WYSS CAMPAIGN FOR NATURE

AKADEMI SAINS MALAYSIA

THE NEXUS OF BIODIVERSITY CONSERVATION AND SUSTAINABLE SOCIOECONOMIC DEVELOPMENT IN SOUTHEAST ASIA

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FOREWORD

The Academy of Sciences Malaysia (ASM) carries the mandate to address the needs of humanity by providing the best scientific advice and advocacy that is independent, credible, relevant and timely. ASM champions planetary health and is developing a National Planetary Health Action Plan driven by science, technology, innovation and economy (STIE) with all stakeholders. Biodiversity conservation, preservation, and management are a vital part of ensuring planetary health. ASM is currently carrying out a pilot project on precision biodiversity to demonstrate the application of next-generation technological systems such as artificial intelligence, machine learning and internet of things to monitor and manage biological resources for the protection of the planet as well as ensure sustainable socio-economic advancement.

Mankind's journey toward economic progress has divorced us from nature. We are rapidly reshaping and destroying the environments that have nurtured the diversity of life forms for over a billion years. Biodiversity, the variety of life on earth is the keystone of human survival. It provides an array of ecosystem services - the provision of food, clean water and air, wild pollination and carbon sequestration, just to name a few. Sadly, overexploitation of the planet's resources has endangered biodiversity and is predicted to lead to the sixth mass extinction if we continue on the current trajectory. The Covid-19 pandemic as well as previous outbreaks of SARS, MERS and Ebola has cast the spotlight on the spread of zoonotic diseases and the disastrous consequence of destruction of forests and natural environments that brings humans and wildlife into contact. The human activities that drive biodiversity loss are the same that drive climate change and pandemic risk, thus highlighting the centrality of nature for a healthy planet.

Protected areas are a cornerstone of biodiversity protection. Not only do they secure biodiversity but also enhance ecosystem resilience, contributing to food and water security, reduction of disaster risk and mitigating climate change. The contributions of well-managed protected areas are often underappreciated in development policy decisions. It is telling that Southeast Asia has very few marine protected areas, with Malaysia's 5% being the highest percentage of marine protected areas. The 2020 CBD global framework calls for protection of at least 30% of the planet by 2030. This report makes a case for the importance of both terrestrial and marine protected areas toward green and blue economies.

The time has come for us to re-connect with nature in a big way. Although biodiversity conservation competes with the social and economic predilection for resource extraction and land and water development, the economic case for protecting nature is compelling. The economic value of the ecologic services provided by biodiversity is estimated at about $150 trillion per year. This far exceeds the world's gross domestic product but is often ignored in decision making processes. We must highlight the fact that biodiversity protection and economic development are not mutually exclusive. Biodiversity must be harmonised into our economic system.

Southeast Asia is one of the most mega biodiverse regions of the globe, boasting the most extensive and diverse coral reefs and mangrove areas on the planet. We must open our eyes and minds to the fact that these are national treasures of great sovereign worth. They are also powerful carbon sinks, that absorb carbon dioxide and prevent our planet from overheating. The Biodiversity Intactness Index shows that while the developed countries have depleted most of their natural capital, Southeast Asia has best retained its biodiversity and hosts about 80% of the world's biodiversity. However, there is still much to be done. Southeast Asia could become an agent of change and a role model of economic development through nature protection. This is an opportune time for Southeast Asia to carve a new path toward planetary health. This report identifies gaps in the enablers of the natural ecosystem and proposes 9 key recommendations to close the gaps and ensure that socio-economic development and biodiversity can coexist for planetary health and the wellbeing of the people of Southeast Asia. ASM is honoured to publish this report to serve as a useful reference for regional planning and forge sustainable development initiatives. I am confident that if all parties work together in the spirit of regional interest, we can successfully mainstream biodiversity conservation and sustainable economic development in Southeast Asia.

Professor Emerita Datuk Dr Asma Ismail FASc
President, Academy of Sciences Malaysia

MESSAGE

Prioritising Biodiversity Conservation in ASEAN as a Strategy for Sustainable Development and Economic Growth

The ten-member states of ASEAN is a well-known biodiversity hotspot with three of its members, namely Indonesia, Malaysia and the Philippines in the global league of 17 megadiverse countries. However, the countries in the region are in a constant state of balancing their conservation priorities with the demands for socio-economic development.

It would be interesting to analyse how these countries could focus on biodiversity conservation and restoration as a way to help achieve the region's Sustainable Development Goals (SDGs), particularly those related to economic growth, clean water, food security, rural development, job creation and poverty alleviation.

Specifically, we would like to see how the region's sustainable development strategies can move away from practices that exploit nature to approaches that preserve or even enhance biodiversity and natural ecosystems. Investing in ecological infrastructure refers to investing in naturally functioning ecosystems and the restoration of degraded ecological infrastructure that deliver valuable services to people and reduce risk.

This concept of ecological infrastructure relies on better understanding the role that nature plays in supporting people and the economy as well as preserving cultures and otherwise benefiting local communities. Restoration, conservation, establishing and better managing protected and conserved areas, and advancing rights of Indigenous Peoples and local communities and supporting the management and governance of their territories are all examples of economic strategies for megadiverse countries that a shift in sustainable development could promote.

A 2020 report from The University of Cambridge found that protecting 30% of the world's land and ocean provides greater benefits than the status quo, both in terms of financial outcomes and non-monetary measures like ecosystem services. The authors concluded that these benefits outweigh the costs by a factor of at least 5:1. Based on the work of over 100 scientists and economists, the report is the most comprehensive global assessment of the financial and economic impacts of protected areas ever completed.

McKinsey also recently completed an analysis of the economics of 30% protection in its Valuing Nature Conservation report. The authors found that increasing protected areas to 30% of land and ocean would support 30 million jobs in ecotourism and sustainable fisheries, directly add 650,000 new jobs in conservation management and support $500 billion of GDP in ecotourism and sustainable fisheries. Other benefits include reducing CO_2 emissions by 2.6 gigatons annually, decreasing the risk of zoonotic diseases and more than doubling the protected habitats of endangered species.

A 2014 study found that, every year, nature provides over $125 trillion worth of critical ecosystem services that underpin human wellbeing and economic development. These include providing clean drinking water and fertile soil, stabilising the climate and pollinating the crops we eat. The study found that these ecosystem services are more than 40% more valuable than global annual GDP. However, these services are typically not priced and are not accounted for in global markets. That means that they are over-exploited and massively underfunded. The study also found that our destruction of nature results in an estimated US$1.4 trillion of economic losses each year, equivalent to 1.6% of global GDP.

The World Economic Forum's (WEF) 2020 Global Risks Report ranks biodiversity loss and ecosystem collapse as one of the top five risks in terms of likelihood and impact in the coming decade.

An analysis from Swiss Re Institute found that 55% of global GDP depends on high functioning biodiversity and ecosystem services. The study revealed that one fifth of countries worldwide are at risk of their ecosystems collapsing due to a decline in biodiversity and related services.

An international team of 26 authors found that a substantial increase in ocean protection could have triple benefits, by protecting biodiversity, boosting the yield of fisheries and securing marine carbon stocks that are at risk from human activities. The experts identified specific areas that, if protected, would safeguard over 80% of the habitats for endangered marine species, and increase fishing catches by more than eight million metric tons. The study, published in Nature in March 2021, is also the first to quantify the potential release of carbon dioxide into the ocean from trawling, a widespread fishing practice—and finds that trawling is pumping hundreds of millions of tons of carbon dioxide into the ocean every year, a volume of emissions similar to those of aviation.

In a study published in November 2020, a group of researchers found that strategically locating marine protected areas (MPAs) in overfished fisheries can have important benefits for both conservation and the provision of food. They conclude that a strategic, 5% expansion of the existing global network of MPAs can improve future fish catch by at least 20%.

The UK Treasury's Dasgupta Review provides a useful economic framework for understanding how the global economy is embedded in nature and why our institutions and markets are failing to adequately value, invest in and protect nature. The report defines natural capital as an asset, similar to built capital and human capital, and describes how the world is mismanaging its portfolio of assets by under-investing in nature. This is due to institutional and market failures, including the failure to properly value the services that nature provides for free and the difficulty of defining and enforcing property rights.

I would like to thank the Academy of Sciences Malaysia (ASM), in particular the team led by Professor Dr Helen Nair FASc, for valiantly taking up the challenge of undertaking the study to illustrate how biodiversity conservation can be considered as a strategy for sustainable development and economic development in ASEAN.

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EXECUTIVE SUMMARY

Global Biodiversity Loss: An Emerging Crisis

Biodiversity is a crucial component of all natural ecosystems on the planet and plays a fundamental role in moderating earth's ecological balance through a vast variety of nature-enabled interactions with air, water, soil and sunlight. Earth's nature-based assets provide resources for life to exist, economies to thrive, and humanity to flourish. Despite the vital and critical importance of biodiversity for human and planetary wellbeing, anthropogenic activity, especially over the course of the last century, has driven biodiversity loss across the globe at such an alarming rate that the planet's current era is being labelled as the Anthropocene epoch – created and powered by humankind. The rate of species extinctions is accelerating and the planet is facing its sixth mass extinction with the prediction that approximately one million plant and animal species (a quarter of the world's species) will face extinction in the coming decades (Ceballos *et al*., 2015).

The degradation of vast swathes of the world's terrestrial, marine and freshwater ecosystems is due to a variety of factors, including habitat destruction, overexploitation of natural capital, the spread of invasive alien species, pollution, and climate change. Tragically, biodiversity loss has also seen the displacement and gradual loss in the number of indigenous people (IP) native to a region (see Section 1.3). IP as traditional guardians of natural capital are inherent keepers of a rich repository of knowledge on foods, medicines, habitats, and forest products.

Earth's natural ecological balance and vibrancy have been upended to the degree that we are now fast approaching a tipping point. It is becoming increasingly clear that continued loss of natural habitats and biodiversity will eventually lead to an amplification of a range of risks, such as climate change, flooding, disease emergence and pandemics, clean water shortages, weak crop pollination and a decline in economic productivity.

This paper focuses on the last of these risks, examining the nexus between biodiversity and economics. There is growing evidence of the dependence of global and regional economies on natural assets, and the degradation of global biodiversity could lead to significant economic risks. Viewed from another vantage point, there is considerable opportunity for countries and regions around the world to embrace biodiversity conservation and invest in natural infrastructure as a core component of strategies for development, job creation and socio-economic growth. As we highlight in this report, there are numerous case studies globally and across Southeast Asia that show how this approach can and in many cases already has started to work.

The Nexus Between Biodiversity Loss and Economic Risk

The speed and scale of biodiversity loss has been of such magnitude that at the 2020 World Economic Forum (WEF), it was ranked as one of the top five predicted risks to the global economy over the coming decade, and disturbingly placed even ahead of risks such as geophysical disasters and terrorist attacks. The fabric of nature's abundant living and non-living resources is integrally interwoven into the global economic ecosystem. An estimated USD 44 trillion of value generation arises through the assets provided by nature globally. This dependency on nature's assets as a driver of economies, accounts for more than half the world's gross domestic product (GDP) (Dasgupta, 2021; WEF, 2021).

Indeed, there is growing evidence of the positive contributions that biodiversity conservation makes to economic growth (Dasgupta, 2021; Living Planet, 2018; Waldron *et al*., 2020; Bradbury *et al*., 2021; Kurth, 2021; Claes, *et al*., 2020; World Bank, 2021a). Comparing the monetary worth of ecosystem services (e.g., carbon storage, flood protection) against revenues from converting nature's assets into production goods (such as timber, crops), research has shown that the net benefits of conserving nature far outweigh alternative more intensive human use (Bradbury, 2021). Moreover, the net benefits rise with increasing social cost of carbon.

Bradbury's findings echo the points made by the seminal Dasgupta Review, and supporting this position, cost-benefit simulations by Waldron *et al*., (2020) show that increasing biodiversity conservation and protection from the current level of 15% terrestrial and 7% marine protected areas (PA) to 30% protection leads to approximately US$250 billion increase in annual economic output and US$350 billion in enhanced ecosystem services. This analysis, the most comprehensive ever done on the economic implications of protected and conserved areas, considered various scenarios of achieving the global target of protecting or conserving 30% of the planet's terrestrial and marine areas by 2030, which the U.N. Convention on Biological Diversity (CBD) has proposed as one of its action targets in the Post-2020 Global Biodiversity Framework that 196 countries are expected to agree to in Kunming, China later this year. Deriving these benefits would require an annual investment in protected areas globally of US$140 billion by 2030, which is not even a third of the harmful subsidies provided by governments to activities that damage nature (e.g., fertiliser subsidies to farmers).

Furthermore, a McKinsey report found that protecting 30% would support 30 million jobs in ecotourism and sustainable fisheries globally, directly add 650,000 new jobs in conservation management and support $500 billion of GDP in ecotourism and sustainable fisheries.

On the other hand, what would happen if the world continued along a business as usual trajectory, following the conventional mode of exploiting nature's resources for

immediate gain? The World Bank (World Bank, 2021a) estimates that neglecting nature and biodiverse ecosystems and continuing business as usual will lead to the collapse of select nature-based ecosystem services, such as food provision from marine fisheries, wild pollination and timber from natural forests, amounting to US$2.7 trillion per year. This constitutes a drop of 2.9% in global GDP. Moreover, the impact will be felt hardest by low- and lower-middle income level countries, which tend to be more reliant on nature-driven sectors. For these countries, the impact is likely to be a 10% or higher drop in GDP. For instance, Sub-Saharan Africa and South Asia would suffer the biggest relative contraction in ecosystem services of 9.7% and 6.5% respectively. To avert such economic losses, a carefully designed mix of nature smart policies, which include the expansion and effective management of protected areas, need to be implemented with urgency.

How Southeast Asia can become a model for Socio-Economic Development

Although Southeast Asia only covers 4% of Earth's surface in landmass area, the region is blessed with abundantly rich terrestrial and marine biodiversity, including 18% of all species as assessed by the International Union for Conservation of Nature (IUCN). Southeast Asia is also home to three of the world's 17 megadiverse nations and biodiversity hotspots, namely, Indonesia, Malaysia, and the Philippines. The region abounds in endemic species of mammals, birds, and vascular plants besides being the world's centre for marine biodiversity. It encompasses the most extensive and diverse coral reefs and major mangrove areas in the world. Within this vast pool of biodiversity resources resides the much sought-after potential for the discovery of new products in medicines, foods, materials and amenities for humankind.

Global biodiversity league tables provide data that support Southeast Asia's richness in biological diversity. One such data set is the global Biodiversity Intactness Index (BII), which examines the percentage of natural biodiversity that remains across the world and in individual countries. It reveals that tropical countries, including in Southeast Asia, have best retained their biodiversity and house 80% of the world's biodiversity (Scholes & Biggs, 2005). In contrast G7 countries, like the UK, occupy the bottom 10% of the league table, having depleted their natural capital to alarming levels in the wake of rapid industrialisation and economic development. In fact, the UK ranks lowest among the G7 nations registering a BII of less than 50% (Briggs, 2021). Southeast Asia therefore serves as a hotbed for further biodiversity research, development and innovation that could drive new and exciting economic development to meet the environmental ecosystem service needs of the global community. If managed responsibly the region could even be the vanguard to realign the global nexus between biodiversity and sustainable economic growth that guarantees both fiscal and non-fiscal returns.

Historically, economists and policymakers have considered conservation as a 'nice-to-have', but in many cases oppositional to the more conventional model of exploitation

of natural resources. Emerging evidence demonstrates the path of biodiversity conservation is not only not oppositional to economic growth, but that it may well be the unique engine of Southeast Asia's growth. Already, natural capital generates 30% of Asia's GDP. Instead of trying to follow the conventional development model of the West, which has brought us to the brink of disaster, Southeast Asia would well learn from the mistakes of those who have gone before them and embark on a positive trajectory of sustainable growth built on planetary health. If planned and executed properly, Southeast Asia could move from an economic model based on natural resource exploitation to one based on natural resource enrichment and could become a role model of economic development through nature protection.

One area of emphasis for the region could be marine conservation. Southeast Asia has great potential for a dynamic blue economy given its rich marine biodiversity. The ASEAN territorial waters are about three times its land area and it is estimated that about 625 million people from the 10 ASEAN countries depend on the ocean for their livelihoods. This is significantly higher than for most countries across the globe (Spalding, 2017). The ASEAN region is responsible for 15% of the world's fish production, and harbours one of the most extensive seagrass beds, coral reefs and mangrove acreage. In fact, the oceans of Southeast Asia contribute significantly more to its GDP than those of developed countries (ASEAN Catalytic Green Facility, 2021) and the economic earnings from coral reefs especially tourism are about $23,100 to $270,000 per square kilometre of healthy coral reef annually (ADB, 2014). Governance frameworks and policy tools are going to be imperative in protecting Southeast Asia's fragile marine ecosystem and stimulating a sustainable blue economy.

Additionally, Southeast Asia holds the largest global concentration of carbon for investments in nature-based solutions with its abundance of carbon-rich ecosystems like mangroves and peatlands (Raghav *et al*., 2020). A study by the National University of Singapore Centre for Nature-based Climate Solutions identified Indonesia, Malaysia, Thailand, Cambodia, and Myanmar as the top five countries in the region for return-on-investment from nature-based carbon projects (Raghav *et al*., 2020). Nature-based solutions (NbS) present a substantial opportunity for businesses and investments in Southeast Asia. The world demand for high-quality carbon credits in the voluntary carbon market is projected to increase at least fifteen-fold in the next decade to reach 2 billion tonnes in 2030, with more than 1,800 companies globally pledging to reach net zero emissions (Parker, 2021).

Perhaps most evident is the opportunity that Southeast Asia has to further leverage its rich biodiversity to create jobs and enhance the livelihoods of neighbouring communities through ecotourism. Investing in improving and expanding our conserved and protected areas for ecotourism as part of the new 30% global goal could be an effective rural development strategy. This paper highlights numerous case studies that show where this is already happening. For example, a recent report on Kuala Tahan National Park, which occupies 54% of the Taman Negara National Park, in Pahang,

Malaysia, describes how ecotourism (tourism industry within protected areas) has brought about income generation and poverty reduction (Mukrimah, 2015). Research revealed that an average of about 47% of the monthly household income for the village was derived from activities within the PA (harvesting rattan, bamboo and honey) or outside it (related to forestry and ecotourism, including spill-over business activities, such as from food and beverage outlets, souvenir shops and chalet operations, tour guiding, boatman activities etc.).

Similar examples of clear and significant socio-economic benefits have been reported for many ecotourism spots in various parts of Southeast Asia, such as Betung Kerihun National Park, the largest conservation area in West Kalimantan (Sekartjakrarini *et al*., 2015). To quote Reef Watch Malaysia (2019), "Research suggests that eco-tourists are often prepared to pay a premium to visit undisturbed destinations, with intact ecosystems and cultures. Perhaps this is an alternative tourism model for Malaysia to contemplate in order to protect its fragile ecosystems and ensure they are sustainable for future generations."

The Need for Nation States to Embrace Science-Based Targets and a Holistic Approach

This paper argues that it is only possible to fully realise biodiversity conservation's significant socio-economic benefits by taking a holistic approach, rather than advancing discrete policies or actions in isolated sectors or geographies. To accomplish this, we propose the full adoption of an ecosystem framework characterised by 8i enablers (ASM SO2020, 2021), namely, infrastructure (natural and man-made infrastructure), info-structure (advanced technologies), intellectual capital (talent stock), integrity systems (rules of engagement and good governance), incentives (fiscal and non-fiscal, from both supply and demand sides), institutions (institutional governance and stewardship to manage the environment and biodiversity conservation initiatives), interactions (cooperation and collaboration among stakeholders), and internationalisation (adherence to global best practices and standards to help move up the biodiversity conservation value chain).

We consider the 30x30 global target as a fundamental pillar of this holistic approach. Given the robust scientific and economic support for protecting or conserving at least 30% of the world's terrestrial and marine areas, we recommend that Southeast Asia nation states embrace and support the 30x30 target at the global level in the U.N. CBD negotiations and that they work in partnership with each other to increase the extent and effectiveness of protected and conserved areas across the region as a means of contributing towards the global 30% figure.

If each nation state in Southeast Asia dutifully adopts the ecosystem supported by the 8i enablers and the 10×10 STIE Framework, recently adopted by Malaysia (10-10 MySTIE Framework - ASM, 2020b) and now adapted for Southeast Asia (see Section

6.1), the combined effort, bolstered by the 30×30 initiative, should enable the region to become a powerful advocate for biodiversity conservation as well as sustainable socio-economic development.

Key Findings:

1. Evidence globally and from the ASEAN region shows that continued degradation of global biodiversity could lead to catastrophic economic risks and that the net benefits of moving to an ASEAN regional development model based on natural resource enrichment far outweighs the status quo alternative model based on intensive human use and natural exploitation.

2. Evidence demonstrates that biodiversity conservation is not only not oppositional to economic growth, as has often been considered the case by policy makers, but that it may well be the unique engine of Southeast Asia's growth and sustainable economic future.

3. Evidence globally and from the ASEAN region has found that supporting the global target of 30% protection of land and ocean by 2030 in negotiations at the UN CBD, and investment in expanding and improving protected and conserved areas in the region as part of achieving that global goal, would be an effective development for job creation and as a socio-economic growth strategy.

4. ASEAN's abundance of biodiversity means Southeast Asia could become a global role model of economic development through a number of pathways including expanding nature protection ecotourism and carbon storage for investments in NbS (Nature-based Solutions). This region could be the vanguard to realign the global nexus between biodiversity and sustainable economic growth that guarantees both fiscal and non-fiscal returns.

1.0 INTRODUCTION

1.1 Background

After two long years of living with the COVID-19 pandemic and its disastrous effect on lives and livelihoods, the world in December 2021 is finally seeing a welcome light at the end of a very dark corridor! Economies around the world are slowly starting to open up and humankind is anxiously anticipating a welcome return to normal life.

But have the lessons garnered from the pandemic truly hit home, namely, that biodiversity loss and illegal wildlife trading drastically impact our health and also the health of the planet – in particular it not only opens the door to zoonotic diseases (Keesing & Ostfeld, 2021) but also aggravates climate change-associated catastrophes, such as droughts, storms, floods, forest fires and melting polar ice caps (Watson, 2020).

From an examination of various global plans put forward as National Recovery Packages, it would appear that most countries are burying their heads in the sand like the proverbial ostrich. The substantial stimulus packages do not contain provisions that would ensure sustainable development and safeguards to restrain further loss of natural capital. This is despite a growing call to integrate biodiversity conservation into COVID-19 recovery plans to ensure economies are more resilient to systemic shocks and to prevent future pandemics (OECD, 2020). Unfortunately, this is particularly evident in plans put forward by the less developed economies (Daly *et al*., 2020), primarily because of a need to get back "to business as usual" – but this could also be a fast track to ruin whether advocated within the region or globally.

Asia and in particular Southeast Asia, which comprises the 10-member ASEAN bloc as well as Timor Leste must not go down that road more so as it is blessed with abundantly rich natural resources both in its terrestrial and seascapes. These however need to be treasured and sustainably managed since Earth's–biodiversity loss and climate change have already brought it to a "Tipping Point" that may even lead to a Sixth Mass Destruction (Ceballos *et al*., 2015). Development heralded by The Industrial Revolution in developed countries, has endangered the "triple bottom line" to sustainable development that requires a balance between social, economic and environmental development. In contrast, league tables such as the BII (estimates the percentage of natural biodiversity that remains across the world and in individual countries plotted across various nations; Scholes & Biggs, 2005) reveals that it is Asia that now houses the bulk of land and sea areas that still harbour Earth's invaluable biodiversity. This natural resource is critical as a source of food, shelter, clothing and well- being as well as for new discoveries and innovations that fuel products for better medicines, materials and peoples' daily needs (WWF, 2020). There is an urgent need therefore to preserve it.

It is incumbent on Southeast Asia to get its act together so that by conserving, protecting, restoring and managing its biodiversity in a responsible and equitable manner, it can lead the way towards full planetary health even as it advances economic development. A corollary to failure is that the next pandemic could easily sprout from somewhere in the region, perhaps fuelled by the fact that there has been a huge explosion in Southeast Asia's trade demand and harvest rates, of captive animals for luxury foods, medicine, tonics, horns and other trophy parts (Duckworth *et al*., 2012)

It is now generally acknowledged that it has been reckless destruction of biodiversity and other natural capital through anthropogenic activities (in the name of progress and development) that have exposed humankind to the zoonotic scourge brought on by the severe acute respiratory syndrome (SARS) virus (Keesing & Osfeld, 2021). Harmful viruses once housed almost symbiotically in wild animals living in deeply forested environments begin to crossover into new hosts, including humans once they get free passage to the "outside world" through forests diminished by legal or illegal activities. Captured animals may also be traded in open markets, as for example in Wuhan, China (Tobin-de la Puente & Mitchell, 2021)

Anthropogenic activities generally impact on natural capital which refers to "the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people" (Natural Capital Coalition, 2021) through produced capital (roads, machines, buildings, factories and ports) and human capital (health and education). Needless to say, natural capital as it holds the key to economic development, constitutes the major currency for much needed development, especially in poorer economies. It has been estimated that more than 50% of the world's GDP ($44 trillion) draws on natural capital but its cost on biodiversity loss and the environment has been severe (Dasgupta, 2021).

On the other hand, as presented by Waldron *et al*. (2020), from a study conducted by more than hundred economists and scientists, we now have convincing data to show that by placing nature and ecology at the centre of the economic equation, and working towards protecting at least some natural capital, it would be possible to generate trillions of dollars far exceeding what is currently being achieved and at the same time minimizing the impact on the environment. Furthermore, there would be a wider scope for more growth through innovative nature-based green financing mechanisms that would repurpose business opportunities in a host of new and exciting areas, but also in a sustainable manner that will ensure a healthy planet (Deutz *et al*., 2020). The current report has also made an attempt to adapt these global findings to present estimates for just the Southeast Asian region (see Section 7.0).

The findings are of special relevance to Southeast Asia, as before the pandemic, it was the fastest growing economy in the world! In fact, it was predicted to grow by 4.6% in 2019 and 4.8% in 2020 (Rajah, 2021) until the pandemic reduced it to near zero. A closer analysis suggests that the region may have to take some of the blame for the

global upending of normal life. Why? Because the recorded rapid economic growth each year ran in parallel with the emission of about 1.5 billion tons of CO_2 to the atmosphere according to data compiled by the European Commission (Gronewold, 2019). In fact, on its own, ASEAN's annual emission of greenhouse gases exceeded even that of highly industrialised countries such as Japan and Germany (1.3 billion and 796 million tonnes per year respectively) even if not as much as the two greatest polluters, USA and China. Post-pandemic, the region cannot afford to continue along this reckless trajectory as it opens the door to numerous disasters, including the impact from climate change, notably rising sea levels, droughts, storms, floods, landslides, wildfires, shifts in tectonic plates etc. that are able to wreck its economy and destroy its natural capital as well as the life of its inhabitants. Southeast Asia, much of which is surrounded by coastal waters, is in fact seen to be the world's most vulnerable region in terms of climate impact and rising sea levels. A shift to renewable energy sources would of course go a long way towards alleviating the threats ahead (Gronewold, 2019)

Remedial measures are long overdue. Besides advocating for a better energy budget, Southeast Asia, needs to judiciously manage its precious natural capital! Although it covers only 4% of Earth's landmass, Southeast Asia, is home to three of the world's 17 mega-diverse nations, namely, Indonesia, Malaysia, and the Philippines. The region is rich in endemic species of mammals, birds, and vascular plants besides being the world's centre for marine biodiversity, encompassing the most extensive and diverse coral reefs in the world (Wiki, 2021). Within this vast pool of biodiversity resources resides also the potential for further exciting discoveries for the well-being of humankind, as mentioned earlier. Hence it needs to be researched, conserved, utilised and managed judiciously.

A detailed study of the global BII not surprisingly reveals the stark reality that it is the tropical countries, including in Southeast Asia, that have best retained biodiversity, and now house 80% of the world's total (Si, 2020), primarily because economic development had a slow start in these areas. G7 countries like UK occupy the bottom 10% of the league table, having depleted their natural capital to alarming levels in the wake of rapid agricultural and economic development. In fact, UK ranks lowest among the G7 nations registering a BII of less than 50% (Briggs, 2021). Southeast Asia remains then a hotspot for future BD research, development, innovation, and economic benefits to answer global needs. If properly managed, it can be the vanguard to realign the global nexus between biodiversity and economic development so as to guarantee both fiscal and non-fiscal returns.

How can this be accomplished?

This report sets out to strategize how to manage our natural assets and development in Southeast Asia, so that the economic benefits do not come at a dilapidating cost to life, as we know it, on Earth. And more importantly, it will show that by adopting an

appropriate ecosystem framework powered by the right enablers both within rural and urban settings (see Section 6.1), it will ensure sustainable conservation, restoration and application of biodiversity, can alleviate the impact of climate change while ensuring tangible and non-tangible socioeconomic returns to citizens. In particular, it will support wellness and good health of the citizenry, promote economic growth, provide clean water and environment, food security and rural development, while also creating numerous job opportunities thus assuaging poverty.

The tools required will be new and emerging technologies of The Fourth Industrial Revolution (4IR) as well as the bio-revolution. New nature-based financial mechanisms and strategies that put a value on natural capital will also be introduced (see Section 7.0). In this context it is interesting to note that Singapore's Monetary Authority is reported to have already formed a Green Finance Industry Taskforce to work with industry including BNP Paribas, to set up an ASEAN green investment taxonomy modelled upon the European Union green taxonomy (BNP, 2021). This development is expected to meet the needs of companies seeking to drive their Environment, Social and Governance (ESG) programmes in a more sustainable manner.

For this strategy to work all anthropogenic activities will need to be assessed against risks and benefits that impact on nature and the environment instead of safeguarding planet earth, as is starting to be implemented in some developed economies (see Section 8.1). An ecosystem that supports a science, technology, innovation and economy (STIE) Framework, much like that already adopted by Malaysia (10-10 MySTIE Framework - ASM, 2020b) will be detailed (see Sections 6 and 7). None of this can take place in the region, without strong political will and good governance that engages fully with the Quadruple Helix (industry, government, academia, and users/civil society), not least the indigenous peoples of Southeast Asia. The time to act is now, especially by supporting the CBD's 30x30 initiative presented as follows.

1.2 The "30×30 initiative"

The World Economic Forum (WEF) 2020 ranked biodiversity loss as one of the top-five risks to the global economy, and surprisingly even ahead of risks such as geophysical disasters and terrorist attacks (WEF, 2021). This is a clarion call for action. There is an urgent need therefore to examine closely how best to stem biodiversity loss before the economy tanks, more so in Southeast Asia - home to rich biodiversity but also dense populations of people.

How did we get here? The loss of natural ecosystems and biodiversity to fuel developmental and other anthropogenic activities has led to a range of negative impacts, such as climate change, flooding, forest fires, disease emergence (pandemics), clean water shortages, weak crop pollination and a decline in economic productivity. Failure to halt and reverse the decline in biodiversity not only impacts the health of planetary

ecosystems but impacts economies, industries and life and wellbeing of societies across the world. As the Dasgupta Review (Dasgupta, 2021) highlights, the fabric of nature's abundant resources is integrally interwoven into the infrastructure of economies. An estimated USD 44 trillion of value generation arises through the assets provided by nature (WEF, 2021). This dependency on nature's assets as a driver of economies, accounts for more than half the world's GDP.

Recognition of the economic dependency on nature's biodiversity as well as the significant risks of biodiversity decline has over time led to numerous calls for action (WEF, 2021; IPBES, 2019). The need to halt and even reverse biodiversity loss has resulted in the promulgation of national and international conservation goals, most visibly reflected in targets set by the UN Convention on Biological Diversity and also within a number of Sustainable Development Goals (SDGs). One primary policy instrument deployed to remedy the loss of biodiversity was the creation of conservation or PA. According to the IUCN, a protected area is a *"clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."*

The concept of protected area has since been expanded to include other effective area-based conservation measures (OECM). Presently, 16.8% of land (terrestrial and OECM) and 8.01% seascapes (marine and OECM) enjoy the status of protection globally (Protected Planet, 2021). These levels are however inadequate to achieve long-term biodiversity goals (Dinerstein *et al*., 2019; O'Leary *et al*., 2016; UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), International Union for Conservation of Nature (IUCN), & National Geographic Society (NGS), 2018).

In view of this, a fresh call for environmental targets encapsulated within a Post-2020 Global Biodiversity Framework was set in motion by the CBD Working Group in March of 2020 (CBD, 2021). It advocated for an expansion of conservation areas to 30% of the earth's surface by 2030 using PA and OECM. These targets are to replace and go beyond the "Aichi Biodiversity Targets", which had stipulated a goal of 17% terrestrial and inland water, and 10% coastal and marine areas. The Aichi Targets were set in 2011 and were supposed to be reached by 2020 but were unfortunately left largely unrealised.

The recent call mentioned above is commonly referred to as the "30×30 Initiative". It falls under the CBD-Campaign for Nature (CFN) and the High Ambition Coalition (HAC) for Nature and People as first promulgated in July 2021. HAC is an intergovernmental group presently comprising 77 countries, (co-chaired by Costa Rica and France, with UK as Ocean Chair), which is committed to champion a global effort for nature and people with the central goal of protecting at least 30% of the world's land and ocean by 2030. The 30×30 initiative is based on estimates of what it would

take, at a minimum, to halt the accelerating loss of species brought about by the unregulated destruction of vital ecosystems that form the very basis of economic security for people, i.e. to save the planet for survival of human beings.

The HAC and CFN are canvasing in earnest to ensure that the 30×30 initiative is deeply enshrined into the post-2020 Global Biodiversity Framework to be negotiated at the CBD meeting in Geneva in March 2022. This strategy aims to bend the curve of biodiversity decline and thereby attain the 2050 Vision for Biodiversity, "Living in Harmony with Nature" (CBD, 2020). The vision has encapsulated a scenario in which by 2050 by meeting a series of set targets there will exist a shared world perspective in which biodiversity is valued, conserved, restored and wisely used so that ecosystem services are responsibly maintained to sustain a healthy planet and to deliver benefits essential for survival of the global population. Plans on how best to achieve these goals have also been analysed and presented (Claes *et al*., 2020).

Many signatories of the 30×30 initiative see the 2030 target as a stepping stone to an even more ambitious target of conserving half the planet by 2050 (the 50×50 goal). However, supporters of the 30×30 Initiative believe having a clear and achievable target helps to garner interest and attention from governments and other private and public stakeholders. Its simplicity is an effective rallying call to focus stakeholders thinking and action.

Some have claimed that proposals like the 30×30 initiative could negatively impact jobs and curtail livelihoods, although a strong body of research shows that the opposite is true. Counter to these claims, scenario-based modelling of costs, benefits and economic implications from protecting 30 percent of the planet for Nature suggests that the benefits derived exceed the costs by a ratio of at least 5:1 and are likely to provide better financial outcomes and higher non-monetary benefits than currently observed (Waldron *et al*., 2020). Marine expansion would, for example, result in growth in fisheries thus rendering socioeconomic benefits to the attending communities.

Additionally, expansion of PA can provide opportunities to secure additional financial and economic benefits from domains, such as eco-tourism income, the provision of health clinics, education, improved health outcomes, and other forms of support from local communities, as well as by avoidance of spending on natural disaster prevention and recovery measures (e.g. flood defences, storm damage mitigation). The economic and social benefits from expanding Protected Areas are significant. Furthermore, there is potential for even higher growth through innovative mechanisms, such as green financing that repurpose business opportunities in a host of new and exciting areas, but in a sustainable manner that ensures a healthy planet (Deutz *et al*., 2020).

Support for such a positive conclusion with respect to expanding PA is also covered in the Dasgupta review (Dasgupta, 2020). It profoundly concludes that the economics of biodiversity is the economics of the entire biosphere. The author argues that by bringing

economics and ecology together, the natural world can yet be saved - if only just in time. Adding weight to this argument, is how the COVID-19 pandemic has brought into focus and increased awareness for a much needed realignment and reimaging of our relationship with nature (OECD, 2020; Daly *et al.,* 2020).

The unprecedented recognition at United Nations Climate Change Conference (COP26) of the role of nature in the world's efforts to tackle issues pertaining to climate change augurs well as a turning point for the ongoing resolve to confront the climate and biodiversity crisis. It is becoming increasingly clear that both are intrinsically connected, and nature-based solutions (ASM, 2020a) can help countries confront these challenges, while ensuring natural capital is judiciously utilised. Given the amazing biodiversity of Southeast Asia, much of which is currently under threat, the region should strongly support the 30×30 initiative. It needs to play its role too so as not to be left behind. Currently, Cambodia is the only signatory to the initiative.

It is important to note that the 30x30 global target (which is currently Target 3 in the Convention on Biological Diversity's First draft of the post-2020 Global Biodiversity Framework) includes qualitative and quantitative elements. This recognises the fact that increasing the extent of protected and conserved area coverage is important, as is ensuring that the right places are prioritised for conservation and that well thought out execution and governance plans are in place to yield the results intended. It is similarly important to note that the 30x30 is not intended to be a silver bullet. While scientific research has shown it to be a key element of any global biodiversity strategy, it must be complemented by other ambitious targets and strategies, including addressing other drivers of biodiversity loss. Improving the implementation of any spatial target will continue to be a need. Several areas that have been assigned as protected areas to fulfill the Aichi protected area target do not reflect the highest conservation needs. For example, more than 85% of threatened vertebrates are not represented in PA (Barnes *et al*., 2018). Jones *et al*. (2018) reported that about 30% of the area within global PA is under intense human pressure and the actual protection conferred by the current network of PA is much lower than what has been recorded. Thus, in designating PA, the Southeast Asian region should develop a framework for identifying suitable PA and for assessing the conservation impact of the designated protected areas. In this respect, the ASEAN Biodiversity Centre in the Philippines could play an invaluable role.

In the final analysis, it is not just the 30×30 initiative that will ensure biodiversity is responsibly conserved to attain sustainable socioeconomic development. What is essential before any such initiative can be realised and effectively implemented is that the right ecosystem has to be in place. As such this report, after establishing why biodiversity conservation is important to Southeast Asia, goes on to summarise its current status together with the challenges and drivers of biodiversity loss, which could easily tip the balance of planetary health. Remedial measures need to be urgently prescribed. Accordingly, and to ensure the success of the 30×30 initiative, the way forward is advocated through the establishment of the right ecosystem and supported

by a strong STIE framework (see Section 6 and 7), that also recognises the important role played by indigenous people and local communities as traditional custodians of the natural world.

1.3 The 30×30 Initiative and Indigenous People

Image 1.1: Sarawak indigenous people wearing elongated earlobes, a symbol of beauty to the wearer

Source: Sarawak Tourism, photo by Kenneth Lee

The Indigenous People (IP) of the world, are those who populated countries long before the arrival of other settlers, whether these were visitors, colonisers, traders, adventures, conquerors or the likes. IP are therefore the primary ancestors and custodians of all natural capital in their respective countries. By harmonising their existence with that of nature, a habitable sustainable ecosystem was crafted that provided for all their physical, cultural and spiritual needs. However, this balanced existence was disrupted and often destroyed by the arrival of settlers (outsiders/ invaders) and the attending explosion in anthropogenic activities associated with establishing settlements as well as for economic benefits. Global IP population has therefore fallen drastically.

In ASEAN, IPs are estimated to comprise about 100 million from a global IP population of greater than 370 million across 70 countries of which two-thirds are in Asia (Wilson (2020)). Numbers vary within the region (Table 1.1)

Table 1.1: Distribution of IP in ASEAN (*no records for Brunei and Singapore*)

Country	Total Population (million)	IP Population (million)	Comments
Cambodia	16.3	0.5	24 ethnic groups
Indonesia	260	50-70	331 ethnic groups
Laos PDR	7.1	3.6	Most diverse
Malaysia	31.7; Sabah and Sarawak land mass = 60% of Malaysia	4.4; Sabah 58.6% (of 3.8 M pop.); Sarawak 70.5% (of 2.8M pop.)	Collectively known as Orang Asli
Myanmar	54	Not available	Emergency since Feb. 2021
Philippines	101	10-20	Have legal status
Thailand	69.4	5	3 draft laws being finalised
Vietnam	96	14.1	54 ethnic groups

Source: Adapted from ASEAN, 2018

Over centuries, the role of IPs as guardians of natural capital has been drastically blunted as colonisation and land dispossession by settlers have driven them further and further into the limited safe abode within natural forests in each region. With this exclusion from the rest of society, **a rich repository of traditional knowledge on foods, medicines, habitats and forest products has been gradually lost to humankind, even though they were the primary dwellers and natives of the country.**

More recently, IP have been aligned with Local Communities under the acronym IPLC, and together they now play a vital role as custodians of nature (Local Biodiversity Outlooks 2, 2020). **It is estimated that IPLC own, manage, use, and occupy more than 25% of all global land area, which includes up to one-third of formally protected areas, so that 80% of forest biodiversity lies within their territories.** Impressively, in areas managed by these custodians of Natural Capital, biodiversity decline has been less than in other global areas. In fact, as noted by Inger Anderson (Under-Secretary-General of UN), "IPLC territories are islands of diversity in a sea of degraded ecosystems" (Local Biodiversity Outlooks 2, 2020). This has occurred despite drastic encroachment into their native lands.

The impact on livelihoods by displacement has been severe especially from territorial, economic, cultural and political pressures. In particular, land and resources have been threatened by pro-investment government development policies and commercial natural resource exploitation, like mega infrastructure projects for dams and highway construction (see Section 5.2). To cap it all, IPLC have very poor access to healthcare,

education and even to clean water and sanitation. The situation has been exacerbated by an already higher poverty rate compared to the dominant population, as they rely heavily on traditional practices that have increasingly been threatened by a reduction in natural habitats, biodiversity and climate change.

In the last two years when the pandemic was rampant, the situation deteriorated even further with frequent clashes between IP and mostly illegal exploiters of the forest as even the ordinarily weak surveillance and monitoring of forest-based activities were on hold under country wide lockdowns. IPs have tried fruitlessly to defend their livelihood barricading home and property as best as possible as encroachment drastically affected their source of water in wells surrounding the forest and also reduced the flora and fauna which IPLC rely upon for their daily needs (Dwayne, 2021).

And yet IPLC are the best to teach us how to handle pandemics as they have lived in harmony with nature from time immemorial and have coped with infections that must have occurred from pathogenic organisms in wild animals co-existing with them in the forest. Given this history, and with appropriate STIE interventions, IP could be gainfully engaged in programmes to ensure conservation, protection and management of biodiversity. **Their wealth of traditional knowledge can show the rest of us how to protect Nature's essential contributions and to reap benefits from a healthy sustainable environment that could contribute to better health as well as food security.**

Engaging closely with the IPLC will also present a unique education process and open up exciting new opportunities to discover and dissect the inherent genetic strengths that they possess to combat or even live in peaceful coexistence with microbes that can transfer zoonotic diseases to the rest of humankind. Needless to say, it is imperative that the needs and aspirations of these Guardians of Nature are not left out in any recovery plans as well as in the Post-2020 Global Biodiversity Framework. IP are the best custodians of biological diversity, having preserved it from time immemorial and lived in harmony with it and their local communities. In all fairness, consultation with IPLC at the pre-investment and initial stages of land acquisitions would deliver a more amicable, win-win situation to all the stakeholders and help sustain the environment.

For this strategy to take off, Southeast Asian **countries must legally recognise IPLC as distinct peoples with specific rights, particularly with respect to collective rights to lands, territories and resources**. Currently, only the Philippines has acknowledged these rights, while Indonesia is finalising three relevant pieces of legislation. Laos and Vietnam insist that ALL their people are IP (Local Biodiversity Outlooks 2, 2020)!

A heartening development has been the support that IPLC have gained from the recently concluded (September 2021) IUCN World Congress on Conservation in which the Marseille Manifesto among other worthy causes, called for **a global and whole-of-society engagement to ensure effective participation of IP in the urgent task of**

biodiversity protection, conservation and restoration activities guided by "the free, prior, and informed consent of indigenous peoples, and with appropriate recognition of the rights of indigenous peoples to their lands, territories and resources, as set out under the United Nations Rights of the Indigenous People (UNDRIP), and full respect for their diverse knowledge systems*"* (Manifesto, 2021). This would be especially beneficial if applied within the Heart of Borneo Initiative (see Section 5.1.2) as it envelopes a huge expanse of pristine natural forested areas, which is home to IPLC.
Once the cultures, rights and traditional knowledge of IP are also immersed deeply into the global biodiversity framework to save the planet, humankind could at least retrospectively learn more about sustainability and how to live in harmony with Nature, as they have done for centuries.

2.0 THE ASEAN LANDSCAPE

Southeast Asia comprises the Association of Southeast Asian Nations (ASEAN) and Timor-Leste. It is a hotspot of biodiversity, and is biologically unique and complex, mirroring its unique biogeography. Although it covers only 4% of the Earth's land area, Southeast Asia hosts 20–25% of the world's plant and animal species and is a major global biodiversity hotspot (Lechner *et al*., 2021; Hughes 2017; Sodhi *et al*. 2010). A combination of expanding human population and economic development has placed unprecedented pressure on Southeast Asia's natural capital. Concerted action is vital at the regional level for the protection of biodiversity to ensure sustainable economic development, a healthy ecosystem and food security for a fast-growing population in the region. Southeast Asian biodiversity is often described in terms of biogeographic units, the 4 major units being Sundaland, Wallacea, Indochina, and the Philippines. These 4 biogeographic zones are each considered as one of the most biodiverse regions of the globe (Myers *et al.*, 2000) but are also the most biologically threatened (Schipper *et al.,* 2008). With a population exceeding 655 million, and population densities of twice (Wallacea), thrice (Indochina and Sundaland), and six times (Philippines) the world mean of 44 people/km^2 (demographic data from The Economist 2008, cited by Woodruff, 2010), Southeast Asia has seen the highest rate of habitat loss in the world with estimated loss of 95% of its original habitat (Sodhi *et al.,* 2010). The threats are complex, and it is important to understand **the drivers of the biodiversity threats** to devise effective conservation and restoration strategies for the region.

2.1 Sundaland

Sundaland covers Peninsular Malaysia, Borneo, Java, Sumatra, and smaller islands on the Sunda Continental Shelf (Myers *et al*., 2000). The Sundaland Biodiversity Hotspot is home to a diversity of ecosystems such as coral reefs, lowland rainforests, mangrove forests, swamp forests, and montane and subalpine forests. It houses about 25,000 vascular plant species, of which 60 percent are endemic (Brooks *et al.,* 2002). The hotspot holds around 380 species of mammals, 115 of which are endemic (Brooks *et al.,* 2002) including iconic species like the critically endangered Javan (*Rhinoceros sondaicus*) and Sumatran (*Dicerorhinus sumatrensis*) rhinos. It is home to the Sumatran (*Pongo abelii*) and the Bornean (*Pongo pygmaeus*) orangutan, both of which are critically endangered. It also houses the endangered proboscis monkey (*Nasalis larvatus*), which is only found in Borneo. Sundaland faces the highest deforestation rates in Southeast Asia, and is considered a terrestrial global conservation priority based on its high species endemism and habitat loss (Myers *et al.,* 2000; Polgar & Jaafar, 2018).

