TEEB Implementation in Malaysia: "Promoting biodiversity and sustainability in the agriculture and food sector project"

A background review of agriculture in Malaysia

(Draft1)

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List of Acronyms

ASEAN	Association of Southeast Asian Nations
BIOFIN	Biodiversity Finance Initiative
CBD	Convention on Biological Diversity
CFS	Central Forest Spine Master Plan
COP	Conference of the Parties
CPO	Crude Palm Oil
ESMERALDA	Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking
EU	European Union
FAO	Food and Agriculture Organization
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority,
GDP	Gross Domestic Product
MOA	Ministry of Agriculture and Agro-based Industry
NPBD	The National Policy on Biological Diversity
NPP	National Physical Plan
NTCAP	National Tiger Conservation Action Plan
OECD	Organisation for Economic Co-operation and Development
RISDA	Rubber Industry Smallholders Development Authority
RSPO	Roundtable on Sustainable Palm Oil
TEEB	The Economics of Ecosystems and Biodiversity
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
USAID	United States Agency for International Development
WWF	World Wildlife Fund

Executive Summary

1. BACKGROUND

Malaysia has achieved impressive economic growth over the past four decades making it the fourth largest economy in South East Asia, after Indonesia, Thailand, and Philippines. Currently, an upper middle-income country, Malaysia is attempting to achieve high-income status by 2020. Since 1960, Malaysia has pursued various economic reforms and the country has transitioned through a number of phases which can be grouped into three broad economic eras, namely: agricultural (1960 - 1974); industrial (1975 - 1999) and urbanization (2000 - date). Particularly during this era of urbanization, the services sector (currently estimated at 54.7% of GDP) and manufacturing sector (currently estimated at 36.9% of GDP) have increasingly spearheaded the country's economic growth, while **the agriculture sector's contribution has declined from around 43.7% of GDP in 1960 to 18.7% in 1990 and further down to 8.7%** in 2016. However, **agriculture remains the mainstay of the economy, employing nearly 11% of the 14.94 million people from the labour force.**

Divided into three main regions: Peninsular Malaysia, Sabah and Sarawak, the country has a total land area of 33.03 million ha of which, as of 2015, 23.1% is agricultural land, 63.6% is forest area and 13.3% is for other land uses. **Peninsular Malaysia has the largest land area suitable for agriculture accounting for nearly 48% of the total agricultural land**.

In terms of crops, the Malaysian agricultural sector can be divided into three sub-sectors: industrial crops, food crops, and other miscellaneous crops. The key industrial crops include oil palm, rubber, cocoa and tobacco, which mainly serve the export market. The food crops, which mainly comprise paddy, livestock, fisheries, fruits and vegetables primarily serve, though not exclusively, the domestic market. The production structure, except for poultry, consists mainly of small and medium scale production units. Lastly, the other miscellaneous crops include sugarcane, cassava, maize and sweet potato, which cater for both export and domestic markets. For a long time, Malaysia's agricultural policy has mainly revolved around the industrial crops and, to some extent, the food crops.

Malaysia is the world second largest producer of oil palm which occupies around 5 million hectares of land across the country. **In 2016, Malaysia produced 86.3 million metric tons of oil palm accounting for about 28.7% of global output.** At local level, **Peninsular Malaysia produces** the largest amount of oil palm followed by Sabah then Sarawak. The key growers of oil palm in Malaysia are the **private estates, accounting for 61.2% in 2016**. Independent smallholders come second, accounting for 16.3% of the total oil palm cultivated in 2016.

Malaysia is the world fourth largest exporter of natural rubber. Nearly 92% of rubber plantations in Malaysia are smallholder owned. Most rubber plantations are in the western plains of the Malaysian coastal regions. **Rice is the most important staple food in Malaysia**. **Although rice is grown throughout Malaysia, Peninsular Malaysia is the major producer followed by Borneo.** Apart from oil palm, rubber and rice, Malaysia grows a variety of other major crops such as cocoa, tobacco, coconut, pepper, fruits and vegetables.

2. PROBLEM DEFINITION: Challenges to sustainable agriculture and biodiversity in Malaysia

Malaysia is endowed with an extremely rich and very diverse biological resources. It is recognized as **one of the twelve mega diverse countries in the world, harbouring over 170,000 species of flora and fauna, accounting for 16% of the worlds classified species**. The country is rich in flora with conservative estimate of about 15,000 species of flowering plants and more than 1,000 species of ferns and fern allies. Malaysia is also rich in fauna, with 306 species of wild mammals; more than 742 species of birds; 567 species of reptiles; 242 species of amphibians; more than 449 species of freshwater fish; and it is estimated that there are 150,000 invertebrate species.

Malaysia forms part of the Sundaland biodiversity hotspot, the second most important hotspot in the world, consisting of a wide array of coastal, marine and terrestrial ecosystems. According to Conservation International, the Sundaland hotspot hosts about 25,000 plant species, 15,000 of which are endemic, and 2,795 vertebrate species, of which 1,103 are endemic. Vertebrate species, are estimated at about 769 bird species, (142 endemic), 380 mammals (172 endemic), 567 reptiles (243 endemic), 244 amphibians (196 endemic), and 950 freshwater fish species (350 endemic).

Unfortunately, many of these iconic biological resources are increasingly under threat. **According to the 2012 World Conservation Union (IUCN) Red List of threatened species, 686 plants and 225 animals in Malaysia are at risk of extinction and 256 are at least critically endangered, placing Malaysia third in the list of countries with the largest number of threatened species**, behind only Ecuador and the United States. The latest IUCN Red List estimates threatened species in Malaysia at over 1,000. Selected endangered species of flora and fauna in Malaysia.

