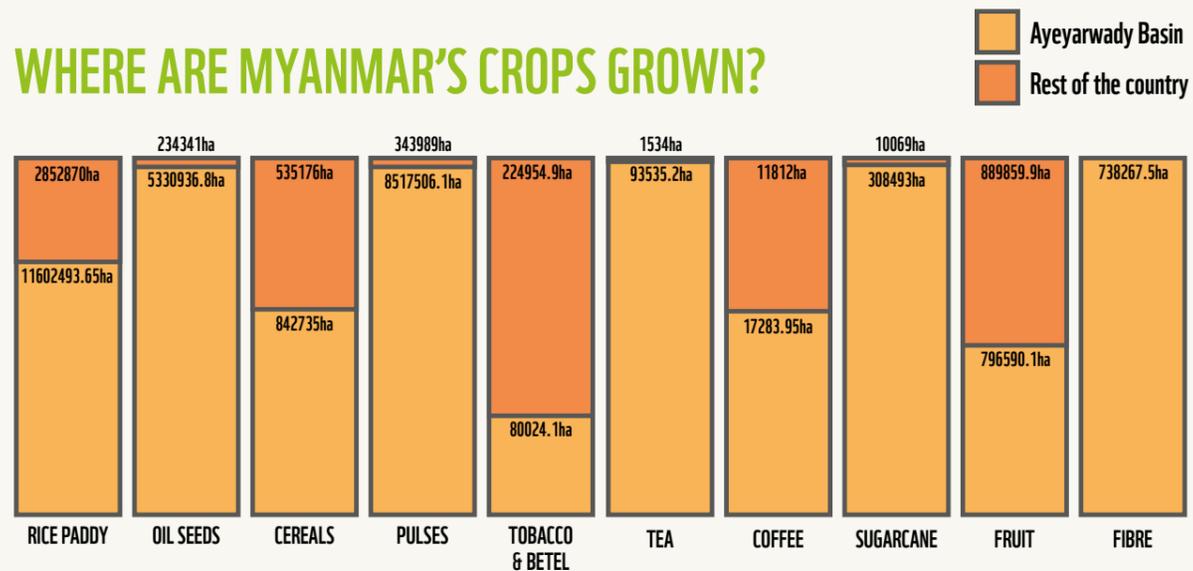
AGRICULTURE

Agriculture is one of the most significant contributors to the Myanmar economy. Agriculture represents: 32% of the GDP and 17.5% of the total export earnings
Agriculture employs: 61.2% of the labour force (FAO 2009-2010).

The huge value that Myanmar receives from the agricultural sector is largely due to the ecosystem services provided by a healthy Ayeyarwady River. For instance, according to the State of the Basin Report, the estimated annual economic values attributable to irrigation water supplies (provisioning services) is 62 to 121 million USD in the dry season and is 29 to 50 million USD due to yield gains in the monsoon season. This means that the clean water provided from the Ayeyarwady alone contributes 6% to the value of agricultural exports from Myanmar. This is without considering the value of other ecosystem services including sediment nutrients for example.

Rice is the most cultivated crop in Myanmar (8 million hectares) but mainly during the monsoon season (with other crops grown during the dry season). Beans and pulses are the second most grown crop in the country (4 million hectares), most of which are produced during the cool and dry season. Other important crops include maize, groundnuts, sesame, sunflower, and culinary crops (2.5 million hectares). The ARB is home to the majority of crops grown in the country

WHERE ARE MYANMAR'S CROPS GROWN?

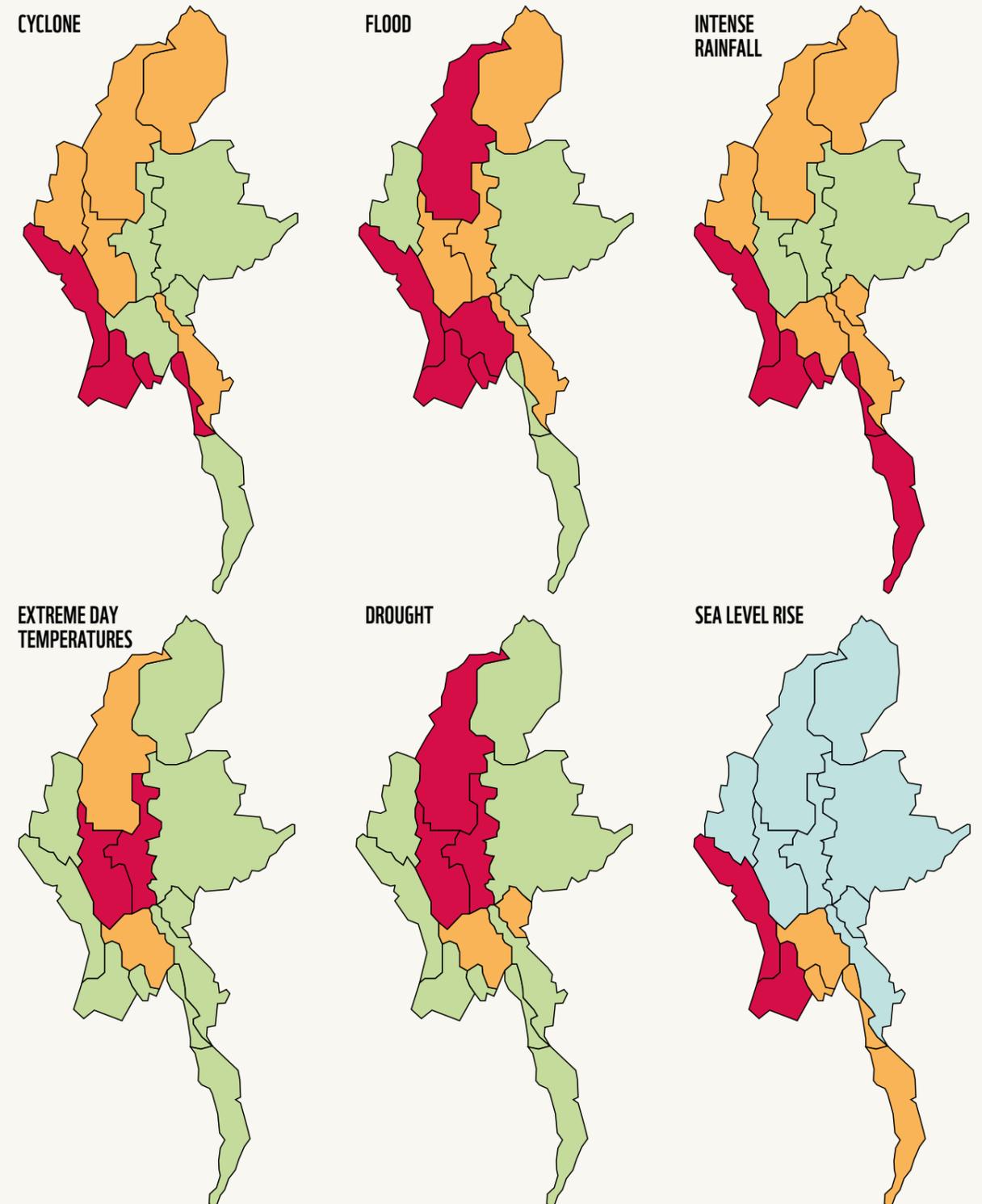


AGRICULTURE AT RISK

Myanmar's most productive agricultural zones (the Ayeyarwady Basin) are in the areas most vulnerable to climate change. In the face of potential cyclones, flooding, intense rainfall, extreme day temperatures, drought or sealevel rise, the country's future food supply is at risk.