2.2 Wallacea

Wallacea is defined by thousands of oceanic islands, the largest being Sulawesi Island hosting a highly endemic faunal assemblage (Sodhi *et al*., 2004). Its high endemism is

attributed to the formation of a speciation region (where new species are naturally bred) between the species of Asian and Australian continental shelves. Wallacea is home to more than 10,000 plant species of which 15% are endemic and 1142 vertebrate species of which 45% are endemic (Hernani, 2018). It has 220 different mammals, 125 of which are endemic, over 220 species of reptiles and 50 amphibian species (Mala, 2021). Its 100 endemic reptiles include the Komodo dragon (*Varanus komodoensis*), the largest reptile on Earth. Wallacea has the richest marine biodiversity on earth and is exceptionally rich in coral reefs (Critical Ecosystem Partnership Fund, 2014). Coastal and inland indigenous communities have developed diverse mechanisms to control and manage their natural resources. However, immigration, population expansion and the development of policies in favour of large-scale plantations, and logging and mining concessions have changed these mechanisms. The region's bioresources are stressed but less than 6% of the region is within protected areas (Mala, 2021).

2.3 The Philippines

The Philippines with its 7,107 islands is one of the most biodiverse countries of the planet, containing two-thirds of the Earth's biodiversity and 70 percent of the world's plants and animal species. The Philippines ranks second among the world's 25 top biological hotspots in terms of number of species per square kilometre, and outweighs the Galapagos in species biodiversity and endemism. It been described as tenfold more diverse than Galapagos (Heaney & Regalado, 1998). About 30% of the highly diverse avi-fauna comprising 572 species are endemic to the Philippines (Kennedy *et al*., 2000). Between 2000 and 2005, it lost an estimated 2.1% of its forest cover annually. This was the second highest rate of deforestation in Southeast Asia after Myanmar and seventh in the world (CBD, 2021).

2.4 Indochina

Indochina comprising Cambodia, Lao PDR, Thailand, Myanmar and Vietnam and parts of southern China has a wide diversity of ecosystems such as mixed wet evergreen, dry evergreen, deciduous, and montane forests, lowland floodplain swamps, and mangroves. Critical ecosystems include the great Mekong River and Southeast Asia's largest lake, the Tonle Sap in Cambodia. Indochina hosts more than 7,000 endemic plant species representing 52% of its flora (van Dijk *et al*., 2004). More than 430 mammalian species have been reported of which 71 are endemic. 74 of the 1,277 bird species found in Indochina are endemic. It has the highest global diversity of freshwater turtles (53 species) (van Dijk *et al*., 2004; Conservation International, 2007) and a staggering **1,262 documented species of freshwater fish, representing about 10 percent of the total global fish fauna, including 566 endemics** (van Dijk *et al*., 2004). **Of the 34 global hotspots, Indochina has the largest human population.** This is reflected in the statistic that its remaining natural habitat is only about 5% of its original extent (Mittermeier *et al*., 2004). The accelerating habitat loss and overexploitation have placed immense pressures on both plant and animal populations. **There was more**

than a 70% increase in species listed as threatened on the International Union for Conservation of Nature (IUCN) red list between 2011 and 2020 (Indo-Burma Biodiversity Hotspot, 2020).

The natural richness of the 4 biogeographic regions of Southeast Asia reflects its inherent wealth, including as a power-house for carbon sequestration and for future products for food, shelter and biomaterials as well as new medicines to support better health and wellness. Strategies are therefore urgently needed to address conservation and protection issues so as to ensure that anthropogenic activities such as expansion of agro-industry, wildlife trade, hydropower development in Southeast Asia, do not strip the region of its intrinsic wealth and thus impact people's livelihood and well-being.

Kindly refer to Annex 1 for a more detailed description of the Southeast Asian Landscape.

3.0 POLICIES AND INITIATIVES FOR BIODIVERSITY AND CONSERVATION IN SOUTHEAST ASIA

3.1 Policies and Initiatives for Conservation

While Southeast Asia is blessed with a rich and biodiverse natural environment, rapid increase in population and the need for economic and industrial development are rapidly crowding-out the biodiversity and conservation efforts. The region is under significant pressure to manage a delicate balance between the environment and economic development. In other words, the region must transform from a "zero-sum-game" to one that reinforces environmental and economic sustainability.

Governments in the ASEAN region recognise the importance of the biodiversity of the region, especially for socioeconomic development and the preservation of high quality of life. Hence, many of them have formulated various plans to manage the environment whilst balancing economic needs of the region. The regional framework to develop a dynamic and sustainable Southeast Asia entails the preservation of biodiversity and conservation of biological species unique to the region. In this context, there is a commitment via the Multilateral Environmental Agreements (MEAs) to increase awareness, foster research & development (R&D) and intensify capability building. MEAs are developed to help harmonize policies and implementation strategies on key environmental issues that impact the region.

A central feature within ASEAN is the *ASEAN Socio-Cultural Community Blueprint,* and the conservation part of the institution is spearheaded by the ASEAN Centre for Biodiversity (ACB), a centre of excellence to promote conservation efforts and derive better RoV from the biodiversity within the region. The Centre was set up to act as a key catalyst in implementing strategic plans related to biodiversity and conservation efforts of the region. The key focus areas for biodiversity and conservation are driven by the following (ASEAN, 2016, 2009a, 2009b):

- Transboundary environmental pollution and the haze problem, which includes implementation of the *ASEAN Agreement on Transboundary Haze Pollution* and *ASEAN Peatland Management initiative*;

- Movement of hazardous wastes and alignment to the Basel Convention Procedures and Modalities;

- Enhance the standards of living in ASEAN cities and urban areas via the *ASEAN Initiative on Environmentally Sustainable Cities*, to work towards a low carbon society, environmentally-friendly transportation system and eco-friendly city initiatives;

- Sustainable use of coastal and marine environment via several initiatives, such as the *ASEAN Water Quality Criteria*, *ASEAN Criteria for Marine Heritage Areas*, *ASEAN Criteria for National Protected Areas*, *Coral Triangle Initiative on Coral Reefs Fisheries and Food Security*;

- Promote sustainable management of natural resources and biodiversity of the region through coordinated management of transboundary ASEAN Heritage Parks and protected areas;

- Develop holistic ways to reduce the impact of invasive alien species within ASEAN and other countries;

- Curtail transboundary trade in wild fauna and flora via the *ASEAN Action Plan on Trade in Wild Fauna and Flora* and the *ASEAN Wildlife Enforcement Network*, which addresses the commitments made under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES);

- Implement the *ASEAN Strategic Plan of Action on Water Resources Management* to ensure sustainable management of water resources in the region, including equal access to water in order to meet needs of the ASEAN community;

- Put in place collective efforts to address climate change and its impact to the ASEAN community via the *ASEAN Climate Change Initiative*, which include transitioning ASEAN member countries to low-carbon economies;

- Promote sustainable management of the forest resources in the region by implementing the *Strategic Plan of Action of the ASEAN Cooperation in Forestry*, including implementation of the "Heart of Borneo" initiative, the Asia Forest Partnership and Asia-Pacific Network for Sustainable Forest Management and Rehabilitation; and

- Raise awareness and enculturate environmental consciousness among the youth through the *ASEAN Eco-Schools* and *Youth Eco-Champion Award programmes*

These ASEAN conservation and biodiversity plans provide a framework and support for individual member countries to formulate their respective policies and strategies. Summaries of the regional and national level initiatives are given in Figures 3.1 and 3.2, respectively.

Figure 3.1: ASEAN flagship biodiversity and conservation initiatives

Note: the initiatives presented are some of the major regional initiatives and not an exhaustive list

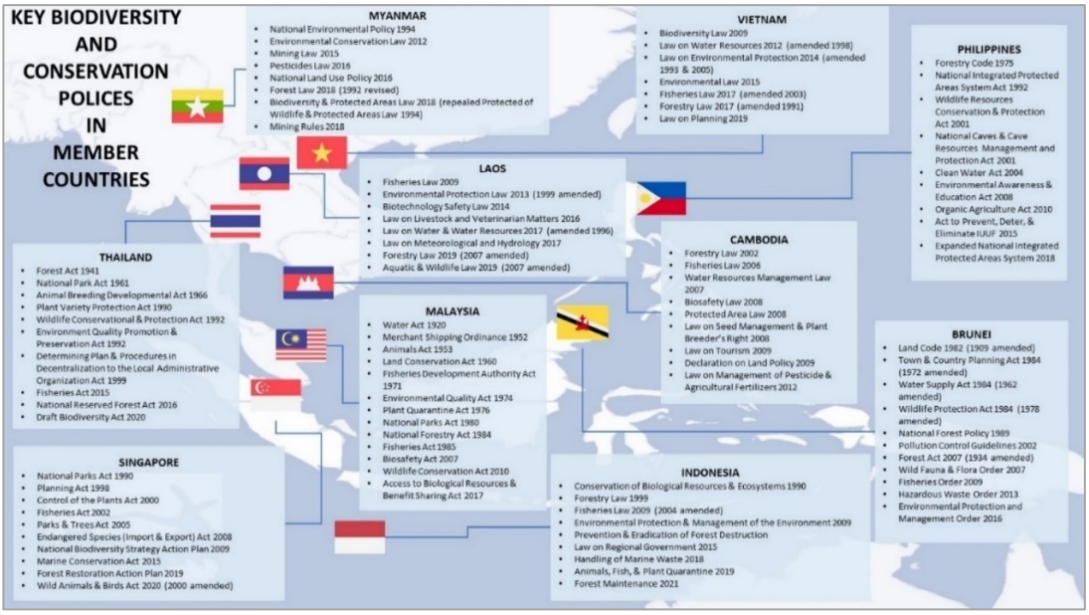

Figure 3.2: ASEAN member countries biodiversity policies, strategies, and initiatives

Note: the initiatives presented are some of the major regional initiatives and not an exhaustive list

The initiatives highlight that ASEAN has put in place regional policies to promote biodiversity and conservation efforts through regional coordination and partnership efforts within member states, working closely with the ASEAN Centre for Biodiversity. ASEAN also works closely with dialogue partners, international development agencies and other key stakeholders to develop ASEAN as a region, and has placed considerable emphasis on developing circular economy practices that value-add to the socioeconomic development of the region and the global community, as outlined in the 2025 ASEAN Community Vision (ASEAN, 2015).

While there are many plans and strategies in place within the region, effectiveness of the measures in ensuring the 30×30 initiatives are dependent on several factors. These include the level of harmonisation of various environmental policies and the standardising of information and databases related to key environmental metrics, intensifying environmental education, literacy and awareness, enculturation of environmental ethics, and public and corporate participation in conservation and preservation of biodiversity in the region. Other ASEAN initiatives include increasing R&D efforts in environmentally sustainable technologies through greater cooperation among member countries, as well as with advanced countries. An important consideration in this respect is to ensure the technologies are affordable and are adopted by the corporate sector and the community in the region. An important driver for adherence to global environmental practices is the level of transitional financial support for firms and people to make the switch towards sustainable production and consumption patterns.

3.2 State of Play of Outcomes

Major efforts have been put in place to ensure environmental best practices are in place to engender a balance between economic and environmental sustainability. Nonetheless, the region has come under intense pressure to balance environmental conservation and biodiversity efforts against meeting the increasing needs of a growing population. Increasing demand for urbanisation, industrial development, food production, access to water and energy and meeting other socioeconomic needs of population has put immense pressure on the environment. In common with the rest of the world, Southeast Asia has not been spared from the impact of climate change. Increasing temperature and uncertain weather patterns have resulted in frequent floods, forest fires, droughts and increasing zoonotic diseases. These phenomena have had adverse impacts on both the environment and socioeconomic ecosystems of the region. This has placed considerable financial strain on countries to meet the long-term socioeconomic development of the region whilst simultaneously financing environmental sustainability initiatives to shift towards a circular economy.

Examples of conservation efforts include intensive efforts to protect orangutans, with close to 75% of them now residing in Sabah, Malaysia under protection as compared to 25% in 2000 (ASEAN Studies Centre, 2021). This was due to the community-based Kinabatangan Orangutan Conservation programme. Other conservation initiatives include the collaborative partnership between the UN Environment Programme (UNEP) and Vietnam's coffee chain Highland Coffee, whereby close to 200 pangolins were rescued in 2018 (UNEP, 2019). Similar conservation efforts in the Philippines led to the rescue of 86 rare indigenous eagles (Bittel, 2021). In Myanmar, Burmese roof turtles, which were on the verge of extinction in 2000, have increased in population to close to 1,000 in 2021 (Nuwer, 2020). Other success stories include the birth of 540 animals of 145 species of which 39 are on the endangered list, at the Wildlife Reserve Singapore in 2017 (Tee, 2018).

Besides species protection, investments have been channelled into environmental initiatives that indirectly impact biodiversity of the region. Included among them is the *Upcycling the Oceans* campaign in Thailand, which resulted in 10 tonnes of waste bottles being collected from the Samet Island, which otherwise would have adversely impacted marine life in these localities (National Geographic, 2021). In Malaysia, the government invested close to USD50 billion for the National Blue Ocean Strategy under the 11th Malaysia Plan (ASEAN Studies Centre, 2021). Likewise, Singapore via the Maritime Singapore Green initiative provided USD 100 million worth of incentives for the adoption of green shipping, an initiative that surpassed the standard set by the International Maritime Organisation (Maritime and Port Authority of Singapore, 2022). A summary of the efforts undertaken by ASEAN member countries is shown in Figure 3.3.

Figure 3.3: Conservation and Biodiversity Efforts in ASEAN

Note: The initiatives listed are not exhaustive.

Sources: (1) ASEAN Studies Centre, 2021; (2) Tatarski & Johnson, 2016; (3) Ezeli, 2019; (4) People Resources and Conservation Foundation, 2022; (5) Fuze Ecoteer, 2022; (6) Devex, 2022; (7) World Bank, 2021b; (8) Mongabay, 2014; (9) WWF, 2021; (10) Gaworecki, 2016.

In spite of the several biodiversity and conservation efforts mentioned earlier, many of the initiatives have faced challenges resulting in continued environmental degradation and biodiversity loss. Deforestation for economic development continues to be a challenge. ASEAN countries have lost close to 376,000 km^2 of forest cover and 25 million hectares of tropical peatland over the last three decades (ASEAN Studies Centre, 2021). These have 'knock-on' effect on conservation initiatives. For example, close to 1988 species in Indonesia and 1928 species in Malaysia were lost, leading the two countries to be ranked 4th and 5th globally for the greatest number of threatened species (ASEAN Studies Centre, 2021). Close to half of Singapore's butterfly species have disappeared due to extinction of indigenous plants (Tan, 2020).

Pollution and overfishing have also had an adverse impact on marine life in Southeast Asia. Approximately, 310 fish species in the Mekong River are on the endangered species list (ASEAN Studies Centre, 2021). Close to 70% of the coral reefs are degraded due to coral bleaching (ASEAN Studies Centre, 2021). Due to overfishing and unfettered tourism in the Coral Triangle region, more than 85% of the reefs are experiencing degradation (WWF, 2020). Further, 79% of the reef fishing reproductive gatherings have declined (WWF, 2020). This has had a major financial impact on countries in the region. It is estimated ASEAN economies will lose close to USD57.98 billion from 2000 to 2050 if measures to address these problems are not given adequate attention (ASEAN Studies Centre, 2021).

Illegal wildlife trading and poaching in the region are widely prevalent despite the enactment of strict regulations in the ASEAN region. These unsavoury acts have had a major impact on conservation efforts and have sent some of the species into extinction as described earlier. For example, tigers in Cambodia are functionally extinct now due to demand from lucrative markets for live tiger and tiger body parts (The Guardian, 2016). The Javan Rhino in Vietnam was deemed extinct in 2011 and the Sumatran rhinoceros in Malaysia in 2019 (Than, 2011; Bittel, 2019). It is envisaged that approximately 13% to 42% of the flora and fauna species in ASEAN will go extinct by 2100 due to habitat loss (ASEAN Studies Centre, 2021). A summary of the challenges experienced by ASEAN countries with respect to biodiversity and conservation efforts is shown in Figure 3.4.

Figure 3.4: Conservation & Biodiversity Challenges in ASEAN

Sources: (1) ASEAN Studies Centre, 2021; (2) World Bank, 2019; (3) Erickson-Davis, 2021; (4) WWF Thailand, 2013; (5) Shutay, 2020; (6) Livingstone & Shepherd, 2014; (7) Erickson-Davis, 2017; (8) Chandra, 2019; (9) Gokkon, 2021; (10) Cowan, 2021; (11) Fabro, 2020; (12) Roberts, 2019; (13) Wasli, 2019; (14) CBD, 2022.

The discussion thus far highlights that despite the Southeast Asia region enacting legislation and devising numerous policies and initiatives, there still remain numerous challenges that continue to hinder efforts to protect biodiversity and conserve the environment. Nonetheless, as the case studies in the following section illustrates, there are many success stories, from which to learn and understand that conservation is within reach at the local, national and regional levels if the right plans and initiatives are devised and executed.

3.3 Case Studies of Biodiversity initiatives in Southeast Asia

As highlighted in the earlier sections, Southeast Asian countries have common as well as unique challenges and problems arising from within their own specific history and contexts. We demonstrate through case studies that despite some instances of dismal failure (such as species trafficking) and huge challenges faced by the region there are many positive cases of success which demonstrate it is possible for Southeast Asia to continue its positive journey of protecting the environment and creating inclusive societies in which the needs of all its inhabitants, humans as well as plants, animals and other organisms are met, allowing them to co-exist and thrive in harmony. The cases that follow are simply illustrative examples of initiatives taking place across the region.

Case Study 3.3.1_Laos & Vietnam: The CarBi Project

Between 2011 and 2017, local communities in the Greater Mekong region (involving Laos and Vietnam) partnered up with international institutions, such as the WWF to carry out the Carbon and Biodiversity Project (CarBi) (WWF, 2017). The project spanned across 200,000 hectares of forest (i.e., size equivalent of 280,000 football pitches), along the Greater Annamites mountain range (WWF, 2021a). This area possesses high biodiversity, as well as the highest concentration of endemic species among continental areas (Wildlife Conservation Society, 2021). In particular, the project aimed to combat the widespread illegal activities in the area (e.g., illegal logging), promote sustainable forest resource management, and preserve the unique species and biodiversity (WWF, 2021a). In addition, an important goal of the project was to reduce carbon dioxide emissions by 1.8 million tonnes within five years of implementation through reduced deforestation and enhanced management effectiveness of four protected areas in the region (i.e., Bach Ma National Park, Sao La Nature Reserves in Quang Nam and Thura Thien-Hue provinces, and Xe Sap National Park in Laos) (KFW, 2021; WWF, 2021a).

While the ambitious goal of reducing carbon emissions of 1.8 million tonnes was not achieved, the CarBi managed to address several important driving factors of deforestation and wildlife poaching, including the lack of law enforcement, reduced institutional capacity, dearth of data on the state of ongoing forest activities and

ecosystems, as well as the lack of livelihood alternatives for the local communities (KFW, 2021). Specifically, to ensure effective law enforcement, rangers were provided with the necessary technical and leadership training. Such technical training programs included geographical information (GIS) training, tactical mapping capabilities to facilitate identification of hotspots area of illegal activities, as well as training to set up camera traps to capture images of forest fauna. Furthermore, this project facilitated training and employment for the local communities, specifically in activities related to forest and biodiversity protection (WWF, 2014). Policies to enhance livelihoods of local communities were also heavily supported by the CarBi – for instance, the Payment for Forest Ecosystem Services System that incentivized local communities to manage and protect their forests by providing monetary compensations for their efforts (Centre for International Forestry Research, 2021; WWF, 2014).

Key biodiversity and economic/social outcomes:

- Camera traps played critical roles in establishing species baselines to assess species population status and their subsequent trajectories. E.g., the camera trapping program led to the rediscovery of Saola in Vietnam, which is one of the rarest and most threatened mammals globally (WWF, 2014);

- Training programs were provided to the local communities, such as training for geographical information system (GIS) and tactical mapping, increasing skills and capabilities of local communities;

- As of 2014, it has provided over 12,660 capacity building opportunities, generated in excess of 70,000 person days of work, and generated more than USD 1,000,000 of income for the communities (WWF, 2014); and,

- Building on the experiences of the CarBi project, a second phase (i.e., CarBi 2) was launched in 2019 (WWF, 2021b). In particular, the project will continue to focus on implementing sustainable livelihoods for the communities. For instance, a new Village Development Funds program will be carried out to modify or generate income for local communities from agroforestry and other sustainable livelihood means (Tho, 2019).

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Case Study 3.3.2_Thailand: Mangrove restoration at Pred Nai Village

Located at the eastern seacoast of Thailand, the Pred Nai village contains one of the final remaining mangrove forests in Thailand (UNDP, 2017). During the 1980s, the mangrove forest in the Pred Nai village underwent major destruction due to uncontrolled logging and intensive shrimp farming (UNDP, 2017). Due to their unique root structures, high salinity environment, and muddy anaerobic soils that provide important nutrients and shelter, mangrove forests are highly productive ecosystems with rich and diverse variety of biodiversity (Innovation News Network, 2020). In addition to having important ecological functions, they possess great economic importance as they are heavily involved in the production of food, timber, fuel, and medicine (Carugati, 2018).

Realising the serious ramifications of mangrove destruction, the villagers of the Pred Nai village assembled and initiated a protest against the government, which successfully led to the ban of commercial logging in 1987 (Silori, 2011). Subsequently, with the aid of stakeholders, such as the local and provincial governments, religious leaders, volunteers, organizations and technical experts, the villagers took active measures to protect and restore the mangrove population (Silori, 2011). For instance, the Pred Nai Community Forestry Group was created by the villagers to execute intensive mapping of forest resources, create patrol teams to prevent illegal logging and charcoal production, as well as to carry out mangrove replanting at degraded areas (UNDP, 2017). To ensure sustainable management, harvesting regulations were also introduced for the Grapsid crab (UNDP, 2017). To effectively implement successful

management policies, a network was formed between the villages along the coast, which was eventually formalized as the Community Coastal Resource Management Network, Trat Province. By sharing and exchanging experiences, villagers gained valuable knowledge through each other's successes and failures. In addition, this collaboration facilitated the generation of novel ideas and practices, all of which are vital to effectively address and contribute to ecological and economic needs (UNDP, 2017).

Key biodiversity and economic/social outcomes:

- Over 1900 hectares of mangrove have been restored and protected;

- Villagers have reported an increase and return of wildlife species to the coastal area; this is critical as the marine forest plays a critical role towards the livelihoods of the local communities; approximately 74% of the total average household income in the Pred Nai village can be attributed to the mangrove forests (Silori, 2011);

- The immediate beneficiaries of the sustainable management of mangrove in the Pred Nai villagers are the poorest members of the community, as crab collecting is a vital economic activity for low-income villagers (UNDP, 2017). For landless households, over 71% of income is directly derived from the sale of Grapsid crab (69%) and honey (2%) gathered from the mangrove forest for small and large landowners. While the direct contribution of crab sale to income is not as significant (i.e., <2% to 19%), income from fish and shrimp farming have contributed to the improved conditions of mangrove forest dwellers (i.e., 56% for small landholders, 59% for medium landholders, and 72% for large landholders) (Silori, 2011); and,

- It was estimated that the annual crab harvest was almost 95 tons in 2008 with a market value of 4.68 million baht, and a persisting upward trend over the following years (Silori, 2011). This increased quantity of harvest created employment opportunities – i.e., the number of crab harvesters has increased from 6 persons per day in 2000 to almost 70 per day in 2011. Time spent collecting crabs also decreased significantly due to the greater availability of crabs (UNDP, 2017).

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Case Study 3.3.3_Myanmar: The Moeyungyi Wetland Wildlife Sanctuary

Located at the Bago region of Myanmar, the Moeyunggi Wetland is a wildlife sanctuary that encompasses an area of 10360 hectares (The Government of the Republic of the Union of Myanmar, 2018). Originally built as a reservoir more than a century ago, it was dedicated as a Ramsar site in 2004 due to its important ecological, economic, and scientific value (Ministry of Environment, Japan, 2014). In particular, the Moeyunggi Wetland Wildlife Sanctuary (MWWS) houses over 65000 individuals from 17 villages, as well as 20000 mammals, birds, reptiles, amphibians, fish, insects, and aquatic plants (The Government of the Republic of the Union of Myanmar, 2018). It plays a crucial role as a provider of numerous ecosystem services, including fresh water for domestic purposes (e.g., drinking and cooking), irrigation water for rice paddies, fisheries and wildlife goods (e.g., lotus), food for domestic animals (e.g., ducks and water buffaloes), and as a tourism and recreational site (e.g., birdwatching, especially migratory birds) (Ministry of Environment, Japan, 2014; The Government of the Republic of the Union of Myanmar, 2018).

Continuous efforts have been put in place to manage and protect the MWWS, many of which are critical to ensure sustainability. For instance, the MWWS is one of the sites covered under the "Conservation of Biodiversity and Improved-Management of Protected Area in Myanmar" project, funded by the Norwegian Environment Agency to improve the management of protected areas in Myanmar (San, 2019). Among some of the key goals, this project introduced sustainable fishing practices to the local communities, as well as identified key challenges that hinder fishermen from implementing such practices (IUCN, 2020). Importantly, a revolving fund was provided to fishermen, on condition that they only carried out fishing activities in the "transition and wise-use" zones at the site (IUCN, 2020).

Key biodiversity and economic/social outcomes:

- Increased trust among fishermen and park rangers indicated by the continuous support from fishermen; as of June 2020, 196 illegal activities have been reported by the local fishermen (IUCN, 2020); and,

- Continuous role of the natural ecosystem in supporting the livelihood of over 65000 villagers - using the Toolkit for Ecosystem Service Site-based Assessment (TESSA), Figure 3.5 shows the estimated economic value of the various ecosystem services.

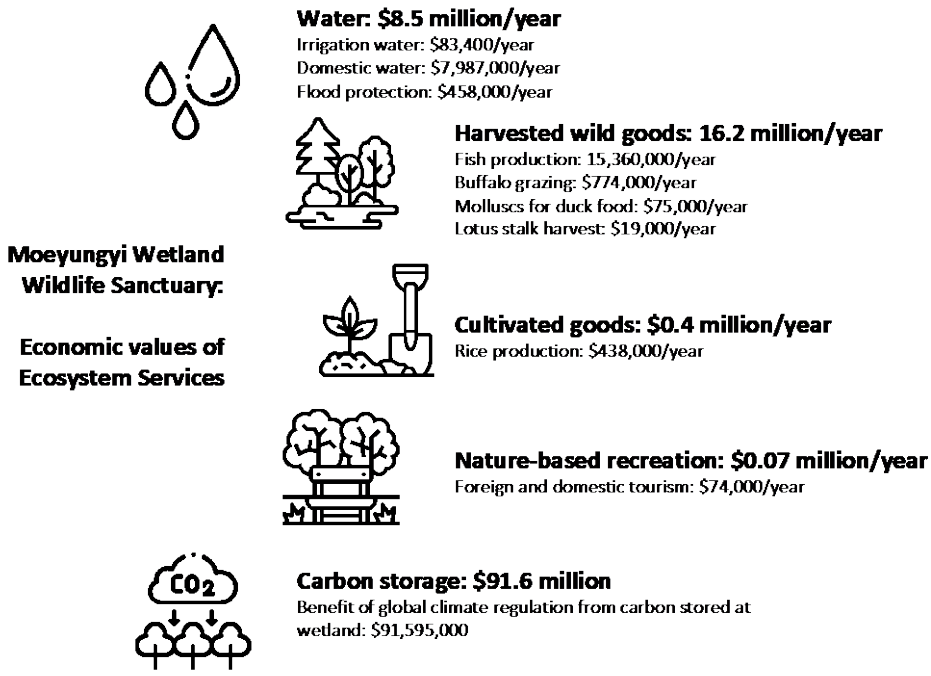

Figure 3.5: The estimated economic values of the various ecosystem services in Moeyungyi Wetland Wildlife Sanctuary.

Source: Ministry of Environment of Japan, 2014

Given the importance of the aforementioned ecosystem services, it is vital that there is continuous management of the wetlands to ensure a healthy and sustainable ecosystem.

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Case Study 3.3.4_Singapore: The Sisters' Island Marine Park

The Sisters' Island Marine Park (SIMP) was established in 2014 as a critical marine habitat in Singapore (Nparks, n.d.). Encompassing an area of approximately 40 hectares (equivalent to about 50 football fields), it spans along the western reefs of St John's Island and Pulau Tekukor (Koh, 2015; Nparks, 2020). In particular, the establishment of the SIMP serves as an important site to protect Singapore's coral reefs, which is home to a variety of unique species of seahorses, clams, and other marine life (Koh, 2015). Notably, Singapore's waters contain more than 350 species of hard corals, which is approximately 32% of the global total (Koh, 2015).

There have been continuous efforts to ensure effective management and enhancement of biodiversity at the SIMP. For instance, NParks and JTC Corporations have collaborated to initiate the "Grow-a-Reef Garden" project at the SIMP – this is a large artificial reef installation project, where right reef structures were put into the bare seabeds to facilitate the growth of new coral reefs (National Parks Board Singapore, 2020). Each coral structure was carefully designed to maximize coral settlement, expedite the growth of encrusting species, as well as provide an optimum living environment for fishes and other mobile organisms. In addition, the Marine Conservation Action Plan (MCAP) has been created to improve the country's marine biodiversity conservation efforts (National Parks Board Singapore, 2020). With the SIMP as the central conservatory location, it details new programs to be carried out, such as species reintroduction, coastal enhancement, the conduct of applied research around the coastal and marine habitats on the island, etc.

Key biodiversity and economic/social outcomes:

- Situated at a close proximity to one of the busiest ports in the world, the SIMP serves as a safe haven for the vast marine biodiversity around the Sisters' Island and its surrounding waters. For example, the SIMP houses Singapore's first turtle hatchery, which aims to increase turtle survival rates through the utilization of advanced technologies, scientific research, and community engagement (Koh, 2015); and,

- In addition, the SIMP is an important tourist destination: The Big Sister's Island is the gateway for visitors (while the Small Sister's Island serves as a dedicated location for marine conservation research). On the island, tourists are able to visit recreational sites such as the intertidal pools and forest trails (Nparks, 2021a). Dive trails have also been created; nonetheless, to minimise harm to marine biodiversity, only individuals with relevant experiences would be allowed to carry out diving activity (e.g., certificate from reputable diving institutions and a minimum of 20 dives within the past two years) (Nparks, 2021b). In addition, a floating pontoon will be cautiously installed along the shore to enable up-close viewing of marine life such as sea anemones and sea fans. The Big Sister's Island is currently undergoing enhancement work, which is scheduled to complete by 2021 (Nparks,

2021a). On St. John's Island, a Marine Park Public Gallery has been established to showcase Singapore's marine biodiversity. It is an important site for visitors to learn more about the marine biodiversity in Singapore (Nparks, n.d.).

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Case Study 3.3.5_Brunei: The Hua Ho Agricultural Farm

The Hua Ho Agricultural Farm was founded by Pehin Kapitan China Kornia Diraja Dato Paduka Lau Ah Kok in 1947 (BIMP-EAGA, 2017). Presently managed by his son, Lau How Teck, the farm has transitioned from a conventional farming system to a contemporary system through the utilization of advanced technologies (BIMP-EAGA, 2017). In particular, the successor of the farm has introduced modern farming technologies, such as the closed-house system in poultry production, hydroponics and greenhouse system for vegetable production, as well as fertigation and protection cultivation to produce nonseasonal fruits (BIMP-EAGA, 2020). Specifically, the polytunnel protected and semiprotected houses minimize pests and disease infestation of crops (BIMP-EAGA, 2017). In addition, biopesticides are utilized to substitute chemical pesticides. This avoids chemical leaching, thus reducing pollution in the nearby drains and waters. Furthermore, the farm also creates its own natural compost from chicken manure gathered from its poultry farms (BIMP-EAGA, 2017). This leads to reduction of farm inputs in terms of fertilisers, and has also reduced the risk of fertilizers overuse.

Key biodiversity and economic/social outcomes:

- As a whole, the use of environmental-friendly agricultural practices (e.g., biopesticides) and advanced technologies (e.g., polytunnel protected houses) not

only reduces the risks of environmental pollution, but also ensures the production of farming goods that are of good quality and safe for human consumption (BIMP-EAGA, 2017);

- With the utilisation of technologies, farm productivity and production have increased immensely: in 2013, 117 metric tons of fruits and vegetables were produced; by 2017, the farm was able to produce over 129 metric tons of fruits and vegetables, which is more than a 10% increase in productivity (BIMP-EAGA, 2020); and,

- The farm was accredited with the Brunei Darussalam Good Agricultural Practice seal by the Department of Agricultural and Agrifood, which is a national recognition for safe and high-quality agricultural products achieved through a systematic and well-managed farming system (Norjidi, 2019).

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Case Study 3.3.6_Timor-Leste: Nino Konis Santana National Park

Established in 2007, the Nino Konis Santana National Park (NKSNP) is Timor-Leste's first national park (Weeks, 2014). The park encompasses more than 1236 km^2 of terrestrial land and 556 km^2 of marine area, both of which are home to numerous endangered and endemic species in the region, such as the Timor-Green Pigeon (endemic), Timor Imperial Pigeon (endangered), as well as the Yellow-crested Cockatoo (endangered) (Weeks, 2014). In addition to being a Wallacea Biodiversity hotspot with a rich variety of ecological habitats and marine biodiversity, it directly supports the livelihoods of the local communities in the NKSNP (da Silva, 2021).

As the NKSNP plays a vital role in supporting both the survival of biodiversity and livelihoods of villagers, numerous efforts have been carried out to support its management and development (Da Silva, 2021; Weeks, 2014). In particular, efforts have been centred on developing low-cost and effective management solutions that incorporate strong community participation (Weeks, 2014). For instance, with the support from the US Agency for International Development's Coral Triangle Support

Partnership, the Timor-Leste government has explored a co-management approach to marine resource management, alongside the NKSNP communities. The central goal of this program was to facilitate knowledge, skills, and capacity building for community members and government personnel at all levels (i.e., national, district, and village), specifically with regards to marine resource and fisheries management (Weeks, 2014). Some of the key knowledge and skills include awareness of marine ecology, project planning, design and implementation of collaborative compliance, biological monitoring, as well as the process of results reporting to stakeholders. In addition, the fishing communities in the NKSNP have established multiple-use zoning of their marine area; these zones include no-take zones, buffer zones, and special regulation zones that comprise a combination of gear restrictions and species-specific take limits (Bioone Complete, 2013). This program serves as an example of shrewd management of NKSNP, which is key in ensuring the sustainability of biodiversity and livelihoods in the region (Bioone Complete, 2013; Weeks, 2014).

Within the national park, there is also a historical and heritage site named *ili-kerekere* that serves as a favoured destination for tourists from around the world (PEMSEA, 2019).

Key biodiversity and economic/social outcomes:

- Shrewd biodiversity management plans, such as the use of marine zones (e.g., no-take zones) and regulatory schemes (e.g., specific species take limits) to ensure sustainable marine resources;

- Continued support of local livelihoods - more than 13,000 inhabitants across 9 villages (Da Silva, 2021); and,

- Cited as one of the vital emerging sites for ecotourism in the country (PEMSEA, 2019). For instance, the abundance of cetaceans at the coastal waters provides a great opportunity for ecotourism development, such as whale and dolphin watching (Edyvane *et al*., 2012).

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Case Study 3.3.7_Cambodia: Keo Seima Wildlife Sanctuary Project

Officially initiated in 2010, the Keo Seima Wildlife Sanctuary (KSWS) is one of the first "Reducing Emissions from Deforestation and Forest Degradation" (REDD) projects in Cambodia (The Royal Government of Cambodia, 2019). KSWS is located in the eastern Cambodia, which lies mainly in the Mondulkiri and Kratie Provinces. This wildlife sanctuary serves as the ancestral lands for the Bunong people, who largely rely on the forest for their sources of income. Moreover, this wildlife sanctuary also shelters more than 40 threatened vertebrate species, including Asian Elephants, primates, wild cattle, several carnivores, and birds such as the Giant Ibis and Green Peafowl (Wildlife Conservation Society, 2015). Jointly managed by the Forestry Administration, Wildlife Conservation Society (WCS), and other local NGOs and authorities, this project set out to minimize deforestation, reduce carbon dioxide (CO_2) emissions into the atmosphere, conserve biodiversity value, protect and enhance the livelihoods of the local communities, as well as contribute to national economic development (Wildlife Conservation Society, 2015).

The main activities of the KSWS project include enforcing laws to reduce illegal activities, promoting sustainable use of land and natural resources, helping local communities to secure land tenure, and protecting their livelihoods (Wildlife Conservation Society, 2015). The vision of the KSWS is: "A well-managed forest landscape that supports increasing wildlife populations and improving livelihoods for the people who currently live there." (Wildlife Conservation Society, 2015, p. 29). Importantly, this project has encouraged the local communities to be actively involved in economic activities that are less harmful to the flora and fauna, such as eco-tourism, agriculture, non-timber forest products (NTFP) harvesting, education, etc. 12,763 members of the local communities were involved in a wide array of training and development activities, including sustainable natural resource management skills, forest patrol skills, and eco-tourism training program. In turn, these training programs enhanced capabilities of participants to generate income (Earthly, n.d.).

Key biodiversity and economic/social outcomes (The Royal Government of Cambodia, 2019; Wildlife Conservation Society, 2018):

- Prevented approximately 30,000 hectares of deforestation since 2010;

- Avoided 11.5 million tons of greenhouse gas (GHG) emissions from unplanned deforestation since 2010;

- 449 jobs were created through law enforcement, community patrols, forest conservation, and eco-tourism activities;

- Alleviated poverty by promoting alternative livelihoods that are environmentally sustainable, such as eco-tourism, optimal non-timber forest products (NTFP) harvesting, etc. The alternative livelihood approach has helped generate income and offered skills development opportunities.

- Agricultural advisory services and infrastructure support was given, which has resulted in higher income levels, improved food security, and has even eradicated climate change-related threats; and,

- Established the Jahoo Gibbon Camp, which is a community-based ecotourism project, in 2014. Specifically, this project involved the Bunong community in eco-tourism activities, which allowed them to embrace and protect their ancestral land while generating important income; park entrance fees were also used to support park operations, maintenance, and community development. As a result, more than $14,000 was generated annually from these eco-tourism activities, improving the annual income of the local communities (World Hope International, 2019).

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Case Study 3.3.8_Vietnam: National Green Growth Strategy & Five Million Hectare Reforestation Program (5MHRP)

Green Growth Strategy in Vietnam is a strategy that the Government of Vietnam has used to achieve sustainable economic development through realizing a low carbon economy and enriching natural resources (Green Policy Platform, 2012). Specifically, this strategy aims to encourage economic sectors to utilise energy and natural resources in an efficient and environmental-friendly manner, which helps reduce the intensity of greenhouse gas emissions and decelerate global warming. Furthermore, this helps to generate employment opportunities from green industries, contributing to poverty alleviation, and driving economic development in a sustainable manner (Green Policy Platform, 2012).

To achieve the abovementioned objectives, economic sectors were encouraged to develop and implement policies based on the Green Growth Strategy, particularly, focusing on practicing efficient use of natural resources, minimizing pollution, and applying green technologies in order to protect Mother Earth. In addition, the growth strategy also focuses on the development of sustainable infrastructure, including transportation, energy, irrigation, and urban works that are economically and environmentally friendly. A sustainable urban development approach (green, ecological, and economic urban areas), which highlights the sustainable use and management of natural resources, is also part of the Green Growth Strategy in Vietnam. Additionally, conducting research on topics related to the green economy was considered essential in facilitating the development of a sustainable green economy (Green Policy Platform, 2012).

The Five Million Hectare Reforestation Program (5MHRP), which cost about USD 2.5 billion, was launched by the government of Vietnam in 1998 and ended in 2010. The main objective of this program was to plant five million new hectares of forest and protect 9.3 million hectares of existing forest area, with the aim of increasing the national forest cover from 28% to 43% by 2010 (Huong *et al*., 2014). These initiatives have helped contribute significantly to environmental protection, biodiversity conservation, job creation, poverty eradication, and socio-economic development in the mountain regions (Government of Vietnam, 1998). To be specific, 700,000 lien hectares (including 260,000 hectares of protection and special-use of forests) were planted and 350,000 hectares were reforested in combination with supplementary planting from 1998 to 2000. In the second phase of the project (from 2001 to 2005), 1.3 million hectares of new forests (including 350,000 hectares of protection and special-use forests) and 650,000 hectares of forests were reforested in combination with supplementary planting. In the final phase of the project (from 2006 to 2010), 2 million hectares of new forests (including 390,000 hectares of protection and special-use forests) were planted (Government of Vietnam, 1998).

The government of Vietnam involved local farmers in the 5MHRP initiative so as to improve their living standards. Most of the upland farmers were subsidized to participate in afforestation and reforestation activities. Four types of contractual arrangements were offered by the government, each with different lengths of services, such as "planting and protection of new forests" with 9 years of services, "zoning for protection of existing, natural forests" with 5 years of services, "zoning for regeneration and protection of existing, natural forests" with 6 years of services, and "planting of forests" with 1 year of services. Essentially, the farmers serve as the sellers and the government acts as the buyer of environmental goods and services (Huong *et al*., 2014).

Key biodiversity and economic/social outcomes of the Green Growth Strategy (Green Policy Platform, 2012):

- Reduced the intensity of greenhouse gas emissions by 8% – 10% in 2020;
- Decreased energy consumption per unit of GDP by 1-1.5% per year;
- Increased the market share of high technology and green technology to 42 - 45% of GDP by 2020;
- Increased the percentage of environmentally friendly commercial manufacturing facilities to 80% in 2020; and,
- Increased the usage of clean technologies to 50% in 2020.

Key biodiversity and economic/social outcomes of the 5MHRP (Choi *et al*., 2019; Ministry of Natural Resources and Environment, 2019):

- Poverty alleviation and hunger eradication of local farmers who were involved in the initiative;
- Created employment opportunities for two million people and increased the income of the local communities;
- Established five million hectares of new forest and protected 9.3 million hectares of the existing forest to conserve flora and fauna; and,
- Increased national forest cover area from 33% in 2000 to 41.45% in 2017.

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Case Study 3.3.9_Indonesia: Hutan Harapan Initiative

Hutan Harapan Initiative is the first Ecosystem Restoration Concession (ERC) in Indonesia for ecosystem restoration (Hutan Harapan, 2022). Specifically, ERC serves to preserve and rehabilitate biological (e.g., flora and fauna) and non-biological elements (e.g., soil, climate, etc) in a particular area. Hutan Harapan is located between Kambi and South Sumatra Provinces, Sumatra (Ministry of Environment and Forestry of Indonesia, 2014). With approximately 100,000 hectares, Hutan Harapan, which is also known as the "Forest of Hopes", is a habitat for a number of unique species, such as Sumatran tigers, Storm's storks, Sumatran elephants, and helmeted hornbills, all of which are critically endangered (NABU, 2019). Besides that, this biodiverse habitat is also home to the indigenous community - Batin Sembilan (Nature and Biodiversity Conservation Union (NABU), 2019). Unfortunately, this type of forest has substantially declined as a result of illegal logging and massive agricultural plantations (Ministry of Environment and Forestry of Indonesia, 2014). This led to the establishment of the Hutan Harapan Initiative to restore Indonesia's biodiversity and ecosystem functions. This initiative has played a vital role in protecting the wildlife and securing the livelihood of the Batin Sembilan community through conservation and preservation of the forest (Ministry of Environment and Forestry of Indonesia, 2014; International Climate Initiative, 2022).

The main activities of the Hutan Harapan Initiative include forest conservation and restoration, research and development activities, as well as community engagement and empowerment (Hutan Harapan, 2022; Nature and Biodiversity Conservation Union (NABU), 2019). For instance, exploited forest areas were reinstated so that a closed canopy forest could be achieved. To improve the initiative and better understand the condition of the forest, research and development activities were consistently carried

out on biodiversity and ecosystem services, such as observation of soil erosion rate, rainfall observation, fauna monitoring, Non-timber forest product potential (NTFP) survey, Phenology Survey, etc (Hutan Harapan, 2022). The community development and empowerment programme was also implemented to secure and protect the Batin Sembilan community, local Malays, and other communities in Hutan Harapan (Ministry of Environment and Forestry of Indonesia, 2014). Under this programme, special settlements were built for the Batin Sembilan community in the Mitra Zone, which is near the Hutan Harapan base camp. Other than supplying electricity and clean water, essential facilities like prayer rooms and primary education facilities were also provided in this area. Also, the Batin Sembilan community was given the privilege to enjoy free healthcare services at Besamo Clinic, which is located in Hutan Harapan (Nature and Biodiversity Conservation Union (NABU), 2019).

To further empower the Batin Sembilan community, training activities were provided to enhance handicraft skills so that locals can convert the skills into income-generating activities. Many have made a variety of handicrafts from rattan such as brooms, baskets, and spoons and successfully generated income from selling handicrafts (Hutan Harapan, 2018). Furthermore, the Batin Sembilan community was paid to search for native plant seeds and look after native plants in Hutan Harapan (Hutan Harapan, 2018). Overall, the Hutan Harapan Initiative has helped conserve endangered species, preserve lowland forests against exploitation, whilst simultaneously supporting and empowering local communities (Hutan Harapan, 2018).

Key biodiversity and economic/social outcomes:

- Provided biodiversity value: Hutan Harapan is a biodiverse habitat for a vast array of plants and animals. For instance, 307 species of bird species, 64 species of mammals, (including the Sumatran Tiger, Clouded Leopard, Agile Gibbon, Sumatran Elephant, and Malayan Tapir), 71 species of reptiles, 55 species of Amphibian, 123 species of fish, and 728 tree species have been identified in Hutan Harapan (Ministry of Environment and Forestry of Indonesia, 2014);

- Provides ecosystem services: provision of water resources, protection against flood and soil erosion, climate regulation, carbon sequestration, conservation of biodiversity and genetic resources, soil, water, and air quality regulation, and cultural enrichment;

- Has served as a source of income for the local communities, such as the income generated from non-timber forest products, hunting, and eco-tourism (Ministry of Environment and Forestry of Indonesia, 2014);

- Is home to 228 Batin Sembilan families who rely on the forest for income-generating activities (e.g., collecting non-timber forest products and hunting) (Hutan Harapan, 2018);

- Minimised terrestrial habitat loss through area-based conservation measures;

- Reduced species extinction rate; and,
- Inspired 11 other ecosystem restoration concessions in Indonesia (Ministry of Environment and Forestry of Indonesia, 2014).

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Case Study 3.3.10_Philippines: Sustainable Ecotourism in Mt. Kitanglad Range Natural Park, Bukidnon

The Mt. Kitanglad Range Natural Park (MKRNP) was declared as a protected area in November 2000 through the Republic Act 8978. It was avowed as the 28th ASEAN Heritage Park in October 2009 (Jonathan, 2021a). The 47,270-hectare natural park is located in Bukidnon province on Mindanao Island and serves as an active nesting site for the critically endangered Philippine eagle. It is the fourth highest mountain in the Philippines with an approximate height of 2,938 meters above sea level (BIMP–EAGA, 2017). MKRNP is also the ancestral homeland of three indigenous tribes, namely the Higaonon (45.64%), the Talaandig (27.84%), and the Bukidnon (14.91%) (Parr, 2017). MKRNP is considered the most well-managed protected area in the Philippines (La Viña *et al*., 2010). As evidence, the natural park scored 91 out of 100 in 2017 in its assessment through the management effectiveness measuring tool (BIMP–EAGA, 2017).