Malaysia is one of the 14 tiger range countries, harbouring the Malayan Tiger (*Panthera tigris*) subspecies. In the 1950's, Malaysia was estimated to have 3,000 tigers, but unfortunately, its numbers have declined to just 250 – 340 in just over half a century.

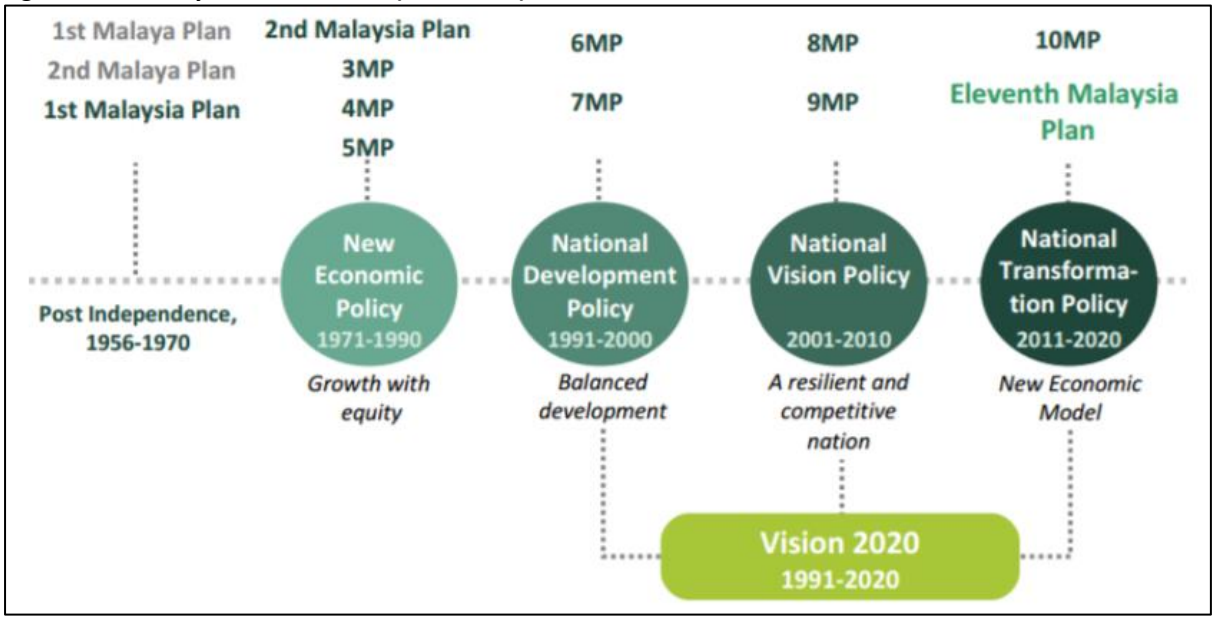
Habitat loss and fragmentation as well as poaching are identified as key threats to biodiversity in Malaysia. Conversion of forest, wetlands, peatlands and other natural ecosystems to other land uses and degradation reduces the extent and quality of habitat, leading to a loss of biodiversity. Such challenges are not just unique to Malaysia but are rather widespread across the Southeast Asia region.It is estimated that Southeast Asia may lose three quarters of its original forests by 2100, and as a result up to 42% of its biodiversity. This is of great concern given that Southeast Asia is amongst the most biodiverse regions containing high levels of endemism.

While, sustainable development of the agricultural industry is a key focus of the national agri-food policy, coupled with a policy focus on protected area implementation (e.g. The National Forest Policy 1978, revised in 1992), has largely prevented the expansion of agri-food industry into forests systems, challenges still remain. For example, **it is estimated that over half of palm plantations established since 1990 occurred in areas deforested** for this purpose. However, estimates for **the proportion of deforestation caused by the expansion of oil palm cultivation vary**. The Malaysian Government has maintained a net loss of 129 million ha of forest between 1990 and 2015. It is estimated that between 2010 and 2015 there was an annual loss of 7.6 million ha and an annual gain of 4.3 million ha per year. Thus, leading to **a net annual decrease in forest area of 3.3 million ha**. This comes in contrast to the EU Resolution estimate of 13 million ha forest loss. On a positive note, Malaysia is making great strides towards promoting sustainable practices across its landscapes as well as conserving its biodiversity.

3. CURRENT SITUATION: Malaysia's national level strategies and policies

Malaysia has embraced sustainable agriculture and biodiversity conservation through a variety of national level strategies and policies, which has evolved over time. Malaysia's economic planning follows the 2020 Vision Plan launched in 1991. The 2020 Vision Plan considers Malaysia a fully developed country across six different aspects: economic, political, social, spiritual, psychological, and cultural - by the year 2020. The Vision 2020 has been realised through a series of **National Policies and five-year plans called Malaysia Plan (MP)**, each with different development priorities as shown in Figure-ES 1.