For example, the main paddy producing region is the coastal and delta zone, particularly the Ayeyarwady basin, while the intensive mixed upland crop area is in the central dry zone. Under climate change projections, the coastal zone will experience increased rainfall during a shorter and more intense wet season, leading to flooding. At the same time, sea level rise will increase inundation and lead to greater salinity intrusion in coastal areas. Cyclones will exacerbate these effects through associations with flooding, as well as wind damage. In the dry zone, drought risk will rise, particularly as the length of the monsoon shortens. This will be complemented by increased heat stress, as maximum temperatures may rise up to 4°C by 2051.

WHAT AND WHERE ARE THE CLIMATE CHANGE RISKS FACING MYANMAR?





RICE

Rice accounts for 43% of all agricultural production value, nearly 5 times as high as the second highest value commodity, poultry. This is to be expected given the water resource advantages of Myanmar and the fertile delta.

When summed across all regions and states, it is evident that the Ayeyarwady Basin is a key region for agricultural production and is therefore rightfully referred to as the 'rice bowl' of Myanmar, with 71% of the country's rice production coming from the Ayeyarwady Basin even though it represents only 69% of sown area of paddy in the basin. This means that rice grown in the delta is more productive per hectare than elsewhere in the basin.

PULSES

The second most cultivated crop in Myanmar are pulses, a group that comprises black gram, green gram, chickpeas, pigeon peas, and other grams.

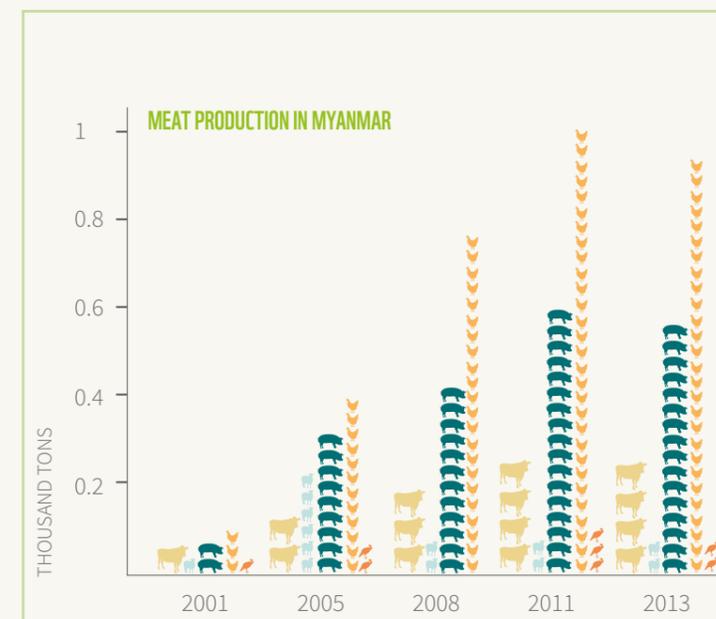
India (58% importers of all legume exports) and China (18% importers of all legume exports) are the largest buyers of Myanmar beans and pulses, resulting in Myanmar being the second largest global exporter of beans and pulses, after Canada.

Pulses are now the top foreign exchange earner among agriculture commodities, representing 12% of total export value from the country (1.4 billion USD). In FY2011, the area planted to pulses was estimated at 4.4 million hectares (about 55% of the area planted to paddy). They are sown mainly in the central dry zone, followed by delta, hilly, and coastal zones. According to the national agricultural statistics, 96% of all pulses produced within Myanmar are grown within the Ayeyarwady Basin.

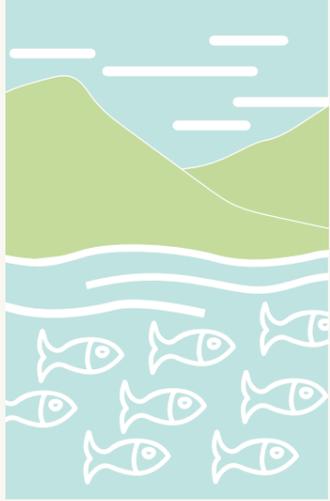
LIVESTOCK

The livestock and fisheries sector contributed 7.4% of GDP in FY2010. However, outside of official GDP numbers, livestock is an integral part of the agricultural economy: cattle (and buffalo) provide draft power and rural transport, dairy cattle provide milk, and other livestock and poultry provide food and income.

In 2012, the livestock population comprised 14 million cattle, 3.1 million buffaloes, 4.6 million sheep and goats, 10.3 million pigs, 172 million chickens, 15 million ducks, and 1.9 million other poultry. Estimated per capita consumption of meat is 11.3 kilograms (compared to 88 kg per person annually in Germany), milk (15.3 kilograms), and eggs (52) per year.



Cattle are densely populated in the central dry zone (Middle Ayeyarwady), making up about 50% of the country's total. The value of animal products exports was \$47.1 million in FY2012, a large proportion from hides. This is small compared to the \$641.7 million of fish exports (marine and freshwater) and \$2600 million of crop exports. However, official statistics suggest that the growth in livestock and dairy production has been much faster than for crops. This is indicated by the figure below, showing the dramatic increase of meat production. Within the meat sector, chicken has grown fastest (accounting for 995,380 MT, or 51.3% of total meat produced in FY2010), followed by pork and beef. Milk production has also made large gains.



FISHERIES

Like rice, fish is a major contributor to Myanmar's national diet, estimated to account for approximately 60% of animal protein intake. Nationally, the livestock and fisheries sector contributed 7.4% of GDP in FY2010.

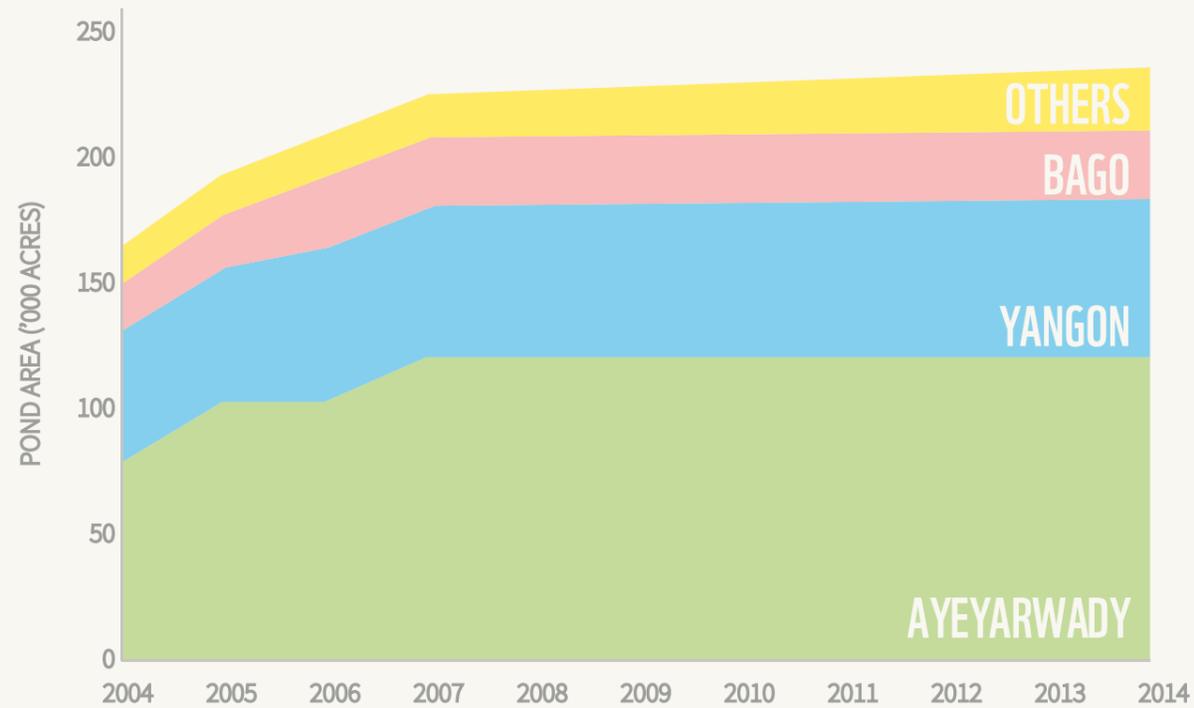
According to national statistics, fisheries provide jobs for approximately 3.2 million people (0.15% of total employment). The significant value attributed to fisheries, is especially dependent on a healthy Ayeyarwady River. According to the State of the Basin Assessment, the ecosystem services provided by the River range between 350 to 530 million USD in freshwater capture and 380 to 600 million USD in aquaculture to Ayeyarwady basin.