In the MKRNP, local communities (indigenous people) were involved in the Protected Area Management Board (PAMB) to help protect the natural park resources, curtail illegal activities, and curb park violations. The initiative successfully reduced

park violation cases (Parr, 2017). As an act of appreciation, the "Aldaw ta Kitanglad" festival is celebrated every November to recognize the efforts and contributions of the local communities (BIMP–EAGA, 2017). In 2002, the government of the Philippines started to fund the development activities in the MKRNP, which amounted to ₱4 million in 2018. Through partnerships and collaborations from 2005 to 2013, the MKRNP successfully generated ₱1.81 million, ₱47.83 million, and ₱10.35 million from the government, private sector, and non-government organizations, respectively, indicating a sustainable financing mechanism (BIMP–EAGA, 2017). Eco-tourism is also part of the sustainable development plan of the MKRNP, which includes several tourism activities such as birdwatching, camping, mountain climbing, and jungle trekking. To further achieve sustainable income, visitors are charged an entrance fee upon entering the natural park (BIMP–EAGA, 2017).

Key biodiversity and economic/social outcomes:

- Empowered local communities: the indigenous communities in the MKRNP have been invited to speak at a variety of international conferences. For example, Datu Malunay Teofilo Sabaon was invited to share his experience in LAWIN Forest and Biodiversity Monitoring in Fiji Island (BIMP–EAGA, 2017); and

- Provision of ecosystem services: water supply for domestic and industrial uses, as well as generation of hydroelectric power. 100,000 households living around the MKRNP are beneficiaries of these ecosystem services (Jonathan, 2021).

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Case Study 3.3.11_Malaysia: Tun Mustapha Park (TMP) – A participatory planning and management project for a multiple use marine park in Sabah

Located in the northern part of *Malaysian - Sabah,* Tun Mustapha Park (TMP) spans a marine area of 898,763 ha, making it the biggest marine park and the largest multi-use marine protected area in Malaysia (WWF-Malaysia, 2017). The TMP was formally declared as a multi-use marine park in 2016 after 13 years of negotiations between local communities, governmental bodies, international partners, and non-governmental organizations. The marine park contains rich marine biodiversity, housing more than 250 species of coral reefs, 400 species of fish, and numerous threatened species, such as the dugong (*Dugong dugon*), otters (*Lutra perspicillata*), humpback whales (*Megaptera novaeangliae*), and sea turtles (Ministry of Water, Land and Natural Resources, 2019). In addition, around 85,000 coastal inhabitants are dependent upon the TMP's rich fishing ground to sustain their livelihoods (WWF-Malaysia, 2017).

The TMP aims to achieve three main objectives: conserving marine biodiversity and protecting endangered marine species in the TMP area, developing environmentally sustainable fisheries and aquaculture, as well as eradicating the poverty of coastal villagers (WWF-Malaysia, 2017). The development of a systematic conservative plan for the TMP was guided by the Interim Steering Committee (ISC) since 2011. The ISC is made up of the local authorities and is overseen by the Ministry of Tourism, Culture, and Environment Sabah (WWF-Malaysia, 2017). Regular consultations and meetings were held with key stakeholders (e.g., local communities, such as the fishermen, government agencies, and the private sectors including the commercial fishing sector, and NGOs) prior to the establishment of the TMP to ensure the effectiveness and success of the program. After seven years of frequent consultations with the key stakeholders, four main zones were identified for TMP with different purposes, namely: 1) Preservation Zone, which prohibits all extractive activities; 2) Community Managed Zone, which allows non-destructive small scale and traditional fishing activities; 3) Multiple Use Zone, which allows non-destructive and small-scale fishing activities and other sustainable development activities; and 4) Commercial Fishing Zone which allows large scale extractive fishing practices. These four zones were established based on the local knowledge and practices of the local communities in order to reconcile biodiversity conservation and the socio-economic development needs of the local communities (United Nations, 2017; WWF-Malaysia, 2017). This zoning plan plays an essential role in preserving marine biodiversity, promoting economic development, and safeguarding the welfare of individuals (United Nations, 2017).

Key biodiversity and economic/social outcomes (United Nations, 2017):

- Enhanced wellbeing of the coastal communities through increased income levels, improved food security, and livelihoods;

- Conserved the rich marine biodiversity in the Coral Triangle in Malaysia;

- Protected coastal ecosystems against environmental and economic impacts (e.g., climate change, pollution, etc.); and,

- Promoted community-based eco-tourism at Supirak-Pitas and turtle conservation activities at Tigabu, which is located within the TMP (Olivia, 2021). Implemented Fisheries Improvement Program to encourage sustainable fishing (Olivia, 2021).

Table 3.1: Outcomes from projects funded by SGP that contributed to the preparedness of local communities towards the establishment of Tun Mustapha Park

Projects	Grantee Partner	Start and End Date	Funding (USD)	Outcomes
Community based resource management and conservation of marine biodiversity in the proposed Tun Mustapha Park (TMP), Sabah, Malaysia. (Strategic Project)	WWF-Malaysia	May 2014 – Dec 2016	150,000	• Improved the reef status through participation of patrolling from community and enforcement agencies. • Established 5 local associations and community groups to contribute to conservation activities and support the establishment of TMP. • Developed the capacity of 50 community members to be involved in livelihood .programme that contributes to conservation. • Fisheries management of TMP using ecosystem approach through capacity building.
Raise Awareness of the Local Community to the Plight of the Sea Turtle Population of the Kudat Area	Persatuan Pemuliharaan Penyu Daerah Kudat, Sabah	Dec 2013 – Jan 2016	50,000	• Conservation of turtle through turtle hatchery management training. • Improved local livelihood through ecotourism. • Demonstration of micro-credit projects for establishment of coral nursery, handicraft development and organic farming.
Protection of Marine Resources Through Environmental Awareness Program and Patrolling	Banggi Youth Club, Kudata, Sabah	Oct 2014 – Jun 2016	25,000	• Youth participation in sea patrolling, coral restoration and mangrove replanting. • Awareness raising and supporting of establishment of TMP.
The Development and Replication of Handicraft As an Alternative Livelihood in Maliangin Within Proposed Tun Mustapha Park	Persatuan Penduduk Pulau Maliangin, Banggi, Kudat, Sabah	Nov 2014 – Jan 2016	10,000	• Capacity building in natural resource management through development of livelihood programme • Promote sustainable livelihood through handicraft development and marketing

Source: SGP (2017)

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4.0 OVERVIEW OF REGIONAL CHANGE IN BIODIVERSITY

The review of the Southeast landscape highlights a rich heritage of biodiversity. The region enjoys high level of species endemism but habitat loss through human activity has placed many species under threat. The Aichi targets, and more recently the 30 by 30 targets are mechanisms put in place by the global community to counter biodiversity loss through increasing the amount of protected areas. In principle, at least, protected areas are safe havens for ecosystems and species to thrive.

4.1 Terrestrial and Marine Protected Areas (MPA) of Southeast Asia

The current pattern of protected terrestrial and marine areas among Southeast Asia can be seen in Figures 4.1 and 4.2. There is considerable variation in the percentage of protected areas among countries. Strikingly, the level of terrestrial protection is high in countries such as Brunei and Cambodia which stand at 47% and 40% respectively in contrast to countries such as Myanmar (7%) and Indonesia (12%). This may suggest a positive picture for Southeast Asia but unfortunately Brunei and Cambodia have small land areas in comparison to the immensely larger land areas of Indonesia and Myanmar. As such, the higher percentage of protected areas of the smaller countries is unable to offset the lower percentage of protection afforded by larger countries. An examination of the marine protected areas in Southeast Asia yields a worrying picture as there are very few protected areas within the region. Among Southeast Asian countries, (excluding those that are landlocked), Malaysia at 5% has the highest percentage of marine protected areas, Thailand 4%, Indonesia 3%, Philippines 2%, and Cambodia and Vietnam 1%, and the remaining ones, none.

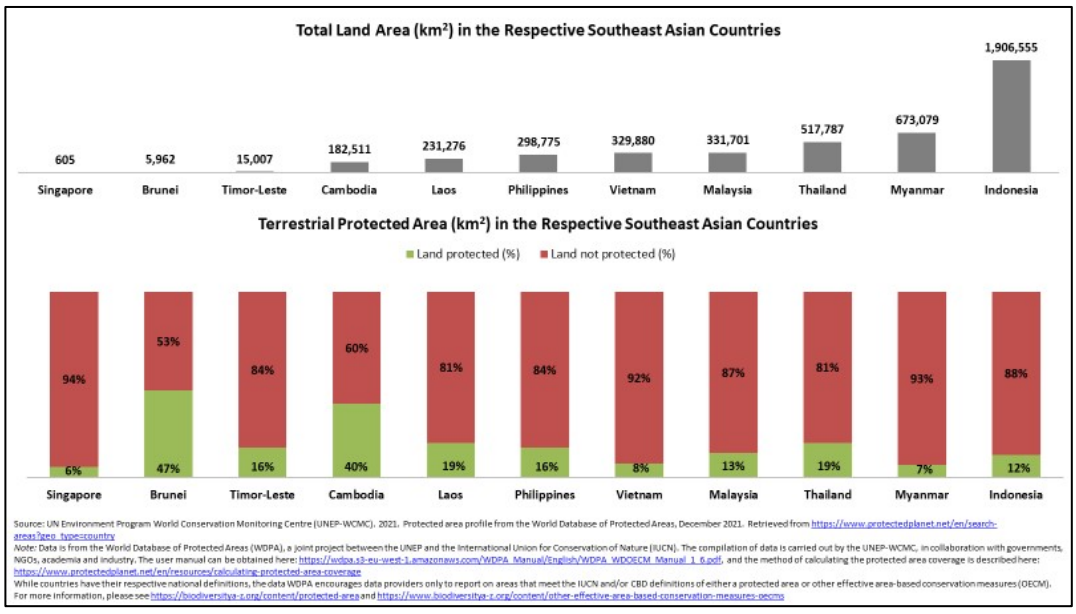


Figure 4.1: Terrestrial protected area: total land area (km^2) and terrestrial protected area (%) in Southeast Asia countries in 2021

Source: UN Environment Program World Conservation Monitoring Centre (UNEP-WCMC, 2019)

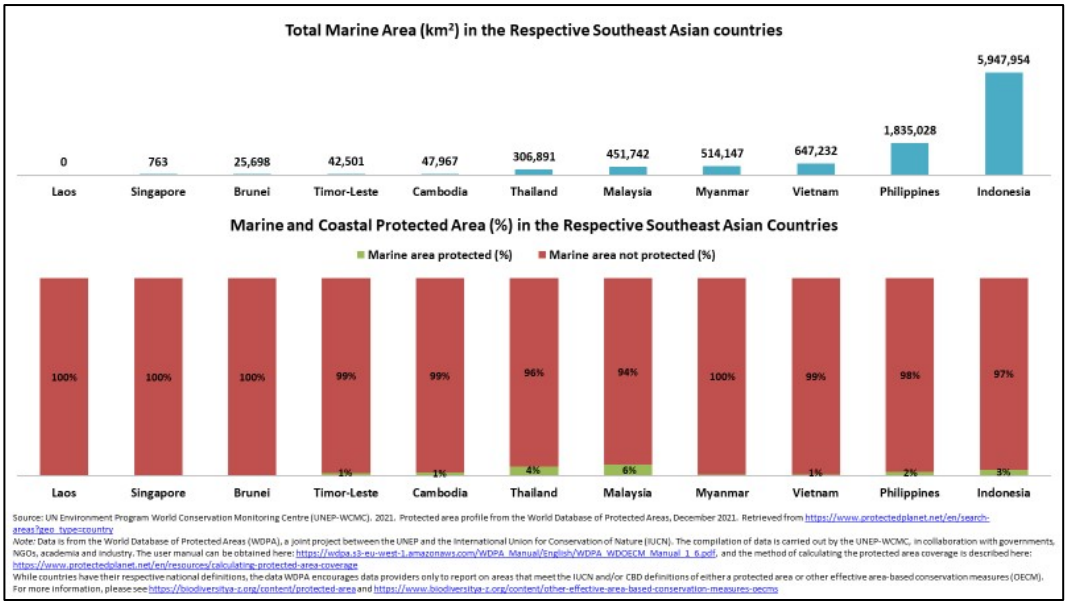


Figure 4.2: Marine protected area: total marine area (km^2) and marine protected area (%) in Southeast Asia countries in 2021

Source: UN Environment Program World Conservation Monitoring Centre (UNEP-WCMC, 2019)

Consideration of longer-term comparative patterns of protected areas between ASEAN and other regional blocs presents a more holistic view of conservation efforts (see Figures 4.3 and 4.4). Historically, Southeast Asia from the 1950s to mid-80s registered an increase of PA from a low stable base position of around 5%. During this time Southeast Asia performed better than OECD and Latin America and Caribbean (LAC) blocs. From the mid-80's onwards, both LAC and OECD countries took significant steps and increased the number of terrestrial protected areas. By late 80s, LAC had overtaken ASEAN and by late 90s OECD also surpassed ASEAN in terms of percentage of protected areas. This pattern continued, with both LAC and OECD pulling further ahead. Middle East and North Africa (MENA) in contrast made very slow relative progress in their initiatives and efforts at conservation through protected areas. The overall trajectory for ASEAN shows that the rate of increase in protected areas was not at the pace observed in the LCA bloc. However, ASEAN was not far behind growth levels observed in the OECD bloc. Considering that ASEAN comprises mainly developing and emerging countries whilst OECD of developed countries, the ASEAN conservation efforts remain significant. Nonetheless, further action needs to be taken to ensure ASEAN keeps pace with OECD and puts in place strategies to meet the aspirational 30% targets.

In contrast to terrestrial protection, the long-term trajectory for ASEAN marine protected areas is relatively flat and much weaker than the benchmark blocs of LAC and OECD. The slow progress in addressing the marine biodiversity in the region is attributed to a number of factors, which are discussed in later sections of the report. Considerable effort must be made to improve upon this languishing status so as to meet the expectations of the 30×30 initiative.

Benchmarking ASEAN's performance vis-à-vis other regional blocs.

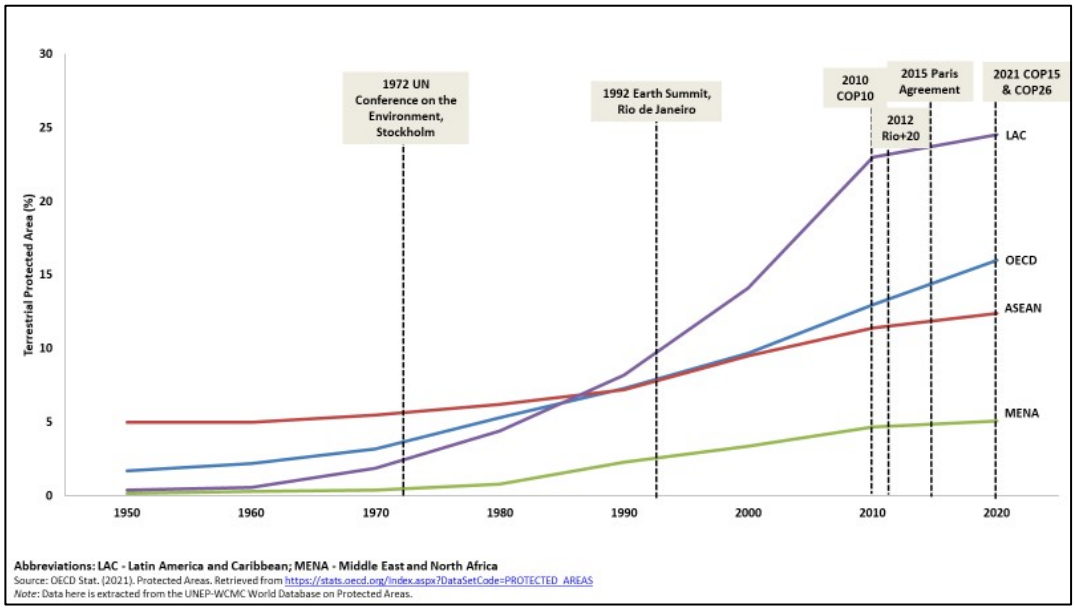


Figure 4.3: Percentage of terrestrial protected area of selected regions and unions between 1950 and 2020

Source: OECD Stat, 2021

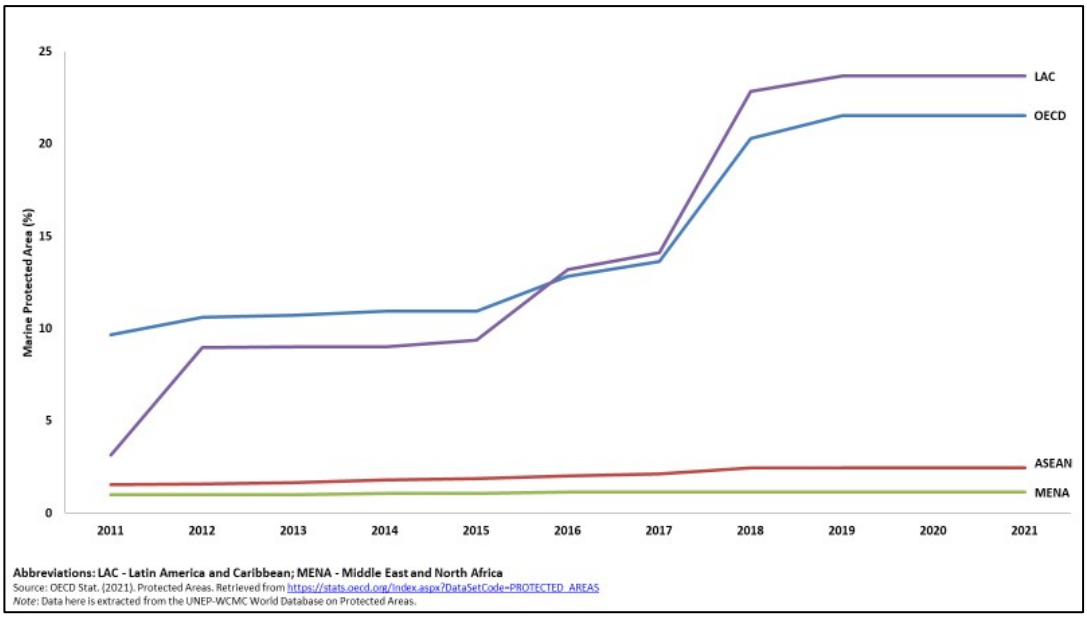


Figure 4.4: Percentage of marine protected area of selected regions and unions between 2011 and 2021

Source: OECD Stat, 2021

Case Study 4.1: Ecotourism Conserves Nature and Brings Economic Benefits

Southeast Asia with its rich biodiversity has successfully shown through its ecotourism efforts that nature and socioeconomic benefits can coexist while generating numerous job opportunities and enhancing the livelihood of neighbouring communities. A recent report on Kuala Tahan National Park, which occupies 54% of the Taman Negara National Park, in Pahang, Malaysia, describes how ecotourism (tourism industry within protected areas) has brought about income generation and poverty reduction (Mukrimah, 2015).

The data sourced in 2012 shows an impressive household income of communities in the area (RM 4,035/month) such that it is almost as much as that within other village communities around the country (RM5,000/month). The area registered a four-fold increase in visitor arrivals from 1990. The survey revealed that an average of about 47% of the monthly household income for the village was derived from activities within the PA (harvesting rattan, bamboo and honey) or outside it (related to forestry and ecotourism, including spill-over business activities, such as from food and beverage outlets, souvenir shops and chalet operations, tour guiding, boatman activities etc.). The rest of the income was not related to forestry or ecotourism and came from salaried jobs in the private or government sector. The highest percentage of cash income was obtained from work as tourist guides. The study clearly shows that ecotourism can reduce poverty among villagers, including that of IPLC, by boosting socioeconomic activities and creating jobs, while maintaining the ecosystem and protecting biodiversity.

Similar dramatic developments have been reported for many ecotourism spots in various parts of Southeast Asia, such as Betung Kerihun National Park, the largest conservation area in West Kalimantan (Sekartjakrarini *et al*., 2015). To quote Reef Watch Malaysia (2019), *"Research suggests that eco-tourists are often prepared to pay a premium to visit undisturbed destinations, with intact ecosystems and cultures. Perhaps this is an alternative tourism model for Malaysia to contemplate in order to protect its fragile ecosystems and ensure they are sustainable for future generations."*

If the 49 ASEAN Heritage Parks (AHP), under the purview of the ASEAN Centre for Biodiversity (ACB, 2021), were to embrace the above approach to value-add on-going activities, the gains to biodiversity protection and socioeconomic development of the region would be highly significant.

4.2 The Human Footprint

Spatial and temporal changes to the environment as a result of human pressures have profound ramifications for biodiversity and human economies. Mapping human pressures to the environment is a fundamental step toward pinpointing priority areas for conservation, or restoration of natural ecosystems and for tracking progress toward policy commitments to conservation.

The human footprint map, a composite measure of anthropogenic pressure on natural ecosystems is considered the most accurate and extensive collective biodiversity threat map (McGowan, 2016). It reflects the totality of ecological footprints of the human population. Human footprint maps give quantitative information on locations where humans are exerting direct and indirect constraints on natural ecosystems, thus altering them from their natural states. Conversely, they also offer insights into where such pressures are absent, and ecosystems appear to be functioning in a more natural state. In quantifying the human footprint, the pressures selected reflect the most critical human activities that can damage local natural systems. Measures of land cover change, such as agricultural and urban land use, connections to natural areas such as by roads or waterways, infrastructures including railways and electric infrastructure, and population density are examples of pressure variables used to compute the human footprint.

Using remotely-sensed and bottom-up survey information on eight variables (including, land cover, infrastructure, and human access into natural areas) Venter *et al.* (2016a, 2016b) constructed a globally standardised measure of the cumulative human footprint on the environment over a 16-year period from 1993 and 2009. This allowed a picture of change in global biodiversity to emerge since the Rio Earth Summit in 1992. They found the global human footprint had increased by only 9% although the global population had increased by 23%, and the world economy had grown 153%. The wealthiest nations and those with strong control of corruption showed the most pronounced decreases in environmental pressures. However, 75% of Earth's land surface was experiencing measurable human pressures. Most worryingly, the most biologically diverse regions of the planet were the ones that were being disproportionately impacted.

The biodiversity trends taking place in Southeast Asia were captured relatively well by the study conducted by Verma and colleagues of the Sundaland region since the Rio Earth Summit (Verma *et al.* 2020). They assessed the human footprint of Sundaland, using the human footprint methodology described by Venter *et al.* (2016a) to measure pressure changes within protected areas (PA), Key Biodiversity Areas (KBA) and bird ranges across Sundaland from 1993 to 2009. The World Database on Protected Areas map (WDPA Consortium, 2018) and World Database of Key Biodiversity Area maps (International Union for Conservation of Nature (IUCN), 2018a) were used to study the dynamics of human footprint exerted on PA and KBA respectively. PA are categorised into six groups by the IUCN based on the levels of protection and restriction (Munoz & Hausner, 2013). Categories I–IV are more restricted, and managed for biodiversity protection, while Categories V and VI are more flexible and allow multiple sustainable use of resources, and attempt to integrate conservation and resource extraction (Munoz & Hausner, 2013). A human footprint score of ≥ 4 indicates there has been intense human pressure in the area and that it can no longer be considered a natural environment. Species are threatened by habitat loss and at higher risk of extinction

beyond this threshold value (Di Marco *et al.,* 2013; Di Marco *et al*., 2018; Jones *et al.,* 2018).

Verma *et al.* (2020) showed that the human footprint was pervasive and had rapidly expanded across PA, KBA, and bird ranges in Sundaland over the 16-year period since the Rio Earth Summit, depriving much of the areas of their status as natural environments. This threatens to thwart PA from achieving their objective of protecting threatened species.

As of 2009, 70.6% of the Sundaland biodiversity hotspot area faced human footprint of ≥ 4, greatly concentrated across Java and coastlines. There was a 55.2% increase in areas under intense human pressure from 1993 to 2009. Moreover, the distribution of human footprint in Sundaland is not uniform. The areas of increased human footprint are concentrated in Sabah, Eastern, Central and Western Kalimantan, Central Sarawak, and in the region of Riau in Eastern Sumatra. Only 10.6% of the biodiversity hotspot registered a decrease in areas under intense human pressure. These small pockets of positive progress are in northwest Peninsular Malaysia and southwest Sabah. Western and Southern Sumatra exhibited minimal changes.

It is disconcerting that the biggest increases in human footprint were in PA of IUCN category 1a, which are in fact intended to give the highest level of biodiversity protection. This implies weak enforcement of bio-protection in Sundaland, and indicates that local dynamics are threatening biodiversity. The results support other studies that indicated that at least 6.5% of forest losses in regions of Kalimantan and Sumatra occurred in areas where forest clearing was prohibited (Broich *et al.,* 2011). For example, the Bukit Barisan Selatan National Park in southern Sumatra, which forms part of the Tropical Rainforest Heritage of Sumatra Natural World Heritage Site experienced widespread habitat loss of up to 10% of its forested area (Allan *et al.,* 2017). This was largely due to encroachment by squatters, who cleared land to plant coffee (Bolliger, 2018).

Research indicates that in Indonesia, category 1a PA that are supposed to be exclusively managed for biodiversity conservation, were not effective at slowing down deforestation (Brun *et al.,* 2015). On the other hand, managed logging concessions were observed to be more effective in curbing deforestation. This appears to suggest that use of timber and logging concessions as buffers around PA, monitoring and prevention of road construction within PA, and prioritisation of control measures in historical illegal logging hotspots may be more effective than depending on PA alone. Gaveau *et al.* (2013), based on studies of Kalimantan's natural forests, similarly reported that combining PAs with natural forest timber concessions may preserve larger forest landscapes than is achievable though PAs alone.

Current policies in Indonesia allow logged forests in natural forest timber concessions to be converted to industrial plantations, such as oil palm or be managed for

rehabilitation and ecosystem restoration. Research suggests that it would be strategically pertinent for the Indonesian government to commit to keep natural forest timber concessions in production alongside PA to collectively conserve its remaining forests, while providing income and employment. This could be accomplished by re-categorising natural forest timber concessions as PA under the IUCN Protected Area Category VI (Brun *et al*., 2015). Such a permanent forest estate would provide advantages for biodiversity conservation and restoration while laying the foundation for further investment in sustainable forestry.

Image 4.1: Logged forests and cleared land for an oil palm plantation in Jambi, Indonesia

Source: Flickr, photo by Iddy Farmer/CIFOR

4.3 Weakness of the Protected Areas Approach

Notwithstanding the positive intent, outcomes of protected areas are not always as expected. When protected areas are appropriately located, well managed and enforced, positive outcomes are forthcoming. However, experience shows that this is not always the case. Verma *et al.* (2020) also noted a mismatch between KBA and allocation/coverage of PA. KBA in Sundaland are mainly situated in (biodiversity-rich) lowland forest. Yet many of the PA locations are in highland areas, leaving the biodiversity-rich lowland forests unprotected.

Malaysia and Indonesia have 19.12% and 12.17% area coverage of terrestrial PAs respectively (WDPA Consortium, 2018), contributing to the Convention on Biological Diversity's Aichi Target 11, which set a global area based conservation target of 17% for terrestrial and inland waters and 10% for coastal and marine areas. However, **based on the human footprint data and following deduction of areas under intense pressure, the actual protection may only be half and one-third of the official protection respectively for Malaysia and Indonesia**. This is in line with findings by Jones *et al*. (2018) that about 30% of the area within global PAs is under intense human

pressure and, in essence, the actual protection conferred by the current network of PAs is much lower than what has been recorded, underscoring the need to improve the accuracy and transparency of global protected area data, including that which countries submit as contributing to global targets established through the Convention on Biological Diversity. Improving the reporting and ensuring accountability will be key for the success of "30×30" initiative, conceived by the High Ambition Coalition for Nature and People (HAC, 2021) which aims to conserve 30% of the world's lands and oceans by 2030 with a priority on the most important ecosystems and ensuring that the resulting system of protected and conserved areas is well connected, fully representative, and effectively managed.

In Sabah too the situation is not encouraging. The human footprint study by Verma *et al.* (2020) observed that the top four species of birds affected by increased area of human pressure were all from Sabah. This finding was concordant with the fact that: (i) Sabah is a primary centre of endemism for birds and other vertebrates in Sundaland, hosting a wealth of species that are narrowly restricted to this state (Eaton *et al.,* 2016); (ii) Sabah has endured some of the largest increases in human footprint over the last few decades. And worryingly many of the species flagged are currently not even recognised as threatened under the IUCN, emphasising the importance and urgency of re-assessing the threat to Sabah endemics. Similarly, the range of all three species of small-island specialist birds that are narrowly endemic to the West Sumatran island chain is completely unprotected, highlighting that **Sundaland's PA network completely ignores an important centre of endemism along the West Sumatran island chain.**

Even though many PA in Sundaland experienced a pronounced increase in human footprint, there are also success stories of proper enforcement resulting in reduced human footprint. An example is the Belum-Temengor forest complex in Peninsular Malaysia, bordering southern Thailand, where the Perak state government gazetted 1,175 km^2 as a state park in 2007 (WWF Malaysia, 2007; Schwabe *et al*., 2015). The Endau Rompin National Park, gazetted in 1993 is another area that has witnessed reduced human footprint. Clearly, timely interventions and proper governance structures are powerful mechanisms for restoration and protection of biodiversity and other natural capital.

4.4 Biodiversity Intactness Index (BII)

Another way at looking at conservation effort is through the Biodiversity Intactness Index (BII). BII is a metric of the average abundance of organisms across a broad range of species in an area, relative to their populations in an undisturbed landscape (Scholes and Biggs, 2005; Newbold *et al.,* 2016). BII provides an indication of the overall biodiversity state of a region, and can be estimated for the past, and modelled to forecast the future under different possible scenarios. It is an important index, because it

estimates the consequence of habitat loss on populations of remaining species instead of determining the number of species that are already extinct. It thus gives an indication of how well local ecosystems can continue to function and provide vital services, that are critical for conservation and sustainable development.

The Intergovernmental Platform on Biodiversity and Ecosystem endorsed BII as an indicator of progress toward the achievement of targets (Aichi Targets 12 and 14) under the CBD. An average BII of 90% (i.e. maximum reduction of 10%) was set under the planetary boundaries framework as a safe limit to ensure maintenance of vital ecosystem function and services. While BII is relevant to longer-term maintenance of function over a much larger scope e.g. biome or global scale, a 20% maximum loss of species richness threshold limit was also suggested. This was based on studies that showed that species loss ranks among the key drivers of primary production and decomposition and the supply of numerous ecosystem services, and losses of local species richness exceeding 20% are likely to substantially impair the contribution of biodiversity to ecosystem function and services (Hooper *et al.,*2012; Newbold *et al.,* 2015). Research has reported that by 2005, loss in local species richness had surpassed the 20% threshold across 28% of the global terrestrial surface, while net reductions in total abundance exceeded the 10% threshold in 48.7% of land (Newbold *et al.,* 2015). In another study, Newbold *et al.* (2016) report that the 90% BII safe threshold had been crossed in 58.1% of the global land surface harbouring 71.4% of the human population, and in 22 of 34 terrestrial biodiversity hotspots. The average BII score was 75% at the global level.

Figure 4.5 represents biodiversity intactness in terms of abundance (BII) and species richness, across various biomes and regions of the world.

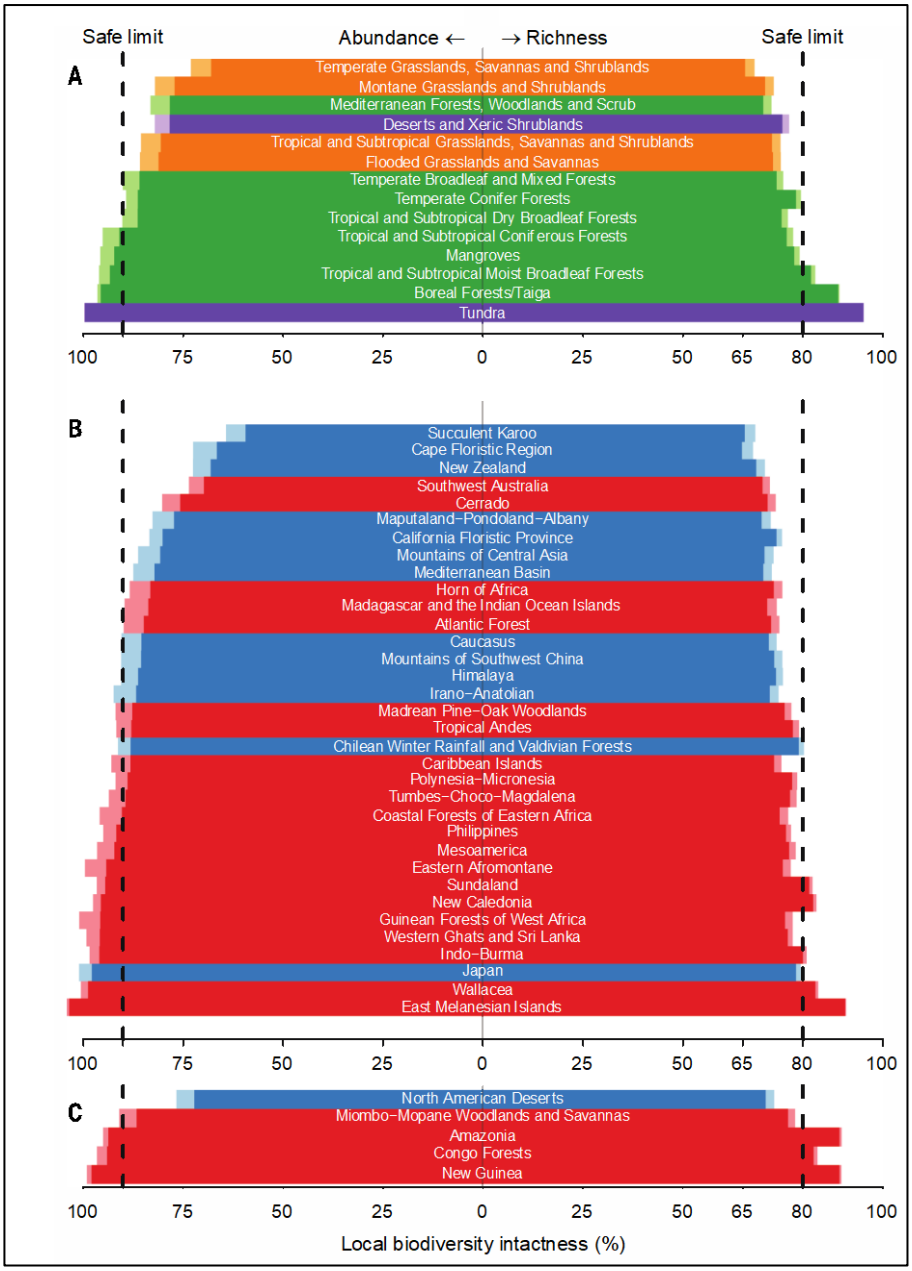


Figure 4.5: Biodiversity intactness for biomes, biodiversity hotspots, and high biodiversity wilderness areas.

Note: (A to C) Biodiversity intactness in terms of total abundance (BII; solid bars on left) and species richness (solid bars on right) in each of (A) 14 terrestrial biomes, (B) 34 biodiversity hotspots, and (C) five high biodiversity wilderness areas. Translucent bars indicate the corresponding relative biodiversity values if novel species are treated as equivalent to those originally present (these numbers can surpass 100% because gains may outnumber losses). Bars in (A) are coloured by major biome type (orange, grasslands; green, forests; purple, other), whereas bars in (B) and (C) are coloured according to whether they are in the temperate (blue) or tropical (red) realms.

Source: Newbold *et al*., 2016

The Biodiversity Trends Explorer, is an online tool launched by the Natural History Museum that enables people around the globe to track BII changes from 2000 to 2050. The tool is accessible to members of the public, and is useful for prioritizing areas for conservation intervention, and for negotiation by policy makers. The tool models 5 different scenarios: i) Sustainable Development, ii) Middle of the Road Development,

iii) Regional Rivalry, iv) Inequality and v) Fossil-fueled Development. Figure 4.6 shows the BII for Southeast Asia as a whole, under the second scenario of Middle of the Road Development. Figure of individual Southeast Asia countries are provided in Appendix A.

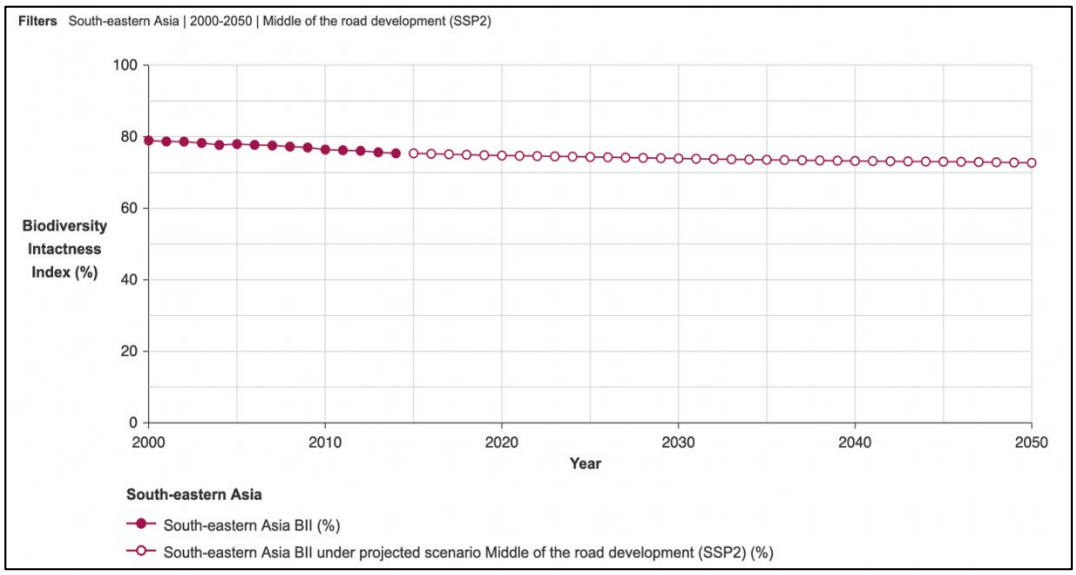


Figure 4.6: BII for Southeast Asia under the second scenario of middle of the road development

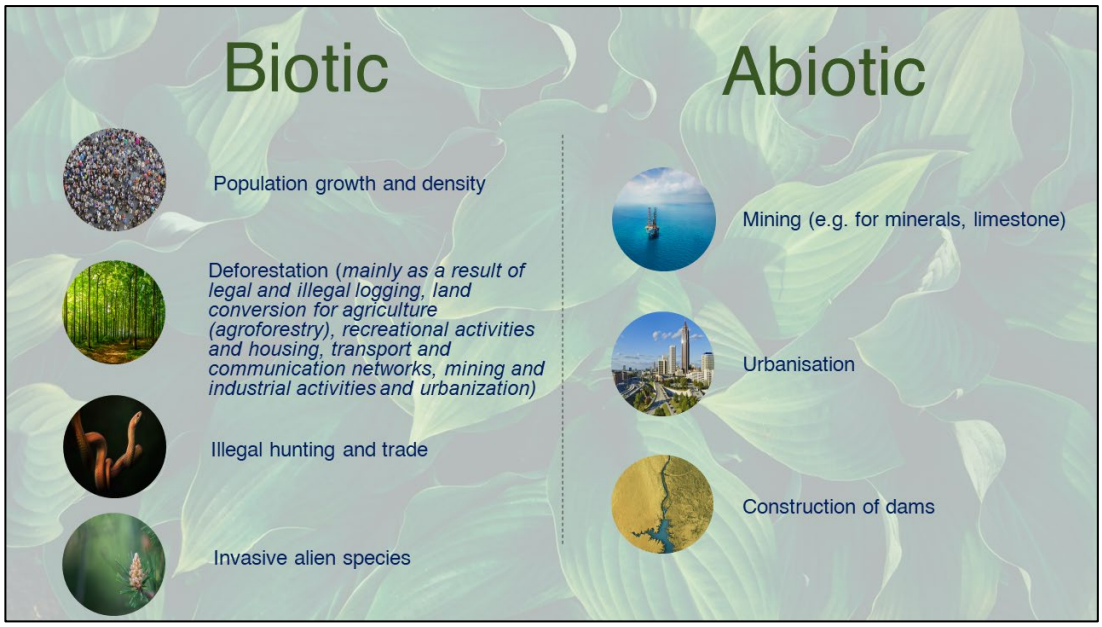
Note: The figures are concordant with Figure 4.5(B) that Sundaland, Wallacea and IndoBurma (IndoChina) are within safe ecological limits. Malaysia has about 80% BII and should increase its conservation efforts. Brunei and Laos, have the highest, whilst the Philippines has the lowest BII among the ASEAN states.
From a broader examination of BII values, it would appear that the world is relying on developing economies, such as in ASEAN with high BII to help alleviate the impact of climate change brought on mainly by developed countries that register dismally low BII values.

While BII is an important spatially explicit indicator, it is important to be cognisant of possible limitations and discrepancies of BII, and not to be complacent about the state of biodiversity. Even though BII is currently accepted as the best metric to assess biodiversity status, Martin *et al*. (2019) cautioned that it may underestimate biodiversity losses, and highlighted possible discrepancies. As examples, he pointed out that Southeast Asia, Central America and eastern Madagascar, despite having a large number of threatened species as a result of large-scale deforestation and habitat loss had BIIs above 90%. A more recent metric termed biomass intactness (BMI) based on assessment of current biomass of vegetation relative to that in the same location in the absence of human disturbance, enabled a more systematic appraisal of the performance of BII. The global average BMI was approximated to be 50% of what it would be without human disturbance, contrary to the BII of about 85% reported by Newbold *et al.* (2016). Similarly, several areas with low BMI such as Brazil, China, and Europe had high BII suggesting that the loss of most primary vegetation has not been accompanied by a proportional decrease in species' populations. Comparison with the human footprint index (HF) confirmed a possible discrepancy in the BII metric. As predicted, BMI scores were inversely related to HF, but BII did not strictly follow this pattern. The mismatch between BMI and BII is most obvious in global biodiversity

hotspots where BMI scores were low, and yet BII suggested that the biodiversity was within safe limits. In fact, BMI and BII were negatively correlated across all 32 biodiversity hotspots, with less intact biomass having higher BII. Further validation of the accuracy of BII may be necessary in view of the discrepancy that BII is unpredictably high when BMI is low and HF high. Clearly, more reliable instruments are necessary into the future to accurately reflect the true status of global biodiversity.

5.0 DRIVERS OF BIODIVERSITY LOSS AND THE IMPACT

Biodiversity loss is driven by a combination of forces. These are categorised as **biotic** and **abiotic drivers**.



Each of these is examined and discussed with respect to biodiversity loss and economic development, citing specific examples as significant to the ASEAN region.

5.1 Biotic Drivers

5.1.1 Population growth and density

The expansion of human population and resultant heightened demand for resources are the key drivers of biodiversity loss in Southeast Asia. Sodhi *et al.* (2010) found that human population density was negatively correlated with percentage of remaining natural forest, and positively correlated with percentage of threatened bird species within Southeast Asia. Based on the United Nations estimates, as of 19 October 2021, the population of **Southeast Asia** was **677,162,159** which is equivalent to 8.58**%** of the total global population (Worldometer, 2021). There is also an increasing urban population in most of Southeast Asia. Urban population is positively correlated with the number of species (both plant and vertebrate) listed on the IUCN Red List as Vulnerable, Endangered and Critically Endangered (Sodhi *et al.,* 2010).

5.1.2 Deforestation

Deforestation is among the greatest threats to terrestrial biodiversity in Southeast Asia which has one the highest deforestation rates in the world with an average annual loss of 1% during the first decade of the century (Miettinen *et al.,* 2011).

Peat swamps encountered the most dramatic declines of 2.2%. Lowland evergreen forests decreased by 1.2% annually. Two areas with severe forest loss exceeding 5.0% yearly were the peatlands of Sarawak, and eastern lowlands of Sumatra, both of which lost about 50% of their peat swamp forest within a decade. While forest loss was concentrated in lowlands of Southeast Asia in the first decade of this century, the following decade saw an acceleration of deforestation in the mountain forests largely because there were less remaining suitable lowland forest areas for conversion for agriculture. Mountain forest loss represented a significant portion of the total forest loss increasing from 24% to 42% in 2019 (Feng *et al.,* 2021). The total mean annual forest loss during 2001−2019 was 3.22 Mha yr^{-1} of which 31% was mountain forest loss.

Besides reducing the habitats and thus endangering the existence of numerous endemic forest species, the high deforestation rates especially of peatlands which store tremendous amounts of carbon would have had serious global consequences as a result of dramatic increase in carbon emissions. The mountains of Southeast Asia have higher forest biomass and hence higher carbon stocks than lowland forests. The accelerated mountain forest loss also has serious implications on climate change.

Agriculture

There are various agroforestry practices in Southeast Asia ranging from small scale fruit farming, a minor driver of deforestation, to **large scale plantations like oil palm, rubber and wood pulp that feature as major drivers of deforestation**. The increasing demand for vegetable oil and the high productivity of oil palm have made it one of the world's most rapidly expanding crops, but often at the expense of primary forest mass. This has been especially intense in Malaysia and Indonesia, which together account for more than 80% of the global palm oil supply. **Forest conversion to oil palm was responsible for 94% of Malaysia's deforestation from 1990 to 2005** (Wilcove & Koh, 2010).

Southeast Asia is also a major producer of natural rubber. Although predominantly a smallholder crop, it contributes to 85–93% of total world production (Fox & Castella, 2013). Besides crops the region has also been a prominent global producer and exporter of timber products since the 1950s (International Tropical Timber Organization (ITTO), 2008). Unsustainable logging practices were carried out for many decades due to poor forestry policies (Ross, 2001). But even selective logging and ecologically sustainable harvesting methods can cause significant forest degradation and affect species richness (Foody & Cutler, 2003) i.e. biodiversity.

While there is an urgent need to preserve their remaining forests, countries in Southeast Asia are targeting to increase their agricultural production and improve infrastructure network. A sustainable approach to development that minimises trade-off costs is important. The Heart of Borneo Initiative is an example of such an approach.