Figure-ES 1: Malaysia's Vision 2020 (1991-2020)



Source: Government of Malaysia (2015)

The current National Policy, called the **National Transformation Policy, 2011-2020,** is people centred and pursues the **New Economic Model**, which sets the goal of becoming a high-income economy **that is both inclusive and sustainable**. The **National Transformation Policy is being realised through the 10th and 11th Malaysian Plans. The Eleventh Malaysia Plan (2016-2020), called "Anchoring growth on people"**, **is the final leg in the journey towards realising Vision 2020**. It builds upon the great strides made in the last half decade and is seen as a fulfilment of the Government's commitment to a vision of growth that is anchored on the prosperity and wellbeing of its rakyat. The Eleventh Plan is based on the theme "anchoring growth on people" and has six strategic thrusts. The policy emphasizes **green growth** that is resource-efficient, clean, and resilient. The green growth strategy aims to significantly **reduce greenhouse gas emissions; improve conservation of terrestrial and inland water, as well as coastal and marine areas including its ecosystems; intensified the conservation of natural resources, including biodiversity and promote sustainable consumption and production practices**

Within the agriculture sector, the Eleventh Malaysian Plan serves to fulfil the policy objectives and strategies of the **National Agro-food Policy (2011-2020**), building upon previous plans and policies. The National Agro-food Policy (2011-2020), has as a key policy objective to "**tackle the issue of sustainable agriculture and the competitiveness of the agro-food industry with food safety and nutrition aspects along its value chain"**.

Other initiatives being undertaken within the agri-food sector include **the National Strategies and Action Plans on Agricultural Biodiversity Conservation and Sustainable Utilization**. This is seen as an important step in mainstreaming the Convention on Biological Diversity (CBD) objectives into the development of the agriculture sector in Malaysia. It also underscores the Malaysian Government commitment and recognition of the important of biodiversity in shaping the agricultural sector over the years. The Government of Malaysia recognizes the huge potential biodiversity holds as a reservoir of future food, natural gene bank harbouring the key ingredients for developing new varieties for better yield and also to meet the potential impacts of climate change.

The Bug That Helped Malaysia Save $10 Billion

Details Published on Tuesday, 23 February 2016 10:24

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African palm oil weevil or its scientific name Elaeidobius kamerunicus was introduced in 1981 for local palm oil pollination

AT a glance, this is just any ordinary bug.

This African palm oil weevil or its scientific name Elaeidobius kamerunicus played a part in helping Malaysia to save a staggering $10 billion!

Speaking at the UN biodiversity meeting at the Kuala Lumpur Convention Centre Monday, Prime Minister Datuk Seri Najib Tun Razak said when the oil palm industry was still at its infancy, the government opted to import the four-legged bug from Cameroon to be part of the plantation labour in 1981.

The weevil played the role in pollinating trees, a chore previously done manually -- which was undoubtedly time-consuming and ineffective.

Introduction of the weevil to the process, led to a significant increase in palm oil production and ultimately saved costs. Between 1982 and 2015, the 'kerching' saved totalled at a whopping US$10 billion!

Source: Awani (2016)

The National Strategies and Action Plans on Agricultural Biodiversity Conservation and Sustainable Utilization compliments the Malaysia's National Policy on Biological Diversity (NPBD).

In 1994, Malaysia became party the United Nations Convention of Biological Diversity (CBD). **In 1998, Malaysia developed its first National Biodiversity Strategies and Action Plan (NBSAP) which is known as the National Policy on Biological Diversity (NPBD).** It serves as a national blue print for the overall biodiversity management in the country as well as to fulfil its obligations under the Convention.

In Malaysia, **the NPBD** provides a general and overarching strategies and action plans with the **vision of transforming Malaysia into a world centre of excellence in conservation, research and utilization of tropical biological diversity by 2020**. **The current NPBD 2016-2025 specifies 5 national goals and 17 national biodiversity targets** to be implemented by all segments of stakeholder and society.

Target 3 of the NPBD 2016-2025 emphasize mainstreaming of biodiversity conservation into national development planning and sectoral policies and plans by 2025. **Under its Target 4, the NPBD aims to ensure that agriculture production and fisheries are managed and harvested sustainably.**

Other related policies include the **National Forestry Policy**, endorsed by the National Forestry Council in 1978. The key **objectives are to conserve and manage the nation's forest** based on the principles of sustainable management and **to protect the environment** as well as **to conserve biological diversity, genetic resources and to enhance research and education**.

Additionally, **the National Policy on the Environment 2002**, integrates the three elements of sustainable development, namely economic development, social and cultural development, and environmental conservation.

Other related plans and initiatives aimed at protecting biodiversity and ecosystem services include the **Central Forest Spine Master Plan (CFS).** It was conceptualized in 2005 under the first National Physical Plan (NPP) and implemented under the Tenth Plan to **link up 4 major forest complexes in Peninsular Malaysia with a network of ecological or green corridors to create one contiguous, forested wildlife sanctuary**. Related to this is the **National Tiger Conservation Action Plan (NTCAP), 2008-2020** which aims to conserve the national emblem of Malaysia.

In addition, beginning with the Chior Wildlife Reserve in 1903, **Malaysia has established an extensive network of protected areas** for the conservation of natural habitats, species and genetic diversity. According to WWF-Malaysia, **by 2013, the number of protected areas had grown to 444, covering a total area of 4,125,895.1 ha**. Out of which the terrestrial and marine protected areas accounted for 10.8% and 1.1%, respectively.

At regional level, **Malaysia joined Indonesia and Brunei in the "Heart of Borneo" initiative which was jointly initiated in 2007 to conserve about 200,000 sq. km of forests**, about 30% of which was in Malaysia.