According to updated statistics, Myanmar fish production is composed of three tiers: one third inland capture fish, one third marine capture fish and one third aquaculture fish, for a total of 2.9 million metric tons in 2015. According to these statistics, Myanmar fish production is composed of about 863,000 metric tons or 30% of inland capture fish, 1,062,000 metric tons or 37% of marine capture fish, and 942,000 metric tons or 33% of aquaculture fish. The trends in fisheries production in Myanmar are shown below, where marine fisheries have remained relatively stable, aquaculture has grown at a rapid pace, while capture freshwater fish is believed to have dropped somewhat in the last few years.

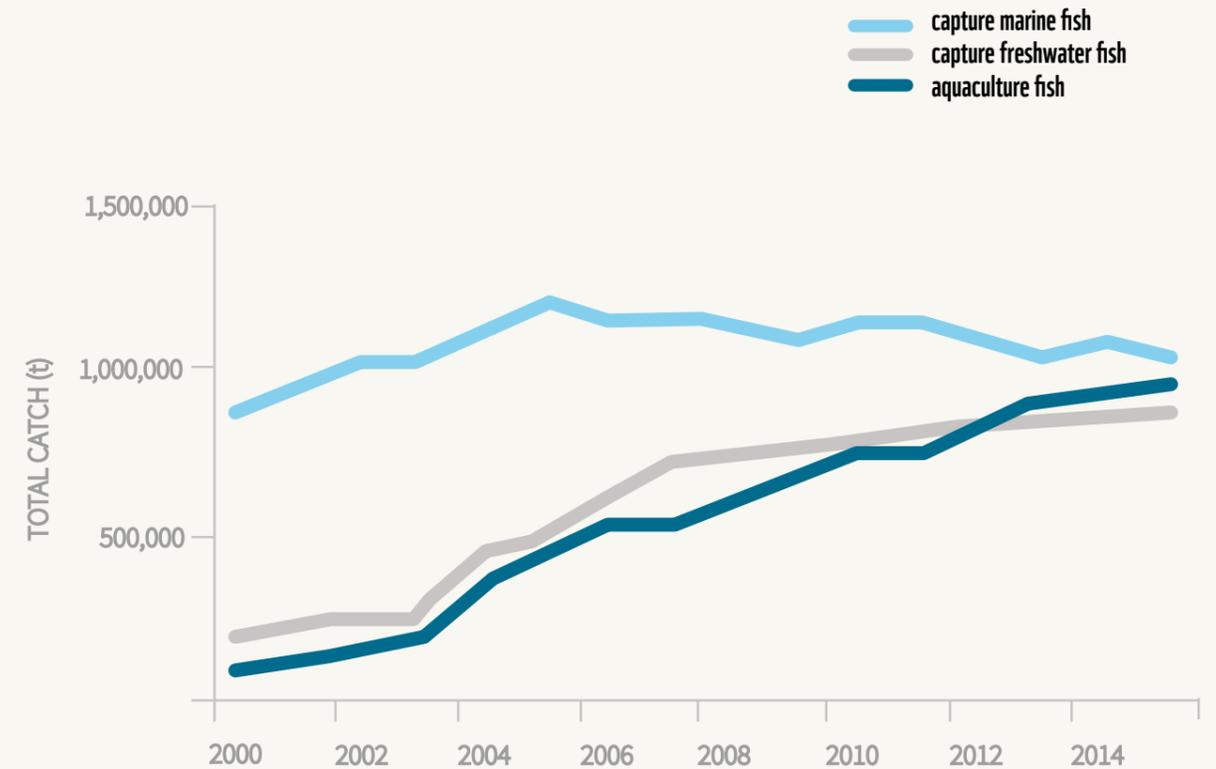
The Ayeyarwady Basin is the most important source of inland fisheries for the country. Both for wild caught fish but also increasingly for aquaculture as the for example, the Ayeyarwady Delta now represents 70% (Ayeyarwady and Yangon regions) of all ponds in the country. The relative importance of the Ayeyarwady is show in the figure below .

The growth of aquaculture (8% a year estimated) in the Ayeyarwady is a risk to the indigenous species in the basin. This risk is especially acute since there is so little known about the wild fish in the Ayeyarwady. For instance, the overall number of fish species recorded in the Ayeyarwady Basin is 388, of which 311 are present in the Myanmar part. The others being found in India and China. Among the 388 fish species, 193 (50 %) are endemic to the basin, and 100 (26 %) of the endemics are presently known only from Myanmar. Imported exotic fish species tend to outcompete the natural, indigenous fish species within a river. According to the SOBA report on fisheries, "there is very little research around the benefits or negative impacts of stocking natural water bodies with cultured fish. Fishers complain about competition between stocked fish and native fish, with a frequent reduction of the wild stock. In 2007, only 7.4% of the leasable fisheries yield consisted of species originally existing in the area. This point requires further investigation."

MYANMAR INLAND FISHPOND AREA ACCORDING TO REGIONS



TRENDS IN MARINE CAPTURE FISHERIES, FRESHWATER FISHERIES AND AQUACULTURE



THE IRRAWADDY RIVER DOLPHIN

60
IRRRAWADDY
DOLPHINS
REMAIN IN THE
AYEYARWADY
RIVER

In addition to the fish, the Irrawaddy Dolphin is also at risk, and is currently critically endangered in Myanmar. There are roughly 60 dolphins left in the Ayeyarwady River.

The Irrawaddy Dolphin habitat overlaps strongly with severe threats from growing human activities. The primary factor responsible for population declines is incidental mortality in small-scale fisheries, especially gillnets and electro-fishing. Habitat loss and degradation is also a major contributing threat in many freshwater areas, especially from existing and planned dams in the Ayeyarwady River, and in coastal estuarine habitats from declining freshwater flows, increasing commercial vessel traffic and pollution.

“Some fishermen feel that a significant part of this stems from the fishing licenses offered by the Ministry of Livestock, Fisheries and Rural Development. The competitive bidding process and the short-term length of the fishing contracts encourages over-fishing, to the detriment of both dolphins and the cooperative fisherman.”

WORKING TOGETHER

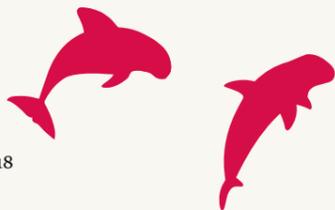
One of the potential lifelines for the Irrawaddy Dolphin is cooperative fishing, whereby fisherman and dolphins work together to catch their fish. Cooperative fishing is also more effective. In 2006 and 2007, DOF and WCS conducted a study, which found that dolphin-assisted fishing resulted in fewer empty nets and higher weight and value of the catch. However, from 2011 to 2013, cooperative fisherman experienced a 17% drop in income. Over 40% of the fishermen say they have no other source of income, while about 38% rely on additional income from farming. Agricultural income is susceptible to seasonal shocks, which make it inconsistent from year to year.