Case Study 5.1: The Heart of Borneo Initiative

Borneo, the world's third largest island, accounts for only one percent of total global land. Yet it houses 6% of global biodiversity, particularly within its pristine forests. But this precious natural resource has been at high risk of being totally depleted. As much as 50 percent was wiped out over the last three decades. Hence in 2007, the Heart of Borneo (HoB) Initiative was formulated in Bali, Indonesia on 12 February by three concerned regional signatories, namely Malaysia, Indonesia & Brunei. It is a conservation initiative to protect 23.4 million hectares of forests in central Borneo. Within the designated area are nature reserves such as the Bentung Kerihun National Park mainly in Indonesia, but bordering also with Sarawak, Malaysia. The park is the largest and richest conservation area within the HoB. It offers a prime example of how biodiversity conservation and protection efforts can simultaneously deliver valuable socioeconomic benefits to citizens of a country, through ecotourism and its multiplier effects. Besides the physical attractions, the Dayak community (IP) around it are further adding value to the experience by providing a more wholesome cultural exposure from opportunities for interaction with park visitors. This successfully implemented ecotourism opportunity has prompted plans to further expand the project (Sekartjakrarini *et al*., 2015). However, the pristine forested regions in HoB have also faced challenges; two mega-infrastructure projects were established in it: 1) *Trans-Kalimantan Road Network* – 5,316 km (16 routes across Kalimantan 2) *Pan Borneo Highway* – 2,333 km of major routes across Sabah and Sarawak. While both these highways have provided much needed transportation access across Borneo island (see insert below) and the opportunity to increase economic development, it has also brought in its wake an increase in the level of forest depletion, destruction, exploitation and appropriation by investors, e.g. the development of an "oil palm belt", although the latter does effect economic development and enhances the growth of human and physical capital while lifting communities out of poverty (see Section 5.3).

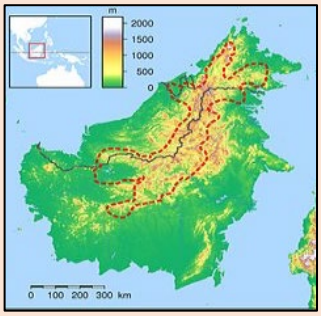


Image 5.1: Map of the proposed Heart of Borneo area
Source: WWF / Sadalmelik


Image 5.2: Pan Borneo Highway in Sarawak (Phase 1)
Source: Bimasia.

But such anthropogenic activities inevitably disrupt wildlife, deplete biodiversity and impact the life of IPLC (see Section 1.3), besides upending the topography of the region. On the flip side it does provide citizens and IPLC the chance for a better livelihood, arising from new infrastructure or spill-over effects that create new job opportunities and business activities, as is expected to happen also once the new ultra-modern capital of Indonesia rises in East Kalimantan, also located within the HoB (refer Box 5.1). With this latest projected development, it is even more vital now, for good governance and a revamped ecosystem supported by new nature-based local and international financing (see Section 7.2), to be initiated urgently within the HoB. A successful roll-out will establish HoB as a model that can be replicated around the region as it would showcase what can be achieved once there is a good fit between biodiversity conservation and economic development.

5.1.3 Illegal Hunting and Trade

The increased purchasing power of a bourgeoning middle-class population in Southeast Asia coupled with an appetite for wildlife products often associated with status and even presumed health benefits has created a huge demand for such products (Nijman, 2010). The illegal wildlife sale within and from Southeast Asia for the pet trade especially for birds and mammals is among the highest globally (Bush *et al.*, 2014). Although the destruction of rainforest ecosystems in Southeast Asia has been largely attributed to rampant deforestation, a recent study has discovered that widespread and intensive hunting, often with indiscriminate snares is a more immediate causative factor (Tilker *et al.,* 2019). Hunting and illegal wildlife trade represent the biggest threat to Southeast Asia's vertebrate diversity and abundance, with many sites of predominantly intact forest losing much of their former diverse and abundant vertebrates, especially in the Annamites where intensive indiscriminate hunting largely with wire snares even in protected areas has greatly reduced terrestrial mammal and bird populations. The study has recorded that 25 species became functionally extinct in the Annamites forest as a result of illegal hunting in comparison to 4 species that went extinct in the logged forests of Sabah. The findings emphasise the need for stricter monitoring on illegal hunting. Over 200,000 snares were removed by wildlife rangers from just five protected areas in Southeast Asia, including Nam-Et Phou Louey, between 2010 and 2015 (Gray *et al.,* 2017).

Technology is an essential tool for monitoring and tracking wildlife trade. In addition to sophisticated use of scripts to decipher trafficking patterns of online auction sites (Kretser *et al.,*2014; Lavorgna, 2014), molecular technology has played a key role in detecting and preventing trade in wildlife especially endangered species. DNA barcoding including metabarcoding can detect and identify animal species in traditional medicines and has the power to discriminate authentic from adulterant material in raw materials, processed products and even within complex preparations (Luo *et al.,* 2013; Yang *et al.,* 2018).

Citizens are ultimately the best solution to the problem. Education and engagement with society on sustainable practices is required across ASEAN to change human behaviour, and stigmatise illegal trade in and consumption of wildlife. The ***trading in wildlife at the Wuhan markets and the suggested zoonotic transmission of*** SARS-CoV-2 from there should serve as a stark reminder of possible dire consequences of legally or illegally traded wildlife.

5.1.4 Invasive Alien Species

Invasive Alien Species (IAS) are species that are accidentally or deliberately introduced into an environment outside their natural geographical range. They pose a serious threat to native species and ecosystems, cause economic loss, and are the third largest threat

to biodiversity worldwide after habitat destruction and species exploitation (WEF, 2020). Increasing globalization, together with environmental changes including climate change, favour the introduction and establishment of IAS. International trade is a key route for IAS, through trade in new plant species and animals. Transportation and shipping and trade in agricultural commodities, can also lead to unintentional introduction of IAS.

As IAS transcend national borders, **it is important to have coordinated action at the ASEAN rather than just at the national level.** Combining information on invasion and establishment of IAS can strengthen early-warning and eradication strategies especially, since most countries have limited capacity to act. **A legislative framework should be in place to manage and mitigate the impact.** The importance of mitigating the spread and impact of IAS is recognised under the Convention on Biological Diversity (CBD). Article 8(h) of the CBD states that *Each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of control or eradication of those alien species which threaten ecosystems, habitats or species.*

In Southeast Asia, invasive plants have clogged up waterways, and invasive fish have displaced native species thus transforming aquatic ecosystems (Yong *et al*., 2014). One of the most destructive invasive weeds threatening ASEAN and global natural ecosystems is the giant salivinia (*Salvinia molesta*). It is found in different waterbodies including water catchment areas, irrigated rice fields, ponds and slow-moving rivers. It has infested naturally occurring oxbow lakes in Kinabatangan, Sabah in Malaysia. Mechanical and physical control have been ineffective and uneconomical. However, biological control using the weevil *Cyrtobagous salviniae* has proven to be highly effective in Peninsular Malaysia and has recently been distributed in Sabah also so as to establish populations in areas infested with *S. molesta*.

Image 5.3: Clidemia hirta
Source: Wikimedia, photo by Forest & Kim Starr

The IAS, *Clidemia hirta* from tropical America suppresses the native canopy tree species that are dependent on gaps for successful regeneration. It was postulated to have the potential to modify the forest ecosystem at Pasoh Forest, a near pristine primary forest in Peninsular Malaysia by changing the composition of the plant communities in the treefall gaps thus altering forest regeneration (Peters, 2001). It thus suppresses the native canopy tree species that are dependent on gaps for successful regeneration.

As Southeast Asia is mainly an agricultural region, early monitoring and rapid action at the operational level are extremely important for mitigating IAS, especially those that may destroy crops. Malaysia adopted the National Action Plan on Invasive Alien Species (NAP IAS) in 2014−2018 which was subsequently renewed

in 2020 for adoption between 2021 and 2025. NAP IAS provides a valuable framework for policymakers, government agencies, and private institutions engaged in IAS management, and is anticipated to play a pivotal role in mobilising resources including relevant experts in various fields to address IAS issues in Malaysia.

In particular, disruptive technologies can play a pivotal role in the management of IAS in the region and countries should leverage these powerful technologies to enhance biosecurity. One of these, genomics, with its high molecular precision is a powerful tool for rigorous diagnostics, identification of sources and risk assessments. DNA barcoding, the use of unmanned aerial vehicles (UAVs), engineered biomimetics, acoustic detection and genetic biocontrol are a few additional disruptive technologies.

5.2 Abiotic Drivers

5.2.1 Mining

Mining is a major driver of biodiversity loss that has received less attention than other drivers. There are two main types of mining in Southeast Asia, both of which have a serious impact on biological diversity**: i) underground mining for minerals and ii) mining of limestone outcrops (karsts) for the production of cement.**

Mining for minerals
ASEAN accounts for a significant share of global trade in tin, copper and nickel with Indonesia and Malaysia ranked as the 7th and 15th largest exporters of minerals. Malaysia was the world's biggest exporter of copper powder in 2019 (OEC, 2019a). Copper ore was the second most exported product of Laos in 2019 making it the world's 17th largest exporter of the mineral in 2019 (OEC, 2019b). While developing and operating a mine has a direct impact on biodiversity, for example by the clearing of land, there is also a multiplier effect caused by problems such as pollution of ground water from seepage, heavy metal accumulation, soil destruction and altered soil chemistry and fauna from open cast mining (Andres & Mateos, 2006). Aquatic diversity may especially be affected by mining activities (Brosse *et al.,* 2011; Wantzen & Mol, 2013). Coal mining is the fourth largest contributor to deforestation of large parts of Indonesia, especially Sumatra and Kalimantan (Abood *et al.,* 2014) indicating that despite having in place a framework for environmental management of mining (Maryati *et al.*, 2012), it has obviously not been properly implemented.

Mining of limestone outcrops (karsts)
The cement industry has been growing exponentially in tandem with the increase in construction and urbanisation. Limestone is the most common form of calcium carbonate which is used extensively for the manufacture of cement. **Vietnam and Malaysia are among the top five exporters of limestone** in the world (OEC, 2019a).

Karsts are associated with rich self-contained biodiversity. The often extreme soil and water conditions within karsts and their isolated characteristic, have provided the perfect environment for the creation of **unique biological species**. Karsts thus represent hotspots of endemism, and harbour highly specialised species. However, such species that are highly adapted to extreme environments cannot survive outside those habitats, and are prone to local extinction from environmental disturbance. They need to be also protected so that genome research can be conducted to unravel the unique features of their genomes.

Southeast Asia has an extensive karst landscape, and eight of the 47 world-heritage protected karsts are in this region (Williams, 2008). Limestone caves are also an important habitat and resource for many species of bats. The steep topography and general inaccessibility of karsts have allowed many such landscapes to retain their forest cover and serve as a refuge for many species that have adapted to their new habitat when their previous habitat in surrounding more accessible forests were destroyed by anthropogenic activities. However, the refuge offered by karsts is being seriously **threatened by quarrying activities**.

Although a few mining companies have started to pay more attention to reducing their negative impact, **the IUCN has yet again urged stronger commitment to stop further extinctions** (IUCN, 2014). Destruction of limestone habitats is especially alarming since for example, when these normal habitat of bats is disturbed or destroyed, it could easily open the door to new pandemics as viruses coexisting in bats may now find their way into the human population.

5.2.2 Urbanisation

In 2019, 50% (334,418,881 people) of Southeast Asia's population already lived in urban areas (Worldometer, 2021). The urban populace is forecasted to increase to 66% by 2050 (United Nations, 2014). As urbanisation in Southeast Asia intensifies, the demand for ecosystem services will become increasingly critical. It is pertinent for the region to **preserve natural ecosystems through urban ecosystem services (UES) planning** as it has been shown that conserving nature and supporting provision of UES is usually more cost effective than restoring ecosystems that are degraded (Holl *et al.,* 2000). As such, due consideration and priority should be given by authorities to ecological resources like river corridors and remnant forest patches during the initial planning and development stage of cities, as these habitats cannot be readily re-created later. Urban green spaces can support biodiversity and confer a whole spectrum of ecosystem services, such as by helping to filter air pollution and mitigate urban heat island effects.

Very few studies have been carried out in Southeast Asia on maximising urban biodiversity (Lourdes *et al.,* 2021). More research is also required on the unique and diverse socio-cultural attributes of Southeast Asia that need to be taken into

consideration in efforts to support land use planning and decision-making. An excellent success story is evident in Singapore, the only developed country in Southeast Asia (see Case Study 5.2).

Case Study 5.2: Singapore: A Green Garden City

The transformation of Singapore from a dirty and polluted city to one of the cleanest and greenest cities in the world is one of the globally recognised success stories of Southeast Asia. The idea of creating a garden city was first announced by its founding Prime Minister Lee Kuan Yew on 12 May 1967. It was aimed at improving the quality of life of its citizens and improving tourism. A target of the garden city project later renamed 'Singapore, a city in a garden' was to introduce vegetation into public spaces. New laws such as the '*Parks and Trees Act'* were enacted and implemented "*to provide for the planting, maintenance and conservation of trees and plants within national parks, nature reserves, tree conservation areas, heritage road green buffers and other specified areas compelling agencies, both government and private to put aside spaces in their buildings and projects for trees and vegetation…"*


The Straits Times, 12 May 1967, Page 4

Article also available on Microfilm Reel NL12193

Previous Article Next Article

S'pore to become beautiful, clean city within three years

PM ANNOUNCES TWO-STAGE PLAN

SINGAPORE, Thursday

A TWO-STAGE plan, which will make Singapore into "a garden city beautiful with flowers and trees, and as tidy and litterless

Today, greenery covers over 40 percent of Singapore. This includes nature reserves, parks, gardens, roadside greenery, skyrise greenery and vacant lands (National Parks Board Annual Report 2020/2021). Acting as expanded habitats for flora and fauna, and green buffers to reduce human pressure on the nature reserves, the nature parks protect them from the impact of urbanisation and human activities. Further nature parks are currently being established to buffer the Bukit Timah and Central Catchment Nature Reserves to protect them from the impact of urbanisation and serve as complementary habitats. Park connector networks bridge different parks. As of 2020, Singapore has a Park Provision Ratio of 0.78 ha/1,000 population, 360 km of park connectors open to recreational activity and 93% of households are within a 10-minute walk to a park. Greening efforts on streets include multi-tiered planting to create a forest- like structure (National Parks Board Annual Report 2020/2021). In efforts to restore Nature into the built environment, in 2009 the National Parks Board of Singapore introduced The Skyrise Greenery Incentive Scheme which promotes greenery on high-rise buildings and now has become an important component of sustainable urban development in Singapore.

The success story of Singapore in creating a garden city despite its limited biodiversity sends a clear message to other Southeast Asian countries that they can do as well or better. Long term vision rather than a focus on short-term gain, and policies grounded on sound economic policies are the way forward.

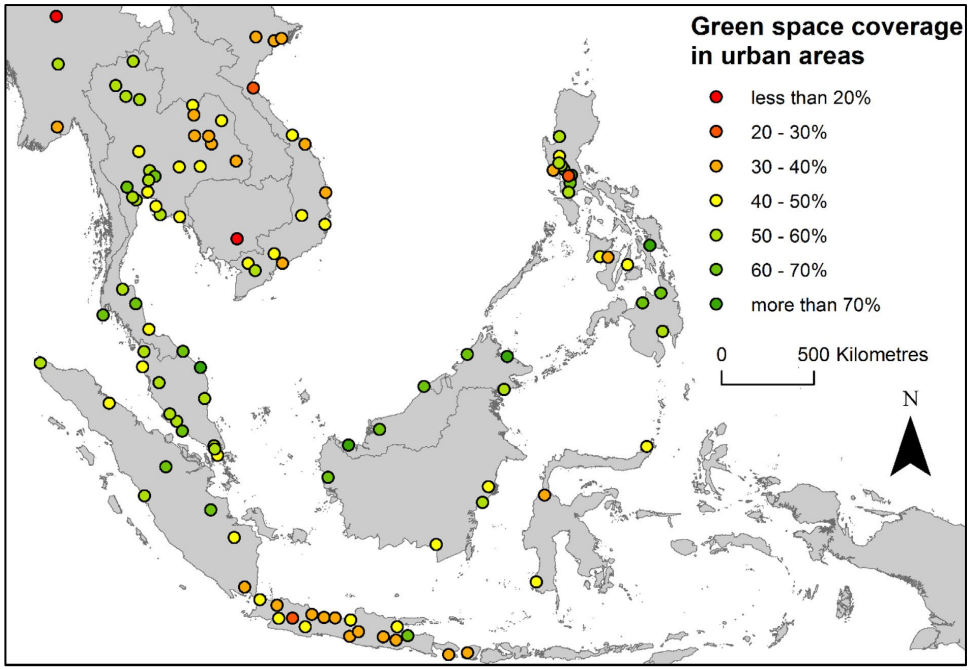


Figure 5.1: Percentage coverage of green space in 111 cities in Southeast Asia
Source: Richards *et al.*, 2017

Malaysia has relatively high green space coverage, while Indonesia and Vietnam have less coverage. The Philippine city of Tacloban was recorded as the greenest city with 79% green cover whereas Mandalay in Myanmar had the least with only 17% cover. **The wealthier cities with higher GDP per capita had significantly more green space.**

By 2000, almost the whole of the urban landscape of Southeast Asia was located within biodiversity hotspots (Guneralp & Seto, 2013). Most of this urban land was spread across two biodiversity hotspots: Sundaland and Indochina with approximately 13,000km^2 in Sundaland (covering most of Peninsular Malaysia and the island of Java), and around 10,000km^2 in the IndoChina hotspot (includes a major portion of the region's mainland) (Elmqvist *et al.,* 2013). It has been projected that urbanisation of East Asia and Southeast Asia will disproportionately impact protected areas and increase four-fold (Elmqvist *et al.,* 2016) with the predicted median distance from a protected area to a city in Southeast Asia decreasing from 57km in 1995 to 40km by 2030 (McDonald *et al.,* 2008). This does not augur well for the "30×30 initiative".

It is important to put in place management practices such as biodiversity corridors in areas that have a strong probability of urbanisation. While urbanisation presents myriad challenges, it also offers unprecedented opportunities to improve sustainability by introducing innovating systems for increased resource efficiency, and through improved stewardship of biodiversity and ecosystem services, both within and beyond city boundaries. **A framework must be in place to reconcile urban development and biodiversity.**

ASEAN has started to address the problem. On November 13th, 2018, ASEAN Sustainable Urbanisation Strategy (ASUS) was launched. **ASUS provides a sustainable urbanisation framework focusing on six areas and 18 sub-areas (see Figure 5.2)** which are closely aligned to the ASEAN Smart Cities (ASC) framework under the ASEAN Smart Cities Network (ASCN). The six areas are: i) civic and social, ii) health and wellbeing, iii) security, iv) quality environment, v) built infrastructure, vi) industry and innovation.

As ASEAN cities have developed differently at various paces and have had their own challenges, they can learn from each other's experiences and relative advantages to customise their own urbanisation strategies based on their unique situations. **Connecting cities through ASCN will help coordinate and expedite such efforts and help shape urbanization strategies that can reconcile urban development and biodiversity**. A good opportunity to test-bed these strategies would be the relocation of the capital of Indonesia from highly congested Jakarta to what is expected to be an ultra-modern, nature-sensitive metropolis in east Kalimantan (see Box 5.1). Plans for the new development have been consolidated by the passing of a law in parliament on 18 January 2022 approving its relocation and providing a legal framework on how development of the capital will be funded and governed (Reuters, 2022). If successfully executed by applying the ASUS strategies as well as good governance under a strong 8i ecosystem (see Section 5), Indonesia could offer the world an invaluable template for the construction of modern cities that are eco-friendly, and nature-sensitive while also maintaining enough green spaces to ensure richness in both urban development and biodiversity.

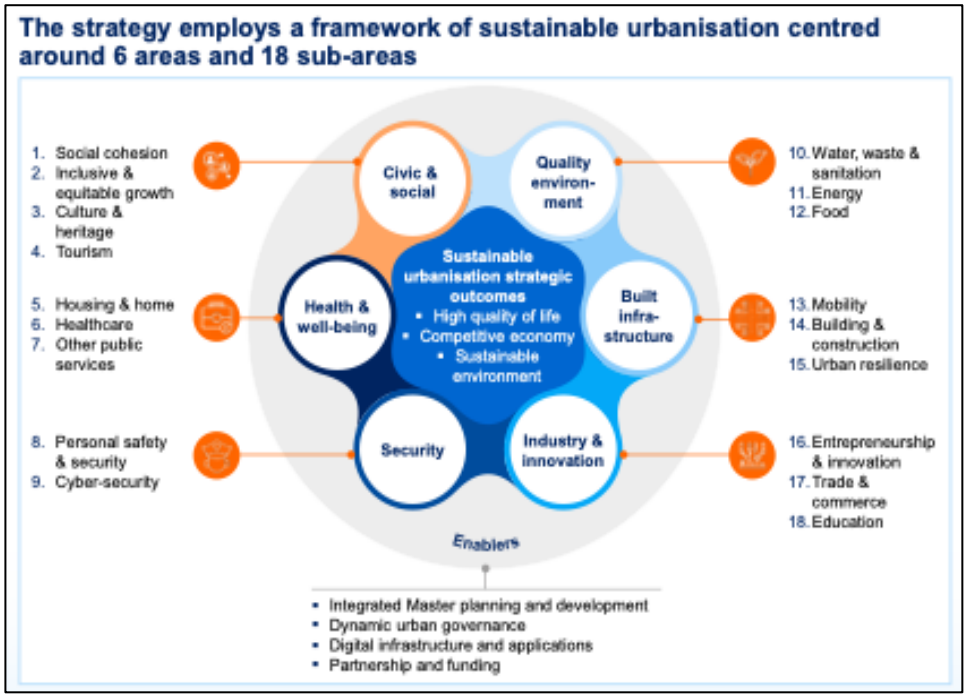


Figure 5.2: The ASUS Framework

Source: ASEAN Sustainable Urbanisation Strategy (ASUS) Report, 2018

Box 5.1: Indonesia's capital relocation plan to Kalimantan, Borneo

In 2019, President Joko Widodo announced the relocation of Indonesia's capital from Jakarta in Java Island to East Kalimantan in Borneo, with an expected completion date by 2024 (Clark, 2021). Planned as an ultra-modern smart city driven by the latest in technologies, it is to be a cradle for innovation and creativity while establishing ecosystems that would promote environment-friendly activities. The plan therefore includes the use of renewable energy and clean technology to drive social and economic development which should then go a long way towards ensuring sustainable livelihoods (Sardjono, 2021).

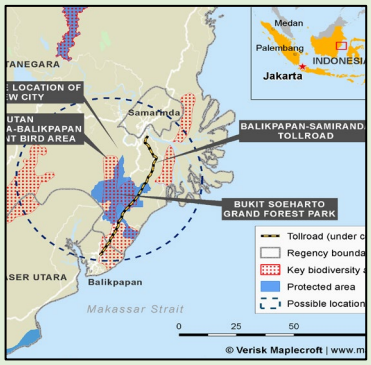


Image 5.4: Proposed city location could overlap with a protected forest park and areas of important biodiversity

Source: Verisk Maplecroft/ Dobson, 2019

An award-winning architectural design is already in place and even an initial budget of Rp510 billion has been allocated, as of October 12, 2021. Funds are also expected to flow in from the Middle East, especially UAE. However, alarm bells are already ringing as pristine forests are starting to be logged. A transboundary highway development in Kalimantan, the Indonesian portion of the Borneo Island that sustains about 37 million hectares of native tropical forest, has become a hive of intense activity ever since news broke about the location of the new capital (Alamgir *et al*., 2019). Infrastructure development in the West Kalimantan Kapuas Hulu district has warranted substantial issuance of concessions, alongside the establishment of large oil palm plantations. In 2013, the plantation area in Mahakam Ulu was about 3,000 hectares but it has since grown exponentially to reach 25,000 hectares within 6 years (Dinas Perkebunan Provinsi Kalimantan Timur, 2020). Oil palm companies have taken over 80% of the land. Sadly, at least 13,000 hectares of concessions originate from ancestral lands of the indigenous Dayak community in Kalimantan (United Nations, 2020).

Image 5.5: A gas station at Kayan river, Kayan Monitoring National Park

Source: Wikipedia ESCapade

Roads connecting to Nunukan that are to be completed by 2023, will dissect protected and reserve areas, including the Kayan Mentarang National Park, which is an important refuge for numerous species, and a home for the largest unbroken stretch of protected rainforest in Borneo. It is right in the centre of the initiative, which is home to more than 10 indigenous groups.

Such fragmentation of the intact Kalimantan Forest by land clearance, infrastructure expansion and development, will have detrimental ecological impact on the rich biodiversity including key native species, as well as upending the ecological dynamics within the heart of Indonesian Borneo (Laurance & Arrea, 2017; Sloan *et al*., 2019). There is still time to rethink development plans by instituting good governance supported by political will so that the dream of establishing an eco-friendly and ultra-modern smart city that advocates sustainable livelihoods through strong advocacy for planetary health, can indeed be realised.

5.2.3 Construction of Dams

Another driver of biodiversity loss is the construction of dams. According to a projection by the International Energy Agency, demand for electricity in Southeast Asia by 2040 will grow by two-thirds. In general, **hydroelectric power is considered an efficient, powerful and green source of energy that maximally leverages the countries' topography and resources.** Dams have also been used for flood control, irrigation, and navigation. However, there is increasing recognition of their negative effects which can far outweigh their benefits. Degradation of organic matter in the dams produces greenhouse gases such as methane, carbon dioxide and nitrous oxide (Demarty & Bastien, 2011). Rasanen *et al*. (2018) reported that one in five dams along the Mekong River emit even more GHG than fossil fuels. **Dams and reservoirs also have a significant negative impact on biodiversity.**

Entire river-catchment systems are altered, including aquatic as well as terrestrial flora and fauna. The destruction of aquatic habitats results in a loss of fish breeding sites, and a reduction in fish stock which in turn lead to the erosion of food security and puts pressure on livestock in remaining unaltered areas. **Dam construction entails land clearing which leads to soil erosion, a decline in water quality, sediment transport and silting as well as increased likelihood of landslides along the river course** (Li *et al.,* 2013). Forest clearing results in habitat destruction as well as loss of carbon sequestration. The development-forced displacement and resettlement (DFDR) of indigenous people, and their loss of sustenance is a human rights issue of particular concern (Aiken & Leigh, 2015). Heightened awareness of the detrimental effects of dams on the environment, and their failure to provide anticipated economic benefits (World Commission on Dams, 2000) have resulted in **hesitancy by the World Bank to fund further construction of dams in Southeast Asia** (The Economist, 29th Nov 2003; 13th June 2007). However, dams continue to be built throughout Southeast Asia as governments consider them as key to their development agenda for income generation and poverty alleviation, besides providing energy security (see Case Study 5.3).

Case Study 5.3: The Once Mighty Mekong

Sustainable development in the Lower Mekong Basin is dependent on the conservation of biodiversity and natural capital. The construction of dams along the Mekong, Southeast Asia's largest river, to augment a thriving hydropower industry is an example of how well-intentioned plans have gone awry and not yielded the expected positive outcomes to the environment.

Image 5.6: Dams along Mekong River.
Source: The ASEAN Post, 2019

The Mekong, the second most biodiverse river in the world after the Amazon River is of great strategic importance. The lower Mekong Basin sustains more than 60 million people (Mekong River Commission (MRC), 2011) representing 10% of the ASEAN population. The Mekong River is the world's largest inland fishery accounting for about 2.3 million tonnes of freshwater catch per year (Mekong River Commission (MRC), 2011). Construction of dams on the Mekong River and its tributaries is threatening the capacity of the Mekong River basin to sustain fisheries as well as upland and riverbank agriculture.

By 2019, there were 89 hydropower projects in the Lower Mekong Basin, 65 in Lao PDR, 14 in Vietnam, 7 in Thailand and 2 in Cambodia (MRC n.d.). Based on a study by the Mekong River Commission Council (Mekong River Commission (MRC), 2017), hydroelectric power was the sector with the greatest potential to boost economic development along the Lower Mekong Basin especially for the fisheries, agriculture and navigation sectors, all of which are important for food security, flood management, drought relief and regional trade. The study projected economic gains exceeding $160 billion by 2040. However, hydropower is also linked to the highest biodiversity trade-offs. It has been estimated that the impact on fisheries could result in losses of about $23 billion while that from forests, wetlands, and mangroves could amount to as much as $145 billion by 2040.

According to a survey caried out by the ASEAN Studies Centre of the Institute of Southeast Asian Studies (ISEAS) – Yusof Ishak Institute, in Singapore, many ASEAN nations are concerned about the impact of the environmental problems of the Mekong on regional food security and climate change. There is an urgent need for ASEAN to pay greater attention to the Mekong. This is especially so considering riparian countries are among the world's main rice exporters. However, ASEAN's compartmentalised sub-regional approach to many issues has not given the problem its due full attention. **There is a need for ASEAN to recognise the seriousness of the Mekong basin issues by considering Southeast Asia as a whole and discarding its current sub-regional stance** (Hoang & Seth, 2021).

Sarawak - the Industrial Powerhouse of Borneo

The Sarawak State Government's plan to transform the state into the industrial powerhouse of Borneo via the development of a multitude of hydroelectric mega-dams

was conceived to provide clean and green energy to the Sarawak Corridor of Renewable Energy. Although the Sarawak Integrated Water Resources Management Master Plan concluded that the abundant water resources from the annual rainfall made hydroelectric power generation a viable option, there were serious concerns about the impact on the environment and local communities (Aeria, 2016). Lessons can be drawn from the Bakun Hydro-electric Power Dam (see Case Study 5.4).

Case Study 5.4: The Bakun Hydro-electric Project (BHP)

The Bakun dam, the largest in Southeast Asia and located on a tributary of the Rejang River in Sarawak received approval for construction by the Malaysian government in 1986 but after several setbacks, delays and controversies, and an escalated cost of RM7.3bil, impoundment started in October 2010 (Sovacool & Bulan, 2011). It was fully commissioned in July 2014. **Transparency International included Bakun Dam in its 'Monuments of corruption' Global Corruption Report 2005** (Transparency International Global Corruption Report, 2005).

The Bakun dam at full capacity can generate 2400 Megawatts of electricity. The artificially formed reservoir with a storage volume of 43.8 billion m^3 is the largest lake in Malaysia, and approximately the area of Singapore. Its impoundment resulted in the destruction of 69,640 ha of virgin forest home to one of the oldest and richest biodiversities on the planet. Although the Bakun Hydroelectric Project was touted as the Green Energy for the Future (Economic Planning Unit (EPU), 1996), it never was as green as envisaged. The biomass in the of forestland and river valleys was not cleared prior to inundation, so that the Bakun dam is now a significant producer of greenhouse gases, predominantly methane, carbon dioxide and hydrogen sulphide from the decomposition of organic matter from the 69,640 hectares of submerged forest, vegetation, wildlife, and soil (Choy, 2005a; Aeria, 2016). It also had major socio-economic impact on the indigenous communities inhabiting the Bakun area.

Had a proper check and balance mechanism grounded on the 8i ecosystem framework been in place, the Bakun dam project would have been a success story providing environmental, economic and social benefits. **However, as iterated by Sovacool & Bulan (2011),**

"If for no other reason, then, Bakun is an excellent case study for policymakers because it intimately sketches the anatomy of failure, a failure of government planning, implementation, and oversight, no matter how technically sound the dam's concrete face, spillway, or powerhouse become…"

Large hydropower dams create serious social challenges for local communities. Indigenous peoples are especially vulnerable as they have depended largely on the land where the dams are built for their livelihood. They enjoy few of the benefits of the building the dams but on the contrary suffer from economic and social marginalisation. The Bakun Dam is an example of such social injustice (see Case Study 5.5).

Case Study 5.5: The Dam that Resulted in Major Social Impact to the Indigenous Communities

The Bakun dam forced the displacement and marginalization of the whole indigenous population estimated to be 10,000 people, mostly indigenous Orang Ulu from 15 communities inhabiting the Bakun area. They were forcibly removed from the approximately 70,000 hectares Bakun dam area to a 4,000 hectare Resettlement Scheme at Sungai Asap (Sovacool & Bulan, 2011) in the middle of an oil palm plantation, a considerable distance from their original homes and any notable town.

This raised serious issues of sustainability as it brought about socio-economic collapse and cultural extinction of the indigenous people who had previously been living independently and self-sufficiently, relying on the forest for hunting, gathering of forest products and agriculture (Choy, 2005a). The displacement of the indigenous populations from their ancestral lands disrupted their traditional social and cultural practices that are tightly linked to access to the land and forest at Bakun. Based on the Human Rights Commission of Malaysia Report (Suhakam, 2009), 80 percent of the land in the Asap Resettlement Scheme was not suitable for cultivation. The remaining 20 percent that was cultivatable was rocky and distant. To make matters worse, the resettled families were compelled to fork out about RM50,000 to RM60,000 to the government for the individual apartments in the longhouses built for them (Aeria, 2016). Isolated from their river surroundings where they had access to fishing and river transportation, and forced to resettle on poor soils while having to pay for their apartments, they were essentially forced into abject poverty. According to the Human Rights Commission of Malaysia Report (Suhakam, 2009), the average annual family income in Resettlement Scheme at Sungai Asap was a meager RM 5,000, mainly from the sale of food and vegetables. However, at a bare minimum, about RM 16,000 is required to subsist. The meagre income also exposed the truth that the goal of the resettlement programme ostensibly to generate higher income for the indigenous community by restructuring their socio-economic activities, failed miserably.

5.3 Oil Palm and Biodiversity

Oil palm (*Elaeis guineensis*) is the world's largest source of vegetable oil and thrives in regions representing biodiversity hot spots. Increasing global demand for palm oil has resulted in rapid expansion of the global oil palm planting area.

Image 5.7: Aerial footage of oil palm and the forest in Sentabai Village, West Kalimantan

Source: Flickr, photo by Nanang Sujana/CIFOR

Between 1990 and 2010, oil palm hectarage increased from 6 to 16 million hectares worldwide, with Malaysia and Indonesia at the focal point of this aggressive development (Pirker *et al.,* 2016). About 30% of this expansion occurred on peat soils, resulting in large CO_2 emissions (Carlson *et al*., 2012; Miettinen *et al.,* 2012) and disruption of ecosystem services.

According to The IUCN Red List of Threatened Species™, at least 193 threatened species are affected by global palm oil production (Figure 5.3). Oil palm expansion has reduced the diversity and abundance of most native species and has been largely responsible for the decrease in species such as orangutans and tigers.

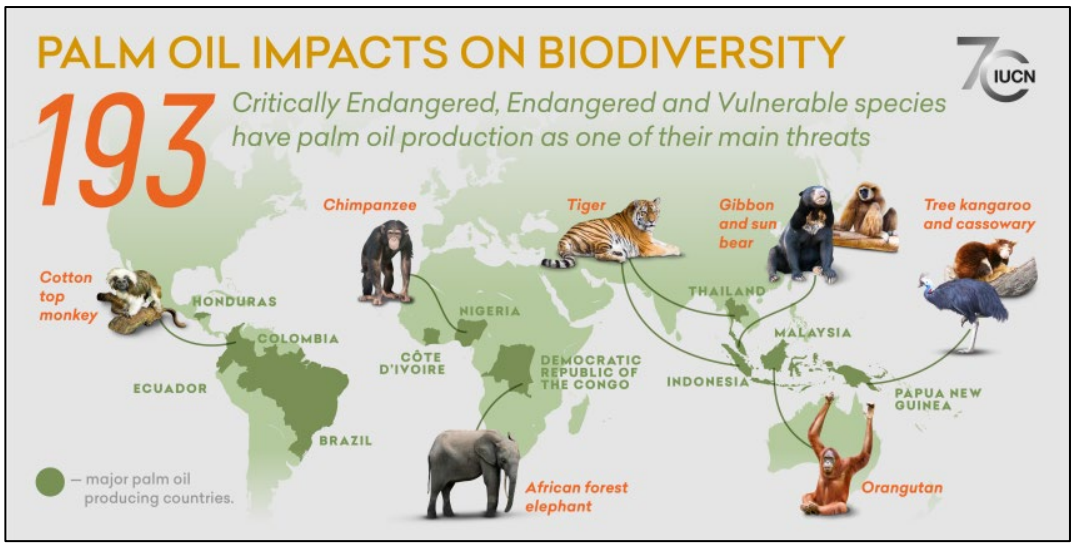


Figure 5.3: Impact of Oil Palm on Biodiversity

Source: International Union for Conservation of Nature (IUCN), 2018

5.3.1 Superior Productivity of the Oil Palm Vis-à-vis Other Oil Crops

Despite the effects of the oil palm on deforestation and loss of biodiversity, its superior productivity makes it irreplaceable in the face of increasing global demand for food and fuel. Planted on just 0.36% of world agricultural land and 7% of the total land attributed to oil crops, oil palm contributes to 36.5% of global vegetable oils (Oil World, 2018)**. It thus has the lowest global footprint in terms of land use compared to other oil crops.** On average, oil palm produces 3.9 t/ha/yr of oil compared to 0.7 t/ha/yr for rapeseed, 0.6 t/ha/yr for sunflower, and 0.4 t/ha/yr for soy (d'Enghien, 2016).

The world population is projected to reach 9.8 billion in 2050 according to the United Nations and FAO. To help meet the needs of such growing populations, the global demand for vegetable oils is estimated to reach 310 million tonnes by 2050 compared to the current annual consumption of 165 million tonnes (International Union for Conservation of Nature (IUCN), 2018). Table 5.1 summarises information to indicate which is the best oil crop to meet this additional demand of 145 million tonnes, based on current oil yields of the major oil crops, and the additional land that would be required:

Table 5.1: The best oil crop to meet this additional demand of 145 million tonnes

Crop	Yield/ha	Extra land required to meet additional demand by 2050 (M ha)
Oil palm	4.0	38
Rapeseed	0.75	193
Sunflower	0.63	230
Soya	0.39	372

Oil palm with the highest yields/ha and the lowest amount of extra land requirement is by far the most suitable crop for effective land use. A shift from oil palm to other oil crops is not an answer as it would lead to further clearing of forest and a shift of biodiversity loss to the regions producing the alternative oil crop. However, it has to be acknowledged that palm oil needs to be produced more sustainably. Yield improvement is a means of reconciling oil production and forest conservation. The Malaysian palm oil industry is committed to increasing yield and productivity by good agricultural practices and placing emphasis on R&D in biotechnology including genetics and genomics. The Malaysian Palm Oil Board's (MPOB) successful sequencing of the oil palm genome, and its ground-breaking discoveries of genes of economic importance including the *Shell* gene, the single most important determinant of oil quality for oil palm were published in Nature (Singh *et al.,* 2013a, 2013b; Ong-Abdullah *et al*., 2015) and have paved the way for increased yield and sustainability. The discoveries led to the development of the first ever molecular diagnostic assays to screen out low yielding palms thus ensuring improved land use and increased economic benefits.

Economic analysis predicted annual economic gains of ~$300M USD to Malaysian GNI annually by application of DNA testing for just the *Shell* gene (Ooi *et al*., 2016). In 2019, the Malaysian government announced the capping of oil palm planted area at 6.5 million ha. Malaysia has also announced stopping the planting of oil palm in peatland areas and strengthening regulations concerning existing oil palm cultivation on peatland. Additionally, oil palm plantation maps will also be made accessible to the public for greater transparency.

5.3.2 Oil Palm and Rural Socio-Economic Development

The industry has contributed to alleviation of rural poverty. Oil palm plantations have created millions of jobs and enabled tens of thousands of smallholder farmers to own their own land. Smallholders account for about 40% of oil palm cultivation in Southeast Asia. Smallholder schemes such as the Federal Land Development Authority (FELDA) scheme in Malaysia and corporate-led development of smallholder schemes in Indonesia have played a significant role in alleviating poverty. In fact, the FELDA scheme which started in 1956 as a resettlement scheme for landless peasants, with the aim of eradicating poverty and raising incomes has been heralded as one of the most successful land settlement organisations in the world (Sutton, 1989). The World Bank Group Framework and The International Finance Corporation (IFC) Strategy for Engagement in the Palm Oil Sector (World Bank, 2011) reported *"The recent rapid expansion of oil palm activity in Indonesia is associated with significant poverty reduction. For example, in 2005 and 2008, reported national headcount poverty rates in Indonesia were roughly equal at 15.7 and 15.4 percent, while districts with increases in palm oil production saw significant poverty declines over the same period."* In 2019, it was estimated that the palm oil industry had lifted 2.6 million rural Indonesians out of poverty (Edwards, 2019).

5.3.3 Producing Palm Oil Sustainably

Certification, complemented by good agricultural practice and strong governance plays a critical role in advancing the environmental and social sustainability of oil palm by promoting greater transparency in the value chain. Approximately 19% of all globally produced palm oil is RSPO (Roundtable of Sustainable Palm Oil)-certified (RSPO 2021). In comparison only 1% of all soy is certified by the Round Table on Responsible Soy Association (RTRS) (Solidaridad 2020).

Case Study 5.6 describes the efforts of Sabah's efforts to become the world's first sustainable oil palm state.

Case Study 5.6: Sabah Aspires to be World's First Sustainable Oil Palm State

Sabah, which produces about 6 percent of the world's palm oil launched the Jurisdictional Certification of Sustainable Palm Oil (JCSPO) initiative in 2015, with a target of producing 100% [1]RSPO certified palm oil by 2025 in efforts to be a global leader in the production of sustainable palm oil (WWF, 2021; Taylor, 2022). Currently about 26% of palm oil produced in Sabah is RSPO-certified. A jurisdiction refers to a region with governmentally or administratively defined boundaries. Thus, in the case of JCSPO, the region (jurisdiction) gets certification for palm oil produced within its boundaries rather than a specific agency. The jurisdictional approach allows a more a structured way to secure broader commitments toward sustainable practices across the state from stakeholders (businesses, local communities, local government, and NGOs) by aligning interests and coordinating actions. The JSPO initiative, will facilitate efforts by the State government to address deforestation in the palm oil supply chain by implementing appropriate strategies, policies and measures. According to the WWF (2021), *the Sabah JCSPO has been globally recognized as a pioneering model to address deforestation from the palm oil supply chain.* In practical terms, the JCSPO represents a 2-step approach which first requires national (MSPO) compliance, followed by RSPO compliance. Implementation has started in priority landscapes. WWF-Malaysia is involved in the Living Landscapes programme funded by Unilever and HSBC which will be implemented in Sugut, Tabin (Laha Datu) and Tawau landscapes. A Sustainable Palm Oil Team set up by WWF-Malaysia offers technical support and guidance to growers within the landscapes to form growers' groups and subsequently obtain group certification under the RSPO.

Kindly refer to Annex 2 for a more detailed description of the drivers of biodiversity loss and the impact.

6.0 BIODIVERSITY AND CONSERVATION IN SOUTHEAST ASIA

6.1 Gap Analysis of the Region's Ecosystem

The analysis in the previous sections highlights that Southeast Asia has several areas of strengths as well as challenges with respect to biodiversity and conservation efforts. Its natural ecosystem, one of the most globally diverse habitats, is home to many unique flora, fauna and biological species that are not found in other regions. It is also an important carbon sink for the world. Many sectors of the economy in the region are dependent on the available natural resources. Good biodiversity conservation practices will have a significant spill-over impact on multiple sectors of the economies, with the potential to create value-added jobs.

While the natural ecosystem has significant potential for generating socioeconomic and environmental value for communities in the region, many countries struggled to make significant and measurable progress towards meeting the Aichi Biodiversity targets.

Box 6.1: The 8R-Nature-centric Philosophy

The 8R-Nature Centric philosophy (N8R philosophy) has 8 elements that interact and combine to create an all-encompassing outlook for conservation and protection of biodiversity. The elements are outlined as follows:

1. **Respect:** Inculcate appreciation for natural ecosystems in the region and ensure resources in the ecosystem are managed effectively in a manner that protects the biodiversity and unique biological species in the region.
2. **Rethink**: Shift in mind-set of people, industry and nation states from a "what can we get from the natural ecosystem" ("Profit Maximisation") mindset to a "Purpose Maximisation" mind set, in order to transition from unsustainable practices to a perspective that builds on a regenerative framework by ensuring biodiversity and conservation are core to all human activities.
3. **Reduce**: Reduce our human footprint by minimizing human encroachment into ecological ecosystems as a way to protect biodiversity and endangered species. This includes reducing carbon footprint and release of harmful waste by-products from human activities.
4. **Reuse**: Develop materials and products that can be used multiple times. This helps reduce demand for resources from the natural ecosystem and prevents depletion at rates faster than the ecosystem can regenerate. This also reduces the level of waste that ends up in landfill sites, rivers and oceans resulting in adverse impacts on the biodiversity and conservation efforts of the region.
5. **Recycle**: Ensure all forms of waste (bio-degradable and non-biodegradable) are recycled to support a Circular Economy.
6. **Replant:** Increase the 'green' cover so as to ensure that there is an adequate 'carbon sink' to balance human activities that contribute to carbon emission.
7. **Repurpose**: Develop creative ways to increase the RoV from biodiversity of the natural ecosystem. This includes creating nature-centric socioeconomic drivers.
8. **Revitalise**: Increase investments for the revitalisation and preservation of biodiversity and biological species within their natural habitats.

Figure 6.1: 8R-Nature Centric Philosophy
Nair, Ahmed and Vaithilingam (2022).

Earlier parts of the report highlighted key aspects of the state of play of biodiversity within Southeast Asia (Sections 4.0 & 5.0). In this part we present an evaluation of the biodiversity ecosystem, using an 8i framework which provides a systematic way of

assessing gaps in the ecosystem, especially those that contravene full compliance to the *8R-Nature-centric philosophy*[1] (see Box 6.1). The 8i-ecosystem framework and each of the enablers are presented in Figure 6.2.

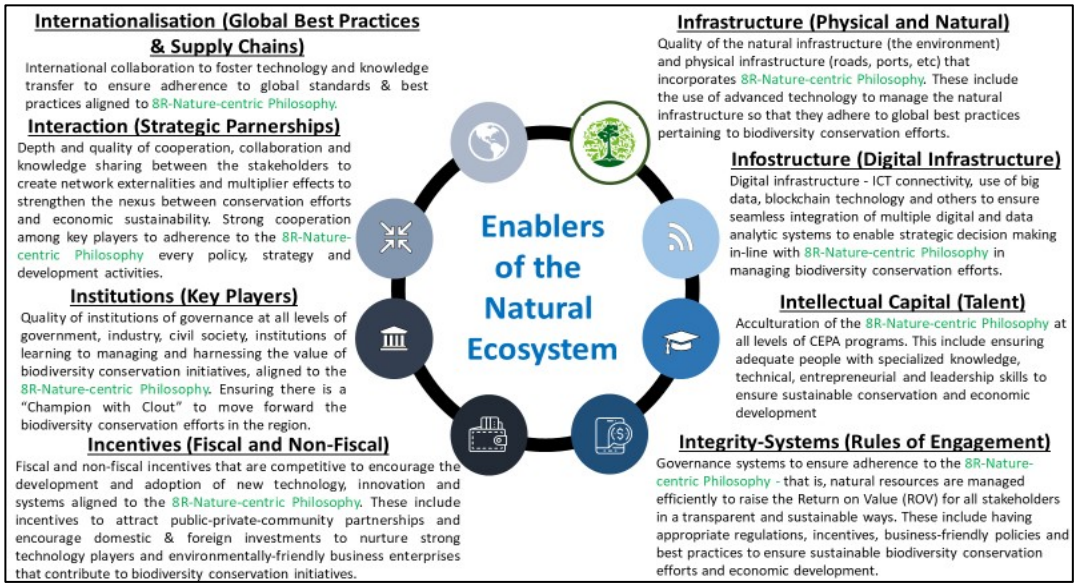


Figure 6.2: Characterising the enablers of the natural ecosystem: 8i-ecosystem analysis

Note: The 8i-ecosystem was adapted from Nair, Ahmed and Vaithilingam (2022). Other applications of the 8i-ecosystem model can be found in Strategic Paper on Precision Biodiversity (ASM, 2020a); 10-10 Malaysian Science, Technology, Innovation and Economy (MySTIE) Framework: Trailblazing the Way for Prosperity, Societal Well-Being & Global Competitiveness (ASM, 2020b).