4. ACCOUNTING FOR ECOSYSTEM IMPACTS AND DEPENDENCIES

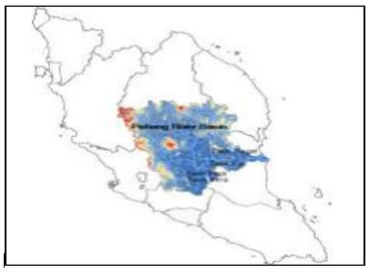
Promoting the sustainable management of agricultural landscape is considered a key solution for biodiversity and natural resources conservation. The Malaysian Government is making strides in this direction. However, m**ainstreaming biodiversity and ecosystem values into the agri-food value chain remains a major challenge**. Consequently, **the expansion of agricultural land and conversion of forests in Malaysia remain the key drivers to ecosystem services and biodiversity loss**.

However, there is paucity of studies assessing environmental impacts of agri-food systems across the value chain in Malaysia. A **few studies conducted mostly at farm gate points towards significant impacts on biodiversity, climate change and natural resources**. One such case study is reported here.

Case Study: Oil palm and rubber plantations driving land use change and ecosystem services

With a 440-km main stream length, **Pahang watershed is the largest watershed in Peninsular Malaysia**. About 2/3 of the surface area is dominated by tropical rainforest. From 2000 to 2010, Pahang Watershed has experienced an increase in commercial plantation and built-up area as shows in Table-ES 1. During this period **over 62,000 ha of primary forest and over 4,000 ha of secondary forest were converted to plantation crops** with higher commercial values such as oil palm and rubber or construction to broaden residential and industrial areas. **Oil palm land increased by over 33,000 ha and that of rubber plantations by over 20,000 ha.**

Figure-ES 2: Pahang Watershed



Source: Foo and Hashim (2014)

Table-ES 1: Land Use Changes from 2000 to 2010

General Land use	2000	2005	Changes	2010	Changes
	Area(ha)	Area(ha)	Area(ha)	Area(ha)	Area(ha)
Forest	2,505,801	2,298,612	-207,189	2,235,976	-62,636
Secondary Forest	55,864	105,177	49,313	100,885	-4,292
Oil Palm	230,365	392,341	161,976	425,381	33,040
Rubber	22,776	27,199	4,423	47,386	20,187
Built-Up Area	15,971	9,019	-6,952	18,128	9,109
Wetland	2,339	811	-1,528	5,224	4,413
Mix cultivation	35	68	32	302	235
Total (Area)	2,833,151	2,833,227		2,833,281	
Annual soil loss(ton/year)	2,993,061	2,478,559		14,211,170	

Source: Foo and Hashim (2014)

Forest **conversion to agricultural land led to an increase in erosion and the amount of soil loss had increased from 3m ton/year in 2000 to 14m ton/year in 2010**. Among the land use features, forest produced least amount of soil loss, while a significant amount could be attributed to oil palm and rubber plantations.

The total ecological service values and goods (ESVG) for each landscape features across 11 indicators of ecosystem services from 2000 to 2010 were estimated **across 11 indicators of ecosystem services** as shown in Table-ES 2 The ESVG estimates are a partial indicator of ecosystem services value since only 11 indicators were used. The **ESVG for oil palm was the highest at 1,202 US$/ha/year** followed by forest and secondary forest. The **cost of soil loss due to erosion was estimated at 6 US$/ha** (Table-ES 2).

Table-ES 2: Ecology Service Values and Good in Watershed for 2000, 2005 and 2010

Ecology Service Values And Goods												
	Ecological Services							Ecological Goods				
Landscape Features	water supply #	Erosion Contol #	Waste Treatment #	Carbon Stock *	Carbon Sequestration *	Recreation #	Cultural and Artistic info #	Food Production #	Raw Materials #	Medical Resources *	Ornamental Resources *	Total Rate (USD/ha)
tropical primary forest	8	245		8	8	112	2	108.24	330	50	250	1121.4
tropical secondary forest	8	245		6	6	112		32	330		250	989
oilpalms	2								1200			1202
rubber	2								77			79
wetland		96.7						204				300.71
Built-up area												0
Mix cultivation								54				54
soil loss due to erosion(ton / year)												6

Source: Foo and Hashim (2014)

The total annual sum of ESVG and cost of soil loss was calculated for each land use as shown in Table-ES 3. The **ESVG for tropical primary forest were highest at about US$ 2.8 billion/year in 2000, but declined to US$ 2.5 billion in 2010**. The **annual ESVG for oil palm increased from about US$ 0.3 billion in 2000 to US$ 0.5 billion in 2010** and that of **rubber from US$ 1.2 million to 3.7 million in 2010.**

Conversely, the **annual cost of soil loss increased from US$ 17 million in 2000 to US$ 85 million in 2010.**

Table-ES 3: Ecology Service values and goods (ESVG) for Pahang Watershed

	US$/Year			
General Land use	2000	2005	2010	Net Change (2005-2010)
Tropical primary forest	2,809,603,939	2,577,295,662	2,507,065,216	-70,230,446
Tropical secondary forest	55,249,480	104,020,283	99,775,067	-4,245,216
Oil palm	276,899,248	471,594,116	511,307,642	39,713,526
Rubber	1,799,282	2,148,722	3,743,459	1,594,737
Built-up area	-	-	-	-
Wetland	703,239	243,869	1,570,859	1,326,990
Mix cultivation	1,916	3,646	16,312	12,666
Annual cost of soil loss(ton/year)	17,958,366	14,871,354	85,267,020	70,395,666
Net value of total Ecology Services and Goods	**3,126,298,738**	**3,140,434,943**	**3,114,951,858**	**-25,483,085**