THE TOURISM LIFELINE

Ecotourism, in the form of tourists going to view the cooperative fishing, one of the only places in the world where this is practiced, in addition to seeing the endangered Irrawaddy Dolphin, is hoped will relieve some of the financial pressures on the fishermen, reducing the need to practice electrofishing. The potential for ecotourism for the dolphins is significant. The Mandalay Region, where most of the Irrawaddy Dolphin can be found, hosted more than 38 5031 tourists in 2016. Among them, 19 810 tourists used river cruises. Although these cruises were likely to go to Bagan, there is a potential for dolphin watching to be an additional activity. If this is the case, the same number of boat tours for dolphin watching could amount to an income of about 10.5million US\$ in 2016.



The Ayeyarwady River is one of the only places in the world where dolphins work together with man to catch fish. Sadly, this age-old alliance is under threat. Could tourism save the Irrawaddy Dolphins?





MINING & EXTRACTIVES

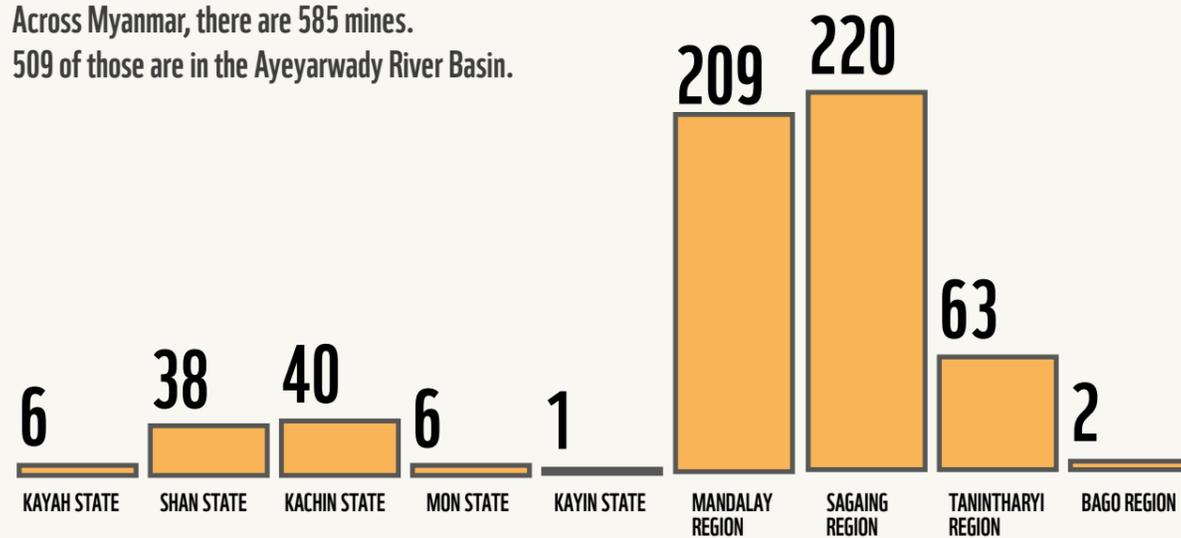
Myanmar's natural resources include oil and gas, minerals including gold, silver and copper and gems such as rubies and jade. The extractive sector accounted for 6% of GDP, 23.6% of State revenue and 38.5% of exports in 2013.

The mining sector is an important driver of economic growth and a source of employment. Artisanal mining is widespread throughout the Ayeyarwady Basin but is a particularly important income source for many people in the Upper Ayeyarwady, Middle Ayeyarwady, and the Chindwin Basin.

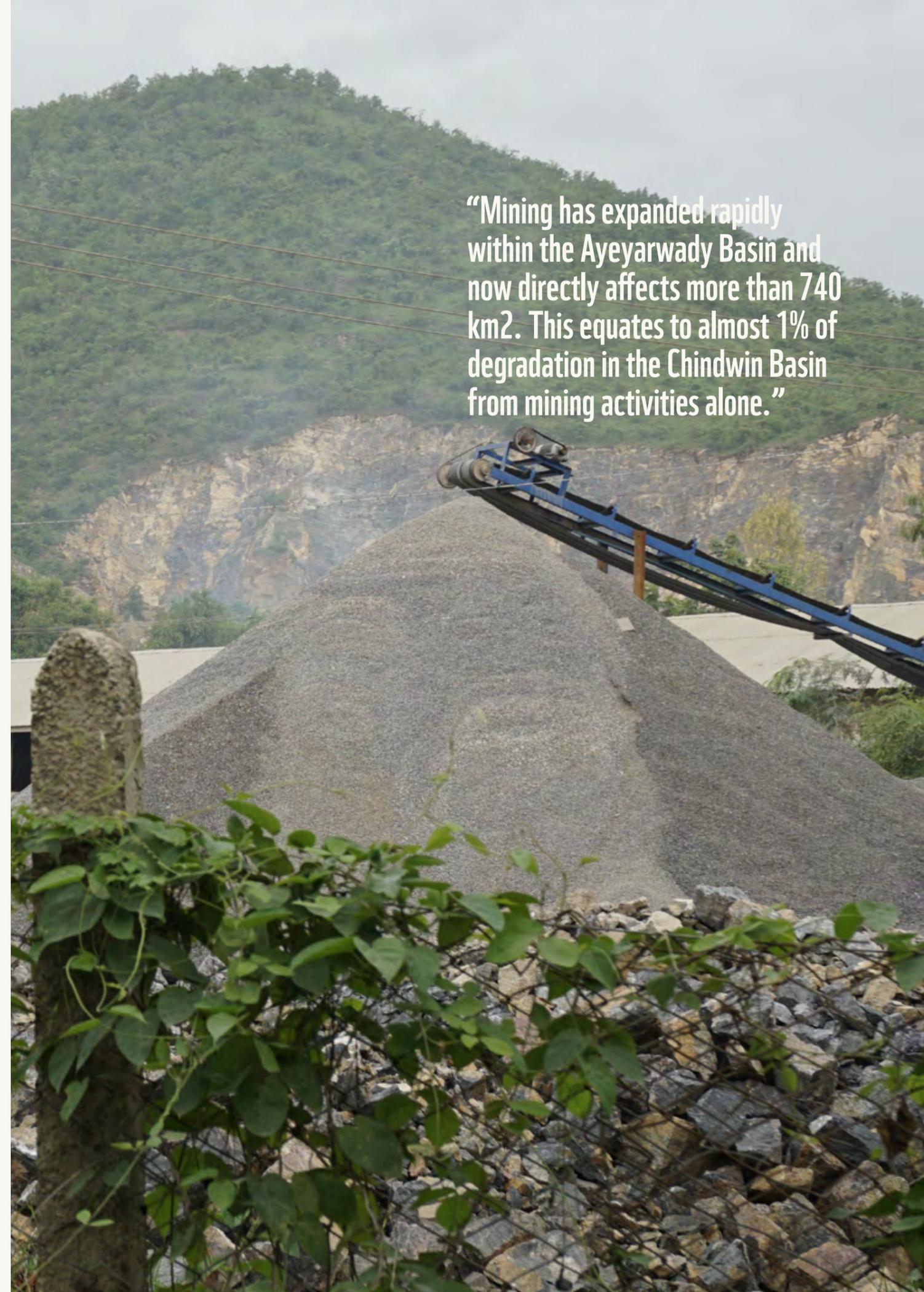
Mining in the Ayeyarwady Basin is a growing and important part of the Myanmar economy. Sagaing Region and Mandalay Region are the two areas of the country home to the majority of the mines. Both of these areas are in the Ayeyarwady Basin, hence the high proportion (87%) of mines that are found within the Ayeyarwady Basin.