[1] A detailed analysis can be found in Nair, Ahmed and Vaithilingam (2022).

Using the 8i ecosystem framework a gap-analysis of the ecosystems of Southeast Asia was conducted. The key gaps identified, based on the 8i-ecosystem enablers are detailed as follows:

1. **Infrastructure (physical and natural)**
    - **Gap 1:** The number of protected areas and other effective area-based conservation measures (e.g., state parks, marine protected areas, community conserved areas etc.) in most of the Southeast Asia countries continue to lag behind targets and must be increased substantially to achieve the 30 by 30 goal (Protected Planet, 2022).

    - **Gap 2:** Biodiversity conservation efforts in the Southeast Asia region have been hampered by the increase in the number of large infrastructure projects that do not incorporate a holistic nature-based approach. Besides adversely affecting and displacing indigenous people and local communities in many parts of Southeast Asia, large scale infrastructure projects (such as dam construction, reclamation of land and other development projects) have had a major impact on the biodiversity of ecosystems (ASEAN Studies Centre, 2021; Hughes, 2017; Maclnnes, 2021). The design and construction of physical infrastructures more often than not fail to adequately account for the impact on the natural ecosystem. For example, the close proximity of roads to forest regions in Sabah has resulted in increased animal road-kills and a heightened risk of declining wildlife populations (Miwil, 2021).

    - **Gap 3:** Advanced technologies have been insufficiently utilized in natural ecosystems to monitor important indicators, such as the level of environmental degradation, biodiversity loss and poaching (Raitzer *et al*., 2015; Institute for Development Studies (Sabah), 2019; Ministry of Water, Land and Natural Resources Malaysia, 2019; Yunus, 2019; Ekawati *et al*., 2022). Inadequate adoption and integration of advanced technology in the monitoring, management and control of the "natural infrastructure" (land, river, sea, and air) perpetuates destruction and disruption of natural ecosystems. Adoption of advanced technologies could allow countries in the region to combat extensive exploitation by various nefarious agents of ecological destruction.

2. **Infostructure (digital architecture and disruptive technologies)**
    - **Gap 4:** Southeast Asian countries have experienced an increase in information and communication technology (ICT) penetration rates and the region is a major exporter of ICT hardware. However, Southeast Asia has been weak in developing ICT services (Vu, 2017). While many countries in the region are currently using technologies, such as satellites, sensors, and drones to carry out vital economic activities, adoption of advanced technologies in biodiversity and conservation efforts remains limited. For instance, a lack of tracking devices in the half a million fishing boats across the Indonesian archipelago impedes the

collection of reliable data to monitor regulation compliance among fishermen (Ekawati *et al*., 2022).

- **Gap 5**: In addition to low uptake and poor quality infostructure, lack of inter-operability of diverse information and communication systems used by various stakeholders, as well as the lack of integrated data management systems have led to data fragmentation and a duplication of efforts by different agencies (Latt, 2017; Convention on Biological Diversity, 2019). Uncoordinated ICT strategies within Southeast Asia countries and across the region means efforts at conservation are not cost-effective.

- **Gap 6:** Use of digital governance systems is relatively low among Southeast Asian countries. This has prevented streamlining of processes and instead allowed high levels of bureaucracy to persist in the implementation of environmental programmes and policies. (Hasnain, 2017; Kearney, n.d.; Milakovich, 2014). The low use of a digital governance system makes it difficult to manage complex multi-institutional relationships among players within the ecosystem resulting in weak oversight and governance. This provides space to undertake and potentially perpetuate rent-seeking and moral hazard behaviour in the management of biodiversity conservation initiatives (Hasnain, 2017; Pelicice, 2019). This feeds back and further undermines the adoption of transparent comprehensive nature-based solutions to manage the natural ecosystem.

3. **Intellectual capital (communication, education and public awareness):**
   - **Gap 7:** Even though within Southeast Asia the ASEAN Eco-School initiative is in place, the level of education and awareness about nature-based solutions, climate change and environmental consciousness generally remains low among citizens (Khai & Yabe, 2014; Hassan, 2021). As the importance of biodiversity is little understood, its intrinsic value is often overlooked, which has allowed the rise of unfettered industrial and economic development across Southeast Asia. For example, the Biodiversity Baseline Survey 2018 indicated that 91% of Malaysians possess poor understanding of the significance of biodiversity (Ministry of Water, Land and Natural Resources, 2019; Hassan, 2021).

   - **Gap 8:** While there is growing recognition and adoption of ESG in Southeast Asia, more effort is required to expedite this process, especially given the fact that sustainability initiatives are adopted at different rates by organisations of distinct sizes (Bloomberg, 2021; Oxford Business Group, 2021). Adoption of ESG is often slower among small and medium enterprises (SMEs), partly because of their lower awareness and knowledge on how to implement ESG programmes (Groves, 2020). The problem is further exacerbated by the cost of

ESG training and compliance. This is an important consideration, given SMEs represent a significant proportion of the economy in the region (Schaper, 2020).

- **Gap 9:** There is a lack of capable personnel, equipped with ample technical knowledge of biodiversity conservation, to meet the needs of agencies and other conservation bodies in the region (e.g. Ahmad, 2015; Sajise, 2015; Ministry of Natural Resources and Environment, 2016; Republic of the Philippines, 2016).

- **Gap 10:** More effort is needed to increase formal training of indigenous and local communities to support them in their on-going activities to safe-guard and manage the biodiversity of their natural habitats (Ministry of Natural Resources and Environment, 2016; Tong, 2020; Hamid, 2021).

4. **Integrity system (governance)**
   - **Gap 11:** There are numerous environmental policies to protect biodiversity and promote good conservation efforts in the region. However, implementation of these policies tends to give way to economic imperatives, even if these economic activities have an adverse impact on natural ecosystems (Lee, 2021; Sahabat Alam Malaysia, 2021; The SunBiz, 2021).

   - **Gap 12:** Robust monitoring mechanisms to measure the effectiveness of environmental programmes are lacking (Ministry of Water, Land and Natural Resources Malaysia, 2019; Tong, 2020), and are often weakly coordinated and weakly aligned. Federal and/or state legislations to protect endangered and threatened species are often not comprehensive (Krishnasamy & Zavagli, 2020).

   - **Gap 13:** In many Southeast Asian countries, significant inadequacies and loopholes exist within their national legislations. These inadequacies include low fines and weak penalties, substandard requirements for monitoring and managing captive facilities (e.g., breeding facilities and zoos), as well as legal loopholes that render law enforcement agencies powerless or disinclined to take actions against illegal activities (Krishnasamy & Zavagli, 2020). In view of this, ASEAN countries have been urged by TRAFFIC Southeast Asia to improve conviction and prosecution rates of wildlife poaching, trading, and trafficking (Zainal, 2020).

   - **Gap 14:** Wildlife protection laws are poorly harmonized, even within a country far less across the ASEAN member states. For example, biodiversity policies vary significantly across Peninsular Malaysia, Sabah, and Sarawak (Zainal, 2020).

- **Gap 15:** Importantly, there is an absence of robust market mechanisms (both the supply and demand sides of the ecosystem resources and services) in Southeast Asia that encourage the development and adoption of environmental-friendly technologies, products and services. This hinders the region from developing new eco-friendly industries and jobs which could help reinforce biodiversity and conservation initiatives.

- **Gap 16:** The problem of pervasive negative market externalities, such as rent-seeking and moral hazard behaviour continues to haunt ASEAN countries (Krishnasamy & Zavagli, 2020). Notwithstanding the regions' participation in the United Nations Convention Against Corruption (UNCAC), corruption remains a prevalent problem. In fact, with the exception of Singapore and Brunei, most Southeast Asia countries are ranked at the bottom half of the Transparency International's 2021 Corruption Perceptions Index (Transparency International, 2022). The perils of corruption within the realm of conservation and biodiversity efforts are substantial, ranging from enabling illegal trade and smuggling activities, hindering investigations and prosecutions of law offenders, to facilitating large scale land mismanagement (e.g., deforestation) (Ganda, 2020; Krishnasamy & Zavagli, 2020; Bertrand, 2021). Examples of past corruption incidents in Southeast Asia include the alleged bribery of forest regulators in Indonesia to gain logging permits or access to forests managed by the Ministry of Forestry, as well as the "protective immunity" of rhino horn dealers in Vietnam (Wildlife Crime Initiative, 2015, p.12). While the sale of rhino horns is illegal, it is considered as an accepted "open secret" and rhino horns have long been sold by retailers and traditional medicine practitioners.

5. Incentives (fiscal and non-fiscal incentives)

- **Gap 16:** While the last few decades have seen an increase in conservation funding, the level of resources currently provided by both the public and private sectors remain insufficient for conservation activities and biodiversity initiatives in many ASEAN economies (Gawi, 2014; Nilsson, 2019; Treerutkuarkul, 2021). For instance, in Thailand, biodiversity-related expenditure was estimated to be US$330 million in 2019, which is 0.1% of its GDP or 0.5% of overall national budget. To achieve its national biodiversity targets by 2021, Thailand would have needed to increase its expenditure by at least threefold (United Nations Development Programme, 2022). The picture is similar in other Southeast Asian countries. For example, the share received by the Ministry of Land, Water and Natural Resources in Malaysia for conservation of biodiversity has been less than 1% of the county's national expenditure since 2012 (i.e. RM1.54 billion from RM208 billion) (Ministry of Water, Land and Natural Resources Malaysia, 2019).

- **Gap 17:** At the regional level, there is insufficient funding to properly manage and conserve protected areas within the region, such as the 44 ASEAN Heritage

Parks (Treerutkuarkul, 2021). For Malaysia, the funding for R&D from National Conservation Trust Fund for Natural Resources (NCTF) has fallen short of the set target of RM2 million per year (i.e. RM1.7 million in 2017 and 1.44 million in 2018) (Ministry of Water, Land and Natural Resources Malaysia, 2019). A similar situation exists for other Southeast Asian countries.

- **Gap 18:** The process of identifying, rationalising and reviewing perverse subsidies in agriculture, forestry and fishery sectors needs to be expedited. Examples include the extensive subsidies for fisheries in Indonesia, where most fish stocks have already been depleted (Ekawati, 2022), and the widespread use of subsidised chemical-based fertilisers by farmers in the region, which is leading to extensive water and soil pollution (Far Eastern Agriculture, 2021). These harmful subsidies are having a devasting and long lasting impact on the ecosystem services of the region.

- **Gap 19:** There are insufficient economic and financing instruments for biodiversity and conservation initiatives in many Southeast Asian countries. Financial instruments include biodiversity-relevant taxes, biodiversity-relevant fees and charges (payment for ecosystem services), biodiversity-related tradeable permits, and environmental-subsidies. In a study by OECD covering 62 countries (on four broad economic and the financial incentives mentioned), only Indonesia and the Philippines in ASEAN were observed to be using financial instruments; and even they recorded the lowest number of incentives compared to other developing and developed countries (OECD, 2021). There is a clear lack of economic and financial instruments to create strong RoV streams from nature-based solutions within most Southeast Asian countries – and yet the natural ecosystem and biodiversity are crucial for food provisioning, carbon storage, water and air filtration, which together have been valued to be worth as much as US$150 trillion annually (twice as much as the world's GDP) (Kurth, 2021).

6. **Institutions (key players):**
   - **Gap 20:** The task of embedding biodiversity considerations into policies and legislations across all levels remains challenging. A primary cause for this is a lack of a 'Champion' with sufficient clout to lead the ESG and biodiversity efforts of individual countries in Southeast Asia.

   - **Gap 21:** Weak governance of forest and marine land is one of the key reasons behind unsustainable land use, especially in countries where economic growth is heavily dependent on export of primary commodities (e.g., mineral fuels and agricultural products) (USAID, 2019). Unfortunately, effective management of critical environmental and biodiversity resources by relevant national institutions within Southeast Asia has been woefully lacking. A critical factor that reduces the quality of governance and efficacy of resource use is the

existence of overlapping and compartmentalized environmental and biodiversity management within most nations of the region (Critical Ecosystem Partnership Fund, 2020; Sandhu, 2021; Tong, 2020; The SunBiz, 2021; USAID, 2019). For example, there are multiple ministries managing marine ecosystems in Malaysia (The Ministry of Agriculture (MOA), Ministry of Energy Science Technology Environment & Climate Change (MESTEC) and Ministry of Land, Water and Natural Resources) resulting in uncoordinated, and oftentimes overlapping, duplicated efforts. Similarly, there are over 30 agencies in Philippines that supervise numerous aspects of water resources, leading to tight silos, overlaps, and counterproductive decisions (Critical Ecosystem Partnership Fund, 2020).

- **Gap 22:** Unstable political developments in several countries of Southeast Asia have contributed to inefficient biodiversity governance. This is further exacerbated by excessive red tape in organizations managing the national biodiversity and conservation efforts (USAID, 2019; Tong, 2020; ASEAN Studies Centre, 2021; Flynn *et al*., 2021; Lee, 2021).

- **Gap 23:** Lack of coordination as well as ongoing disputes among federal and state governments' over issues and priorities, including that of local & indigenous communities, have made biodiversity governance a challenge due to conflicting developmental priorities and limited institutional capacity (Ministry of Water, Land and Natural Resources Malaysia, 2019; Yunus, 2019; Critical Ecosystem Partnership Fund, 2020; Keeton-Olsen, 2020; The Star, 2021).

7. Interaction (smart partnerships)

- **Gap 24:** The state of collaboration between the federal-state government, private sector and civil society to facilitate planning and execution of critical environmental matters and projects continues to remain weak and patchy across Southeast Asia (Asian Development Bank, 2013; Critical Ecosystem Partnership Fund, 2020; Tong, 2020; USAID, 2019; Keeton-Olsen, 2020). Part of this can be attributed to the lack of an integrated digital governance system, absence of a systematic registry and established baselines for collaborative engagements, projects and initiatives (Latt, 2017; USAID, 2019; Tong, 2020).

- **Gap 25:** There are significant challenges in consultations and information sharing between governmental and non-governmental stakeholders across different sectors of the economy and jurisdictions in the region (Nesadurai, 2017; Institute for Development Studies (Sabah), 2019; Verawaty *et al*., 2020; ASEAN Secretariat, 2021). These severely hinder strategic decision-making on policies, strategies, implementation mechanisms and reporting of outcomes pertaining to biodiversity management and conservation efforts. All these

factors lead to fragmentation and lack of coordination and harmonisation of biodiversity and conservation initiatives across the ASEAN region.

8. **Internationalisation (Global best practices and standards)**
    - **Gap 26:** Most Southeast Asian countries have formally adopted the United Nation's Sustainable Development Goals, as well as other environmental standards, including preservation of biodiversity and conservation efforts. However, due to challenges in critical areas such as governance, technical skills and capacity, stakeholder engagement, and enforcement of laws, a number of endorsed international standards and commitment to biodiversity and conservation targets have not been achieved. For example, ASEAN is signatory to the London Illegal Wildlife Trade Conference 2014 and 2018 (Department for Environment, Food & Rural Affairs, UK Government Gov.UK., 2014, 2019). Unfortunately, despite declarations (indicating national support and commitment), Southeast Asia remains a hotbed for wildlife poaching and trafficking, as well as a critical transit location for international wildlife trade (Koshy, 2020). Given this background it is unsurprising that the Environment Performance Index indicates that Southeast Asian countries exhibit the highest likelihood for biodiversity loss. For example, Malaysia recorded the second highest rate of biodiversity loss in the Asia Pacific region over the last decade (Yale University, 2020).

We observe from the 8i gap analysis that the region's natural ecosystem framework has several weaknesses despite the considerable progress that has been made to date. Addressing the gaps is crucial if Southeast Asia is to access the significant opportunities presented. These issues are addressed in the sections that follow.

7.0 ACCESSING THE BIODIVERSITY OPPORTUNITY

7.1 The Biodiversity Opportunity: Economic Benefit

The trajectory of protected areas in Southeast Asia suggests that the region is making good progress. There is gradual flattening in the growth of protected areas (refer to section 3.1), but other effective conservation measures (OECMs), which can include Indigenous and Community Conserved Areas (ICCAs), are another tool that the Convention on Biological Diversity has promoted for meeting the area-based conservation target and is one that could be key for ASEAN. Furthermore, the proposed 30x30 target currently in the latest draft of the CBD's post-2020 Global Biodiversity Framework is a global target and is not one that every country or every region is expected to meet. The 8i ecosystem analysis of the region suggests considerable progress has been made in the region, through a range of conservation programs and actions. For continued progress, these programs need to be sustained and further strengthened.

This raises the question as to why it is even necessary to follow the 30×30 target. Critics of the 30×30 initiative adopt positions that argue that the protected areas and other biodiversity initiatives stunt economic growth and development, and the costs of conservation far outweigh the benefits. Much of the research supporting these positions is based on early valuation studies that failed to incorporate the full value of nature's assets, and relied on narrow functional service attributes for their estimations. A more recent valuation provides a fuller account of nature's assets. For instance, Kurth *et al*., 2021 estimate the value of nature's ecosystem assets to be greater than US$ 150 trillion annually by taking into account nature's contribution across four domains: i) *Regulating services* (e.g., climate regulation via carbon sequestration, water storage and filtration, air purification, recycling of nutrients, prevention of soil erosion, and control of biological disturbances, such as zoonotic diseases), ii) *Habitat services* (firstly, affordance of space for microorganisms, plant and animal species to survive, procreate, and migrate, and secondly, supporting soil formation for food production and survival of other organisms reliant on soil and vegetation for their survival), iii) *Cultural services*, such as nature based amenities and arts, education and recreational services (e.g., tourism), and iv) *Provisioning services*, which captures the value of wood, foods, pharmaceutical and chemicals derived from nature.

Indeed, there is growing evidence supporting the case that conservation is not mutually exclusive to economic growth (WWF, 2018; Claes, *et al*., 2020; Waldron, *et al*., 2020; Bradbury *et al*., 2021; Dasgupta, 2021; Kurth, 2021; World Bank, 2021a). Comparing the monetary worth of ecosystem services (e.g., carbon storage, flood protection against revenues from converting nature's assets into production goods, such as timber, crops), Bradbury *et al*. (2021) suggest that the net benefits of conserving nature far outweigh alternative more intensive human use. Moreover, the net benefits from the latter arise with increasing social cost of carbon. The findings echo the points made by the

Dasgupta Review. Supporting this position, cost-benefit simulations by Waldron *et al*. (2020) show that increasing biodiversity protection from the current level of 15% terrestrial and 7% marine protected areas (Aichi Targets) to the 30% protected areas target set in the CBD's Post-2020 Global Biodiversity Framework leads to an approximately US$250 billion increase in annual economic output and US$350 billion in enhanced ecosystem services. Deriving these benefits would require an annual investment in protected areas of US$140 billion by 2030, yet the world currently invests only around US$24 billion per year. To put the investment to protect nature into perspective, one should take note that this figure is not even a third of the harmful subsidies provided by governments to activities that damage nature (e.g., fertiliser subsidies to farmers). The Waldron *et al*. (2020) study presents a compelling case for following a 30% target, since it is comparatively better for economies relative to any losses incurred by climate change fuelled disasters to sectors, such as agriculture, forestry and fisheries.

On the other hand, what would happen if the world continued along a "business as usual" trajectory, following the conventional mode of exploiting nature's resources for immediate gain? The World Bank (World Bank, 2021a) estimates that neglecting nature and biodiverse ecosystems and continuing business as usual will lead to the collapse of select nature-based ecosystem services, such as food provision from marine fisheries, pollination cycles vital for agriculture and resources from natural forests, amounting to US$2.7 trillion per year. This constitutes a drop of 2.9% in global GDP. Moreover, the impact will be felt hardest by low- and lower-middle income level countries, who tend to be more reliant on nature-driven sectors. For these countries, the impact is likely to be a 10% or higher drop in GDP. For instance, Sub-Saharan Africa and South Asia would suffer the biggest relative contraction in ecosystem services of 9.7% and 6.5% respectively. To avert such losses, a carefully designed mix of nature smart polices, which include protected areas, need to be implemented. Nature smart policies and solutions when used in conjunction with agricultural R&D, can be expected to deliver the biggest gains, and are especially beneficial for low- and middle-income countries, who are likely to accrue up to 80% of the gains. In devising the smart policy mix, investments should look to leverage synergies with climate change and zoonotic disease mitigation. The nature and climate agenda are synergistic and have complementarities that can be utilised to foster nature-led economic development that is green, inclusive and robust over the long term.

An important question surrounding protected areas and conservation programs revolves around the value of preserving these areas, and the biodiversity that is encompassed within them, for Southeast Asia. Recently, WWF Living Planet Index 2018 estimated the global value of economic activity underpinned by nature to be US$125 trillion (WWF, 2018). Just like the approach used by Kurth *et al*. (2021), the Living Planet index, based on the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) framework is a multi-dimensional consideration of economic contribution that goes beyond narrow dollar functional attribution to nature's

actual assets. It incorporates not just the transactional value of nature's products and services, but also includes jobs created, risks avoided (flood protection, etc.) as well as the socio-cultural aesthetics derived from nature. The economic value estimation by the WWF Living Planet Index 2018 can be used as a benchmark to estimate nature's economic activity contribution to the Southeast Asian region, based on the proxy of marine and terrestrial protected areas (see Table 7.1). Table 7.1 estimated nature's economic contribution to ASEAN member states to be approximately US$2.19 trillion, and shows different nation states derive different levels of economic benefit. The biggest beneficiary by a significant margin is Indonesia, followed by Philippines, Thailand, Cambodia, Malaysia, Myanmar, Laos, Vietnam, and the smaller states at the end.

Table 7.1: Nature's Economic Value Contribution to ASEAN and regional countries

Country/Region	Marine (PA+OECM) square km	Terrestrial (PA+OECM) square km	Total (PA+OECM) square km	Economic Value (US$)
World	29.08 million	22.72 million	51.8 million	125 trillion
ASEAN	294,021	611,699	905,720	2.19 trillion
Malaysia	25,099	44,203	69,304	167.24 bn
Thailand	13,635	96,038	109,673	264.65 bn
Indonesia	181,865	231,946	413,811	998.58 bn
Myanmar	2457	44289	46746	112.80 bn
Cambodia	691	72,527	73,218	176.68 bn
Brunei	52	2,794	2,846	6.87 bn
Laos	0	43,220	43,220	104.29 bn
Philippines	66,592	51,650	118,242	285.33 bn
Vietnam	3,630	24,994	28,624	69.07 bn
Singapore	0	34		0.082 bn
Timor-Leste	583	2,401	2,984	7.20 bn

Note: Country estimates based on assumption that size of conservation areas (marine and terrestrial protected areas) is a proxy indicator for nation states or regions natural assets, and thereby a source for economic value contributor. WWF Living Planet Index 2018 estimation of global economic activity contribution of US$125 trillion is the benchmark.

Source of data for protected area and OECM is https://www.protectedplanet.net/en.

The more all-encompassing valuation of nature's total ecosystem service highlights that nature presents tremendous opportunities for economic growth. These estimations counter the argument that conservation is oppositional to economic development. The size of the annual opportunity for Southeast Asian economies is immense. Based on the emerging valuation studies (WWF, 2018; Kurth *et al*., 2021), conservation if properly managed and implemented can lead to significant revenue streams and can be a crucial driver of economic development in Southeast Asia. Indeed, conservation efforts can be a central plank in uplifting the economic development of the region, given its sizeable biodiversity heritage. Rather than exploiting nature, exploring the full potential of nature is likely to deliver far higher long-term benefits. Exploitation of nature's

resources for immediate profitability for a one point in time spurt in growth irreversibly depletes nature's assets. Such an approach is undeniably a myopic and ultimately unsustainable strategy for the planet and humanity.

Additionally, consideration of global shifts suggests that the markets are responding to a growing group of consumers across the globe, who are environmental-conscious and willing to express their power by purchasing green products, boycotting socially irresponsible firms and investing in green and climate friendly investment portfolios. They are not alone in this shift, being joined by an elite group of philanthropists who aspire to create positive legacies by supporting causes and initiatives to protect the wellbeing of the planet.

Emerging evidence demonstrates the path of conservation is not oppositional to economic growth. Conservation of biodiversity may well be the unique engine of Southeast Asia's growth in contrast to the economic development trajectories of the developed world that was built on a process of industrial development that relied heavily on exploitation of nature's resources. Instead of trying to follow the conventional development model of the West, which has brought us to the brink of disaster, Southeast Asia would well learn from the mistakes of those who have gone before them and embark on a positive trajectory of sustainable growth built on planetary health. If planned and executed properly Southeast Asia could become a role model of economic development through nature protection.

Opportunities do not materialize without effort and investment. Without appropriate actions to attain the 30×30 agenda, Southeast Asia could easily forego a huge economic opportunity. This means undertaking investments to materialize and leverage the opportunity.

7.2 Accessing the Opportunity: The Funding Challenge

Calculating the full value of biodiversity and conservation to society is challenging. The science of capturing the value of these efforts has been improving over the years. Numerous studies have attempted to capture the biodiversity cost and the financing required to ensure more sustainable biodiversity trajectories for countries[2]. In this report we utilise the global biodiversity financing model proposed by Deutz *et al*. (2021) to estimate the biodiversity financial investments in Southeast Asia in 2019 and investments needed by 2030. These estimates are presented in Figures 7.1 and Figure 7.2, respectively. The figures show that estimated financing in 2019 was approximately USD10.1 billion and to meet its biodiversity conservation commitments of 2030, the region will need to increase biodiversity financing to close to USD45.9 billion.

[2]A comprehensive review can be found in Dasgupta (2021).

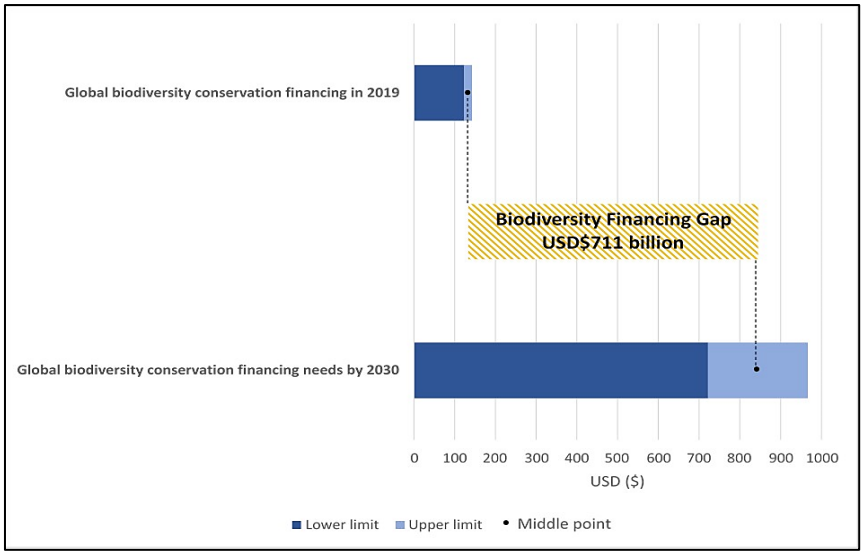


Figure 7.1: Global biodiversity conservation financing compared to global biodiversity conservation needs (USD Billions)

Note: Using mid-points of the current estimates and future needs, current global diversity conservation financing (upper graph) may need to increase by a factor of 5–7× to meet the estimated global need for biodiversity conservation (lower graph)

Source: Deutz *et al*., 2020

Table 7.2: Estimated positive and negative flows to biodiversity conservation (*in 2019 US$)*

Financial and policy mechanisms	**2019 US$ billion/year**	**2030 US$ billion/year**
A. Mechanisms that decrease the overall need for funding to be spent on biodiversity conservation		
Harmful subsidy reform (agriculture, fisheries, and forestry sectors)	(542.0) – (273.9)	(268.1) – 0*
Investment risk management	N/A	
B. Mechanisms that increase capital flows into biodiversity conservation		
Biodiversity offsets	6.3 – 9.2	162.0 – 168.0
Domestic budgets and tax policy	74.6 – 77.7	102.9 – 155.4
Natural infostructure	26.9	104.7 – 138.6
Green financial products	3.8 – 6.3	30.9 – 92.5
Nature-based solutions and carbon markets	0.8 – 1.4	24.9 – 39.9
Official development assistance (ODA)	4.0 – 9.7	8.0 – 19.4
Sustainable supply chains	5.5 – 8.2	12.3 – 18.7
Philanthropy and conservation NGOs	1.7 – 3.5	Not estimated**
Total Positive Financial Flows	**123.6 – 142.9**	**445.7 – 632.5**

Note: All figures in this table are reported in 2019 US$

**Assumes a global subsidies reform scenario that phases out by 2030 the most harmful subsidies as described by OECD (2020).*

***While future flows 1 for philanthropy and conservation NGOs are seen as highly catalytic for mobilizing private sector financial flows, it was determined that they did not pass the threshold for inclusion in this report as a main mechanism for scaling up to close the biodiversity financing gap*

Source for the table: Deutz *et al*., 2020

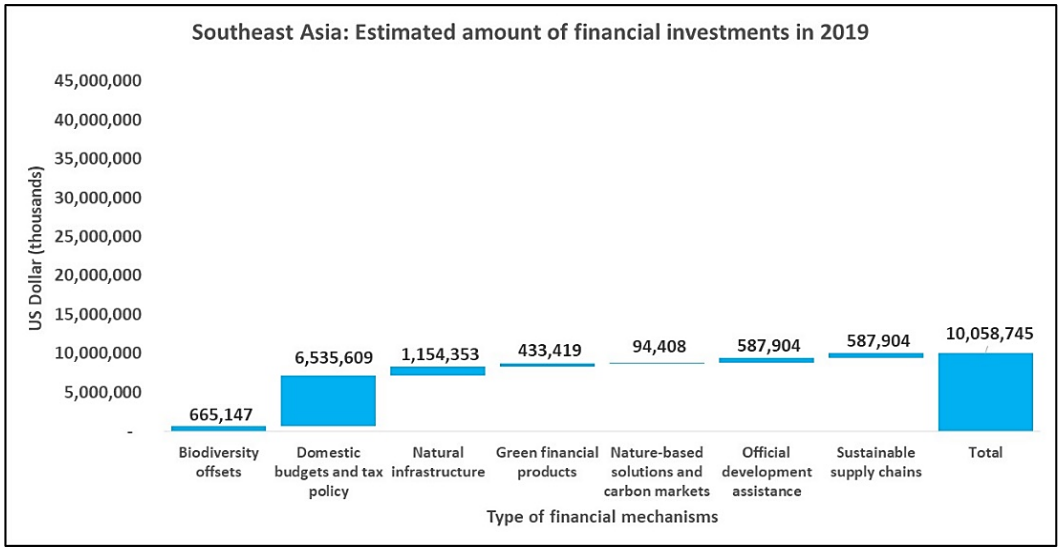


Figure 7.2: Estimated amount of biodiversity financial investment in 2019 in Southeast Asia (*in 2019 US$)*

Notes: the SEA biodiversity financing was computed by assessing the biodiversity cost per person using the global population data. Once this was ascertained, the biodiversity cost for SEA countries were estimated by multiplying the biodiversity cost per person and population size of the SEA countries. The total SEA biodiversity financing was an aggregation of the all the SEA countries total biodiversity cost.

Data source: Deutz *et al*. (2020). Computations for SEA was undertaken by the research team.

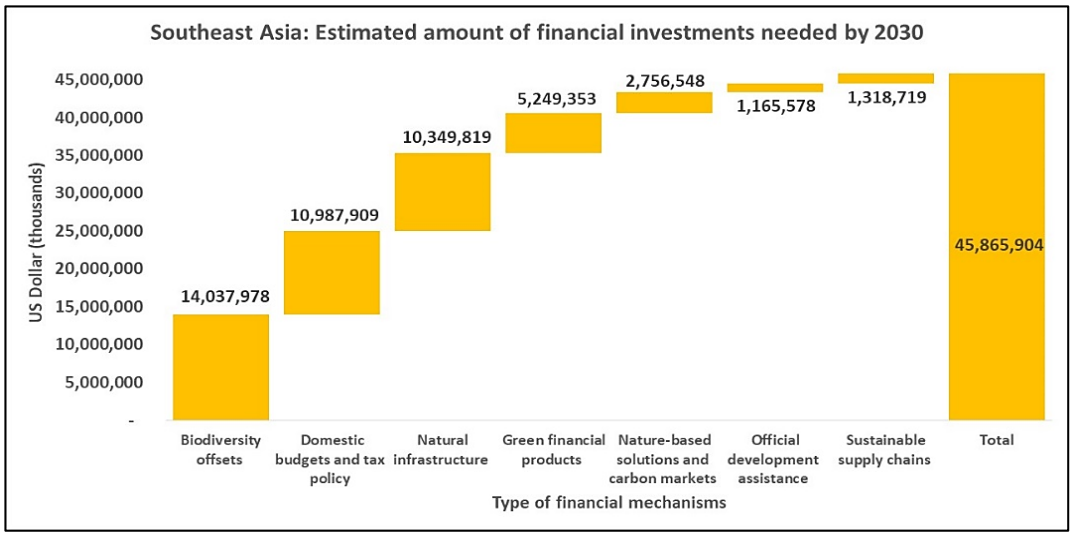


Figure 7.3: Estimated amount of biodiversity financial investments needed in 2030 in Southeast Asia (*in 2019 US$)*

Data source: Deutz *et al*. (2020). Computations undertaken by the research team using the same approach above.

From the above, we can surmise that for Southeast Asia to access the annual US$2.19 trillion opportunity requires it to invest US$ 10.06 billion. Over time the size of this nature-based opportunity will grow and with it the amount of funding needed as efforts are made to increase the level of protected areas and conservation to reach the aspirational 30×30 targets (and thereafter even higher targets). This highlights the potential to generate huge return of investment (RoI) by investing in nature's ecosystems and its services. Having estimated the immense opportunity and the investments needed to materialize the opportunity, it is then necessary to know what

are the areas to which the funds should be directed, and what are the strategies and nature-based programs of action for sustainable economic development. These are covered in the next section, “Closing the Gaps”.

8.0 A "WHOLE-OF-SOUTHEAST ASIA" BIODIVERSITY AND CONSERVATION STRATEGY

8.1 Closing the Gaps

ASEAN has put in place various plans and strategies over the last two decades to get better return on value (RoV) from its rich natural habitat. However, due to the gaps in the enablers of the natural ecosystem, the region continues to face major challenges in preserving its biodiversity and preventing the extinction of unique species endemic to the region. The loss of biodiversity is a major concern with respect to quality of life and socioeconomic development of communities in the region. To overcome this challenge there is a need to take a "Whole of Southeast Asia" strategy. This new approach requires not just a focus on the 3Rs (Reduce-Reuse-Recycle), but to transition to a more all-encompassing perspective that incorporates the *8R-Nature-centric philosophy* (see Box 6.1).

A "Whole of Southeast Asia" strategy will require 1) building a strong nexus between the supply and demand-side of the natural ecosystem; 2) a mind-set change towards the N8R philosophy among all stakeholders; 3) alignment of the capability development initiative so as to enculturate the N8R-philosophy throughout the region's communities; and 4) science, technology & innovation plans to facilitate full engagement with the N8R-philosophy. This will help to sustain the natural ecosystem and ensure resilient socioeconomic development within the region. To achieve these objectives, gaps in the enablers of the ecosystem need to be addressed and closed.

The required strategies are outlined below.

(i) Infrastructure: Building and strengthening nature-based infrastructure through nature-based solutions

In the management of large infrastructure conservation projects, the 8R-philosophy should be made core to the design, development, and deployment process so as to ensure nature-based solutions (NbS) are given priority in all existing natural ecosystems and development initiatives. The importance of NbS was acknowledged globally when it featured as one of the five primary focus themes at the 2021 UN climate conference (COP26) in Glasgow. The IUCN defines Nature-based solutions (NbS) as "*actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".*

The benefits of NbS compared to man-made solutions are significant considering the additional added value advantages in terms of ecosystem services, decreased disaster risk, and increased resilience of social systems. NbS are based on the premise that healthy and well-managed ecosystems provide crucial benefits and services to

mankind, such as food security, reduced greenhouse gas emission, cleaner air and safe water resources, whilst simultaneously helping to mitigate climate change impacts, slow down warming of the planet and ensure effective delivery of ecosystem services. NbS covers a wide spectrum of actions, such as applying ecosystem-based fundamentals to agricultural systems, protecting, and managing natural and semi-natural ecosystems, and integrating green and blue infrastructure in urban areas. The success of NbS will vary regionally depending on social-ecological processes and environmental conditions. Examples of NbS include a greener blue economy, protecting and restoring mangrove belts, coral reefs, and forests and building greener cities.

a) Toward a "Greener" Blue Economy

The oceans and coastal regions of Southeast Asia are one of the world's richest marine resources. However, these precious natural assets are under immense threat from both biotic and abiotic drivers of biodiversity loss such as population expansion, agriculture, urbanisation and mining, leading to environmental pollution, unsustainable fishing, farming and aquaculture, unregulated coastal development and dumping of solid and liquid wastes. The importance of ocean health is recognised under SDG14, and the World Bank defines Blue Economy as the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem" (World Bank, 2017).

Southeast Asia has great potential for a dynamic blue economy given its rich marine biodiversity. The region's territorial waters are about three times its land area and it is estimated that about 625 million people (estimated for the 10 ASEAN countries) depend on the ocean for their livelihoods. This is significantly higher than for most countries across the globe (Spalding, 2017). The region is responsible for 15% of the world's fish production, and harbours one of the most extensive seagrass beds, coral reefs and mangrove acreage. In fact, the oceans of Southeast Asia contribute significantly more to its GDP than those of developed countries (ASEAN Catalytic Green Finance Facility, 2021), for example, the economic earnings from coral reefs, especially through tourism is about $23,100 to $270,000 annually per square kilometre of healthy coral reef (ADB, 2014). Governance frameworks and policy tools are going to be imperative in protecting Southeast Asia's fragile marine ecosystem and to stimulate a sustainable blue economy. Appendix B shows some of the initiatives by ASEAN member states towards such a sustainable blue economy.

Case Example 8.1: Pulau Tioman Marine Park

Pulau Tioman Marine Park in Malaysia is an excellent example of a marine protected area (MPA) that has been effective in building ecological and social resilience. Local community engagement is an important reason for its success. A long-term programme known as *Cintai Tioman (Love Tioman)* has involved local stakeholders in conservation and marine resource co-management. Lack of such community involvement in many other MPAs has been cited as one reason for their ineffectiveness (Rahman *et al.,* 2019).

b) Protecting and Restoring Mangroves

Mangroves are dense tropical and sub-tropical coastal forests and act as buffer zones providing natural barriers against extreme weather, wind, and erosion. According to a report by Earth Security (Earth Security Report, 2020), mangroves save an estimated USD 65 billion annually by preventing storm and flood damages. During the Indian Ocean Tsunami of 2004, areas of Malaysia which had healthy mangrove forests had lower death rates and loss of property compared to those where mangroves had been lost due to harvesting or development (Dahdouh-Guebas *et al*., 2005; Ghazali *et al*., 2016). Additionally, mangrove forests can sequester carbon up to 400% faster than land-based tropical rainforests. They provide breeding grounds for thousands of commercial marine fish species thus supporting local economies, especially coastal communities in Asia.

Despite their vital importance, mangroves are one of the most threatened ecosystems in the world. Fifty percent of the world's mangrove forests have already been lost and continue to disappear under the weight of unsustainable urban pressures and industries, such as agriculture, aquaculture, land reclamation and infrastructure.

Southeast Asia alone harbours 42% of the world's mangroves (Gopal, 2013) and the highest global mangrove tree diversity (Polidoro *et al.,* 2010; Giri *et al*., 2011). Mangroves can contribute toward a lucrative blue economy. However, a large part of these wetlands have already been cleared. In fact, the Philippines has lost over 80% of its original coastal wetlands (Gopal, 2013). Southeast Asia was identified as a hotspot of global mangrove carbon stock losses between 2000 and 2012, with Indonesia alone accounting for almost 48.56% of the loss (Hamilton & Friess, 2018).

An estimate of the mangrove carbon stock in 2012 (Hamilton & Friess, 2018), revealed that globally the total content was 4.19 billion tonnes of carbon, with Indonesia, Brazil, Malaysia, and Papua New Guinea accounting for over 50% of the world stock, and Indonesia alone accounting for more than 30% (refer to Appendix C). Clearing mangrove forests releases more CO_2 per hectare than any other type of deforestation, as these forests can hold up to four times as much organic carbon per unit area compared to other terrestrial forested ecosystems (Donato *et al*., 2011).

Image 8.1: Mangrove conservation in the peat swamp of Lampung, South Sumatra, Indonesia. Peat swamp is tropical moist forests where waterlogged soil prevents organic material from fully decomposing

Source: Unsplash, photo by Aldino Hartan Putra.

Mangrove-rich Southeast Asian nations should view their mangrove carbon stock as sovereign national assets and leverage them for climate finance and bilateral carbon trading. They can also be used to meet decarbonisation targets. However, as emphasised in the Earth Security Report (2020), it is important for these governments to recognise the value of their mangrove stocks in their Nationally Determined Contributions (NDCs), as they update these for COP26. Unfortunately, Indonesia, Malaysia, Thailand, the Philippines, despite their rich mangrove stock did not mention mangroves in their NDCs (Earth Security Report, 2020). There is a window of opportunity for nations in the region to think in future on a bigger scale about the role of mangroves as a nature-based solution to buffer against biodiversity loss and climate change.

Activities to manage mangroves, should include i) reforestation of degraded mangrove areas, ii) removal of sediments in mangrove channels to improve their filtration capacity and enhance salinity and water quality, iii) implementation of good governance, iv) capacity building to enhance management of local resources, v) monitoring and surveillance activities to prevent further clearing of mangrove areas.

Case Example 8.2: The Matang Mangrove Forest Reserve

The Matang Mangrove Forest Reserve in the state of Perak in Malaysia is globally recognized as one of the best examples of a sustainably managed mangrove forest reserve (Chee *et al.*, 2021).

Malaysia is a party to the Ramsar Convention, an intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. Six out of Malaysia's seven Ramsar sites are mangroves (Ong, 2017). Stringent conservation rules restrict public access to specific Ramsar sites. An example is Pulau Kukup, the second largest mangrove island in the world. This uninhabited island is located in the state of Johor. Its ecological integrity has been preserved, with little negative impact on the local community in the mainland. Although restrictions to access may have hampered cultural and trade activities, ecotourism linked to the island's Ramsar status is a trade-off and has boosted the local economy (Barau & Stringer, 2015).

c) Protecting and Restoring Coral Reefs

Coral reefs are important for biodiversity, and also for coastal resilience. They also play an important role in the blue economy. The rising seas and intense storms caused by climate change have pushed tides higher and further inland, thus increasing the risk of floods and threatening local communities and economies. Coral reefs dissipate wave energy and have been reported to reduce wave heights by about 70%, followed by seagrass and kelp beds (36%) and mangroves (31%), and are two to 5 times more cost-effective than engineered structures (Narayan *et al*., 2016). Coral reefs and their surroundings also provide coastal food security, and other income generating activities for coastal communities. However, coral reefs represent very fragile ecosystems. Pollution, overfishing, destructive fishing practices (e.g. using dynamite or cyanide), collecting live corals for the aquarium market, mining coral for building materials, and a rise in water temperatures have resulted in their destruction. This has increased risks to the coastal ecosystem, reduced coastal protection and increased the loss of biodiversity and natural capital. The damage caused has to be mitigated and healthy coral reefs restored if the region is to reap economic benefits from its highly productive coral reef services.

Image 8.2: Shallow colourful coral reef at Koh Lipe, Thailand
Source: Unsplash, photo by Milos Prelevic.

d) Protection, Restoration and Management of Forests

Forests are a perfect example of nature-based infrastructure that can contribute to numerous nature-based solutions. Plants through photosynthesis, inherently hold the only natural technology for pulling carbon from the atmosphere. Primary forests represent substantial carbon sinks sequestering massive amounts of carbon in tree biomass and soils. Without forests, mitigating climate change is an almost impossible task. Forests harbour 80% of the world's terrestrial biodiversity, and also provide a livelihood to indigenous communities. The IPCC Climate Change and Land Report highlighted that the mitigation potential from terrestrial ecosystems comes from curbing of deforestation, and restoration and management of forests (IPCC, 2019) especially in tropical and subtropical regions rich in fast-growing forests (Brancalion *et al.,* 2019). The IPCC Report indicated a mitigation potential of 0.4–5.8 Gt CO_2 yr^{-1} from avoided deforestation and land degradation and a carbon sequestration potential of 0.5–10.1 Gt CO_2 yr^{-1} in vegetation and soils from afforestation/reforestation.

Reducing emissions from deforestation and forest degradation (REDD+) in developing countries is a framework developed under the United Nations Framework Convention on Climate Change (UNFCCC) for sustainable management of forests and enhancement of forest carbon stocks. It aims to incentivise protect, conserve, and restore forest ecosystems in developing countries by adding value to carbon sequestration, storage, and other social and environmental services. It is the most widely recognised and globally accepted framework for implementation of mitigation actions within the forest sector.

Case Study 8.1: The Rimba Raya Biodiversity Reserve Project

Image 8.3: The Rimba Raya Biodiversity Reserve, an InfiniteEARTH Project
Source: SA 4.0, photo by Eric Hehl

The Rimba Raya Biodiversity Reserve Project in Indonesia is the largest REDD+ project in the world. The project helps to preserve carbon-dense tropical peat swamps in Kalimantan Indonesia and has halted deforestation of about 65,000 hectares of forest originally intended for conversion to oil palm plantations, thus avoiding more than 130 million tonnes of carbon emissions over the 30-year span of this carbon offset project. It also protects the world-renowned Tanjung Puting National Park adjacent to it by providing a physical buffer zone on its eastern border. The focus is on both community and biodiversity conservation, including the protection of the 105,000 endangered orangutans. Part of the revenue from the sale of carbon credits goes directly towards local community development and provincial government infrastructure (Carbon Streaming, n.d.). The project provides food security, income opportunities, health care, and education for the local communities – all with the support of carbon finance (Natural capital partners, n.d.). It is the world's first REDD+ project to be verified under the Sustainable Development Verified Impact Standard to have contributed to all 17 United Nations' Sustainable Development Goals.