Source: Foo and Hashim (2014)

When the soil loss is accounted for, the overall ESVG began to show losses for about US$ 26 million/year in 2010. The increase in soil loss was closely linked to the landscape development that was conducted in the watershed. Across all land use categories, forest produced the least soil loss at less than 10 ton/ha/year. **The study further demonstrated that although oil palm had the highest commercial values compared to other land uses, the gains brought by oil palm was still insufficient to cover losses in the overall estimated ESVG due to the forest clearance and soil degradation.**

5. PROJECT AIMS AND OBJECTIVES: TEEB Implementation in Malaysia, "Promoting biodiversity and sustainability in the agriculture and food sector project"

1. To complement the Malaysian Government's initiatives for agriculture sustainability and biodiversity conservation, **the United Nations Environment (UN Environment), with the support of the European Union (EU), launched a four-year project for "Promoting biodiversity and sustainability in the agriculture and food sector in Malaysia**.

2. This project is in line with the Cancun Declaration adopted at the 2016 December CBD COP13 in which governments committed to mainstream biodiversity across all sectors. The project would contribute to integrating biodiversity values into national accounting and reporting systems and will encourage sectors that depend or have an impact on biodiversity to adopt integrated approaches for its conservation and sustainable use. In line with the Declaration, the project will also contribute to supporting sustainable production and consumption throughout value chains, the safe and sustainable application of technologies, and the phasing out of harmful incentives and strengthening of positive incentives.

3. **The overall objective of this project is to protect biodiversity and contribute to a more sustainable agriculture and food sector with well-functioning ecosystems**. This will be achieved by:
   - developing and applying instruments to capture the value of ecosystems services across the entire life cycle in the agri-food and the non-food agricultural raw material sectors;
   - identifying intervention options protecting biodiversity and promoting well-functioning ecosystems and by direct engagement with farmers, agri-businesses, government, and civil society (including consumers).

The example above – on **oil palm and rubber plantations impacts on ecosystems**– has not been funded by the UN Environment/EU project, but **demonstrates the often-invisible externalities, impacts and dependencies between the agricultural sector and ecosystems & biodiversity**. This Executive Summary is limited to this one example, but the main report provides three such examples.

The studies presented are more limited in scope that the full TEEBAgriFood assessments that would be conducted under the current UN Environment/EU project. For instance, these analyses do not cover the **entire value chain** 'from farm to fork' (and including final waste management), does not consider all impacts such as **human health**, and do not present a **Theory of Change**, i.e. what can be done to intervene to switch away from the current business-as-usual scenario to an alternative – the sustainable management of agricultural landscapes.

Although 'partial' vis-à-vis the TEEBAgriFood Evaluation Framework, the studies described herein reveal the potential for **complex trade-off** between social- economic and environmental objectives in the Malaysian agri-food systems. Research into this area is still evolving, with an evaluation of possible trade-offs mainly focused at farm level or partial agri-food value chains. More comprehensive analysis of potential social- economic and environmental trade-offs is generally constrained by the complexity of the agri-food value chains and data availability. However, an understanding of these trade-off is crucial for the effective implementation of the Malaysian green agricultural initiatives and biodiversity conservation, and this is the focus of the UN Environment/EU project.

1 Introduction: Snapshot of agriculture in Malaysia

Currently, an upper middle-income country, attempting to achieve high-income status by 2020, Malaysia has steadily progressed from a producer of raw materials in the 1970s to a multi-sector economy. With its GDP estimated at US$ 309.9 billion in 2017, Malaysia is currently the fourth largest economy in South East Asia, after Indonesia, Thailand, and Philippines (CIA, 2017). Since 1960, Malaysia has pursued various economic reforms and the country has transitioned through a number of phases which, according to Olaniyi et al. (2013), can be grouped into three broad economic eras, namely: agricultural (1960 - 1974); industrial (1975 - 1999) and urbanization (2000 - date). The agricultural era was characterised by policies that promoted heavy investments in agriculture and rural development. The industrial era transformed the economy from agricultural to industrial, leading to massive withdrawal of inputs from the agriculture sector. Finally, the urbanization era is envisaged to transform Malaysia into a high-income nation by the year 2020.

Particularly during this era of urbanization, the services sector (currently estimated at 54.7% of GDP) and manufacturing sector (currently estimated at 36.9% of GDP) have increasingly spearheaded the country's economic growth, while the agriculture sector's contribution has declined from around 43.7% of GDP in 1960 to 18.7% in 1990 and further down to 8.7% in 2016 (CIA, 2017, World Bank, 2018, Dardak, 2015). **Much as Malaysia is not a major player in the world agricultural economy, agriculture is a very important sector, employing nearly 11% of the 14.94 million people from the labour force.**

Divided into three main regions: Peninsular Malaysia, Sabah and Sarawak, the country has a total land area of 33.03 million ha of which, as of 2015, 23.1% is agricultural land, 63.6% is forest area and 13.3% is for other land uses as shown in Figure 1. Peninsular Malaysia has the largest land area suitable for agriculture accounting for nearly 48% of the total agricultural land area (Olaniyi et al., 2013).