WHERE ARE MYANMAR'S MINES?

Across Myanmar, there are 585 mines.
509 of those are in the Ayeyarwady River Basin.



Analysis of remote sensing data suggests that mining has expanded rapidly within the Ayeyarwady Basin and now directly affects more than 740 km². This equates to almost 1% of degradation in the Chindwin Basin from mining activities alone. Much of this expansion is in the Chindwin River Basin or around Mandalay.



“Mining has expanded rapidly within the Ayeyarwady Basin and now directly affects more than 740 km². This equates to almost 1% of degradation in the Chindwin Basin from mining activities alone.”



OIL & GAS

Myanmar is an important natural gas and petroleum producer in Asia. It is home to one of the world's oldest petroleum industries, with its first crude oil exports dating back to 1853. Today, the country is one of the major natural gas producers in the Asian continent.

According to DICA, Myanmar has received more than US\$69 billion in cumulative foreign direct investment (FDI) as of January 2017. The oil and gas sector attracted over US\$22.4 billion in FDI which is approximately 32% of the total FDI from 154 permitted foreign enterprises. This makes the country's oil and gas sector one of the top sectors for FDI in the country, followed by power, manufacturing, transport and communication.

Most of the oil & gas blocks exist within the Ayeyarwady river basin, with the majority of the remaining wells situated offshore.

The oil and gas within the Ayeyarwady basin is home to a large artisanal sector. Myanmar has a long history of artisanal oil extraction, with individuals or small informal enterprises extracting oil with equipment sometimes as simple as a bucket and rope. There is existing artisanal extraction in several oil field areas that provides important primary or secondary livelihoods for communities.

Hand-gouged wells are widespread in Ngashan Taung in Kyaukpadaung Township, Mandalay Region; Kalay township in Sagaing Region; and Myaing, Pauk, Gangaw and Minhla Townships in Magwe Region. In Minhla, there are tens of thousands of small-scale operations scattered over a couple of dozen or more sites. Most operations occupy plots as small as 5 to 10 square feet. The government needed to introduce tighter safety and environmental standards to the hand-gouged oil business.

These small-scale industries are responsible for significant deforestation within the basin, due to their need to burn the crude oil for refining into more appropriate fuels. This creates negative impacts on the river basin as a whole, including reduced water retention and increased erosion of sediments into the Ayeyarwady River.

“Even these small-scale industries are responsible for significant deforestation within the basin, due to their need to burn the crude oil for refining into more appropriate fuels.”



INDUSTRY & MANUFACTURING

The economic contribution of the industry sector to the economy rose substantially from 26.5% in 2010 to 34.4% in 2014, while the share of agriculture shrank from 36.8% to 27.9% in the same period. Myanmar's industrial sector has grown rapidly in recent decades.

Most of the industrial activity is located close to the major urban and transport centres in the Ayeyarwady Basin, especially the large cities of the Middle Ayeyarwady, the Lower Ayeyarwady, and the Ayeyarwady Delta.

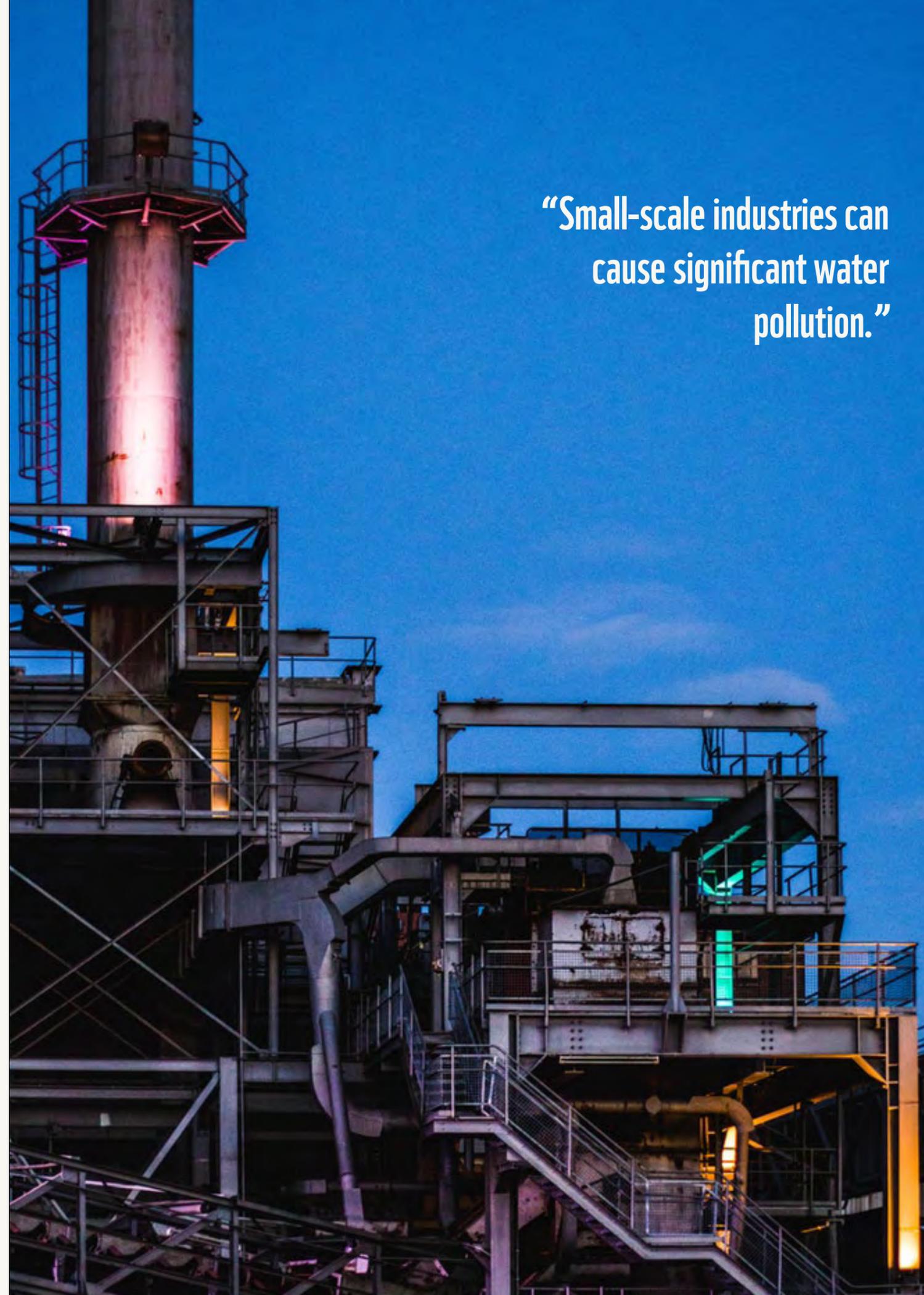
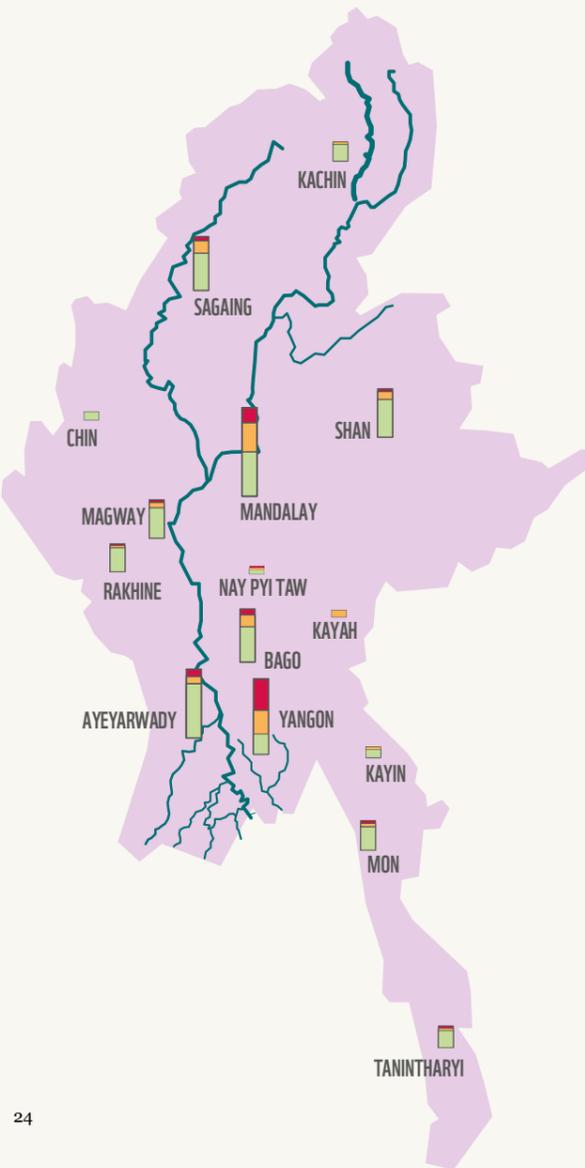
Myanmar's industrial sector is diverse and includes activities, such as food and beverages; clothing and apparel; construction materials; personal, electrical, and household goods; printing and publishing; industrial raw materials; minerals and petroleum products; agricultural and industrial machinery/equipment; transport vehicles; and electrical goods.