Southeast Asia needs to initiate and support more such programmes if it is to regain a healthy and sustainable natural environment that supports the well-being and socio-economic development of its citizenry.

e) Building Greener Cities

Urban development in Southeast Asia has accelerated in the last two decades (World Bank, n.d.) resulting in an increase in air temperature and a higher propensity to severe flooding. The runoff that ultimately reaches streams, rivers and lakes pollutes waterways and affects wildlife. Many of the negative impacts on the natural environment can be mitigated by NbS, such as street trees, rain gardens, green roofs,

green walls, and other urban green infrastructure that are capable of generating a wide range of benefits when designed in an integrative and inclusive way. Notable benefits include flood protection, improving water quality, reducing extreme heat, reducing pollution, improving public health, and even sequestering carbon. Well planned and implemented NbS can save cities billions in damage, repair, and maintenance costs.

f) Business Opportunities for Nature-based Solutions in Southeast Asia

Southeast Asia holds the largest global concentration of carbon for investments in nature-based solutions with its abundance of carbon-rich ecosystems like mangroves and peatlands (Raghav *et al*., 2020). A study by the National University of Singapore Centre for Nature-based Climate Solutions identified Indonesia, Malaysia, Thailand, Cambodia, and Myanmar as the top five countries in the region for return-on-investment from nature-based carbon projects (Raghav *et al*., 2020).

NbS present a substantial opportunity for businesses and investments in Southeast Asia. Nature-based carbon credits are gaining traction as a credible mitigation option. The world demand for high-quality carbon credits in the voluntary carbon market is projected to increase at least fifteenfold in the next decade to reach 2 billion tonnes in 2030, with more than 1,800 companies globally pledging to reach net zero emissions (Parker, 2021).

Even though natural capital generates 30% of Asia's GDP, efforts to protect natural capital are disproportionately underfunded. According to *The Little Book of Investing in Nature* (Tobin-de la Puente & Mitchell, 2021), by 2030, natural capital will be worth an estimated USD722 – 967 billion annually. However, there is a huge gap in funding, as currently only US$143 billion is being directed annually to global biodiversity. Funding is urgently needed from the private sector to bridge this gap. Support is likely to emerge once there is awareness of the huge opportunities, such as those arising from ecotourism.

Case Example 8.3: Emergence of Credit Offsets in Asia

A group of financial firms recently launched a new platform in Singapore that will host a marketplace known as Climate Impact X for nature-based projects that interested companies can invest in. It will also function as an exchange where offset credits can be traded (Parker, 2021). The company will also leverage disruptive technologies, like satellite monitoring, machine learning and blockchain to ensure transparency, integrity, and quality of carbon credits.

However, it must be emphasised that offsets should not be seen as a replacement for decarbonisation but should be carried out in tandem.

(ii) Infostructure: Using Science and Technologies to drive conservation and biodiversity protection

Innovations in digital technologies, high-speed computing and disruptive bioscience technologies is increasingly important in enhancing R&D in life sciences areas. Converging digital and bioscience technology platforms are opening opportunities for new discoveries that can help in the preservation of biodiversity and endangered species throughout the region. In Southeast Asia the use of such technologies is still at an infancy stage. Additionally, many of the environmental management systems are not integrated, nor are they designed to provide seamless flow of information for strategic decision-making, thus hampering effective management of natural ecosystems. Hence, there is a need to review the technology architecture that is in place within Southeast Asian countries and to enhance it in order to better support nature-based solutions.

In the recent 12th Malaysia Plan, the Malaysian government introduced a new science, technology, innovation, and economy (10-10 *My*STIE) framework (ASM, 2020b), which integrates 10 global STI drivers to 10 socioeconomic drivers of the nation (Economic Planning Unit-Prime Minister's Office, 2021). A key issue given prominence in this framework is environment and biodiversity. Use of the 10-10 MySTIE framework in developing advanced precision biodiversity technologies for Malaysia is shown in Figure 8.1. The application of the framework demonstrates how a sound precision biodiversity ecosystem can create strong spill-over impact onto other sectors of the economy, such as water and food, culture, arts and tourism, smart cities and transportation (see Figure 8.2).

Use of emerging technologies will be of vital importance in abating and avoiding negative externalities arising out of human activities in the use of nature's resources. The 10-10 MySTIE framework can play an important role to demonstrate how to enhance and leverage biodiversity conservation initiatives for optimal effect and benefit to all Southeast Asian countries.

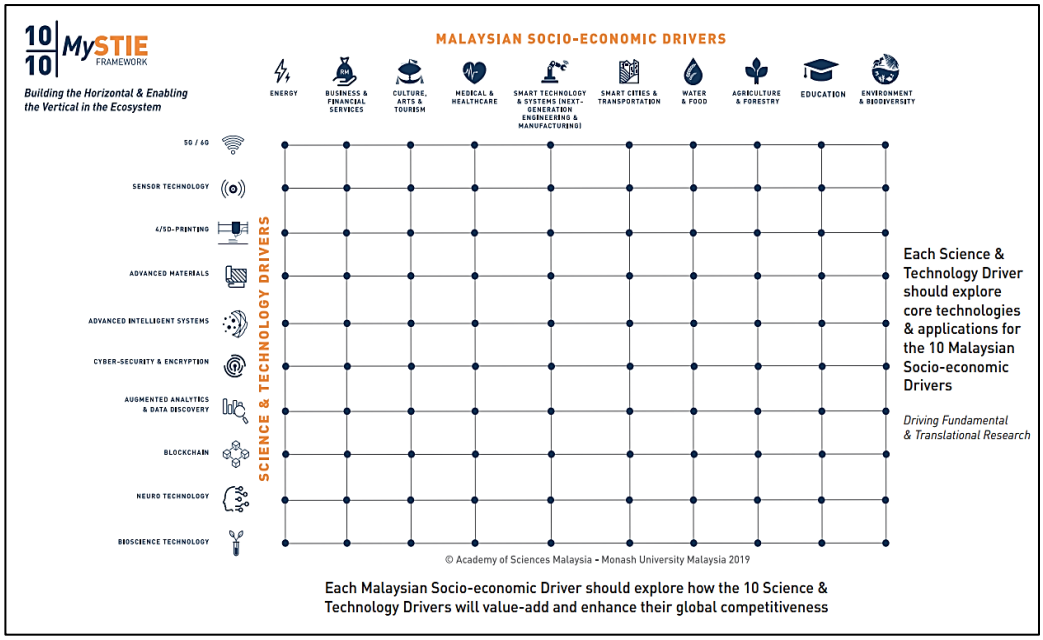


Figure 8.1: The Malaysian Science, Technology, Innovation and Economy Framework

Source: 10-10 Malaysian Science, Technology, Innovation and Economy (10-10 MySTIE) Framework: Trailblazing the Way for Prosperity, Societal Well-Being & Global Competitiveness (ASM, 2020b)

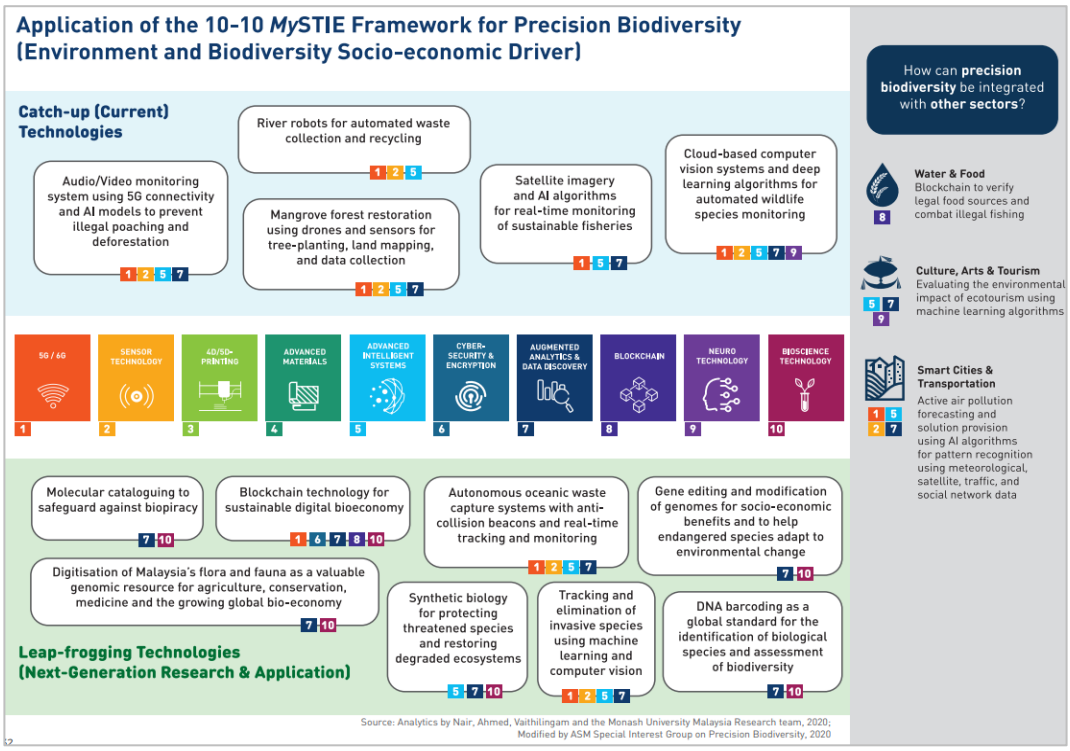


Figure 8.2: 10-10 MySTIE Driven Precision Biodiversity Technologies

Source: Strategic Paper on Precision Biodiversity (ASM, 2020a)

While traditional conservation and restoration efforts remain critically useful for biodiversity, a quantum leap with disruptive technologies is required to accelerate the protection of endangered species as well as ecosystems and ecosystem services.

Disruptive conservation refers to the use of biotechnology, 4IR technologies and the integration of these two technology platforms to fast-track biodiversity preservation by protecting species and habitats, improving genetic diversity, and restoring numbers through the use of technologies identified in the 10-10 MySTIE Framework. Disruptive conservation approaches include among others, Species Rewilding, Species Restoration, Species De-extinction, and Ecosystem Restoration.

- Rewilding is an environmental conservation and ecological restoration strategy to reverse defaunation by introducing missing large wildlife species, or their proxies in cases where they have gone extinct so as to restore natural processes in ecosystems.
- Species Restoration aims to increase endangered species population in specific environments.
- De-extinction, also known as resurrection biology or species revivalism, is the process of resurrecting or generating species that have died out or become extinct.
- Ecosystem Restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Used together, species rewilding, restoration and de-extinction efforts together can even contribute to full ecosystem revival. Disruptive technologies for conservation include cloning/tissue culture, genomics, and genome editing and digital technologies. As summarised below (Full Details are provided in Annex 2).

Cloning/tissue culture: Cloning/tissue culture procedures enable the production of genetic copies of individual organisms with identical DNA. Endangered plant and animal species can be rescued by cell and tissue culture as well as *in vitro* fertilization (IVF) - a suite of technologies that can play a key role in the conservation of endangered species, for example, in the preservation of the Sumatran and Northern White Rhinos.

Tissue culture is also an important tool for germplasm conservation of important plant species as well as for improving crop productivity and sustainability by mass propagation of elite high yielding planting material.

Genomics: Advances in genome sequencing technology complemented by bioinformatics, and artificial intelligence have greatly improved opportunities for conserving and restoring biodiversity. The genomic regions important for adaptation to biotic and abiotic stresses like climate change, pest and disease can be identified and leveraged for selective breeding, and manipulation. Genome sequences may also provide pertinent information on potentially endangered species based on any deleterious mutations in the genes for important functions, such as metabolism and immunity.

Genome Editing: Genome editing such as CRISPR–Cas9 is a revolutionary technology that allows precise gene editing by inserting, deleting, modifying, or replacing DNA in an organism. This can facilitate adaptation to environmental challenges such as climate

change and improve resistance to diseases (Supple & Shapiro, 2018). De-extinction can also be engineered through CRISPR–Cas9 technology.

For instance, the Woolly Mammoth Revival Project is a de-extinction project that aims to re-engineer a creature with genes from the woolly mammoth and re-introduce it into the tundra to combat climate change and promote biodiversity (Zimmer, 2021).

Digital technologies driven bioscience solutions to address biodiversity challenge

Besides biotechnology, the digital revolution is playing a critical role in preserving biodiversity and decoupling economic development from environmental degradation. Digital technology encompasses technologies in the realm of information and communication technology that are also elements of 4IR, such as the internet of things (IoT), robotics, artificial intelligence (AI) and machine learning, drones and blockchain and 3D printing, all elements of 4IR.

An example of the use of such technologies is the Destination Earth (DestinE) project. This is an initiative of the European Union which is being implemented over the next 7 to 10 years using satellites, artificial intelligence, and supercomputers to create a digital simulation of Earth with a digital twin that can replicate the atmosphere, land, ocean, and ice on Earth with unrivaled precision. DestinE is expected to be able to monitor, analyse, and predict climate dynamics, natural disasters, food and water security, and biodiversity very precisely so much so that it will be able to provide forecasts of floods, droughts, and fires days to years in advance. This would enable more effective and timely responses to impending issues and provide policymakers sufficient information and data to analyse and act on to assess the impact and the potential effectiveness of policies related to biodiversity and climate actions (Nativi & Craglia, 2020; Jonathan, 2021b).

In summary, the above discussion highlights that careful curation of the science, technology, innovation and the economic sectors can lead to the development of new technology that will enhance biodiversity conservation initiatives in the Southeast Asian region. These include the development of strong indigenous technologies, start-ups and enterprises that will enhance biodiversity conservation efforts, nurture next generation talent, create high income jobs and contribute to the economies of Southeast Asia.

(iii) Intellectual Capital: Building a nature friendly skills, competencies and outlook in Southeast Asia

Communication, education, and public awareness (CEPA) of nature-based solutions aligned to the N8R philosophy are important drivers for ensuring the preservation of biodiversity and conservation efforts in Southeast Asia. One of the major challenges to

achieving the environmental targets set earlier on as the Aichi Targets and now once again the current 30×30 initiative is the lack of awareness of the value of natural ecosystems for socioeconomic development and overall wellbeing of society in the region. While there are many eco-education initiatives, in many parts of Southeast Asia the level of environmental literacy is low and often natural ecosystems are taken for granted. Poor public awareness negatively impacts biodiversity and conservation and is part of the reason for not reaching targets set in the various regional plans. The state of the current high biodiversity loss and the rate of extinction of various biological species in the region can be partly attributed to low investments in targeted CEPA programs that nurture an N8R-Philosophy mindset among all stakeholders (children, youth, corporate sector, consumers, government, indigenous communities, citizen scientist, civil society and others) in nation states of Southeast Asia. To raise the awareness level on biodiversity and conservation, CEPA programs need to be devised and customised to the different stakeholders. This includes developing nature-based activities and programmes for students and the youth. Other activities include programmes for legal practitioners and political leaders. A key CEPA thrust should include acquiring local knowledge from indigenous people and local communities and supporting them with entrepreneurial training and capacity building programs. This will help indigenous people and local communities develop sustainable living and help them to manage their ecosystem while also adhering to environment-friendly best practices.

(iv) Integrity (Governance System): Raising biodiversity conservation as a priority agenda

While there are numerous policies, plans and targets set for biodiversity and conservation initiatives across multiples sectors, agencies and institutions that manage natural ecosystems in the Southeast Asian region, many of the targets have not been achieved. To ensure biodiversity and conservation efforts are taken more seriously, biodiversity needs to be classified as core to the **'national security'** of member countries. Whilst to date environmental security has not been a major consideration in matters related to natural security in many countries, the transboundary nature of environmental degradation and the potential of emergence of zoonotic diseases and health pandemics has necessitated a revisit of this position (Nair, 2012; Pazzanese, 2021).

Classification of environmental security as a national security is critical since environmental degradation and the loss of biodiversity have a significant impact on the health and economic well-being of all citizens in the region. If not addressed, environmental degradation is likely in the long run to exacerbate geopolitical tensions, social unrest and increase the need for humanitarian aid (National Intelligence Council, 2021). The classification of biodiversity conservation as a national security issue will encourage stakeholders in the region to take biodiversity conservation more seriously. Doing so will help embed biodiversity conservation in all socioeconomic development

plans, implementation mechanisms and programmes. Additionally, regulations pertaining to biodiversity conservation must be supplemented by strong tracking, monitoring and enforcement as well as incentives (both fiscal and non-fiscal incentives).

(v) Incentives: Funding the shift to nature-based solutions

Incentives or the lack of them determines the behaviour of various stakeholders, as it has a bearing on their commitment to biodiversity conservation efforts. To overcome a number of the market failures that impact biodiversity conservation loss, there is a need to introduce a comprehensive economic and financing architecture. There are several economic and financial policy mechanisms (Deutz *et al*., 2020), which if put in place will not only halt biodiversity loss, but have the potential to rejuvenate natural ecosystems in the region and create an estimated economic value of USD2.17 trillion (refer to Table 7.1)[3]. Figure 8.3 shows the instruments to enhance biodiversity conservation in the region; a detailed explanation of each of the incentive schemes is also provided below.

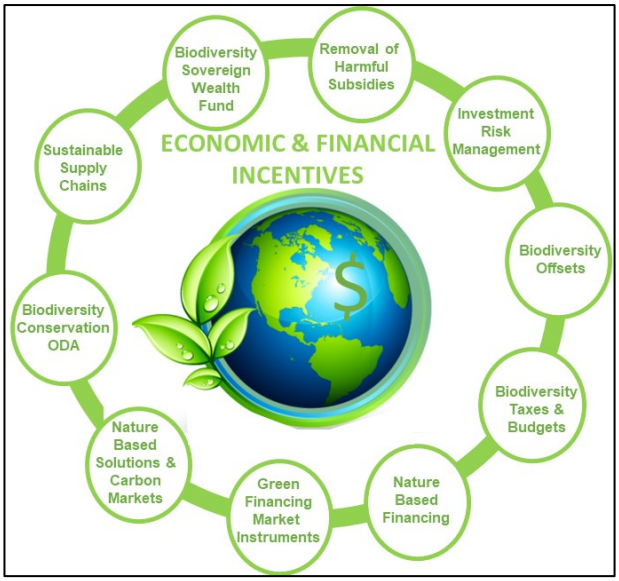


Figure 8.3: A range of biodiversity conservation economic and financial incentives.

- **Removal of harmful subsidies and introduction of a biodiversity subsidy**
  Governments in the region already have several fiscal policy tools to support economic development, but these do not include how to mitigate the attending risks to biodiversity conservation efforts. Essential changes include replacing harmful

[3] A comprehensive analysis for the nine economic and financial policy mechanisms is given in Deutz *et al*. (2020). The study also provides estimates of global biodiversity financing in 2019 and financing needs required by 2030. In the current document, we have adopted a similar framework and have used the data in the Deutz report to similarly estimate the biodiversity financing in 2019 and biodiversity financing needs required in 2030 for countries in Southeast Asia region.

subsidies that contribute to the degradation of biodiversity and conservation efforts with subsidies that veer key sectors towards production processes that mitigate risk to natural biodiversity. These include providing grants and subsidies to acquire technology and environment-friendly fertilisers, pesticides and other input resources that have a positive impact on biodiversity, while still meeting the socioeconomic development agenda of each country. Subsidies should also be given for activities that promote biodiversity and conservation activities, such as sustainable forest management, replanting of green cover, land conservation efforts, renewable energy, environment-friendly agriculture methods and pesticide-free cultivation.

In implementing initiatives, governments in the regions need to assess the socioeconomic impact of these transitions on vulnerable and marginalised communities, and put in place transitional risk assessment measures to minimise any adverse impact on local communities so as to get their buy-in and support. International development agencies, donor countries and more developed countries of Southeast Asia can play an important role in providing financial and technical support to less developed countries which are striving to stop harmful practices. Corporate players in the region could do likewise, as part of their broader agenda to fulfil ESG requirements. Such actions would be helpful in opening new opportunities for businesses to penetrate developed markets that require stringent ESG compliance.

- **Investment Risk Management**

  There needs to be a stronger push by financial institutions in the region on mandatory and voluntary risk management practices in all investments that impact biodiversity conservation efforts in the region. More effective biodiversity conservation risk assessment tools, standards, incentives and policies need to be developed to assist investors in making informed choices to derive better return on value from the natural ecosystem in the region. Given that large scale infrastructure development projects generally have an adverse impact on biodiversity conservation efforts, there is a need to incorporate biodiversity conservation risk assessment protocols in conventional financial and capital markets. These can act as an important impetus for nature-based infrastructure development initiatives in the region. Financial institutions in the region can lead the way by educating and assisting investors to address biodiversity conservation risk by systematically making structural changes to internal structures, risk assessment mechanisms, incentives, metrics and risk disclosure frameworks to ensure strong ESG compliance contributes positively to the environment. Financial institutions and regulators should incorporate broader fiduciary duty that requires the assessment of all investments for their impact on biodiversity conservation. Governments could play a further important role by mandating financial institutions to put in place a robust biodiversity conservation risk disclosure requirement in all their major investment plans.

- **Biodiversity Offsets**

  Biodiversity offsets are measures taken to compensate for unavoidable development projects that contribute to degradation of biodiversity and conservation efforts. These offsets can play an important role in raising financing for biodiversity and conservations initiatives. In this context biodiversity losses due to development are compensated so that countries in the region experience a net gain of biodiversity and conservation outcomes. At least in the worst-case scenario, there is no loss in biodiversity. There is a need to develop biodiversity offsets and mitigation policies to achieve net-gain or at the very least net-zero loss of biodiversity. This requires offsets to be incorporated in all development projects and adequate funding to be made available for biodiversity conservation initiatives long after the development project is completed.

- **Biodiversity Taxes and Budgets**

  Several advanced countries have used *biodiversity-relevant taxes* on materials that have an adverse impact on the environment. The taxes cover pesticides, fertilisers, forest products and timber harvests. These instruments are based on the "polluter pays principle', where additional cost is levied in order to prevent negative environmental externalities. This approach aims to incentivize consumers and producers to adhere to environmentally sustainable practices. Other measures include *biodiversity-relevant fees and charges*, levied for entrants into national parks, hunting licenses; land-based sewage discharge; groundwater abstraction; and fines for non-compliance to biodiversity policies. *Biodiversity traded permits* have also been used to manage biodiversity and conservation efforts in many countries. Among these are individual transferable quotas (ITQs) for fisheries, tradable development rights, and hunting rights. These are also known as "cap-and-trade" initiatives, which prescribe a limit on the total quantum of natural resource that can be used at any one time. These are then awarded as individual permits, which may be used to trade in the open market. Auctions of tradeable permits is a way to generate financing to support various environmental initiatives. Funds received from all the above initiatives should then be rechannelled to biodiversity conservation initiatives in the region.

- **Natural Infrastructure financing**

  The development of natural infrastructure is critical for biodiversity and conservation efforts in the region. Natural infrastructure development plays a key role in ensuring a healthy natural ecosystem, including mitigating natural disasters. For example, good management of mangroves can mitigate flood risk. These natural ecosystems also play a key role in providing vital ecosystem services to communities and are a source of employment for many. All infrastructure projects in the region should incorporate economic development that takes into consideration biodiversity conservation issues. Similarly, insurance and risk

modelling should draw attention to ecosystem services provided by nature in order to highlight its true value to the economies in the region.

- **Green financing market instruments**
  These are financial products, which are primarily debt and equity-based instruments that contribute to biodiversity conservation efforts. There are a host of green financial products, such as green bonds, loans that channel to sustainable development of the environment and private equity funds that contribute to biodiversity conservation. These cover traditional green financing such as retail banking, home mortgages, carbon funds and others (UNEP, 2007) as well as more innovative green financing in the insurance industry and environmental impact bonds (Deutz *et al*., 2020). Green financial products are still at an early stage of development in the region; There is a need to develop this industry. Governments in the region, in partnership with private investment organisations, need to set up a more robust and dynamic green financial ecosystem by formulating clear guidelines, policies, regulations, incentives, penalties and disclosure standards. These institutional reforms are critical for creating new financial products and markets to increase the flow of private capital to support biodiversity conservation efforts in the region.

- **Nature-based solutions and carbon markets**
  Currently, there is a growing acceptance that nature-based solutions can effectively help to mitigate risks associated with global warming. Global warming has a profound adverse impact on biodiversity conservation efforts and socioeconomic wellbeing of communities in the region. Many countries have accordingly developed pathways towards achieving net-zero carbon emission targets. There is a need to intensify a hybrid policy that integrates direct carbon taxes, 'regulated carbon cap-traded market' and carbon offset markets (linked to forest cover). The type of policies undertaken should take into consideration the stage of development in each country so that appropriate transitional financing needs may be put in place to ensure smooth passage onto a path of sustainable development, while creating robust and dynamic carbon trading markets. The resources generated from these initiatives will provide impetus to better manage forests in the region.

- **Biodiversity Conservation linked Official Development Assistance (ODA)**
  Official Development Assistance (ODA) is critical for several of the less developed countries in Southeast Asia, that are also rich in biodiversity. Funding may come from multilateral institutions and donor countries and would be best if channelled to support biodiversity plans to achieve the 30×30 targets. The ODA funding should also go towards supporting major nature-based infrastructure projects, capability development programmes and towards enabling institutional reforms that mainstream the N8R-philosophy across the economic value chain.

- **Sustainable Supply Chains**
  Global supply chains across multiple sectors of the economies have had an adverse impact on biodiversity conservation efforts. This is due to unsustainable practices in agriculture, fishery, forestry and other industrial sectors. There is an increasing recognition of the need to incorporate ESG standards across the relevant supply chains through more effective corporate management policies, standards, certifications and funding. Increasingly, ESG standards are restricting the movement of goods and services provided by regional economies into advanced markets that have adopted more stringent standards and certifications. Future sustainable development of economic sectors in many of the regional countries depends on how well they are able to comply with these international ESG standards. Hence, greater awareness and support is needed to enable suppliers and consumers in the region to adhere to global best practices. One of the significant supply chains in the region is the 'Halal Supply Chain', where the global market potential is envisaged to grow significantly. The Muslim population in Southeast Asia is the largest in the world. It comprises 42% of a total 240 million regional population. In 2019, the global market for halal products was USD2.02 trillion and has been envisaged to grow to USD2.24 trillion by 2024 (BusinessToday, 2022). Incorporation of ESG requirements into the halal certification process will provide a major impetus to the biodiversity and conservation efforts in the region, while opening up new global market potential for regional economies [4].

- **Biodiversity Sovereign Wealth Fund**
  Sovereign Wealth Funds (SWFs) are state-owned investment funds backed by a country or several countries revenue surpluses. Currently, from the surpluses in global sovereign funds, approximately 57% are capitalized from nature-resource revenues (i.e. oil and gas), while the remaining 43% are funded by non-commodity sources (e.g. foreign exchange reserves; OECD, 2020). With an asset value of approximately US$ 8.2 trillion, these funds are a significant share of global invested capital (e.g. around 8% of global listed equity; OECD, 2020). The magnitude of these invested capital in assets and projects across the globe can have a significant impact on biodiversity conservation.

  SWFs are increasingly becoming an important financial instrument to strategically unlock the value of environmental assets in order to generate sustainable economic development, while also preserving it for future generations. SWFs are government-owned special investment vehicles that enable inter-generational

[4] Nasir *et al*. (2021 and 2022) show that halal certification in Malaysia have not incorporate ESG requirements; as such this does not promote adherence to higher environmental practices. Many of the requirements only comply to minimum standards as outlined under environmental regulations. Hence, industry players miss capturing new economic value streams from markets that require higher ESG and are willing to pay a higher premium for products and services that meet these environmental standards. The study also maps the institutional reforms required to ensure ESG is core to the Malaysian halal certification process.

equitable management of biodiversity conservation initiatives, while ensuring long-term economic sustainability of economic sectors that are dependent on natural ecosystems. SWFs draw funds from a wide range of sources across the country and the globe, that include pension funds, fiscal stabilisation funds, saving funds and other global development funds. These funds tend to invest in high yielding long-term assets with reasonable risk exposure and adhere to sustainable environment practices.

There is an increasing trend of SWFs to divest their portfolio of investments from environment-damaging industries to environment-friendly business ventures and infrastructure projects. One of the largest SWF is the Norwegian sovereign fund known as the Government Pension Fund Global (GPFG), managed by the Central Bank of Norway. The SWF manages assets of more than USD 1.4 trillion with a goal to reduce the impact of volatilities in the oil prices, ensure long-term management of revenue from the petroleum sector, and to generate adequate revenue surplus for sustainable management of the national pension scheme (Norges Bank Investment Management, 2019; Taraldsen, 2021). A key component of this fund is the evaluation of climate change and environmental risk to the sustainable management of its financial and natural assets. The fund recently announced that 12 companies will be excluded from the fund due to environmental concerns such as "unacceptable climate gas emissions" (e.g. Cenovus Energy), while some were placed "under observation" (e.g. BHP and Enel) (Business & Human Right Resource Centre, 2020, para. 2; Aljazeera, 2020).

SWFs in other countries such as New Zealand and France are also divesting from firms that contribute to high GHG emissions; and institutional investors in these countries (such as pension funds) are increasing their strategic investments towards climate change risk management processes and environmental assets (Capape & Santivanez, 2018). These new revenue sources provide an impetus to the biodiversity conservation efforts in their respective countries, while ensuring sustainable development in many of the environmental- and climate-sensitive economic sectors. Similar types of biodiversity SWFs have also been introduced in many countries in the Caribbean and Small Island Developing States, that are negatively impacted by climate change (Niles & Moore, 2018)

Given the favourable outcomes from the biodiversity-driven SWFs across the globe, countries in Southeast Asia should leverage their rich biodiversity by putting in place an appropriate financial architecture for the establishment of the Southeast Asian Biodiversity SWF. The primary functions of the SWF would be to undertake the following:

- ensure proper valuation of environment assets, so that the social cost of biodiversity loss in all investment decisions and economic activities are undertaken using the UN System of Environmental Economic Accounting (SEEA) system;

- invest in appropriate science, technology and innovations (STI) to raise the RoV of environmental assets, biodiversity conservation initiatives and the value of existing economic sectors (especially, forestry, tourism, fishery & aquaculture, mining and oil & gas) without adversely impacting biodiversity – e.g. by increasing the yield of sustainable forest farms without encroaching into natural forest reserves;
- invest in biodiversity-friendly technology companies in the region and across the globe, which will open new revenue streams in the form of sale of high-tech products and services, initial public offerings (IPOs) of tech firms & start-ups, increase foreign investment into the local tech-sector, nurture strong technology & knowledge transfer between local and foreign firms in environment-friendly tech sectors - all of which, will boost the local eco-friendly tech supply chain, and generate new sources of economic value, while also increasing funding for the SWF and creating high-tech jobs in the region;
- more effectively capture economic benefit from natural assets, where a percentage of revenue generated from key economic sectors (forestry, tourism, fishery & aquaculture, mining and oil & gas) are channelled to the SWF. For example, the revenue generated from the oil & gas sector of the four main countries in Southeast Asia (Indonesia, Malaysia, Vietnam and Brunei) was close to US$200 billion per annum by 2020[5]. Similarly, the travel and tourism sector in Southeast Asia contributed US$180 billion per annum[6]. A conservative 1% funding from the oil & gas, travel & tourism, including forestry and blue economy sectors will lead to a contribution of US$5 billion per annum to the SWF. The contribution to the biodiversity SWF is envisaged to increase with further growth in these sectors. These sources of core funding will ensure sustainability of the SWF in financing the biodiversity and conservation initiatives in the region.
- like other SWFs, the proposed biodiversity SWF should be permitted to invest not only in Southeast Asia, but also in high-yielding biodiversity conservation initiatives in other developed and emerging markets;
- key feature of the success of the SWF will be dependent on the ability of the SWF to monitor the performance of the investments and get the best professional managers to drive greater RoV and RoI from the investments.

[5] The GDP contribution of these countries was obtained from https://tradingeconomics.com/; while the contribution of oil and gap to GDP was from: https://www.mida.gov.my/industries/services/oil-and-gas/; https://tradingeconomics.com/vietnam/oil-rents-percent-of-gdp-wb-data.html; https://tradingeconomics.com/vietnam/oil-rents-percent-of-gdp-wb-data.html https://www.ceicdata.com/en/brunei/government-revenue-and-expenditure/govt-revenue-oil-and-gas-revenue

[6] https://www.statista.com/statistics/1102510/southeast-asia-travel-and-tourism-gdp-contribution/

(vi) Institutions: Intuitional leadership for a whole of region approach

There are numerous institutions and agencies involved in the management of biodiversity and conservation efforts in the Southeast Asian region. The awareness and commitment among the institutions to the elements covered within the N8R philosophy for biodiversity conservation efforts vary considerably in the various countries. Weakness in awareness and importance of fully rounded N8R perspective of conservation is partly responsible for the fragmentation in policy planning and implementation within the countries. In many of them, environmental management involves multiple players (government agencies, industry, and community organisations) while implementation of the biodiversity conservation policies lacks coordination. Consequently, efficacy of these policy measures is hindered, thus making it difficult for many countries to achieve the desired biodiversity and conservation targets.

While there is strong commitment from the Southeast Asian leadership, effective harmonisation and implementation of regional biodiversity and conservation policies can only take place if there are multiple institutional leaders within the ASEAN secretariat, member states and Timor Liste, who act as "Champions with Clout" to oversee and ensure implementation of biodiversity conservation efforts. The "**Whole-of-Southeast Asia**" strategy must dove-tail into "**Whole-of-Nation**" plan for each of the nation states such that biodiversity conservation is taken as a 'national security' matter and greater prominence is given to the N8R-policy in the development of socioeconomic policies and implementation strategies.

(vii) Interactions: Working with regional, national and local stakeholder in smart partnerships

The inability for the member states to address the negative externalities that adversely impact biodiversity conservation efforts highlights weaknesses in the level of cooperation, coordination and intelligence sharing among the various stakeholders within and across Southeast Asia. Without strong inter-institutional, sectoral cooperation, the local indigenous community and local organisations within the countries addressing the issues of illegal logging, trade of endangered species, dumping of pollutants in the rivers and other negative externalities will remain a challenge for the region.

To overcome the above market failures (erosion of the biodiversity and conservation efforts), it is important to strengthen and incentivize key players in the ecosystem to work together and manage the ecosystem collectively. In this context, '**Community Champions' and the local indigenous population** in the various localities can play catalytic roles. Engendering this requires fostering strong collaboration between government agencies, industry, and community organisations. Through a more

collaborative process, communities can be encouraged to participate more proactively in the management of their local natural ecosystems.

Relationships between multiple stakeholders are complex and can be challenging. Without a strong technological platform to manage the information flow among stakeholders, strategic decision making, monitoring and the tracking of performance on the ground can be challenging. A weak information and communication platform will lead stakeholders to take a functional approach, as opposed to a more integrated and holistic approach in managing the environmental value chain. To ensure the complex relationships between all stakeholders are managed effectively across the multiple jurisdictions, there is a need to intensify the governance systems, through adoption of digital technology, such as blockchain technology.

(viii) Internationalisation: Accessing international markets to drive stronger revenue streams

Biodiversity and conservation efforts can create new value streams and spawn new environmental-friendly economic sectors. Poor governance of the environment can easily lead to products and services from Southeast Asia not being able to reach international markets, particularly those with higher environmental standards. A bigger concern is that poor environmental management practices in the region, which increase transboundary pollution and other environment negative externalities have the potential to heighten geopolitical tensions among member countries in the region and with countries across the globe.

To ensure ASEAN adheres to global best practices pertaining to the environment and biodiversity conservation initiative, the region must put in place a framework to harmonise standards, guidelines, and develop incentive structures that are in line with the N8R philosophy. This can be done by intensifying the international cooperation for biodiversity conservation with more advanced countries to foster the following: technology and knowledge transfer; R&D collaboration to nurture the local eco-friendly industry; strengthen capability development programmes for researchers, industry, community organisations with leading international experts, international development agencies and financial institutions; and increasing foreign direct investment to support nature-based solutions and the development of environment-friendly supply chains.

In summary, this section shows that to strengthen the biodiversity conservation ecosystem in the Southeast Asian countries, careful development of the enablers of the ecosystem needs to be undertaken. This is to ensure that targeted strategies are put in place to address gaps in the enablers of the ecosystem, which include addressing leadership, infrastructure development and institutional reforms to ensure that biodiversity conservation and sustainable economic development are not regarded as a

“zero-sum-game”. In fact, the overwhelming evidence points to the fact that biodiversity protection can lead to significantly positive economic spill-overs in the form of nurturing next-generation environmental friendly industries, foreign direct investments and high income jobs.

9.0 THE WAY FORWARD

The Position Paper identifies a select group of issues and observations that encapsulate the gaps identified through the 8i evaluation of Southeast Asia's biodiversity ecosystem. These eight important observations under Section 9.1 have provided the necessary background to formulate the nine key recommendations under Section 9.2.

9.1 Observations

Observation 1:
Steady progress is being made in increasing the number and area of protected areas, yet this has not halted biodiversity decline in Southeast Asia. To help address this, the protected and conserved area network in the region must continue to be expanded as part of a broader and ambitious biodiversity conservation strategy. As the protected and conserved area system is expanded, there needs to be a renewed focus on ensuring effective management and establishing protected and conserved areas in the right places.

Observation 2:
Each nation within the Southeast regional bloc has enacted numerous policies and put in place many initiatives for the conservation of biodiversity. Unfortunately, the policies and initiatives continue not to deliver upon promised/desired expectations because they are mostly executed in narrow isolation encountering state-federal conflicts or nation and region priority conflicts and divisions.

Observation 3:
Whilst significant biodiversity conservation efforts are being executed at the regional, national and community levels, they have not been able to keep pace with the external changes taking place in the methods and approaches to the expropriation of natural resources. Adoption of emerging new technologies is going to be crucial in addressing this imbalance.

Observation 4:
Progress in protecting the environment and biodiversity cannot be achieved by policies, plans and initiatives or technology alone. Real progress can only be made if the people of Southeast Asia change their attitude and behavior towards nature. This will require a philosophical shift to a nature-centric outlook, i.e. a mind-set change where care for nature is prioritized over short-term profitability and gain.

Observation 5:
Southeast Asia's contributions towards the aspirational conservation targets (Aichi, 30×30, or 50×50) will need a clear commitment to make significant upfront investments in biodiversity. This necessitates design, development and adoption of financial

instruments customised to the regional and national contexts of the Southeast Asia community.

Observation 6:
Southeast Asia possesses immense wealth of biodiversity but many of its' nations lack the wherewithal to adequately protect nature due to the demands placed upon natural capital by rising populations and the imperative of national economic development.

Observation 7:
Despite the existence of parastatal bodies in the Southeast Asia regional context, efforts at biodiversity preservation remains fragmented and often lacks long term coherence due to problems in governance, co-ordination, communication and shared goals, especially when it comes to implementation and execution of plans and initiatives.

Observation 8:
Most extant biodiversity conservation efforts remain largely divorced from the high priority global agendas, such as climate change and they also fail to adequately consider and incorporate the economics of production and consumption. Greater effort must be made to incorporate a fuller consideration of cost versus benefits through more robust evaluation of the long cost-return on value equation.

9.2 Recommendations

To close the shortfalls or gaps in nature's ecosystem (via a process of strengthening the 8i-ecosystem enablers) and in order to ensure that the region is able to achieve the 30×30 targets, whilst simultaneously providing a high quality of life for citizens, the Position Paper proposes 9 (nine) recommendations as presented below. If fully implemented, they will ensure that socio-economic development and biodiversity can coexist for planetary health and the wellbeing of the people of Southeast Asia.

Recommendation 1:
Leverage Biodiversity as an Integral Part of National Security throughout Southeast Asia
Biodiversity must be classified as core to the "national security" of all Southeast Asian countries, since loss of biodiversity has both immediate and long-term impact on the physical health and socioeconomic well-being of citizens, as well as the environment.

Recommendation 2:
Strengthen Biodiversity and Conservation through a Whole-of-Society, Whole-of-Southeast Asia Approach
To overcome fragmentation of plans and resources it is necessary for Southeast Asia *to come together and adopt a Whole-of-Community approach, which harmonises and optimises efforts and initiatives at the regional level, whilst simultaneously integrating*

with national (Whole-of-Government) and international (Whole-of-Society) initiatives that also support sustainable socioeconomic development. This includes strengthening the role of the local and indigenous communities, as guardians of nature, to help deepen the nexus between biodiversity conservation and socioeconomic development.

Recommendation 3:

Leverage STIE enablement of Biodiversity and Conservation through the 8i ecosystem and 10-10 framework

Future conservation initiatives and projects need to be augmented with sound STIE to develop and drive innovations and processes to protect biodiversity loss. Adoption of an 8i ecosystem approach is needed to develop a deep, holistic and well-rounded understanding within the context of each country; nature-based solutions (NbS) can thereafter be devised and driven by the STIE 10-10 framework that also supports economic growth.

Recommendation 4:

Sensitise People towards becoming Biodiversity Agents-of-Change through Communication, Education, Public Awareness (CEPA)

The citizens of Southeast Asia are critical players for the success of biodiversity and conservation programmes. As such their awareness of the importance of biodiversity for health and well-being of their communities, country, region and the world need to be urgently raised. Awareness must be followed up by carefully designed education programmes that build skills and competencies in local communities to a level that allows them to devise nature-based solutions appropriate to their own specific local needs. The CEPA programmes as a whole, must be aligned to the 8R Nature-Centric philosophy.

Recommendation 5:

Shift the Southeast Asian biodiversity-associated behavior and action landscape though a portfolio of nature-based financial instruments

The Southeast Asia *community needs to adopt, like their counterparts in developed countries (e.g., European Union), a portfolio of financial instruments to incentivise and support positive biodiversity-associated behaviour and actions from its citizenry, businesses and other stakeholders. The portfolio should include biodiversity relevant taxes, biodiversity fees and charges, traded permits and biodiversity motivated subsidies.*

Recommendation 6:

All countries in Southeast Asia must be accorded contextual justice by ensuring that equality and equity are explicitly taken into account within any measure or adjudication on biodiversity matters.

Southeast Asia *must campaign for developed economies to honour their obligation to compensate for all the region's activities towards conservation, restoration and adaptation to alleviate biodiversity loss in their terrestrial and marine environments.*

This should also include ensuring that the developed world does not export its biodiversity responsibility to developing countries that possess richer biodiversity, whilst they themselves claim high national biodiversity credentials using domestic production metrics rather than consumption metrics. For example, developed countries may significantly reduce domestic diversity loss by curtailing home country agricultural activities but then use their higher purchasing power to source agri-products from poorer countries.

Recommendation 7:

As a region, embrace and fully support the 30×30 global target and develop regional strategies to contribute towards its implementation.

The Southeast Asian community should support the 30x30 global target currently proposed by the Convention on Biological Diversity in its latest draft post-2020 Global Biodiversity Framework. The countries should work in partnership with each other to increase the extent of protected and conserved areas in the region and to contribute towards the implementation of the 30x30 global target.

Recommendation 8:

Establish a Southeast Asia-wide biodiversity sharing and knowledge platform

Establish a Southeast Asia-*wide, open platform for a digital inventory/database on biodiversity information, implementation, outcomes and adaptive management of Nature-based Solutions. This would act as a core platform to support capacity building, research, sharing of knowledge as well as environmental monitoring. A better information repository and intelligence powerhouse would help reduce the level of fragmentation in policies, plans and implementation actions. This would also help to rationalise and harmonise laws, regulations, and jurisdictions, and initiate a much-needed shift towards best global practice standards.*

Recommendation 9:

Recommendation 9: Institutionalize roll-out of Nature-based Solutions

*Institutionalise the roll-out of nature-based solutions to address challenges to biodiversity and economic development within the jurisdiction of federal, state and local government machineries with full involvement of industry and civil society. This will require a Whole-of-Government, Whole-of-Society, Whole-of-Community (*Southeast Asia*) approach.*

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BRIEF BIOGRAPHY OF THE COMMITTEE MEMBERS

Dr. Helen Nair FASc, FMSA, DF-MABIC

Chairperson

Helen Nair has had an illustrious career in academia, having served at the University of Malaya (UM) for more than 30 years, including as holder of the Professorial Chair in Plant Physiology, before resigning and helping to establish two private universities. She served as the inaugural Senior Professor and Dean of the Science faculties prior to retiring. A pioneering interest in postharvest physiology continues through an advisory role in her former Postharvest Biotechnology laboratory at UM. Currently, a council member of Academy of Sciences Malaysia (ASM) , she also holds Emeritus Membership in the American Society of Plant Biologists. As a Fellow and Council Member of ASM, her expertise has often been drawn upon to advance the development of science, technology and innovation in the country, especially in Government-associated projects. She leads the ASM Task Force on Precision Biodiversity, and together with her team was responsible for producing a strategic paper for the country on leveraging 4IR and emerging technologies for biodiversity protection.

Professor Mahendhiran Sanggaran Nair, FASc, FCPA

Mahendhiran Sanggaran Nair is the Pro-Vice Chancellor (Research Engagement and Impact) at Sunway University, Malaysia. He is a Fellow of Academy of Sciences Malaysia, Fellow of CPA (Australia), a member of the National Science Council of Malaysia and High-Tech Council of Malaysia. He is also a Council Member of the United Nations Sustainable Development Solution Network (UN-SDSN, Malaysia). He is trained as a data scientist and econometrician and is the architect for the development of the *Malaysian Science, Technology and Innovation* (*10-10 MySTIE*) *Framework*, which has been incorporated in the 12th Malaysian Plan (2021-2025). The *10-10 MySTIE* provides a new approach to assess the impact of 10 global science & technology drivers on the socioeconomic drivers of Malaysia. This framework is used by the various government agencies, industry and community organisations to develop their strategic plans. Some of his research work has been published in leading peer-reviewed journals. He has been a subject matter expert for government agencies, public policy organisations, 'think-tanks' and community organisations in Malaysia, the Middle East and the Asia-Pacific region.

Prof. Pervaiz K Ahmed

Pervaiz K Ahmed is Distinguished Research Professor of Management and Director for the Sunway Institute for Global Strategy and Competitiveness (IGSC) at Sunway University. He is a management scholar exploring innovation and strategic dynamics of entrepreneurial change. His outlook on management is heavily coloured by moral responsibility, particularly ethics of care and sustainability. Pervaiz has held a number of senior positions in the UK before coming to Malaysia. He has published extensively in international journals and has been the recipient of a number of academic awards for

his research. He has served as editor and sits on the editorial boards of several international journals. He has extensive experience working with and advising blue chip companies and public sector organizations, such as Unilever, Ford, AT&T, NCR, British Telecommunications, and the NHS in Europe. He has also been involved with corporate clients in Asia, as well as government agencies, such as the Singapore National Productivity Council. In recent times Pervaiz has been involved with the Government of Dubai's Public Sector Innovation and Improvement Initiative, and also served on projects commissioned by Economic Planning Unit (EPU), Ministry of International Trade (MITI) and APEC Secretariat.