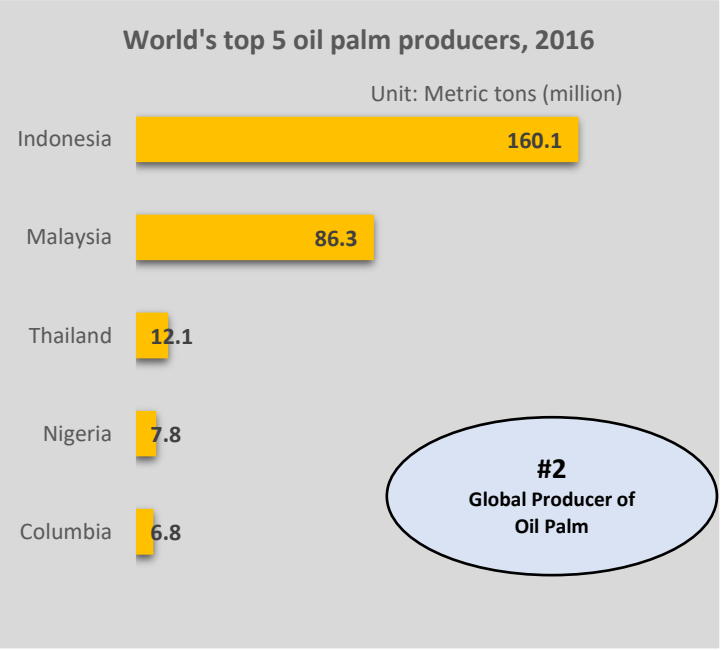
Figure 1: Land use in Malaysia, 2015

Source: Sundram (2017)

Prior to its independence in 1957, Malaysia's agricultural sector was largely dualistic. On the one hand, was the large-scale and relatively capital-intensive plantation sector dominated by Europeans specialising in commercial crops such as rubber (introduced in 1876) and palm oil (introduced in 1917). On the other, was the smallholder sector, owned mostly by Malay peasants who cultivated traditional rice, and Chinese and Indian immigrants who grew a variety of crops on small plots such as pepper, tapioca and vegetables. After independence, the government pursued policies to improve productivity and income for the subsistence sector putting more emphasis on palm oil cultivation (Izad, 2012, Mustapha, 1983). Today, despite some significant declines during the past two decades, **rubber, palm oil and cocoa are the main cash crops** that Malaysia produces. The country also produces other crops including rice, bananas, coconuts, pepper and pineapples. The agriculture sector is still dualistic with (a) the estate sub-sector, unlike previously, now owned by private companies, public-listed corporate entities or public land development agencies each holding at least 40.5 ha of farm land and (b) smallholders owning on average 1.45 ha of farm land but collectively owning about 75% of the 6.6 million ha – the total area under agriculture (Ministry of Agriculture, 2009). Smallholders are now active players in production of some cash crops such as oil palm and rubber.

In terms of crops, according to Fatah (2017), the Malaysian agricultural sector can be divided into three sub-sectors: industrial crops, food crops, and other miscellaneous crops. The key industrial crops include oil palm, rubber, cocoa and tobacco, which mainly serve the export market. The food crops, which mainly comprise paddy, livestock, fisheries, fruits and vegetables primarily serve, though not exclusively, the domestic market. The production structure, except for poultry, consists mainly of small and medium scale production units (Ministry of Agriculture, 2003). Lastly, the other miscellaneous crops include sugarcane, cassava, maize and sweet potato, which cater for both export and domestic markets. For a long time, Malaysia's agricultural policy has mainly revolved around the industrial crops and, to some extent, the food crops.

Malaysia is the world second largest producer of palm oil



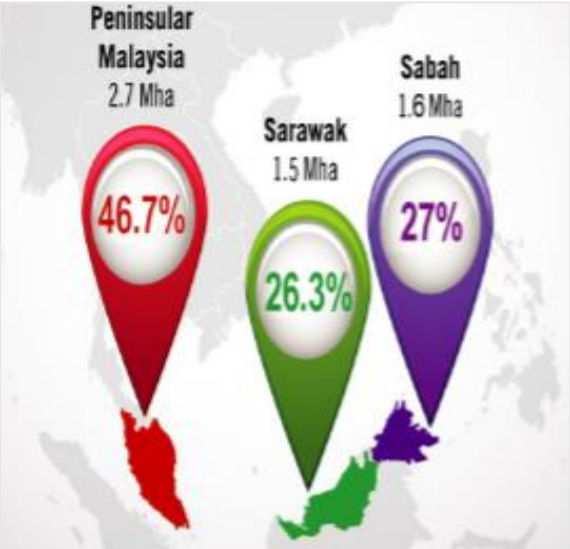
- **Malaysia is the world second largest producer of oil palm** which occupies around 5 million hectares of land across the country
- **In 2016, Malaysia produced 86.3 million metric tons of oil palm accounting for about 28.7% of global output**
- Malaysia is also the world second largest producer of palm oil. For instance, **in 2014, Malaysia** produced 19.7 million metric tons of palm oil

Source: FAOSTAT (2018)

Although Malaysia is the world's second largest producer of oil palm, its yield is lower than that of Columbia and Thailand. As of 2016, oil palm yield in Malaysia stood at 17.2 metric tons per hectare compared to Columbia's 20.4 and Thailand's 18.6 metric tons per hectare. Nonetheless, Malaysia's oil palm yield is still above the world average which, in 2016, stood at 14.2 metric tons per hectare (FAOSTAT, 2018).

At local level, Peninsular Malaysia produces the largest amount of oil palm followed by Sabah then Sarawak as shown in Figure 2.