Food and beverages are the major industrial sub-sector in Myanmar, accounting for approximately 62% of the national industrial operation. Major food and beverage developments are located in Yangon and Mandalay, garment manufacturing in Patheingyi and Yangon, and mineral and petroleum product manufacturing in Monywa and Mandalay.

Small-scale enterprises make up 80% of the industrial sector within the Ayeyarwady Basin. While small-scale industry dominates smaller population centres, it is also prominent in urban centres, making up 42% of the total industry in Yangon and 50% in Mandalay. Small-scale industries can cause significant water pollution risk due to inadequate treatment processes and lack of knowledge to mitigate pollution risks.

REGISTERED INDUSTRY IN STATES AND REGIONS ACROSS MYANMAR

	SMALL-SCALE	MEDIUM-SCALE	LARGE-SCALE
KACHIN	1334	172	53
SAGAING	3271	998	350
SHAN	3165	718	273
CHIN	761	21	5
MANDALAY	3885	2645	1306
MAGWAY	2692	502	172
RAKHINE	2307	132	68
NAY PYI TAW	347	180	142
KAYAH	125	347	25
BAGO	3167	1025	478
YANGON	1732	2057	2822
AYEYARWADY	4856	608	659
KAYIN	773	152	90
MON	1955	324	168
TANINTHARYI	1346	164	189



“Small-scale industries can cause significant water pollution.”



“Many of the activities taking place within the basin hinder navigation, including industrial pollution or the regulation of tributaries through dam infrastructure.”



NAVIGATION

Myanmar has an extensive river network that is well positioned to serve the country's main transport corridors, including the link between Yangon and Mandalay. However, inland water transport is facing unprecedented pressures at the moment.

Main rivers are difficult to navigate because of shallow waters during the dry season, shifting navigation channels, and lack of terminal facilities. However, growth projections remain high, and the sector has been identified as a major bottleneck for increased trade both within the country and within the region. The Ayeyarwady Basin is home to 70% of all navigable rivers in Myanmar. The majority of navigation is represented by transport between Yangon, Mandalay and Bawmaw. Passenger transportation is the highest in Ayeyarwady Region and cargo transportation is the highest in Mandalay Region.

According to the AIRBM Synthesis State of the Basin Report, “in the last few years there has been a significant reduction in waterborne freight transport. A number of factors are perceived to have contributed to this including a backlog of dredging works, slow loading and unloading times, and the growth of land-based transport.”

Navigation is impacted by changes in river flows, sediment transport, the seasonality of flow and the onset of the monsoon season. Many of the activities taking place within the basin hinder navigation including industrial pollution or the regulation of tributaries through dam infrastructure. Other activities such as sand mining in areas that require dredging are seen as supporting navigation. However, the sediment dynamics of areas where sand or gravel is being extracted, and the impact downstream is less understood.





CONSTRUCTION

Construction accounts for around 5.2% of GDP or around 18% of industrial output. Even with this small economic contribution (directly), the sector has devastating impacts on the river.

However, the construction sector has important linkages with other sectors of the economy. For instance, approximately 30% of outstanding credit from the banking sector is for construction and real estate. Therefore, not only is employment affected with a slowing or uncertain construction sector, but the banking sector sees risks too. “Improving regulations in the construction sector, and ensuring that these are enforced, is critical though needs to be managed carefully. Better regulations could improve urban planning, the quality of construction, environmental sustainability, and the welfare of urban dwellers. Ensuring a phased approach that is predictable and transparent is critical to avoid big shocks, which may be difficult for the economy to recover from given the importance of the construction sector.” (World Bank, 2016)

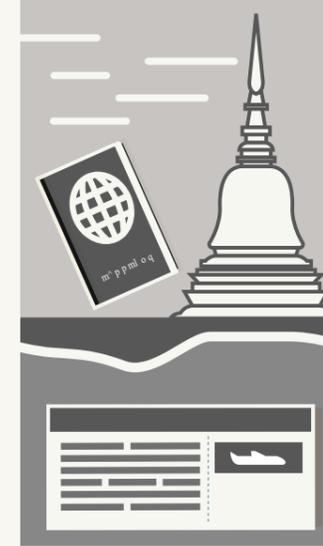
More importantly for the Ayeyarwady River, the construction sector is a driver for the extraction of sand. Typically, coarse sand and gravel is targeted for extraction, as these are the most desirable construction materials. Approximately 10 million tonnes of gravel and sand a year are reportedly extracted from these sites for construction. This is believed to be a gross underestimate of the total sand extraction from the Ayeyarwady River (estimated to be 20 million tonnes, or approximately 10% of the total estimated sediment budget of 220 million tonnes). Since the majority of construction and development is taking place in the basin, it is safe to assume the majority of the buildings, roads and bridges being built are using sand from the river. Given the volumes of materials recorded during the survey, the level of development in Myanmar, and the large volumes of sand and gravel required for construction, road building and dam building, it is highly likely that continued risks such as bank erosion and the increasing vulnerability of a sinking delta will continue.



Sandmining has devastating impacts on the river.



Many of Myanmar's flagship tourist destinations are situated within the Ayeyarwady Basin.