Dr. Ravigadevi Sambanthamurthi, FASc, FMSA, DF-MABIC

Ravigadevi Sambanthamurthi is a scientific consultant to the Malaysian Palm Oil Board (MPOB). She was the founding Director of the Advanced Biotechnology and Breeding Centre of MPOB and Honorary Professor of Biosciences, University of Nottingham Malaysia Campus. She was one of the pioneers in research on oil palm biotechnology, and led the MPOB Oil Palm Genome Project. She has numerous publications, including three in Nature as a corresponding author, and holds more than 40 patents/patent applications. She is a member of Malaysian Mensa. She was honoured as an Intel Environment Laureate, and received the Tech Museum Award, USA in recognition of *"individuals and organisations whose ideas and execution are changing the world".* She was also honoured as a Knight of the International Order of Inventors by the International Federation of Inventors Association for her innovative solutions to environmental challenges

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LIST OF ABBREVIATIONS

ACB	ASEAN Centre for Biodiversity
AEC	ASEAN Economic Community
AI	Artificial Intelligence
ASC	ASEAN Security Community
ASC	ASEAN Smart Cities
ASCC	ASEAN Socio-Cultural Community
ASCN	ASEAN Smart Cities Network
ASEAN	The Association of Southeast Asian Nations
ASUS	ASEAN Sustainable Urbanisation Strategy
BD	Biodiversity
BHP	Bakun Hydro-electric Project
BII	Biodiversity Intactness Index
BMI	Biomass Intactness Index
BOLD	Barcode of Life Data
CarBI	Carbon and Biodiversity Project
CBD	Convention on Biological Diversity
CBOL	Consortium for the Barcode of Life
CEPA	Communication, Education and Public Awareness
CFN	Campaign for Nature
CH_4	Methane
CITIES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO_2	Carbon dioxide
COP	Conferences of the Parties
COVID-19	Coronavirus Disease
DBKL	Dewan Bandaraya Kuala Lumpur
DDBJ	DNA Data Bank of Japan
DestinE	Destination Earth
DFDR	Development-forced displacement and resettlement
DNA	Deoxyribonucleic acid
eDNA	Environmental DNA
EDRR	Early Detection and Rapid Response
EIA	Environmental Impact Assessment
EMBL	European Molecular Biology Laboratory
EPU	Economic Planning Unit
ERC	Ecosystem Restoration Concession
ESG	Environmental, Social, Governance
FAO	Food and Agriculture Organisation
FELDA	Federal Land Development Authority
G7	Group of Seven
GDP	Gross Domestic Product
GHG	Greenhouse gas

GIS	geographical information system
GNI	Gross National Income
GPFG	Government Pension Fund Global
HAC	High Ambition Coalition
HCV	High conservation value
HF	human footprint
HoB	Heart of Borneo
IAS	Invasive Alien Species
iBOL	International Barcode of Life
ICT	Information and Communication Technology
IFC	International Finance Corporation
IoT	Internet of Things
IP	Indigenous People
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPLCs	Indigenous Peoples and Local Communities
IPOs	Initial Public Offerings
ISC	Interim Steering Committee
ISEAS	Institute of Southeast Asian Studies
ISPO	Indonesia Sustainable Palm Oil
ITQs	Individual transferable quotas
ITTO	International Tropical Timber Organisation
IUCN	International Union for Conservation of Nature
IVF	*in vitro* fertilization
JCSPO	Jurisdictional Certification of Sustainable Palm Oil
KBA	Key Biodiversity Area
KSWS	Koe Seima Wildlife Sanctuary
LAC	Latin America and Caribbean
MCAP	Marine Convention Action Plan
MEAs	Multilateral Environmental Agreements
MENA	Middle East and North Africa
MESTEC	Ministry of Energy Science Technology Environment & Climate Change
MOA	Ministry of Agriculture
MPA	Marine Protected Areas
MPAC	Master Plan on ASEAN Connectivity
MPOB	Malaysian Palm Oil Board's
MRC	Mekong River Commission
MSPO	Malaysia Sustainable Palm Oil
MWWS	Moeyunggi Wetland Wildlife Sanctuary
MyBIS	Malaysia Biodiversity Information System
N_3O	Nitrous oxide
N8R	Nature Centric 8R philosophy
NAP IAS	National Action Plan on Invasive Alien Species

NbS	Nature-based Solutions
NCTF	National Conservation Trust Fund for Natural Resources
NDCs	Nationally Determined Contributions
NGOs	Non-governmental Organisation
NTFP	Non-timber forest products
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
OECM	Other effective area-based conservation measures
PA	Protected area
PAMB	Protected Area Management Board
R&D	Research & development
REDD	Reducing Emissions from Deforestation and Forest Degradation
RoI	Return of Investment
RoV	Return on Value
RSPO	Roundtable of Sustainable Palm Oil
RTRS	Round Table on Responsible Soy Association
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SCORE	Sarawak Corridor of Renewable Energy
SDGs	Sustainable Development Goals
SEA	Southeast Asia
SEEA	System of Environmental Economic Accounting
SIMP	Sister's Island Marine Park
STIE	Science, Technology, Innovation and Economy
STIs	Science, Technology and Innovations
SWFs	Sovereign Wealth Funds
TMP	Tun Mustapha Park
UAE	United Arab Emirates
UAVs	Unmanned aerial vehicles
UES	Urban ecosystem services
UK	United Kingdom
UN	United Nations
UNCAC	United Nations Convention Against Corruption
UNDRIP	United Nations Declaration on the Rights of Indigenous People
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
VOCs	Volatile organic compounds
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund for Nature
4IR	Fourth Industrial Revolution
5MHRP	Five Million Hectare Reforestation Programme

APPENDICES

APPENDIX A: BII for ASEAN nations

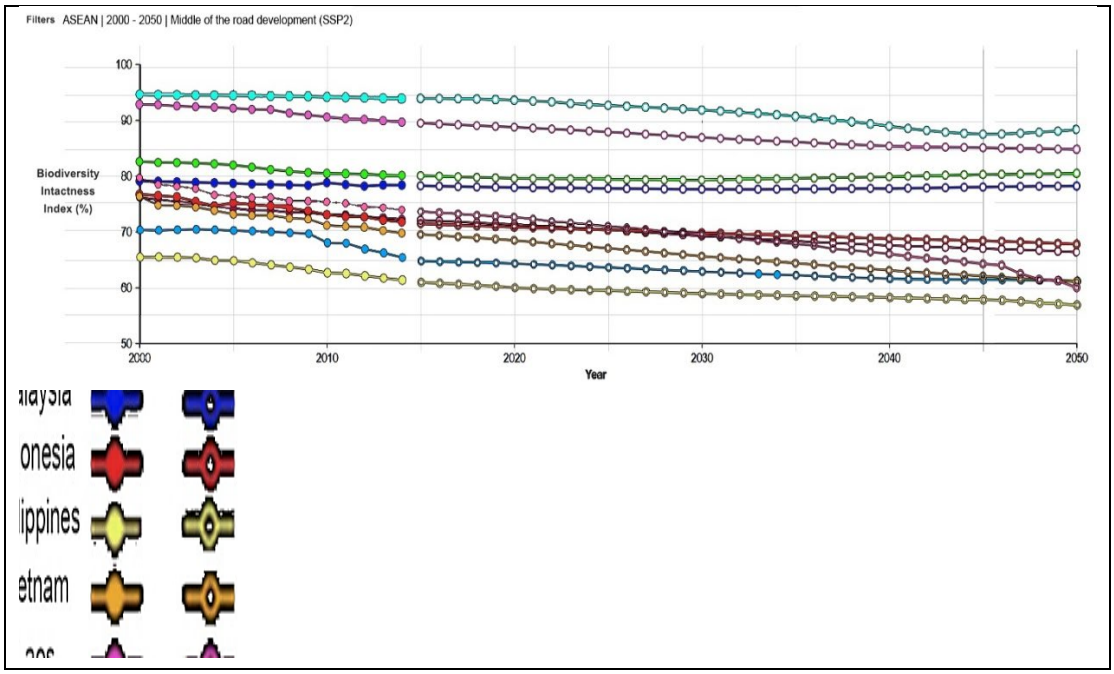


Figure A: BII for ASEAN nations under the second scenario of middle of the road development

Note: Figure A BII for ASEAN nations under the second scenario of middle of the road development. Statistics were not available for Singapore

APPENDIX B: Blue Economy Initiatives in Southeast Asia

Country	Blue Economy Initiatives	Financing Mechanisms
Cambodia	• **Sustainable tourism in Sihanoukville.** This includes zoning of beach for business area, green space, public access, and sanitation facilities as well as solid waste management. • **Sustainable port in Sihanoukville.** This involves implementation of the Port Safety, Health and Environmental Management System (PSHEMS) in the project site. • **Solid waste and wastewater management in Sihanoukville.** The project focuses on improving the garbage collection and landfill facilities, and the construction of a wastewater treatment plant in Sihanoukville. • **Sustainable Coastal and Marine Fisheries Project.** This project aims to enhance sustainable coastal and marine fisheries value chain and contribute to food security, and socioeconomic development of the Cambodian people.[a]	The Sihanoukville Project is part of the PRC's Belt and Road Initiative (BRI) Investment of $4.2 billion.
Indonesia	• Mangrove restoration and coral reef rehabilitation. • Ecotourism and marine protected areas. • PROPER program: This encourages compliance of industries to pollution regulations through an awarding or recognition system. • Green ports: PT Terminal in Lamong Bay has installed semiautomatic technology, which applies efficient sustainable practices for optimal performance and harmonious coexistence with the surroundings. • National Action Plan on Marine Plastic Debris, 2017–2025. • National Plastic Action Partnership.[b] • Sustainable and Equal Growth of Marine and Coastal Regions. • Establishment of blue economy demonstration zones in Lombok and Anamabs islands and Tomini bay for exploring the blue economy model featured with marine industry, fishery, breeding, seaside tourism industries, small island collective, regional, and bay development.	Mix of regional and national budgets, and supported by other programs such as "polluters pay principle" and strategic financing from international organizations and private investors.
Lao PDR	Wastewater management through the Fourth GMS Corridor Towns Development Project.	ADB grant of $48 million and sovereign fund of $6 million.
Malaysia	• Marine protected areas and ecotourism. • Green ports. • Sustainable marine aquaculture. • Sustainable fisheries: stock assessment; management strategies e.g., zonation, gear based, licensing, monitoring, and enforcement. • Alternative livelihood: seaweed cultivation; tourism. • Climate change response: National Coastal Vulnerability Index study. • Implementation of the Integrated Shoreline Management Plan; adaptation measures.	Mainly through regional and national budgets and tourism revenue.

Country	Blue Economy Initiatives	Financing Mechanisms
Philippines	• **Sustainable fisheries.** Work in this area includes amendment of the Fisheries Code; development of an ecosystem approach to fisheries management; establishing a 10-year plan of action to address illegal, unreported, and unregulated fishing; registration of fisherfolk, fishing vessels and gears; conservation of blue crabs and swordfish; implementation of closed season for sardines and small pelagic fishes; and banning the harvesting of sargassum and black corals. • **Sustainable tourism.** Initiatives in this area include preparation of the National Ecotourism Strategy and Action Plan (2013–2022); development of Zero Carbon Resorts and Green Fins program; MPA/tourism branding; promotion of marine and coastal heritage sites and parks such as theTubbataha Reefs Natural Park. • **Ecosystem conservation.** This includes initiatives such as the Mangrove and Beach Forest Development Project; the coral reef rehabilitation; the SmartSeas Program; and the MPA Network for sea turtles.	Public: national and international organizations and tourism fees revenue.
Thailand	• The Laem Phak Bia Project in Phetchaburi province aims to develop simple, natural, and low-cost wastewater and waste treatment models ideal for Thai communities. • The low carbon tourist destination project in Koh Mak, Trat Province uses alternative energy, waste management, and preserve traditional way of life. • The Bor Hin farmstay in Amphor Sikao, Trang province, combines ecotourism, mangrove reforestation, and the Seagrass Seeding Bank. • The Crab Bank Model in Chumporn and Surat Thani promotes education, stock assessment, and co-management with fisher communities.	Public: national and international organizations.
Viet Nam	• Mangrove restoration in Ca Mau and Tien Giang province (GCF). • Biodiversity conservation to respond to climate change (UNDP). • Green growth for 28 coastal provinces in Viet Nam (UNEP).	Public: national and international organizations.

ADB = Asian Development Bank, GCF = Green Climate Fund, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, MPA = marine protected area, PRC = People's Republic of China, PROPER = Program for Pollution Control, Evaluation, and Rating, UNDP = United Nations Development Programme, UNEP = United Nations Environment Programme.

[a] ADB. Cambodia: Sustainable Coastal and Marine Fisheries Project

[b] World Economic Forum. 2020. *Radically Reducing Plastic Pollution in Indonesia: A Multistakeholder Action Plan.* National Plastic Action Partnership. April.

Source: The ASEAN Catalytic Green Finance Facility.

APPENDIX C: National Estimates of Mangrove Carbon Holdings

Country name	Mangrove area (2012) (km^2)	Mangrove area rank	Tonnes of carbon	Percent of global total	C rank
Indonesia	23,324.29	1	1,275,115,175 ± 19,597,086	30.41	1
Brazil	7,674.94	2	389,760,564 ± 9,556,539	9.30	2
Malaysia	4,725.84	3	258,882,085 ± 4,002,528	6.17	3
Papua New Guinea	4,172.29	4	223,096,105 ± 3,836,601	5.32	4
Australia	3,316.21	5	152,539,573 ± 2,104,454	3.64	5
Mexico	2,991.83	6	149,261,592 ± 1,203,826	3.56	6
Nigeria	2,653.99	7	127,914,456 ± 2,559,377	3.05	7
Myanmar	2,557.45	8	118,883,668 ± 1,409,261	2.84	8
Venezuela	2,403.83	9	112,537,865 ± 1,851,142	2.68	9
Philippines	2,064.24	10	104,470,697 ± 1,341,367	2.49	10
Thailand	1,886.33	11	91,793,396 ± 1,414,284	2.19	11
Colombia	1,671.86	13	84,108,157 ± 1,831,402	2.01	12
Cuba	1,633.46	14	81,223,503 ± 651,189	1.94	13
USA	1,568.60	15	75,453,694 ± 622,606	1.80	14
Bangladesh	1,772.98	12	74,049,402 ± 653,854	1.77	15
Panama	1,323.94	16	72,923,978 ± 1,222,387	1.74	16
Gabon	1,082.11	19	58,592,889 ± 1,979,216	1.40	17
Mozambique	1,223.67	17	55,803,315 ± 723,403	1.33	18
Ecuador	935.74	20	55,566,461 ± 1,660,042	1.33	19
Cameroon	1,112.76	18	53,980,215 ± 1,138,012	1.29	20

Source: Hamilton and Friess, 2018

ANNEXES

ANNEX 1

(Complete information for Section 2)

2.0 THE SOUTHEAST ASIAN LANDSCAPE

Southeast Asia comprises The Association of Southeast Asian Nations (ASEAN) and Timor-Leste. ASEAN is an economic bloc formed in 1997 with just five countries, Malaysia, Indonesia, Thailand, Singapore and The Philippines. Today it also includes the five remaining countries of Southeast Asia, namely, Brunei, Cambodia, Laos PDR, Vietnam and Myanmar, except Timor-Leste. Southeast Asia is a hotspot of biodiversity, and is biologically unique and complex, mirroring its unique biogeography. Although it covers only 4% of the earth's land area, Southeast Asia hosts 20–25% of the world's plant and animal species and is a major global biodiversity hotspot (Lechner *et al*., 2021; Hughes 2017; Sodhi *et al*., 2010; Lechner *et al.,* 2021; Myers *et al.,* 2000; Mittermeier *et al.,* 2005). It has 30% of the world's coral reef and the largest diversity of reef-associated animals in the planet (Spalding *et al.,* 2001), facilitated by its shallow warm waters. A combination of expanding human population and economic development has placed unprecedented pressure on Southeast Asia's natural capital. Concerted action is vital at the regional level (e.g. by leveraging on the excellent job currently ongoing at the ASEAN Centre for Biodiversity (ACB) in the Philippines as well as the ASEAN Centre for Development in Jakarta) for the protection of biodiversity to ensure sustainable economic development, a healthy ecosystem and food security for a fast-growing population in the region.

Image A1.1: Underwater marine life in Philippines

Source: Pixabay.com, photo by Baechi.

Southeast Asian biodiversity is often described in terms of biogeographic units, the 4 major units being Sundaland, Wallacea, Indochina, and the Philippines. These four biogeographic zones are each considered as one of the most biodiverse regions of the globe (Myers *et al.*, 2000) but they are also the most biologically threatened (Schipper *et al.,* 2008). With a population exceeding 655 million, and population densities of twice (Wallacea), thrice (Indochina and Sundaland), and six times (Philippines) the world mean of 44 people/km^2 (demographic data from The Economist 2008, cited by Woodruff, 2010), and the related pressures on biodiversity, Southeast Asia has seen the highest rate of habitat loss in the world with estimated loss of 95% of its original habitat (Sodhi *et al.,* 2010). The threats are complex, and it is important to understand **the drivers of the biodiversity threats** to devise effective conservation and restoration strategies for the region.

2.1 Sundaland

Image A1.2: The proboscis monkey (*Nasalis larvatus*) or long-nosed monkey. Picture taken at the Bako National Park, Kuching, Malaysia

Source: Unsplash, photo by Joshua Stitt

Sundaland covers Peninsular Malaysia, Borneo, Java, Sumatra and smaller islands on the Sunda Continental Shelf (Myers *et al*., 2000). The Sundaland Biodiversity Hotspot is one of the most biologically rich regions of the planet, housing about 25,000 vascular plant species, of which 60 percent are endemic (Brooks *et al.,* 2002). Plant species include the Rafflesia, dipterocarps, and orchids. The hotspot holds around 380 species of mammals, 115 of which are endemic (Brooks *et al.,* 2002) including iconic species like the critically endangered Javan (*Rhinoceros sondaicus*) and Sumatran (*Dicerorhinus sumatrensis*) rhinos. It is home to the

Sumatran (*Pongo abelii*) and the Bornean (*Pongo pygmaeus*) orangutan, both of which are critically endangered. It also houses the endangered proboscis monkey (*Nasalis larvatus*), which is only found in Borneo.

Sundaland is home to a diversity of ecosystems such as coral reefs, lowland rainforests, mangrove forests, swamp forests, and montane and subalpine forests. Sundaland faces the highest deforestation rates in Southeast Asia, and is considered a terrestrial global conservation priority based on its high species endemism and habitat loss (Myers *et al.,* 2000; Polgar & Jaafar, 2018). Overall, the Sundaland biodiversity hotspot has been subjected to intense human pressure that hampers key conservation efforts in the region. More than 70% of protected land is under immense human pressures, outstripping the 30% average for global protected land, owing to the high focus of human activities in Sundaland (Jones *et al.,* 2018).

2.2 Wallacea

Image A1.3: The Vagina Mountain in Enrekang, South Sulawesi
Source: Flickr, photo by Axel Drainville

Wallacea is a distinct biogeographic domain defined by thousands of oceanic islands hosting a highly endemic faunal assemblage (Sodhi *et al*., 2004). Sulawesi Island is the largest of these islands. The islands support highly diverse biological communities. Wallacea contributes to the high level of endemism in Indonesia. Its high endemism is attributed to the formation of a speciation region (where new species are naturally bred) between the species of Asian and

Australian continental shelves. Almost 50% of the flora and the fauna in Wallacea are unique to this small region as a result of isolation and speciation. Wallacea is demarcated by a boundary line called the Wallace line. The islands on the west of the line are populated by mammals more similar to those in East Asia such as apes, rhinos, and tigers. Islands east of the line are home to birds and marsupials that are more similar to those in Australasia, while Sulawesi Island has a mix of the faunas from both sides of the line.

Wallacea is home to more than 10,000 plant species of which 15% are endemic and 1142 vertebrate species of which 45% are endemic (Hernani, 2018). It has 220 different mammals, 125 of which are endemic, over 220 species of reptiles and 50 amphibian species (Mala, 2021). Its 100 endemic reptiles include the Komodo dragon (*Varanus komodoensis*), the largest reptile on Earth. One of the most critically endangered animals in the Wallacea, is the Roti Island snake-necked turtle (*Chelodina mccordi*).

Image A1.4: The Roti Island snake-necked turtle (*Chelodina mccordi*)
Source: Wikimedia Commons, photo by H. Zell

Wallacea has the richest marine biodiversity on earth and is exceptionally rich in coral reefs (Critical Ecosystem Partnership Fund, 2014). Almost any location in Wallacea is within 100 kilometres of the coast. Most of its 30 million people live in coastal areas, making their livelihood from farms, forests, wetlands and sea. Coastal and inland indigenous communities have developed diverse mechanisms to control and manage their natural resources. However, immigration, population expansion and the development of policies in favour of large-scale plantations, and logging and mining concessions have changed these mechanisms. Urbanisation and population growth are stressing the regions bioresources but less than 6% of the region is within protected areas (Mala, 2021).

2.3 The Philippines

The Philippines with its 7,107 islands spread across the Western Pacific Ocean, and which includes the islands of the Sulu Archipelago and Palawan, is one of the most biodiverse countries of the planet, **containing two-thirds of the Earth's biodiversity and 70 percent of the world's plants and animal species**. With the exception of Palawan, the other islands of the Philippines have never been connected to any other Asian landmass. This isolation from the rest of Asia explains its unique flora and fauna, and stunning level of endemism. **The Philippines ranks second among the world's 25 top biological hotspots** in terms of number of species per square kilometre, indicating that the endemic species are concentrated in particularly small areas (Myers *et al.,* 2000). The Philippines outweighs the Galapagos in species biodiversity and endemism, and has been described as tenfold more diverse than Galapagos (Heaney & Regalado, 1998). Forty-four percent of its vertebrate species, and almost 70% of its insects are not found anywhere also else on the globe (Sinha & Heaney, 2006). 172 terrestrial mammals have been listed as native to the Philippines, of which 111 (64%) are endemic (Heaney *et al*., 2002). The number of endemics which includes 22 endemic genera is believed to be the highest for any mammalian fauna (adjusted for area). Around 22 new mammal species were discovered between 1992 and 2002 attesting to its rich mammalian fauna and the fact that more species await discovery while several may have become extinct even before discovery. About 30% of the highly diverse avi-fauna comprising 572 species are endemic to the Philippines (Kennedy *et al*., 2000).

Image A1.5: Aerial view of islands in the Philippines
Source: Pexels.com, photo by Symeon Ekizoglou

The Philippines as one of the top global conservation areas has at least 700 threatened species. Between 2000 and 2005, it lost an estimated 2.1% of its forest cover annually. This was the second highest rate of deforestation in Southeast Asia after Myanmar and seventh in the world (Convention on Biological Diversity, 2021).

2.4 Indochina

Indochina comprising Cambodia, Lao PDR, Thailand, Myanmar and Vietnam and parts of southern China has a wide diversity of ecosystems such as mixed wet evergreen, dry evergreen, deciduous, and montane forests, lowland floodplain swamps, and mangroves. Critical ecosystems include the great Mekong River which alone hosts about 1,100 species of fish (Rainboth *et al.,* 2010), and the flood lands associated with it, and Southeast Asia's largest lake, the Tonle Sap Lake in Cambodia.

Indochina hosts more than 7,000 endemic plant species representing 52% of its flora (van Dijk *et al*., 2004). More than 430 mammalian species have been reported of which 71 are endemic. 74 of the 1,277 bird species found in Indochina are endemic. Even higher levels of endemism are observed in other vertebrate groups with 139 of the 323 amphibian species and 189 of the 519 non-marine reptile species being endemic to this hotspot (van Dijk *et al.,* 2004). It has the highest global diversity of freshwater turtles (53 species) (van Dijk *et al*., 2004; Conservation International, 2007). It has a staggering **1,262 documented species of freshwater fish, representing about 10 percent of the total global fish fauna, including 566 endemics** (van Dijk *et al*., 2004). **Of the 34 global hotspots, Indochina has the largest human population.** This is reflected in the statistic that its remaining natural habitat is only about 5% of its original extent (Mittermeier *et al*., 2004). There has been a further increase in deforestation, with the rate of tree cover loss doubling during the 2010-2019 period compared to 2000-2010. The accelerating habitat loss and overexploitation have placed immense pressures on both plant and animal populations. **There was more than a 70% increase in species listed as threatened on the International Union for Conservation of Nature (IUCN) red list between 2011 and 2020** (Indo-Burma Biodiversity Hotspot, 2020).

Image A1.6: Oil palm estate and rainforest in Malaysian Borneo

Source: Mongabay.com, photo by Rhett Butler

The saola (*Pseudoryx nghetinhensis*), which is considered the flagship land animal of the hotspot is critically endangered. Indochina is also notable for its concentration of globally threatened primates, of which 20 are endemic. These include the pygmy loris (*Nycticebus pygmaeus*) and the critically endangered Delacour's leaf monkey (*Trachypithecus delacouri*) The critically endangered hairy rhinoceros (*Dicerorhinus sumatrensis*) may have recently been illegally hunted to the point of extinction in the region. The lesser one-horned rhinoceros (*Rhinoceros sondaicus*) which is also critically endangered, recently disappeared from the hotspot, and currently survives in only one location in Java.

There have been no confirmed records of sightings since 1978 of the white-eyed river-martin (*Eurychelidon sirintarae*) which is considered Indochina's most enigmatic and rarest bird. Although categorized as critically endangered, it may well be extinct already.

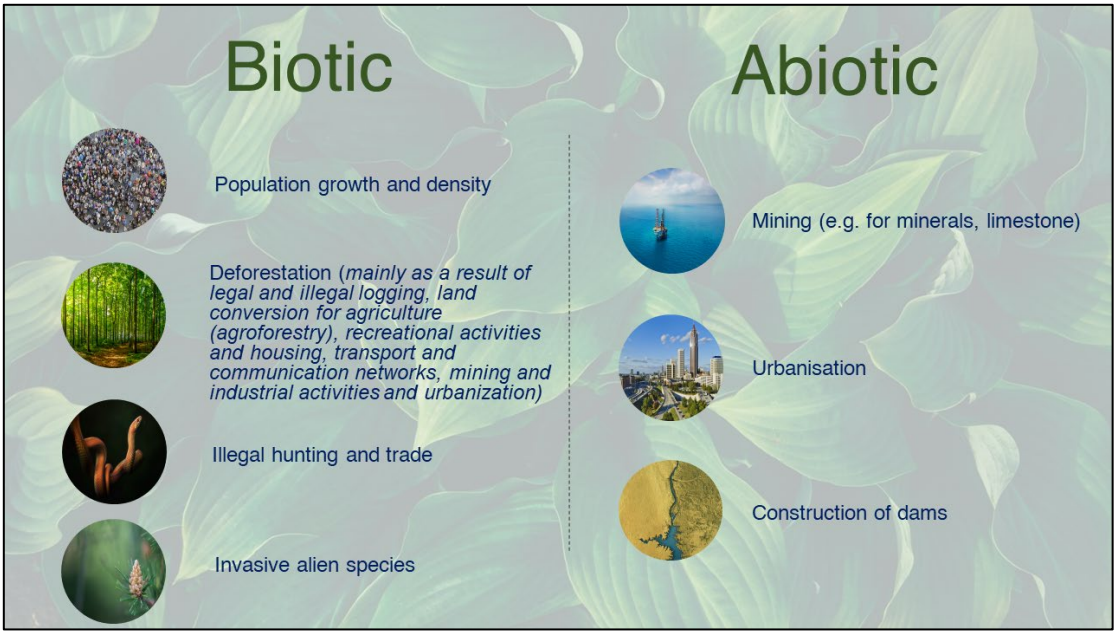
The best-known globally threatened fish in Indochina is the critically endangered Mekong giant catfish (*Pangasianodon gigas*). Other globally threatened species include the critically endangered giant carp (*Catlocarpio siamensis*), endangered Jullien's golden carp (*Probarbus jullieni) and* the endangered Mekong freshwater stingray (*Dasyatis laosensis*) (Critical Ecosystem Partnership Fund, 2021). **Strategies are urgently needed to address the conservation issues of expansion of agro-industry, wildlife trade, hydropower development.**

ANNEX 2

(Complete information for Section 5)

5.0 DRIVERS OF BIODIVERSITY LOSS AND THE IMPACT

Biodiversity loss is driven by a combination of forces. These are categorized as **biotic** and **abiotic**.



Each of these is examined and discussed with respect to biodiversity loss and economic development, citing specific examples as significant to the ASEAN region.

5.1 Biotic Drivers

5.1.1 Population growth and density

The expansion of human population and resultant heightened demand for resources are the key drivers of biodiversity loss in Southeast Asia. Sodhi *et al.* (2010) found that human population density was negatively correlated with percentage of remaining natural forest, and positively correlated with percentage of threatened bird species within Southeast Asia. Based on the United Nations estimates, as of 19 October 2021, the population of **Southeast Asia** was **677,162,159** which is equivalent to 8.58**%** of the total global population (Worldometer, 2021). There is also an increasing urban population in most of Southeast Asia. Urban population is positively correlated with the number of species (both plant and vertebrate) listed on the IUCN Red List as Vulnerable, Endangered and Critically Endangered (Sodhi *et al.,* 2010).

5.1.2 Deforestation

Deforestation is among the greatest threats to terrestrial biodiversity in Southeast Asia which has one the highest deforestation rates in the world with an average annual loss of 1% during the first decade of the century (see Table A2.1) **(**Miettinen *et al.,* 2011). Peat swamps encountered the most dramatic declines of 2.2%. Lowland evergreen forests decreased by 1.2% annually. Two areas with severe forest loss exceeding 5.0% yearly were the peatlands of Sarawak, and eastern lowlands of Sumatra, both of which lost about 50% of their peat swamp forest within a decade (see Table A2.2). Owing to difficulty in differentiating forest from tree-plantations, and since even the word "forest" is often not well defined, this is probably an underestimate. Losses may have been partially masked by the establishment of large-scale plantations. **Megadiverse Philippines has already lost more than 93% of its original forest cover** (Myers *et al.,* 2000, Brooks *et al.,* 2006). Based on analysis by the WWF, between 1973 and 2009, forest cover declined from 73% to 51% in Southeast Asia. The forests also became more fragmented. Cambodia lost 22%, Laos and Myanmar 24% each, and Thailand and Vietnam 43% each of their forest cover during this time period (WWF Greater Mekong, 2013). Only 46% of original forest cover in Indonesia was left by 2015. The period between 2009 and 2013 saw an annual loss of over 917,000 ha (Butler, 2015). Deforestation takes place mainly as a result of conversion to agriculture (agroforestry), commercial/illegal logging, expansion of settlements, road building, mining and urbanization i.e. anthropogenic activities.

While forest loss was concentrated in lowlands of Southeast Asia (SEA) in the first decade of this century, the following decade saw an acceleration of deforestation in the mountain forests largely because there were less suitable lowland forest areas for conversion for agriculture. Mountain forest loss represented a significant portion of the total forest loss increasing from 24% to 42% in 2019 (Feng *et al.,* 2021). The total mean annual forest loss during 2001-2019 was 3.22 Mha yr^{-1} of which 31% was mountain forest loss. The mountains of SEA have higher forest biomass and hence higher carbon stocks than lowland forests. This has serious implications on climate change.

Besides reducing the habitats and thus endangering the existence of numerous endemic forest species, the high deforestation rates especially of peatlands which store tremendous amounts of carbon would have serious global consequences as a result of dramatic increase in carbon emissions.

Table A2.1: Deforestation rates between 2000 and 2010 for different forest types in the total study area. Source: Miettinen *et al.*, 2011

	2000		2010		Change 2000–2010		
	1000 ha	%	1000 ha	%	1000 ha	%	%/yr
Mangrove	2706	1.2	2367	1.1	−339	−12.5	−1.3
Peat swamp forest	13 970	6.4	11 214	5.1	−2756	−19.7	−2.2
Lowland evergreen forest	70 889	32.2	63 020	28.7	−7869	−11.1	−1.2
Lower montane forest	18 397	8.4	18 019	8.2	−378	−2.1	−0.2
Upper montane forest	6574	3.0	6814	3.1	240	3.6	0.4
Total forest area	112 536	51.2	101 434	46.1	−11 102	−9.9	−1.0

Table A2.2: Forest cover change from 2000 to 2010. Source: Miettinen *et al.*,2011

	2000		2010		Change 2000–2010		
	1000 ha	%	1000 ha	%	1000 ha	%	%/yr
Peninsular Malaysia	5388	41.1	4947	37.7	−441	−8.2	−0.9
	287	*2.2*	*235*	*1.8*	*−52*	*−18.0*	*−2.0*
Sumatra	14 555	33.5	11 104	25.5	−3451	−23.7	−2.7
	3131	*7.2*	*1839*	*4.2*	*−1292*	*−41.3*	*−5.2*
Borneo	41 688	56.6	36 688	49.8	−5000	−12.0	−1.3
	4182	*5.7*	*3144*	*4.3*	*−1038*	*−24.8*	*−2.8*
Java	866	6.8	902	7.1	37	4.2	0.4
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Sulawesi	8959	53.0	7993	47.1	−966	−10.8	−1.1
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
New Guinea	31 625	84.8	30 859	82.7	−767	−2.4	−0.2
	6336	*17.0*	*5970*	*16.0*	*−366*	*−5.8*	*−0.6*
Indonesia	94 867	51.3	86 039	46.5	−8828	−9.3	−1.0
	12 740	*6.9*	*10 541*	*5.7*	*−2199*	*−17.3*	*−1.9*
Malaysia	17 242	52.4	14 962	45.4	−2281	−13.2	−1.4
	1230	*3.7*	*673*	*2.0*	*−557*	*−45.3*	*−5.9*
Total study area	112 536	51.2	101 434	46.1	−11 102	−9.9	−1.0
	13 970	*6.4*	*11 214*	*5.1*	*−2756*	*−19.7*	*−2.2*

In addition to the total forest area statistics, peat swamp forest figures are given in *italics*.

Agriculture

Between 1990 to 1997, agriculture was one of the main causes of land conversion of Southeast Asian forests (Achard *et al.,* 2002). There are various agroforestry practices in Southeast Asia ranging from small scale fruit farming, a minor driver of deforestation, to **large scale plantations like oil palm, rubber and wood pulp that feature as major drivers of deforestation**. The increasing demand for vegetable oil and the high productivity of oil palm has made it one of the world's most rapidly expanding crops, but often at the expense of primary forest mass. This has been especially intense in Malaysia and Indonesia, which together account for more than 80% of the global palm oil supply (Wilcove & Koh, 2010). **Forest conversion to oil palm was responsible for 94% of Malaysia's deforestation from 1990 to 2005** according to Wilcove and Koh (2010).

Danielsen *et al.* (2009) reported that in comparison to natural forests, only 23% and 31% of forest vertebrate and invertebrate species were present respectively in oil palm plantations. Koh and Wilcove (2008) suggested that **a possible mitigation strategy would be to confine further expansion of oil palm cultivation to pre-existing croplands and degraded forests** (Koh & Wilcove, 2008). Southeast Asia is also a major producer of natural rubber, accounting for 87% of world exports. Although it is predominantly a smallholder crop, it contributes to 85–93% of total production (Fox & Castella, 2013). Additionally, as a total of 4.3–8.5 million hectares of land was required to meet increased global demand for natural rubber (Warren-Thomas *et al*., 2015), further expansion has taken place even into mountainous terrain which has had a strong negative impact on biodiversity across much of Southeast Asia (Fox *et al.,* 2014).

Apart from the above crops, Southeast Asia has also been a major global producer and exporter of timber products since the 1950s (International Tropical Timber Organization (ITTO), 2008).

Unsustainable logging practices such as **clear cutting where most or all the trees in a harvest area are felled** was carried out for many decades due to poor forestry policies (Ross, 2001). But even with **selective logging** where only particular trees are cut and the rest left intact and therefore is a more ecologically sustainable harvesting method, this practice can still cause significant forest degradation and affect species richness (Foody & Cutler, 2003) i.e. biodiversity.

Besides causing deforestation, agriculture is also a source of pollution from input run-offs. Chemical inputs like pesticides and fertilisers leach through soils to groundwater and run off into rivers and lakes thus impacting aquatic ecosystems. Accumulation of nutrients like nitrates and phosphorus in the water ways leads to eutrophication, with dire consequences on biodiversity, fisheries and recreational water bodies.

While there is an urgent need to preserve their remaining forests, countries in Southeast Asia are targeting to increase their agricultural production and improve infrastructure network. A sustainable approach to development that minimises trade-off costs is important. The Heart of Borneo Initiative is an example of such an approach.

Case Study A2.1: The Heart of Borneo Initiative

Borneo, the world's third largest island, accounts for only one percent of total global land. Yet it houses six per cent of global biodiversity, particularly within its pristine forests. But this precious natural resource has been at high risk of being totally depleted. As much as 50 percent was wiped out over the last three decades. Hence in 2007, the Heart of Borneo (HoB) Initiative was formulated in Bali, Indonesia on 12 February by three concerned regional signatories, namely Malaysia, Indonesia & Brunei. It is a conservation initiative to protect 23.4 million hectares of forests in central Borneo. Within the designated area are nature reserves such as the Bentung Kerihun National Park mainly in Indonesia, but bordering also with Sarawak, Malaysia. The park is the largest and richest conservation area within the HoB. It offers a prime example of how biodiversity conservation and protection efforts can simultaneously deliver valuable socioeconomic benefits to citizens of a country, through ecotourism and its multiplier effects. Besides the physical attractions, the Dayak community (IP) around it are further adding value to the experience by providing a more wholesome cultural exposure from opportunities for interaction with park visitors. This successfully implemented ecotourism opportunity has prompted plans to further expand the project (Sekartjakrarini *et al*., 2015). However, the pristine forested regions in HoB have also faced challenges; two mega-infrastructure projects were established in it: 1) *Trans-Kalimantan Road Network* – 5,316 km (16 routes across Kalimantan 2) *Pan Borneo Highway* – 2,333 km of major routes across Sabah and Sarawak. While both these highways have provided much needed transportation access across Borneo island (see insert below) and the opportunity to increase economic development, it has also brought in its wake an increase in the level of forest depletion, destruction, exploitation and appropriation by investors, e.g. the development of an "oil palm belt", although the latter does effect economic development and enhances the growth of human and physical capital while lifting communities out of poverty (see Section 5.3).

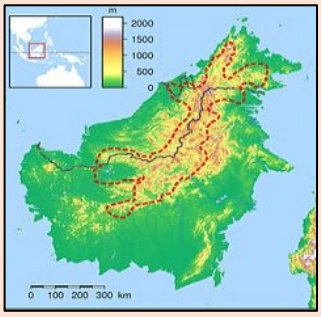


Image A2.11: Map of the proposed Heart of Borneo area
Source: WWF / Sadalmelik


Image A2.2: Pan Borneo Highway in Sarawak (Phase 1)
Source: Bimasia.

But such anthropogenic activities inevitably disrupt wildlife, deplete biodiversity and impact the life of IPLC (see Section 1.3), besides upending the topography of the region. On the flip side it does provide citizens and IPLC the chance for a better livelihood, arising from new infrastructure or spill-over effects that create new job opportunities and business activities, as is expected to happen also once the new ultra-modern capital of Indonesia rises in East Kalimantan, also located within the HoB (refer Box A2.1). With this latest projected development, it is even more vital now, for good governance and a revamped ecosystem supported by new nature-based local and international financing (see Section 7.2), to be initiated urgently within the HoB. A successful roll-out will establish HoB as a model that can be replicated around the region as it would showcase what can be achieved once there is a good fit between biodiversity conservation and economic development.

5.1.3 Illegal Hunting and Trade

In the aftermath of the covid pandemic, there has been sharpened focus on legal and illegal hunting and trading activities in wildlife and their products. The increased purchasing power of a bourgeoning middle-class population in Southeast Asia coupled with an appetite for wildlife products often associated with status and even presumed health benefits has created a huge demand for such products (Nijman, 2010). A great number of species are subject to threat and exploitation, including as bushmeat and traditional medicines (Corlett, 2007). Improved technology and road access to remote areas has escalated hunting in the region including in protected areas (Harrison *et al*., 2016). The sale of Southeast Asian animals caught in the wild, but falsely labelled as captive-bred, to circumvent trade regulations has led to the illegal capture of vast numbers of animals (especially snakes and reptiles) for zoos, aquariums, and for pet-trade (Nijman & Shepherd, 2009; Lyons & Natusch, 2011; Natusch & Lyons, 2012). The illegal wildlife sale within and from Southeast Asia for the pet trade especially for birds and mammals is among the highest globally (Bush *et al.*, 2014).

Although the destruction of rainforest ecosystems in Southeast Asia has been largely attributed to rampant deforestation, a recent study has discovered that widespread and intensive hunting, often with indiscriminate snares is a more immediate causative factor (Tilker *et al.,* 2019). Hunting and illegal wildlife trade represent the biggest threat to Southeast Asia's vertebrate diversity and abundance, with many sites of predominantly intact forest losing much of their former diverse and abundantt vertebrates, especially in the Annamites where intensive indiscriminate hunting largely with wire snares even in protected areas has greatly reduced terrestrial mammal and bird populations. The study has recoded that 25 species became functionally extinct in the Annamites forest as a result of illegal hunting in comparison to 4 species that went extinct in the logged forests of Sabah. The findings emphasise the need for stricter monitoring on illegal hunting. The tiger (*Panthera tigris*), which has been decimated in Vietnam and Cambodia is probably also extinct in Laos, as no tigers have been sighted at the Nam Et-Phou Louey National Protected Area since 2013 (O'Kelly *et al.,* 2012; Rasphone *et al.,* 2019). The Javan rhinoceros (*Rhinoceros sondaicus*) has become extinct in Vietnam (Brook *et al.,* 2014) while the large-antlered muntjac (*Muntiacus vuquangensis*) and Saola (*Pseudoryx nghetinhensis*) are critically endangered (Gray *et al.,* 2017). Their extinction/ decline is attributed to the surge in snaring. Over 200,000 snares were removed by wildlife rangers from just five protected areas in Southeast Asia, including Nam-Et Phou Louey, between 2010 and 2015 (Gray *et al.,* 2017).

This highlights that the same conservation interventions should not be applied for habitat loss and hunting. Hunting is associated with complex cultural, economic and social dimensions; as such new strategies may be required to separately circumvent the challenges presented by each of the two impacting activities.

Technology is an essential tool for monitoring and tracking wildlife trade. In addition to sophisticated use of scripts to decipher trafficking patterns of online auction sites (Kretser *et al.,*2014; Lavorgna, 2014), molecular technology has played a key role in detecting and

preventing trade in wildlife especially endangered species. DNA barcoding including metabarcoding can detect and identify animal species in traditional medicines and has the power to discriminate authentic from adulterant material in raw materials, processed products and even within complex preparations (Luo *et al,* 2013; Yang *et al,* 2018).

Citizens are ultimately the best solution to the problem. Education and engagement with society on sustainable practices is required across ASEAN to change human behaviour, and stigmatise illegal trade in and consumption of wildlife. The ***trading in wildlife at the Wuhan markets and the suggested zoonotic transmission of*** SARS-CoV-2 from here should serve as a stark reminder of possible dire consequences of legally or illegally traded wildlife.

5.1.4 Invasive Alien Species

Invasive Alien Species (IAS) are species that are accidentally or deliberately introduced into an environment outside their natural geographical range. They pose a serious threat to native species and ecosystems, cause economic loss, and are the second largest threat to biodiversity worldwide after habitat destruction.

Increasing globalization, together with environmental changes including climate change, favour the introduction and establishment of IAS. International trade is a key route for IAS, through trade in new plant species and animals. Transportation and shipping and trade in agricultural commodities, can lead to unintentional introduction of IAS.

As IAS transcend national borders, **it is important to have coordinated action at the ASEAN rather than just at the national level.** Combining information on invasion and establishment of IAS can strengthen early-warning and eradication strategies especially, since most countries have limited capacity to act against IAS. **A legislative framework should be in place to manage and mitigate the impact.** The importance of mitigating the spread and impact of IAS is recognised under the Convention on Biological Diversity (CBD). Article 8(h) of the CBD states that *Each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradication of those alien species which threaten ecosystems, habitats or species.*

In Southeast Asia, invasive plants have clogged up waterways, and invasive fish have displaced native species thus transforming aquatic ecosystems (Yong *et al*., 2014).

Image A2.3: A Golden Apple Snail (Pomacea maculata)
Source: Wikimedia, photo by Jpatokal.

One of the most destructive invasive weeds threatening ASEAN and global natural ecosystems is the giant salivinia (*Salvinia molesta*). It is found in different waterbodies including water catchment areas, irrigated rice fields, ponds and slow-moving rivers. It has infested naturally occurring oxbow lakes in Kinabatangan, Sabah in Malaysia. Mechanical and physical control have been ineffective and uneconomical. However, biological control using the weevil *Cyrtobagous salviniae* has proven to be highly effective in Peninsular Malaysia and has recently been distributed in Sabah also so as to establish populations in areas infested with *S. molesta*.

Image A2.4: Weevil Cyrtobagous salviniae
Source: Wikimedia, photo by Commonwealth Scientific and Industrial Research Organisation (CSIRO)

The IAS, *Clidemia hirta* from tropical America suppresses the native canopy tree species that are dependent on gaps for successful regeneration. It was postulated to have the potential to modify the forest ecosystem at Pasoh Forest, a near pristine primary forest in Peninsular Malaysia by changing the composition of the plant communities in the treefall gaps and thus

altering forest regeneration (Peters, 2001). It thus suppresses the native canopy tree species that are dependent on gaps for successful regeneration.

Image A2.5: *Clidemia hirta from the Maui, Hanawi stream in tropical America*

Source: Wikimedia, photo by Forest & Kim Starr

As Southeast Asia is mainly an agricultural region, early monitoring and rapid action at the operational level are extremely important for mitigating IAS, especially those that may destroy crops. Malaysia adopted the National Action Plan on Invasive Alien Species (NAP IAS) in 2014-2018 which was subsequently renewed in 2020 for adoption between 2021 and 2025. NAP IAS provides a valuable framework for policymakers, government agencies, and private institutions engaged in IAS management, and is anticipated to play a pivotal role in mobilising resources including relevant experts in various fields to address IAS issues in Malaysia. The three main goals of the NAP IAS are to i) improve the understanding and public awareness of IAS, ii) carry out risk assessments on all introduced exotic species before their release into the environment, and iii) strengthen quarantine inspection and enforcement at entry points and international borders.

IAS management is typically divided into four phases across an invasion curve (Figure A2.1). Preventing the establishment of IAS is obviously the most cost-effective way to reduce their impacts. Early detection and rapid response (EDRR), while effective and can result in their complete removal is more costly than prevention. As invasive populations grow, complete eradication becomes progressively implausible. Protracted efforts are necessary to contain the core population of a species and to eradicate it from new areas. Long-term management also aims to reduce populations to the lowest levels possible and thus protect valuable resources. Swift reporting and validation are key to any early warning and rapid response programme.