Figure 2: Oil Palm planted area in Malaysia, 2016

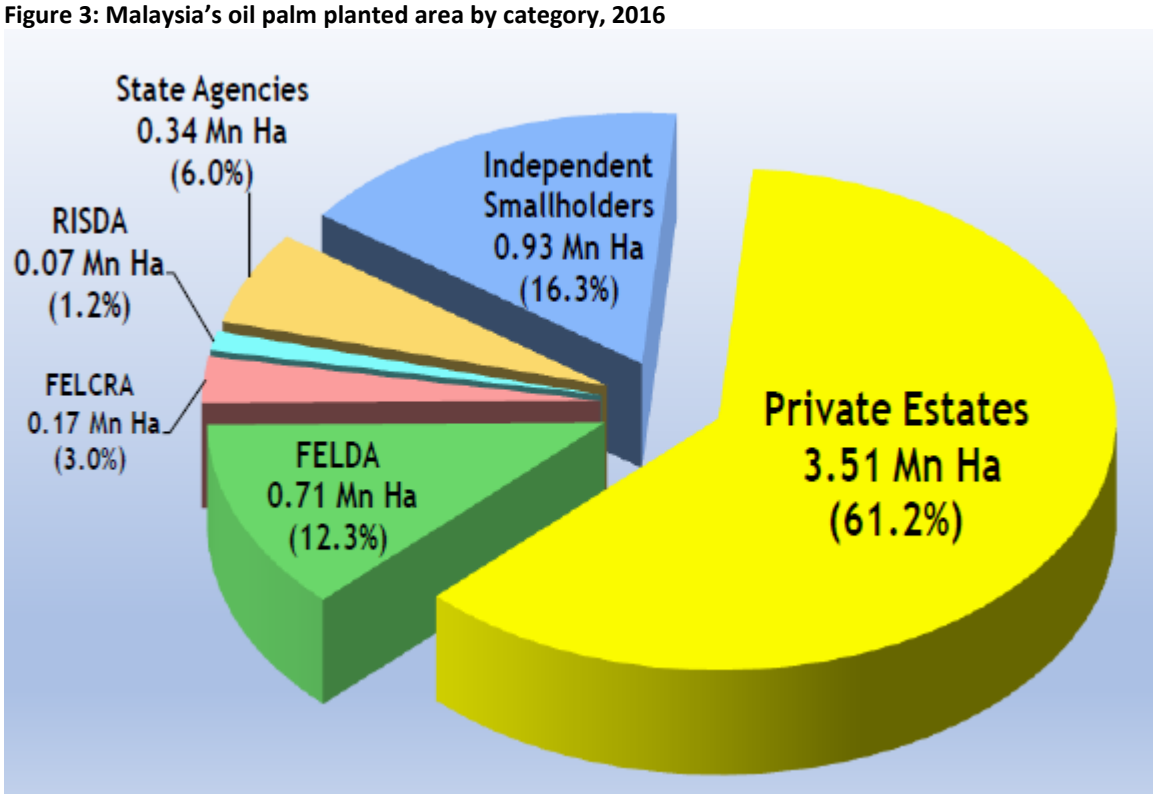


An oil palm farm in Malaysia

Source: Sundram (2017)

The key growers of oil palm in Malaysia are the private estates, accounting for 61.2% in 2016. Independent smallholders come second, accounting for 16.3% of the total oil palm cultivated in 2016. Other key stakeholders include the Federal Land Development Authority (FELDA), Federal Land Consolidation and Rehabilitation Authority (FELCRA), Rubber Industry Smallholders Development Authority (RISDA) and state agencies as shown in Figure 3.

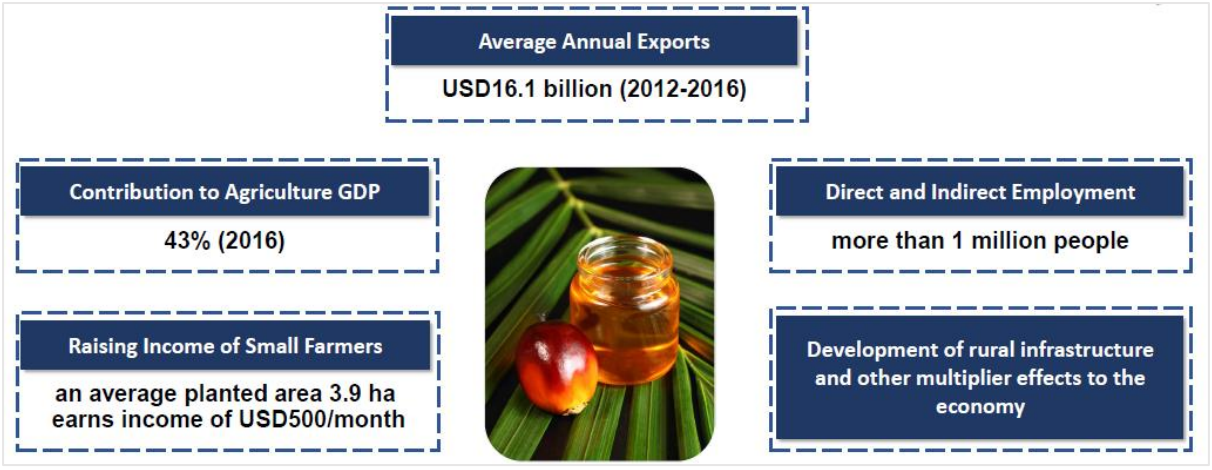
Figure 3: Malaysia's oil palm planted area by category, 2016



Source: MSPO and MPOC (2017)

Apart from being a major contributor to the agricultural revenue in the country, the palm oil industry is one major source of income for smallholders, averaging US$500 per month in 2016 as shown in Figure 4.