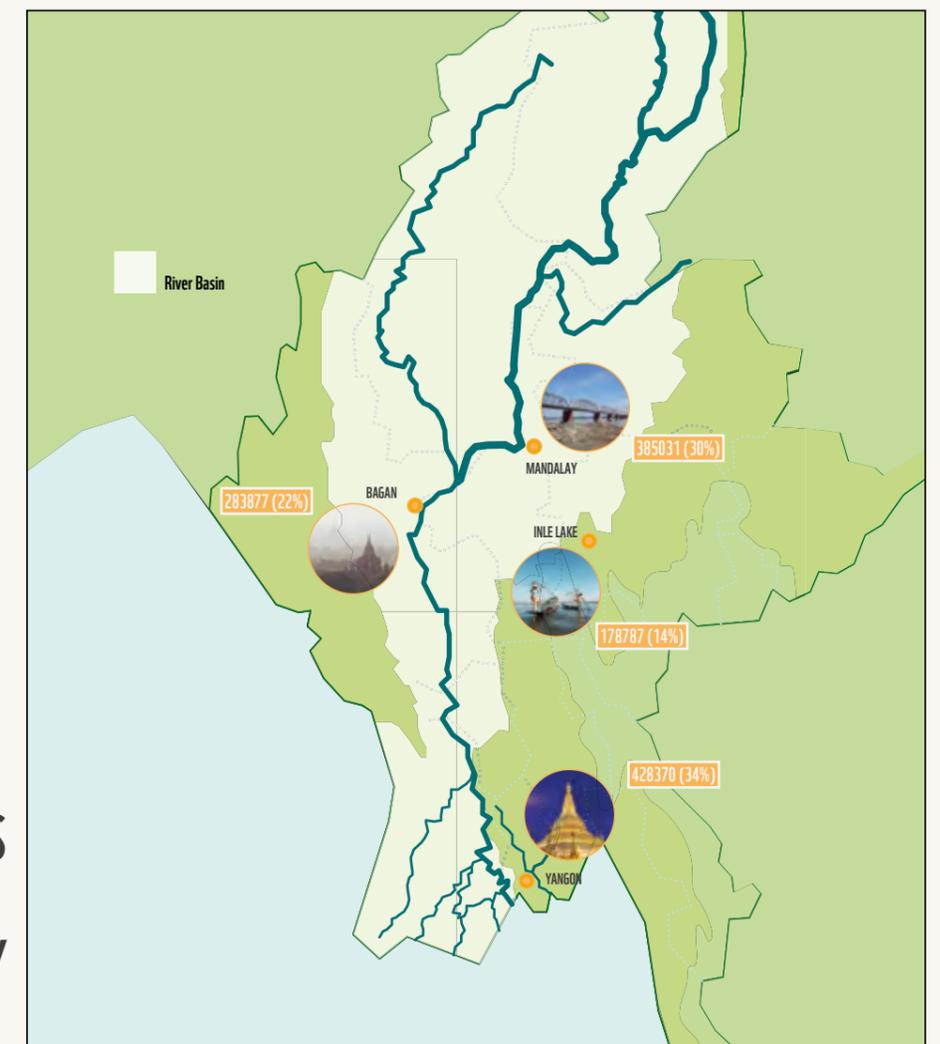
TOURISM

A report by the World Tourism and Travel Council claims that employment in the travel and tourism sector within Myanmar, including jobs indirectly supported by the industry, has grown by 6.5% reaching 877,500 jobs in 2014.

Their estimates include the direct contribution of travel and tourism to GDP at 3%, while together with the indirect contribution; the total contribution of tourism to GDP is 6.6%. In terms of employment, the total contribution is 5.8%.

From a tourism perspective, there are six flagship destinations in the country. These are Yangon, Bagan, Mandalay, Inle Lake, Kyaikhtiyo (Golden Rock) and Ngapali Beach in Rakhine State. Emerging areas include the mountains of Putao, Nagaland, Hakha and Natmataung (Mt. Victoria) in Chin State, and Loikaw in Kayah State and the Myeik Archipelago in Tanintharyi Division in Southeastern Myanmar. Many of the above locations are situated within the Ayeyarwady River Basin (Yangon, Bagan, Mandalay). The following figure shows the tourist arrival to four main sites in 2016, highlighting the importance of a healthy Ayeyarwady River Basin for tourism.

TOURIST ATTRACTIONS IN THE AYEYARWADY BASIN

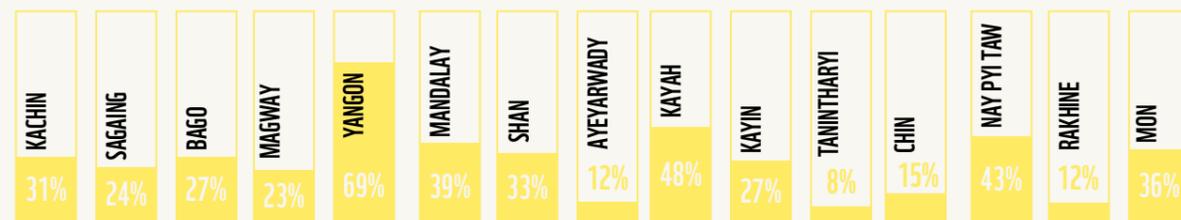




ENERGY

In Myanmar, the total installed capacity in the first half of 2017 was 5 389MW, of which 3 255 MW (60.4%) from hydropower, 1 920 MW (35.6%) from gas, 120MW (2.2%) from coal, 94.3 MW (1.75%) from diesel.

Currently, just one-third of the population has access to the electricity. Electricity accessibility of states and regions is shown below. Yangon has access to electricity with over 60%. Kayah, Nay Pyi Taw and Mandalay have about 30-40% access to electricity.



As a result of the increasing wealth of people in Myanmar as the country develops, electricity consumption has increased significantly in the last five years at an annual average growth rate of 15.7%. Therefore, increasing energy production is at the forefront of the development pathway for the country. Hydropower is a potential solution to the energy deficit.

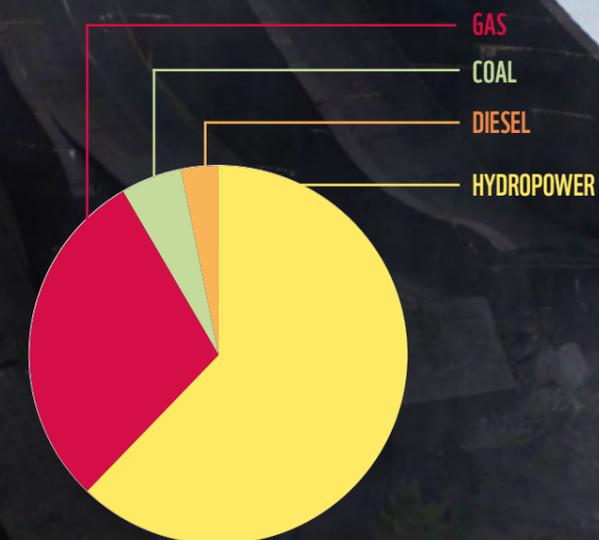
There are 29 existing hydropower plants in Myanmar with a total installed capacity of 3,298 MW, and six power plants under construction with a total installed capacity of 1,564 MW. The remaining 51 projects with total installed capacity of 42,968 MW are in various stages of pre-construction development.

The Ayeyarwady Basin (including Chindwin) currently has 17 hydropower plants in existing and under construction, 31 planned and 1 suspended. The Ayeyarwady has the highest installed capacity in operation (2,100 MW). If all proposed hydropower projects are built, the Ayeyarwady and Thanlwin would have around 28,100 MW (58% of all hydropower) and 16,500 MW (34%) respectively.

According to the WWF Alternative Power Sector Vision for Myanmar, it is critically important that decision makers within Myanmar take into consideration the potential unintended consequences of hydropower development in the upper catchments of Myanmar on the lower and delta catchments of the country. In particular, regulation of flow, connectivity of species including fish for migration and the flows of sediment need to be understood. The “Business as Usual,” Myanmar Energy Master Plan places great emphasis on deriving energy from coal-fired power plants and big dams, despite the long-term risks and environmental damage associated with these methods. However, to meet this increasing demand, WWF have indicated that technically a 100% renewable, greener future is possible. WWF believes that Myanmar has the chance to leapfrog the fossil fuel-based electricity era that started over 130 years ago and embrace the renewable energy era.