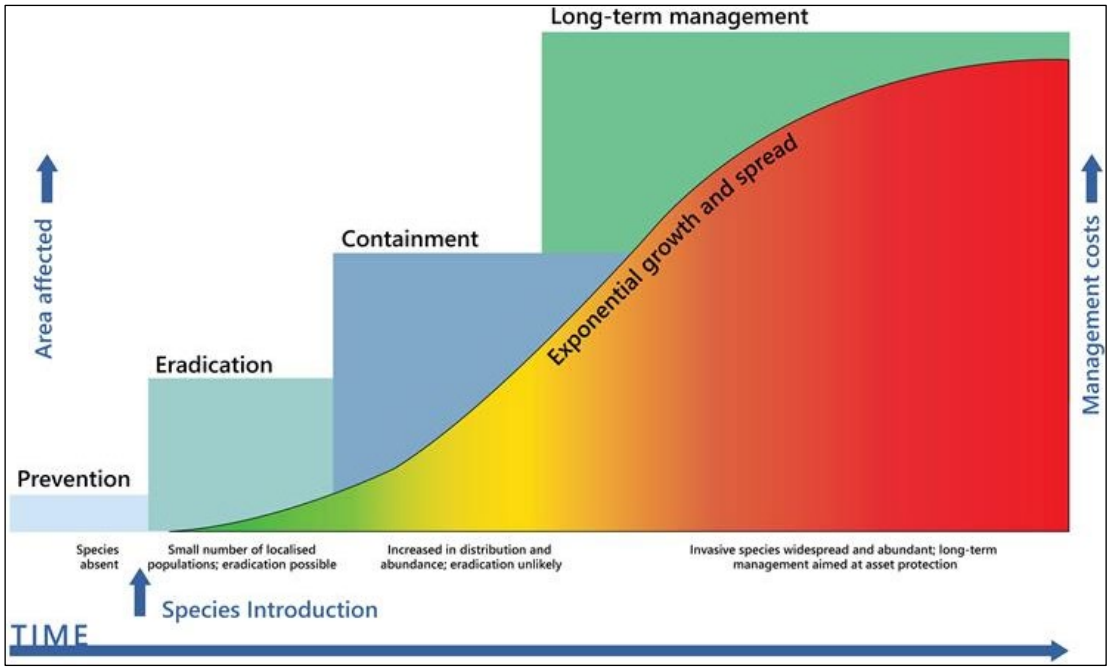


Figure A2.1: Invasion Curve

Source: Begley *et al*., 2020

Disruptive technologies can play a pivotal role in management of IAS in the ASEAN region and member nations should leverage such powerful technologies for biosecurity of the region. Genomics, with its high molecular precision is a powerful tool for rigorous diagnostics, identification of sources and risk assessments. These include DNA barcoding, use of unmanned aerial vehicles (UAVs), engineered biomimetics, acoustic detection and genetic biocontrol among others. Please refer to the Section on Disruptive Technologies for more detailed descriptions of the use of disruptive technologies for managing IAS.

5.2 Abiotic Drivers

5.2.1 Mining

Mining is a major driver of biodiversity loss that has received less attention than other drivers. There are two main types of mining in Southeast Asia, both of which have a serious impact on biological diversity: **i) underground mining for minerals and ii) mining of limestone outcrops (karsts) for the production of cement.**

Mining for minerals

ASEAN accounts for a significant share of global trade in tin, copper and nickel with Indonesia and Malaysia ranked as the 7th and 15th largest exporters of minerals. Malaysia was the world's biggest exporter of copper powder in 2019 (OEC, 2019a). Copper ore was the second most exported product of Laos in 2019 making it the world's 17th largest exporter of the mineral in

2019 (OEC, 2019b). While developing and operating a mine has a direct impact on biodiversity, for example by the clearing of land, there is also a multiplier effect caused by problems such as pollution of ground water from seepage, heavy metal accumulation, soil destruction and altered soil chemistry and fauna from open cast mining (Andres & Mateos, 2006). Aquatic diversity may especially be affected by mining activities (Brosse *et al.,* 2011; Wantzen & Mol, 2013). Coal mining is the fourth largest contributor to deforestation of large parts of Indonesia, especially Sumatra and Kalimantan (Abood *et al.,* 2014) indicating that despite having in place a framework for environmental management of mining (Maryati *et al.*, 2012), it has obviously not been properly implemented.

Mining of limestone outcrops (karsts)

The cement industry has been growing exponentially in tandem with the increase in construction and urbanisation. Limestone is the most common form of calcium carbonate which is used extensively for the manufacture of cement. **Vietnam and Malaysia are among the top five exporters of limestone** in the world (OEC, 2019a).

Karsts are associated with rich self-contained biodiversity. The often extreme soil and water conditions within karsts and their isolated characteristic, have provided the perfect environment for the creation of **unique biological species**. Karsts thus represent hotspots of endemism, and harbour highly specialized species. However, such species that are highly adapted to extreme environments cannot survive outside those habitats, and are prone to local extinction from environmental disturbance.

Southeast Asia (SEA) has an extensive karst landscape, and eight of the 47 world-heritage protected Karsts are in this region (Williams, 2008). Limestone caves are also an important habitat and resource for many species of bats. The steep topography and general inaccessibility of karsts have allowed many such landscapes to retain their forest cover and serve as a refuge for many species that have adapted to their new habitat when their previous habitat in surrounding more accessible forests were destroyed by anthropogenic activities. For example, the critically endangered monkey Delacour's langur (*Trachypithecus delacouri*) endemic to Vietnam has specially adapted pads on its hands, feet and rump that allows it to skillfully navigate the razor-sharp limestone. The refuge offered by karsts is being seriously **threatened by quarrying activities**. The Delacour's langur is also poached for traditional medicine and bushmeat. There are probably fewer than 250 adult Delacour's langurs left in the world as of 2015 (Nadler *et al.,* 2020). Prime Minister Nguyen Xuan Phuc, in 2019, urged scrutiny into the impact of stone mining on animal habitats, and specifically singled out the langur (ASEAN Today, 2021).

Image A2.6: Long bushy tail of the Delacour's Langur is unique amongst Southeast Asian Langurs
Source: The Endangered Primate Rescue Center

The extensive mining of limestone across Southeast Asia has resulted in extensive destruction of karsts and extirpation of some of the region's least known and possibly undiscovered species. For example, many rare and amazingly beautiful species of snail of the genus *Plectostoma, described as microjewels, are endemic to karsts. Several of these have only been recently discovered and are threatened by quarrying and already on their way to extinction* (Liew *et al.,* 2014). *Plectostoma sciaphilum* which was first discovered in 1952 and known only from a single limestone hill at Bukit Panching, Pahang, Malaysia became extinct around 2003 as its karst habitat was quarried away. The rare Tenggek braided snail, (*Plectostoma tenggekensis*), towered braided snail (*Plectostoma turriforme*) and the elephant trunk snail (*Hypselostoma elephas*), which are found in only two limestone hills, namely Gunug Sagu and Gunung Tenggek in Pahang, Peninsular Malaysia are all listed as critically endangered (Dasgupta, 2016). The perennial herb (*Paraboea bakeri) which is also endemic to* Pahang and located only in these limestone hills in Bukit Sagu and Bukit Tenggek, is also critically endangered (*Malaysia Biodiversity Information System (MyBIS),* 2021). Tissue culture efforts are ongoing to conserve the herb (Yahya *et al.,* 2020).

Although a few mining companies have started to pay more attention to reducing their negative impact, **the IUCN has yet again urged stronger commitment to stop further extinctions** (IUCN, 2014). Destruction of limestone habitats is especially alarming since for example, when these normal habitat of bats is disturbed or destroyed, it could easily open the door to new pandemics as viruses coexisting in bats may now find their way into the human population. Much of such negative impacts take place to accommodate a rising trend in industrialisation and urbanization.

Image A2.7: *Plectostoma obliquedentatum, on limestone rocks near Kampung Labang, Interior Province, Sabah*

Source: Wikimedia Commons, photo by Schilthuizen.

5.2.2 Urbanisation

In 2019, 50% (334,418,881 people) of Southeast Asia's population already lived in urban areas (Worldometer 2021). The urban populace is forecasted to increase to 66% by 2050 (United Nations, 2014). Such urbanisation will impact on biodiversity due to habitat loss and fragmentation. Although it was suggested that urbanisation would reduce human pressure from natural rural areas, in reality the reverse trend has occurred with progressive urbanization being linked to an increase in deforestation (DeFries *et al.,* 2010). Southeast Asia is also registering significant economic growth. Myanmar, which has one of the lowest economies in the region and was previously a closed economy, is now open to foreign investment and accelerated economic growth. Middle income nations like Malaysia and Indonesia are expected to experience continued economic growth. The demographic and economic changes in Southeast Asia are likely to impact total urban green space availability in the region. Urban green spaces can support biodiversity and confer a whole spectrum of ecosystem services, such as by helping to filter air pollution and mitigate urban heat island effects. Nature reserves and parks additionally allow for recreation and exercise space which lead to improved physical and mental health.

As urbanisation in Southeast Asia intensifies, the demand for ecosystem services will become increasingly critical. It is pertinent for the region to **preserve natural ecosystems through urban ecosystem services (UES) planning** as it has been shown that conserving nature and supporting provision of UES is usually more cost effective than restoring ecosystems that are degraded (Holl *et al.,* 2000). As such, due consideration and priority should be given by authorities to ecological resources like river corridors and remnant forest patches during the initial planning and development stage of cities, as these habitats cannot be readily re-created

later. Heavily managed and manicured parks and gardens do not give the same level of ecosystem services or human experience as a carefully managed natural environment**.**

Very few studies have been carried out in Southeast Asia on maximising urban biodiversity (Lourdes *et al.,* 2021). More research is also required on the unique and diverse socio-cultural attributes of Southeast Asia that need to be taken into consideration in efforts to support land use planning and decision-making. An excellent success story is evident in Singapore, the only developed country in Southeast Asia (see Case Study A2.2).

Case Study A2.2: Singapore: A Green Garden City

The transformation of Singapore from a dirty and polluted city to one of the cleanest and greenest cities in the world is one of the globally recognised success stories of Southeast Asia. The idea of creating a garden city was first announced by its founding Prime Minister Lee Kuan Yew on 12 May 1967. It was aimed at improving the quality of life of its citizens and improving tourism. A target of the garden city project later renamed 'Singapore, a city in a garden was to introduce vegetation into public spaces. New laws such as the '*Parks and Trees Act'* were enacted and implemented "*to provide for the planting, maintenance and conservation of trees and plants within national parks, nature reserves, tree conservation areas, heritage road green buffers and other specified areas compelling agencies, both government and private to put aside spaces in their buildings and projects for trees and vegetation…"*


The Straits Times, 12 May 1967, Page 4

Article also available on Microfilm Reel NL12193

Previous Article Next Article

S'pore to become beautiful, clean city within three years

PM ANNOUNCES TWO-STAGE PLAN

SINGAPORE, Thursday

A TWO-STAGE plan, which will make Singapore into "a garden city beautiful with flowers and trees, and as tidy and litterless

Today, greenery covers over 40 percent of Singapore. This includes nature reserves, parks, gardens, roadside greenery, skyrise greenery and vacant lands (National Parks Board Annual Report 2020/2021). Acting as expanded habitats for flora and fauna, and green buffers to reduce human pressure on the nature reserves, the nature parks protect them from the impact of urbanisation and human activities. Further nature parks are currently being established to buffer the Bukit Timah and Central Catchment Nature Reserves to protect them from the impact of urbanisation and serve as complementary habitats. Park connector networks bridge different parks. As of 2020, Singapore has a Park Provision Ratio of 0.78 ha/1,000 population, 360 km of park connectors open to recreational activity and 93% of households are within a 10-minute walk to a park. Greening efforts on streets include multi-tiered planting to create a forest- like structure (National Parks Board Annual Report 2020/2021). In efforts to restore Nature into the built environment, in 2009 the National Parks Board of Singapore introduced The Skyrise Greenery Incentive Scheme which promotes greenery on high-rise buildings and now has become an important component of sustainable urban development in Singapore.

The success story of Singapore in creating a garden city despite its limited biodiversity sends a clear message to other Southeast Asian countries that they can do as well or better. Long term vision rather than a focus on short-term gain, and policies grounded on sound economic policies are the way forward.

UES are influenced by the percentage of green space, the per capita green space, and the degree of aggregation or fragmentation of habitats (Beninde *et al.,* 2015). Using remote sensing

analysis of Landsat 7 satellite image data to study 111 urban areas, Richards *et al.* (2017) showed that there was substantial variation in urban green space cover in Southeast Asia.

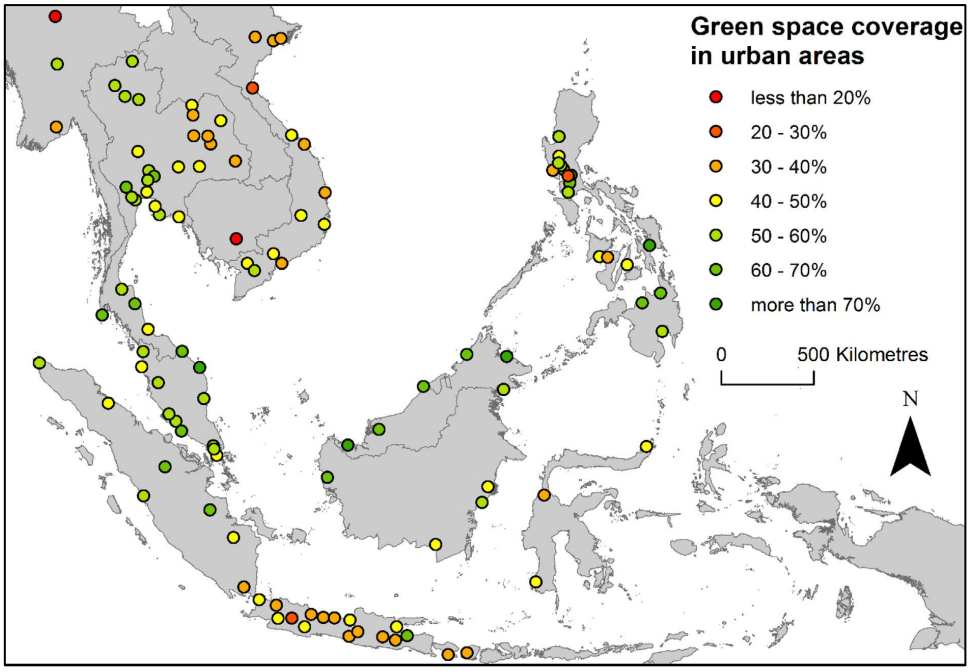


Figure A2.2: Percentage coverage of green space in 111 cities in Southeast Asia
Source: Richards *et al.*, 2017

Malaysia has relatively high green space coverage, while Indonesia and Vietnam have less coverage. The Philippine city of Tacloban was recorded as the greenest city with 79% green cover whereas Mandalay in Myanmar had the least with only 17% cover. Generally, more densely populated cities and those with larger land areas had significantly less green space. **The wealthier cities with higher GDP per capita had significantly more green space.** The green spaces were also more aggregated in cities with higher green space coverage. Rayong in Thailand had the largest green space **per capita** with 600 m^2 per person while Phnom Penh in Cambodia with 6.5 m^2 per person had the smallest green area per capita.

It is also disturbing to note that by 2000, almost the whole of the urban landscape of Southeast Asia was located within biodiversity hotspots (Guneralp & Seto, 2013). Most of this urban land was spread across two biodiversity hotspots: Sundaland and Indochina with approximately 13,000 km^2 in Sundaland (covering most of Peninsular Malaysia and the island of Java), and around 10,000 km^2 in the IndoChina hotspot (includes a major portion of the region's mainland) (Elmqvist *et al.,* 2013).

It has been projected that urbanisation of East Asia and Southeast Asia will disproportionately impact protected areas and increase four-fold (Elmqvist *et al.,* 2016) with the predicted median distance from a protected area to a city in Southeast Asia decreasing from 57 km in 1995 to 40 km by 2030 (McDonald *et al.,* 2008). This does not augur well for the "30×30 initiative".

It is important to put in place management practices such as biodiversity corridors in areas that have a strong probability of urbanisation. This will require coordination of efforts among administrative bodies and countries. While urbanization presents myriad challenges, it also offers unprecedented opportunities to improve sustainability by introducing innovating systems for increased resource efficiency, and through improved stewardship of biodiversity and ecosystem services, both within and beyond city boundaries. **A framework must be in place to reconcile urban development and biodiversity.**

ASEAN has started to address the problem. On November 13th, 2018, ASEAN Sustainable Urbanisation Strategy (ASUS) was launched. The report highlighted the expanding resource footprint of Southeast Asia's cities. While ASEAN's yearly urban population increase had been three percent, its CO_2 emissions had increased by 6.1 percent. ASUS is a key initiative under the Master Plan on ASEAN Connectivity (MPAC) 2025. **ASUS provides a sustainable urbanisation framework focusing on six areas and 18 sub-areas (see Figure AX2.3)** which are closely aligned to the ASEAN Smart Cities (ASC) framework under the ASEAN Smart Cities Network (ASCN). The six areas are: i) civic and social, ii) health and wellbeing, iii) security, iv) quality environment, v) built infrastructure, vi) industry and innovation.

Green spaces come under the ambit of health and wellbeing, and built infrastructure. As ASEAN cities have developed differently at various paces and have had their own challenges, they can learn from each other's experiences and relative advantages to customise their own urbanisation strategies based on their unique situations. **Connecting cities through ASCN will help coordinate and expedite such efforts and help shape urbanization strategies that can reconcile urban development and biodiversity**. A good opportunity to test-bed these strategies would be the relocation of the capital of Indonesia from highly congested Jakarta to what is expected to be an ultra-modern, nature-sensitive metropolis in east Kalimantan (see Box A2.1). Plans for the new development have been consolidated by the passing of a law in parliament on 18 January 2022 approving its relocation and providing a legal framework on how development of the capital will be funded and governed (Reuters, 2022). If successfully executed by applying the ASUS strategies as well as good governance under a strong 8i ecosystem (see Section 5), Indonesia could offer the world an invaluable template for the construction of modern cities that are eco-friendly, and nature-sensitive while also maintaining enough green spaces to ensure richness in both urban development and biodiversity

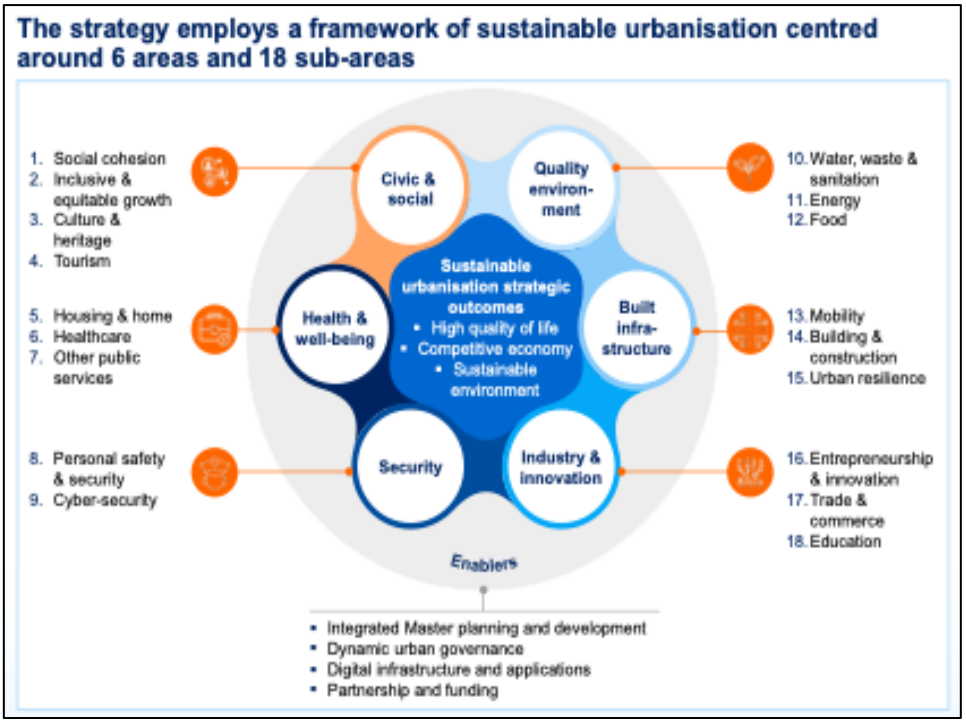


Figure A2.3: The ASUS Framework

Source: ASEAN Sustainable Urbanisation Strategy (ASUS) Report, 2018

Despite ASUS and other strategies that are in place, **urban conservation is under threat from lack of enforcement, budget constraints and mismanagement, and authorities who prioritise commercial development over conservation.** One example of a green space under threat is Taman Rimba Kiara, a designated public park in the capital city of Kuala Lumpur, Malaysia, which is a popular green space for residents and visitors, and harbours 40 recorded species of birds including hornbills, which are protected species. In 2016, Kuala Lumpur City Hall (Dewan Bandaraya Kuala Lumpur, DBKL) proposed a RM3 billion (US$725 million) development project on the site, which residents and several parties strongly opposed, and filed a judicial review application to challenge Kuala Lumpur City Hall's DBKL's decision to issue the Development Order. Although the application was dismissed by the High Court on 28 November 2018, the Court of Appeal on 27 January 2021, in a landmark decision overturned the decision of the High Court. In the most recent development, Kuala Lumpur City Hall and the developer of the proposed Taman Rimba Kiara project have been granted permission to appeal against the Court of Appeal's decision at the Federal Court. **It is a hard reality that conservationists and activists often have to use their scant resources against wealthy developers and powerful authorities in efforts to save the environment.**

Image A2.8: Sampling of birds at Taman Bukit Kiara

Source: https://cilisos.my/uh-oh-dbkl-may-have-picked-the-wrong-fight-with-ttdi-residents-over-taman-rimba-kiara/

Box A2.1: Indonesia's capital relocation plan to Kalimantan, Borneo

In 2019, President Joko Widodo announced the relocation of Indonesia's capital from Jakarta in Java Island to East Kalimantan in Borneo, with an expected completion date by 2024 (Clark, 2021). Planned as an ultra-modern smart city driven by the latest in technologies, it is to be a cradle for innovation and creativity while establishing ecosystems that would promote environment-friendly activities. The plan therefore includes the use of renewable energy and clean technology to drive social and economic development which should then go a long way towards ensuring sustainable livelihoods (Sardjono, 2021).

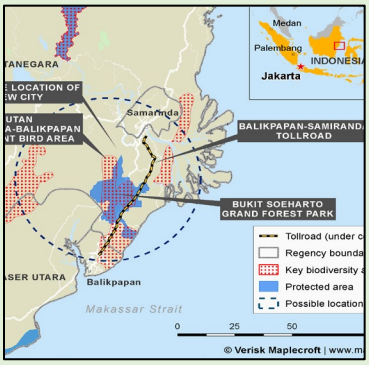


Image 2.9: Proposed city location could overlap with a protected forest park and areas of important biodiversity

Source: Verisk Maplecroft/ Dobson, 2019

An award-winning architectural design is already in place and even an initial budget of Rp510 billion has been allocated, as of October 12, 2021. Funds are also expected to flow in from the Middle East, especially UAE. However, alarm bells are already ringing as pristine forests are starting to be logged. A transboundary highway development in Kalimantan, the Indonesian portion of the Borneo Island that sustains about 37 million hectares of native tropical forest, has become a hive of intense activity ever since news broke about the location of the new capital (Alamgir *et al*., 2019). Infrastructure development in the West Kalimantan Kapuas Hulu district has warranted substantial issuance of concessions, alongside the establishment of large oil palm plantations. In 2013, the plantation area in Mahakam Ulu was about 3,000 hectares but it has since grown exponentially to reach 25,000 hectares within 6 years (Dinas Perkebunan Provinsi Kalimantan Timur, 2020). Oil palm companies have taken over 80% of the land. Sadly, at least 13,000 hectares of concessions originate from ancestral lands of the indigenous Dayak community in Kalimantan (United Nations, 2020).

Image 2.10: A gas station at Kayan river, Kayan Monitoring National Park
Source: Wikipedia ESCapade

Roads connecting to Nunukan that are to be completed by 2023, will dissect protected and reserve areas, including the Kayan Mentarang National Park, which is an important refuge for numerous species, and a home for the largest unbroken stretch of protected rainforest in Borneo. It is right in the centre of the initiative, which is home to more than 10 indigenous groups.

Such fragmentation of the intact Kalimantan Forest by land clearance, infrastructure expansion and development, will have detrimental ecological impact on the rich biodiversity including key native species, as well as upending the ecological dynamics within the heart of Indonesian Borneo (Laurance & Arrea, 2017; Sloan *et al*., 2019). There is still time to rethink development plans by instituting good governance supported by political will so that the dream of establishing an eco-friendly and ultra-modern smart city that advocates sustainable livelihoods through strong advocacy for planetary health, can indeed be realised.

5.2.3 Construction of Dams

Another driver of biodiversity loss is the construction of dams. According to a projection by the International Energy Agency, demand for electricity in Southeast Asia by 2040 will grow by two-thirds. In general, **hydroelectric power is considered an efficient, powerful and green source of energy that maximally leverages the countries' topography and resources.** Unlike coal-fired power plants (the predominant energy source in Southeast Asia) that are highly polluting and non-renewable, hydro-electric power dams generate renewable energy by the flow of water through turbines and are considered relatively clean. Dams have also been used for flood control, irrigation, and navigation. While benefits of dams cannot be denied, there is increasing recognition of their negative effects which can far outweigh their benefits. Degradation of organic matter in the dams produces greenhouse gases such as methane, carbon dioxide and nitrous oxide (Demarty & Bastien, 2011). Rasanen *et al.* (2018) reported that one in five dams along the Mekong River emit even more GHG than fossil fuels, depending on the design of the dams and surrounding landscape. **Dams and reservoirs also have a significant negative impact on biodiversity.**

Dam construction and operation, cause substantial alteration of the ecosystem leading to various environmental impacts. Entire river-catchment systems are altered, including aquatic as well as terrestrial flora and fauna. The destruction of aquatic habitats results in a loss of fish breeding sites, and a reduction in fish stock which in turn leads to the erosion of food security and puts pressure on livestock in remaining unaltered areas. Dam construction entails land clearing which leads to soil erosion, a decline in water quality, sediment transport and silting as well as increased likelihood of landslides along the river course (Li *et al.,* 2013). Forest clearing results in habitat destruction as well as loss of carbon sequestration. The development-forced displacement and resettlement (DFDR) of indigenous people, and their loss of sustenance is a human rights issue of particular concern (Aiken & Leigh, 2015). Heightened awareness of the detrimental effects of dams on the environment, and their failure to provide anticipated economic benefits (World Commission on Dams, 2000) have resulted in **hesitancy by the World Bank to fund further construction of dams in Southeast Asia** (The Economist, 29th Nov 2003; 13th June 2007). However, dams continue to be built throughout Southeast Asia as governments consider them as key to their development agenda for income generation and poverty alleviation, besides providing energy security.

The Once Mighty Mekong

Southeast Asia's largest river, the Mekong is the second most biodiverse river in the world after the Amazon River and is of great strategic importance. The lower Mekong Basin sustains more than 60 million people (Mekong River Commission (MRC), 2011) representing 10% of the ASEAN population. The Mekong River is the world's largest inland fishery accounting for about 2.3 million tonnes of freshwater catch per year (Mekong River Commission (MRC), 2011). Construction of dams on the Mekong River and its tributaries to augment a thriving hydropower industry is threatening the capacity of the Mekong River basin to sustain fisheries as well as upland and riverbank agriculture. More than 100 tributary hydropower dams are

expected to be in place by 2040, of which eleven controversial hydropower plants will be on the mainstream of the Mekong River, seven in Lao PDR, two in Cambodia and two across the Thai-Lao border. The proposed 11 dams pose a major threat to migratory fish by hindering their passage upstream for spawning, as well as the journey downstream of adults, larvae, and juveniles.

By 2019, there were 89 hydropower projects in the Lower Mekong Basin, 65 in Lao PDR, 14 in Vietnam, 7 in Thailand and 2 in Cambodia (MRC n.d.). Based on a study by the Mekong River Commission Council (Mekong River Commission (MRC), 2017), hydroelectric power was seen as the sector with the greatest potential to boost economic development along the Lower Mekong Basin especially for the fisheries, agriculture and navigation sectors, all of which are important for food security, flood management, drought relief and regional trade. The study projected economic gains exceeding $160 billion by 2040. However, hydropower is also linked to the highest biodiversity trade-offs. It has been estimated that the impact on fisheries could result in losses of about $23 billion while that from forests, wetlands, and mangroves could amount to as much as $145 billion by 2040. Losses incurred would vary between the various countries. Lao PDR is most strategically located in the Lower Mekong Basin and is best placed for revenue generation since most of the proposed dams are in this country. The landlocked and mountainous country aspires to become the "battery of Asia" (Brent, 2018) by exporting electricity generated by its dams to the neighbouring nations. It has received billions of dollars from hydropower investors. Cambodia bears the biggest brunt of fish reduction, followed by Thailand, Vietnam and Lao PDR. Yoshida *et al.* (2020) concluded that *"dam construction for hydropower in the Mekong River, as well as other rivers in developing countries, should be gradually removed and shifted toward solar, wind, and other renewable resource*s".

According to a survey caried out by the ASEAN Studies Centre of the Institute of Southeast Asian Studies (ISEAS) – Yusof Ishak Institute, in Singapore, many ASEAN nations are concerned about the impact of the environmental problems of the Mekong on regional food security and climate change. There is an urgent need for ASEAN to pay greater attention to the Mekong. This is especially so considering riparian countries are among the world's main rice exporters. However, ASEAN's compartmentalised sub-regional approach to many issues has not given the problem its due full attention. **There is a need for ASEAN to recognise the seriousness of the Mekong basin issues by considering Southeast Asia as a whole and discarding its current sub-regional stance** (Hoang & Seth, 2021).

Sarawak - the Industrial Powerhouse of Borneo

The Sarawak State Government's plan to transform the state into the industrial powerhouse of Borneo via the development of a multitude of hydroelectric mega-dams was conceived to provide clean and green energy to the Sarawak Corridor of Renewable Energy. Construction of 52 hydroelectric power mega-dams was proposed in 2007 (Aeria, 2016). Although the Sarawak Integrated Water Resources Management Master Plan concluded that the abundant

water resources from the annual rainfall of 4000 mm made hydroelectric power generation a viable option, there were serious concerns about the impact on the environment and local communities (Aeria, 2016). Lessons can be drawn from the Bakun Hydro-electric Power Dam.

The Bakun Hydro-electric Project (BHP)

The Bakun dam, the largest in Southeast Asia and located on the Balui River, a tributary of the Rejang River in Sarawak received approval for construction by the Malaysian government in 1986 but after several setbacks, delays and controversies, and an escalated cost of RM7.3bil, impoundment started in October 2010 (Sovacool & Bulan, 2011). It was fully commissioned in July 2014. In 2017, an agreement was reached for the Sarawak state government to acquire the dam from the Federal Government at a cost of RM2.5bil. In 2018, Sarawak State took control of the dam giving it complete control over its energy resources. **Transparency International included Bakun Dam in its 'Monuments of corruption' Global Corruption Report 2005** (Transparency International Global Corruption Report, 2005).

The Bakun dam at full capacity can generate 2400 Megawatts of electricity. The artificially formed reservoir with a storage volume of 43.8 billion m^3 is the largest lake in Malaysia, and approximately the area of Singapore. Its impoundment resulted in the destruction of 69,640 ha of virgin forest home to one of the oldest and richest biodiversities on the planet. The biodiversity signature of the forest which was gravely affected included i) 1,683 plant species (comprising also 287 valuable medicinal plant species), ii) 6 protected and totally protected mammalian species, iii) 32 protected and totally protected bird species, iv) 109 moth species, v) 34 butterfly species, vi) 205 species of other families of insects, vii) 49 known amphibian species, viii) 6 rare, endangered, migrating and economically important aquatic fauna, ix) 15 families, 42 genera, and 104 species of fish (Choy, 2005a; 2005b). In addition, it destroyed 50 m^3 of biomass, and numerous geological formations, including a waterfall, sixteen major rapids and an archaeological site (Choy, 2005b). Based on these findings, the Bakun Dam was categorized as an unsustainable source of energy - it failed to satisfy the environmental objective of the Malaysian National Energy Policy (1979). The National Energy Policy (1979) covers (i) Supply objective: Ensuring adequate, secure, quality, and cost-effective supply of energy; (ii) Utilization objective: Promoting efficient utilization of energy and (iii) Environmental objective: Ensuring factors pertaining to environment protection are taken into consideration in the production and utilization of energy.

Although the Bakun Hydroelectric Project was touted as the Green Energy for the Future (Economic Planning Unit (EPU), 1996), it never was as green as envisaged. The biomass in the forestland and river valleys was not cleared prior to inundation, so that the Bakun dam is now a significant producer of greenhouse gases, predominantly methane, carbon dioxide and hydrogen sulphide from the decomposition of organic matter from the 69,640 hectares of submerged forest, vegetation, wildlife, and soil (Choy, 2005a; Aeria, 2016). It also had major socio-economic impact on the indigenous communities inhabiting the Bakun area.

Had a proper check and balance mechanism grounded on the 8i ecosystem framework been in place, the Bakun dam project would have been a success story providing environmental, economic and social benefits. **However, as iterated by Sovacool & Bulan (2011)**

"If for no other reason, then, Bakun is an excellent case study for policymakers because it intimately sketches the anatomy of failure, a failure of government planning, implementation, and oversight, no matter how technically sound the dam's concrete face, spillway, or powerhouse become".

Large hydropower dams create serious social challenges for local communities. Indigenous peoples are especially vulnerable as they have depended largely on the land where the dams are built for their livelihood. They enjoy few of the benefits of the building the dams but on the contrary suffer from economic and social marginalisation. The Bakun Dam is an example of such social injustice, as described below (Case Study A2.3).

Case Study A2.3: The Dam that Resulted in Major Social Impact to the Indigenous Communities

The Bakun dam forced the displacement and marginalization of the whole indigenous population estimated to be 10,000 people, mostly indigenous Orang Ulu from 15 communities inhabiting the Bakun area. They were forcibly removed from the approximately 70,000 hectares Bakun dam area to a 4,000 hectare Resettlement Scheme at Sungai Asap (Sovacool & Bulan, 2011) in the middle of an oil palm plantation, a considerable distance from their original homes and any notable town.

This raised serious issues of sustainability as it brought about socio-economic collapse and cultural extinction of the indigenous people who had previously been living independently and self-sufficiently, relying on the forest for hunting, gathering of forest products and agriculture (Choy, 2005a). The displacement of the indigenous populations from their ancestral lands disrupted their traditional social and cultural practices that are tightly linked to access to the land and forest at Bakun. Based on the Human Rights Commission of Malaysia Report (Suhakam, 2009), 80 percent of the land in the Asap Resettlement Scheme was not suitable for cultivation. The remaining 20 percent that was cultivatable was rocky and distant. To make matters worse, the resettled families were compelled to fork out about RM50,000 to RM60,000 to the government for the individual apartments in the longhouses built for them (Aeria, 2016). Isolated from their river surroundings where they had access to fishing and river transportation, and forced to resettle on poor soils while having to pay for their apartments, they were essentially forced into abject poverty. According to the Human Rights Commission of Malaysia Report (Suhakam, 2009), the average annual family income in Resettlement Scheme at Sungai Asap was a meager RM 5,000, mainly from the sale of food and vegetables. However, at a bare minimum, about RM 16,000 is required to subsist. The meagre income also exposed the truth that the goal of the resettlement programme ostensibly to generate higher income for the indigenous community by restructuring their socio-economic activities, failed miserably.

5.4 Oil Palm and Biodiversity

Oil palm (*Elaeis guineensis*) is the world's largest source of vegetable oil. Oil palm thrives within 10 degrees North and South of the Equator. These regions represent biodiversity hot spots. While many oil palm plantations were established on previously cleared agriculture land or on degraded forest and fallow land (Gatto *et al.*, 2015) a large number have also been established at the expense of rainforests and peatlands (Gibbs *et al.,* 2010; International Union for Conservation of Nature (IUCN), 2018; Margono *et al.,* 2014). Increasing global demand for palm oil has resulted in rapid expansion of the global oil palm planting area. A primary concern related to deforestation and biodiversity is that during the planning stage for plantations, insufficient consideration is given to whether the area is of significant biodiversity importance or is of high conservation value (HCV) (World Bank, 2011). The overall environmental impact of oil palm largely hinges on where it is grown. Further complications emerge when the economic impetus for oil palm expansion overlaps with weak governance structures, and lack of enforcement to ensure expansion of oil palm plantations are in areas of minimal ecological impact.

Image A2.9: Aerial footage of palm oil and the forest in Sentabai Village, West Kalimantan
Source: Flickr, photo by Nanang Sujana/CIFOR

Between 1990 and 2010, oil palm hectarage increased from 6 to 16 million hectares worldwide, with Malaysia and Indonesia at the focal point of this aggressive development (Pirker *et al.,* 2016). About 30% of this expansion occurred on peat soils, resulting in large CO_2 emissions (Carlson *et al*., 2012; Miettinen *et al.,* 2012) and disruption of ecosystem services. Direct conversion of forests to plantations has been more common in Sabah and Sarawak (Gunarso *et al.,* 2013; Gaveau *et al.,*2016) where oil palm is the main cause of deforestation accounting for 57-60% of it in Malaysian Borneo between 1973 and 2015 (Gaveau *et al.,* 2016). The situation is more complex in Indonesian Borneo since extensive forest loss and degradation from timber extraction and burning had occurred before oil palm plantings first began. Oil-palm plantations were thus largely established on degraded forests rather than at the expense of primary forests

(Gaveau *et al.,* 2016). Over the last four decades, oil palm has accounted for 47% and 16% of total deforestation in Malaysia and Indonesia, respectively (International Union for Conservation of Nature (IUCN), 2018).

According to The IUCN Red List of Threatened Species™, at least 193 threatened species are affected by global palm oil production (Figure A2.4). Oil palm expansion has reduced the diversity and abundance of most native species and has been largely responsible for the decrease in species such as orangutans and tigers. Some 750 to 1,250 orangutans are killed every year from human-orangutan conflicts linked to expanding agriculture. Of the estimated 75,000–100,000 Critically Endangered Bornean orangutans, around 10,000 are currently found in areas allocated to oil palm.

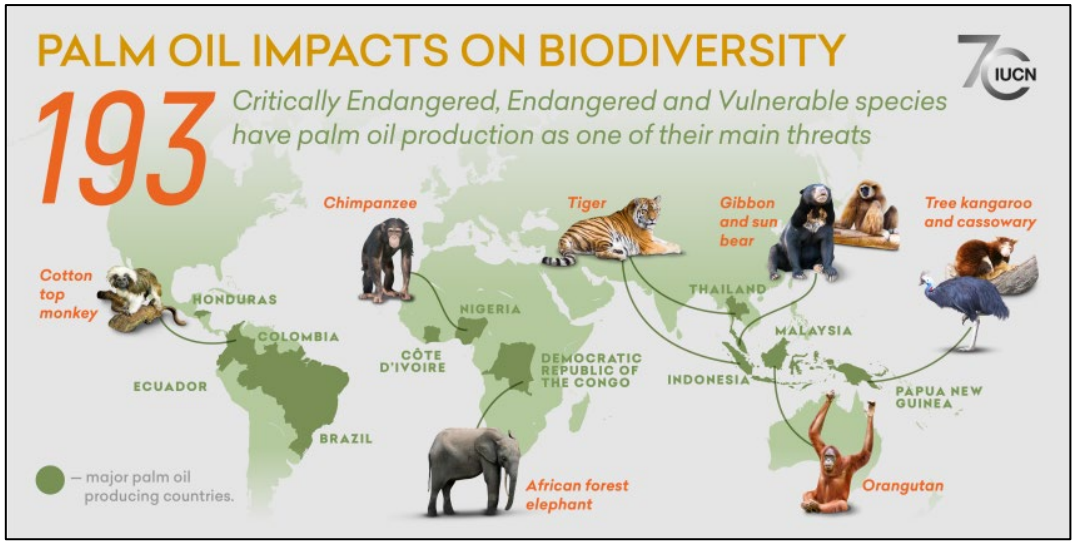


Figure A2.4: Impact of Oil Palm on Biodiversity

Source: International Union for Conservation of Nature (IUCN), 2018

5.4.1 Superior Productivity of the Oil Palm

Planted on just 0.36% of world agricultural land and 7% of the total land attributed to oil crops, oil palm contributes to 36.5% of global vegetable oils *(Oil World, 2018).* It thus has the lowest global footprint in terms of land use compared to other oil crops. On average, oil palm produces 3.9 t/ha/yr of oil compared to 0.7 t/ha/yr for rapeseed, 0.6 t/ha/yr for sunflower, and 0.4 t/ha/yr for soy (d'Enghien, 2016).

The world population is projected to reach 9.8 billion in 2050 according to the United Nations and FAO. To help meet the needs of such growing populations, the global demand for vegetable oils is estimated to reach 310 million tonnes by 2050 compared to the current annual consumption of 165 million tonnes (IUCN, 2018 b, c). Table A2.3 summarises information to indicate which is the best oil crop to meet this additional demand of 145 million tonnes, based on current oil yields of the major oil crops, and the additional land that would be required:

Table A2.3: The best oil crop to meet this additional demand of 145 million tonnes

Crop	Yield/ha	Extra land required to meet additional demand by 2050 (M ha)
Oil palm	4.0	38
Rapeseed	0.75	193
Sunflower	0.63	230
Soya	0.39	372

Oil palm with the highest yields/ha and the lowest amount of extra land requirement is by far the most suitable crop for effective land use. A shift from oil palm to other oil crops is not an answer as it would lead to further clearing of forest and a shift of biodiversity loss to the regions producing the alternative oil crop. However, it has to be acknowledged that palm oil needs to be produced more sustainably. Yield improvement is a means of reconciling oil production and forest conservation. The Malaysian palm oil industry is committed to increasing yield and productivity by good agricultural practices and placing emphasis on R&D in biotechnology including genetics and genomics. The Malaysian Palm Oil Board's (MPOB) successful sequencing of the oil palm genome, and its ground-breaking discoveries of genes of economic importance including the *Shell* gene, the single most important determinant of oil quality for oil palm were published in Nature (Singh *et al.,* 2013a, 2013b; Ong-Abdullah *et al*., 2015) and have paved the way for increased yield and sustainability. The discoveries led to the development of the first ever molecular diagnostic assays to screen out low yielding palms thus ensuring improved land use and increased economic benefits.

Economic analysis predicted annual economic gains of ~$300M USD to Malaysian GNI annually by application of DNA testing for just the *Shell* gene (Ooi *et al.,* 2016). In 2019, the Malaysian government announced the capping of oil palm planted area at 6.5 million ha. Malaysia has also announced stopping the planting of oil palm in peatland areas and strengthening regulations concerning existing oil palm cultivation on peatland. Additionally, oil palm plantation maps will also be made accessible to the public for greater transparency.

The oil palm industry is one of the most highly regulated industries in Malaysia, governed by more than 60 national laws and regulations. Besides these, there are 25 licensing categories across the industry's supply chain to ensure that it complies with MPOB rules and regulations. Key to these is enforcement. Oil palm cultivation is a major vehicle for rural socio-economic development.

5.4.2 Rural Socio-Economic Development

The industry has contributed to employment generation and alleviation of rural poverty. Oil palm plantations have created millions of well-paying jobs and enabled tens of thousands of smallholder farmers to own their own land. Smallholders account for about 40% of oil palm cultivation in Southeast Asia. Smallholder schemes such as the Federal Land Development Authority (FELDA) scheme in Malaysia and corporate-led development of smallholder schemes in Indonesia have played a significant role in alleviating poverty. In fact, the FELDA scheme which started in 1956 as a resettlement scheme for landless peasants, with the aim of eradicating poverty and raising incomes has been heralded as one of the most successful land settlement organisations in the world (Sutton, 1989). The World Bank Group Framework and The International Finance Corporation (IFC) Strategy for Engagement in the Palm Oil Sector (World Bank, 2011) reported "The recent rapid expansion of oil palm activity in Indonesia is associated with significant poverty reduction. For example, in 2005 and 2008, reported national headcount poverty rates in Indonesia were *r*oughly equal at 15.7 and 15.4 percent, while districts with increases in palm oil production saw significant poverty declines over the same period." In 2019, it was estimated that the palm oil industry had lifted 2.6 million rural Indonesians out of poverty (Edwards, 2019).

While oil palm has improved the livelihood of millions, it has also been associated with social concerns, the most important of which are land use rights, forced and child labour, and unfavourable labour conditions related to health, safety and wages. The establishment of industrial plantations has in some cases resulted in local and indigenous peoples losing their customary land, together with traditional livelihoods and cultural reference. This is particularly so in Indonesia (Siscawati, 2001; Colchester *et al.,* 2006, 2007) and to a lesser extent in Malaysia (Chao, 2016). Consultation with indigenous populations at the pre-investment and initial stages of acquisitions would minimise land disputes. Moves to replace top-down, authoritarian processes of land allocation that have further marginalised vulnerable populations, with more inclusive implementation processes have resulted in positive changes. New policies are needed to support this progression, and address the negative ramifications of large-scale land acquisitions, including conflict, loss of previous land use rights and access to natural resources and the threat to livelihoods (Gironde & Golay, 2015).

5.4.3 Sustainability Certification Framework

Certification, complemented by good agricultural practice and strong governance plays a critical role in advancing the environmental and social sustainability of oil palm by promoting greater transparency in the value chain. Various certification schemes have been initiated, with the aim of making oil palm cultivation more sustainable. The evolution and improvement of sustainable palm oil themes in Southeast Asia include a heightened awareness of the complexity of the issue, the importance of maintaining transparency, and a greater recognition of land rights of indigenous people (Ivancic & Koh, 2016). Approximately *19%* of all globally produced *palm oil is* [1]*RSPO (Roundtable of Sustainable Palm Oil)-certified (RSPO 2021).* In

comparison only 1% of all soy is certified by the Round Table on Responsible Soy Association (RTRS) (Solidaridad, 2020).

Case Study A2.4 describes the efforts of Sabah's efforts to become the world's first sustainable oil palm state.

Case Study A2.4: Sabah Aspires to be World's First Sustainable Oil Palm State

Sabah, which produces about 6 percent of the world's palm oil launched the Jurisdictional Certification of Sustainable Palm Oil (JCSPO) initiative in 2015, with a target of producing 100% [1]RSPO certified palm oil by 2025 in efforts to be a global leader in the production of sustainable palm oil (WWF, 2021; Taylor, 2022). Currently about 26 per cent of palm oil produced in Sabah is RSPO-certified. A jurisdiction refers to a region with governmentally or administratively defined boundaries. Thus, in the case of JCSPO, the region (jurisdiction) gets certification for palm oil produced within its boundaries rather than a specific agency. The jurisdictional approach allows a more a structured way to secure broader commitments toward sustainable practices across the state from stakeholders (businesses, local communities, local government, and NGOs) by aligning interests and coordinating actions. The JSPO initiative, will facilitate efforts by the State government to address deforestation in the palm oil supply chain by implementing appropriate strategies, policies and measures. According to the WWF (2021), *the Sabah JCSPO has been globally recognized as a pioneering model to address deforestation from the palm oil supply chain.* In practical terms, the JCSPO represents a 2-step approach which first requires national (MSPO) compliance, followed by RSPO compliance. Implementation has started in priority landscapes. WWF-Malaysia is involved in the Living Landscapes programme funded by Unilever and HSBC which will be implemented in Sugut, Tabin (Laha Datu) and Tawau landscapes. A Sustainable Palm Oil Team set up by WWF-Malaysia offers technical support and guidance to growers within the landscapes to form growers' groups and subsequently obtain group certification under the RSPO.

Kindly refer to Annex 2 for a more detailed description of the drivers of biodiversity loss and the impact.

[7]The Roundtable of Sustainable Palm Oil (RSPO) established in 2004 with the aim of promoting the growth and use of sustainable palm oil products through credible international standards is an international non-profit voluntary scheme. Indonesia and Malaysia established the Indonesia Sustainable Palm Oil (ISPO) and Malaysia Sustainable Palm Oil (MSPO) in 2011 and 2015, respectively. These are mandatory government – led initiatives grounded on the national interpretation of the RSPO and based on the individual countries' national laws and regulations.