WWF have indicated that technically a 100% renewable, greener future is possible.

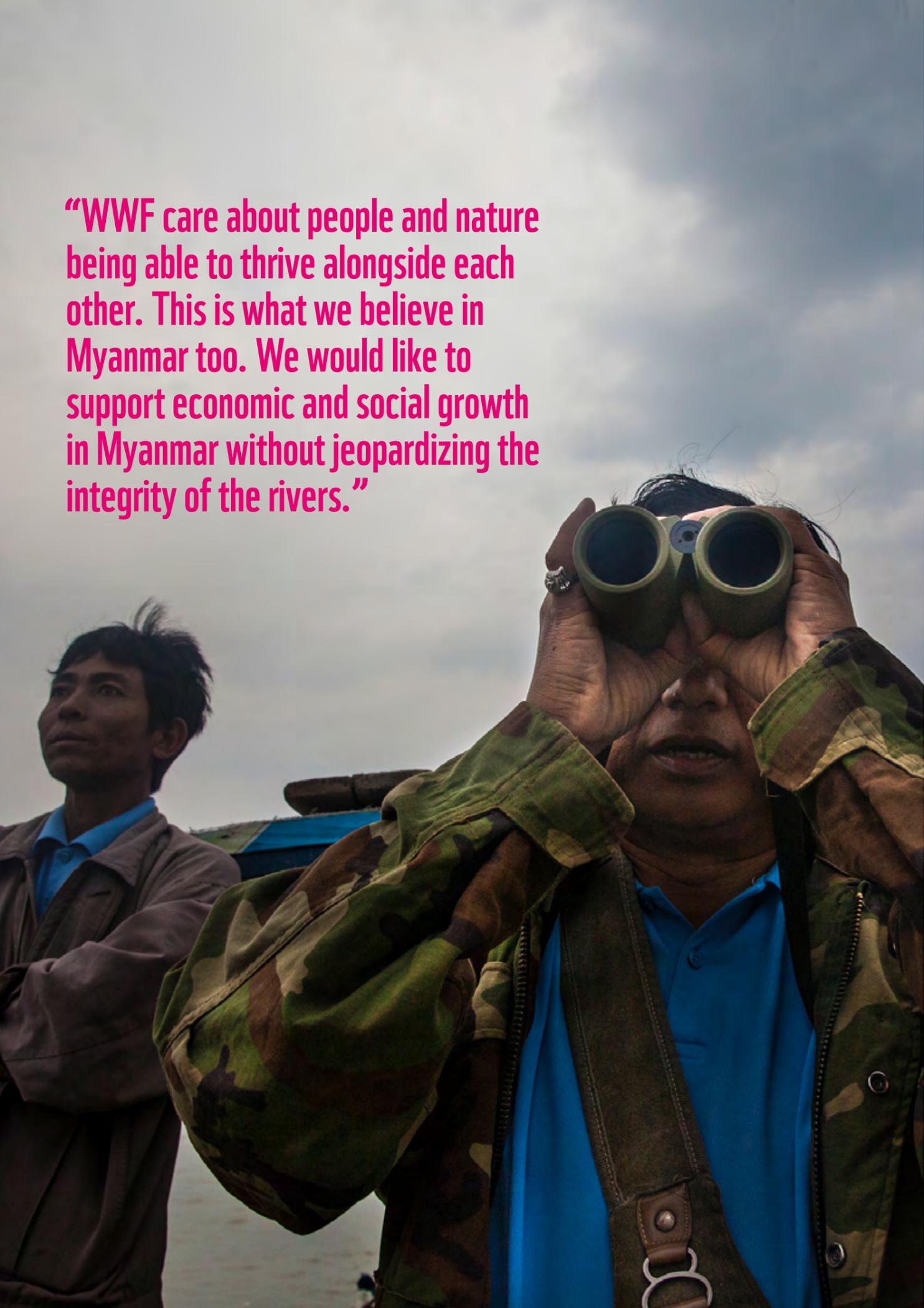
INSTALLED ENERGY CAPACITY IN MYANMAR



HYDROPOWER PROJECTS IN THE AYEYARWADY SUBCATCHMENTS

Subcatchment	Existing	Planned	Suspended
UPPER AYEYARWADY	1	12	1
CHINDWIN BASIN	1	6	0
MIDDLE AYEYARWADY	12	11	0
LOWER AYEYARWADY	3	2	0

“WWF care about people and nature being able to thrive alongside each other. This is what we believe in Myanmar too. We would like to support economic and social growth in Myanmar without jeopardizing the integrity of the rivers.”



CONCLUDING OBSERVATIONS ON THE VALUE OF THE AYEYARWADY RIVER TO THE ECONOMY AND SOCIETY OF MYANMAR

A CALL TO ACTION

Through this document it is evident that the Ayeyarwady Basin provides the majority of economic value to the country. It is also evident that some of these sectors are contributing to degradation of ecosystem goods and services provided by the river. Although economic growth and social development are needed in Myanmar, this does not have to be at the cost of the river health.

WWF care about people and nature being able to thrive alongside each other. This is what we believe in Myanmar too. We would like to support economic and social growth in Myanmar without jeopardizing the integrity of the rivers. The Ayeyarwady River provides goods and services to enable a majority of economic and social activities that take place within Myanmar. Without these services of the river, the economy of Myanmar would not be the same. With looming decisions around hydropower development, industrial expansion, fisheries and in general, economic growth in the country, decision-makers cannot afford to operate in isolation. Without a common vision for the future, all sectors will compete with one another and miss opportunities for holistic efficient development. Highlighting major risks and opportunities for different sectors through a series of short narratives and numbers, shows what is at stake when taking a narrow view of planning – and all that can be gained through a more thoughtful, long-term and integrated approach.

Our call to action for a sustainable, free-flowing Ayeyarwady Basin is as follows:

Economic planning decision makers need to investigate the connections and trade-offs between different development pathways and how they interact with the natural capital and ecosystem services that the people of Myanmar depend on.

Private sector need to ensure that they act as good water stewards in the country, even though in some cases there is uncertainty in terms of regulations. Reducing water-related risks, whether physical, regulatory or reputational in the broader Ayeyarwady Basin is critical for their long-term business ambitions.

Civil society need to continue their demand for transparent dialogue between decision-makers, private sector and civil society regarding preferable options for sustainable development in the Ayeyarwady Basin.

Finally, the coordination of strategies and plans is of critical importance as Myanmar continues on its economic growth and social development trajectory. This is true not only for the Government of Myanmar, but also for development assistance in the country. River basin planning in particular has an important role to play in supporting the coordination of an entire spectrum of economic activities – from mining to tourism and from the upper catchment to the delta. It is important that this planning takes place in a coordinated manner to ensure that the unique position of the Ayeyarwady River, home to the endemic Irrawaddy Dolphin, productive fisheries, industry and mining is able to continue providing the basis of the Myanmar economy.

A person wearing a cap and a t-shirt is leading two water buffaloes through a shallow river. The background is a dense, green forest. The scene is captured in a cinematic style with soft lighting.

“WITHOUT THE SERVICES PROVIDED BY THE RIVER, MYANMMAR’S ECONOMY WOULD CEASE TO EXIST AS IT DOES TODAY. BUT ACTIVITIES ON THE RIVER HAVE MANY NEGATIVE IMPACTS.”

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

<http://www.wwf.org.mm/en/>