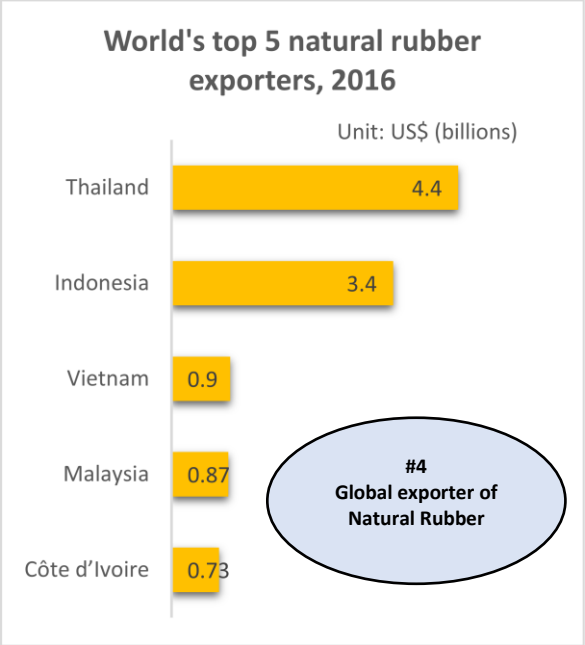
Figure 4: Malaysia's palm oil industry contribution



Source: MSPO and MPOC (2017)

Malaysia is the world fourth largest exporter of natural rubber

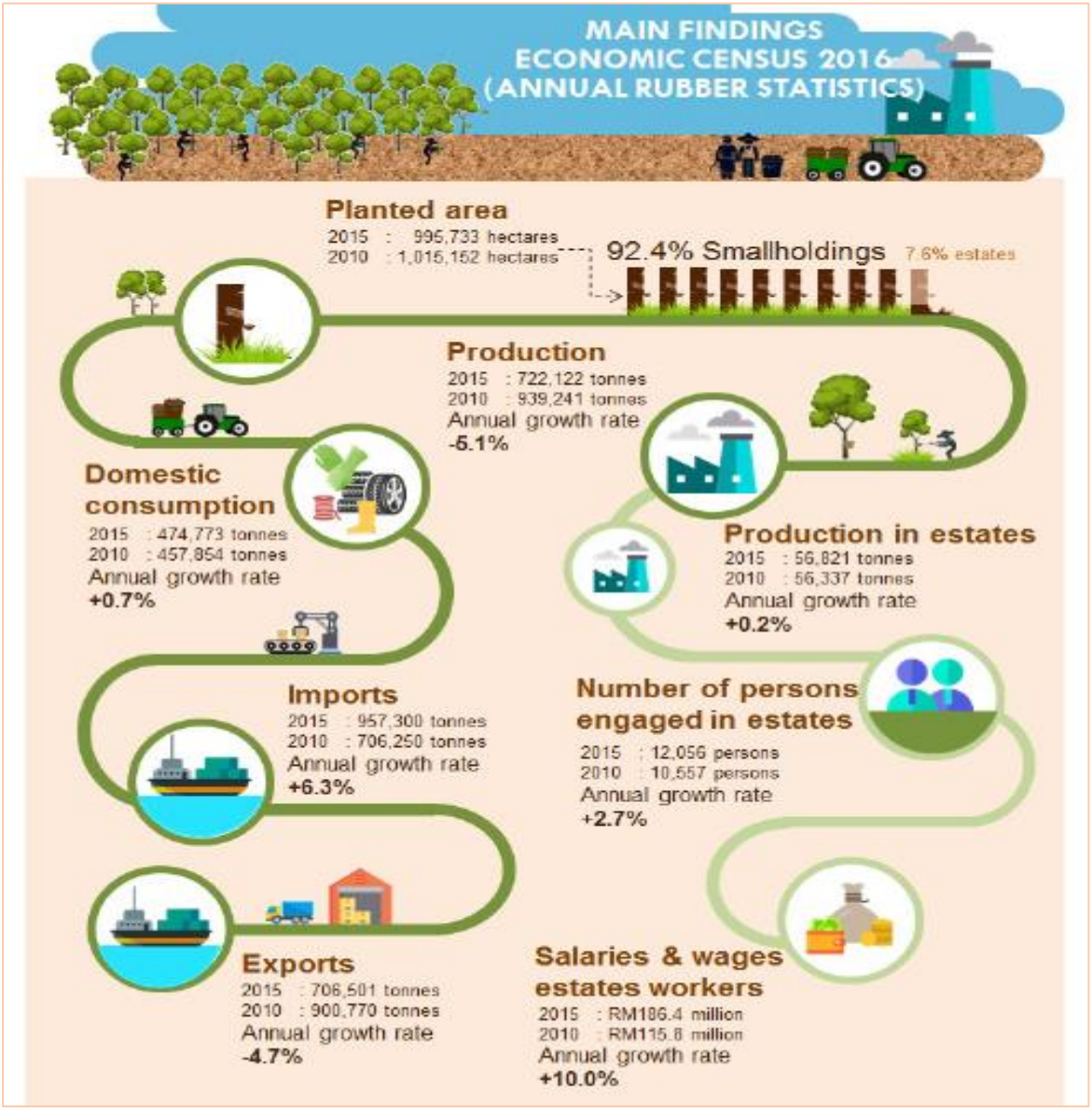
- Natural rubber is one of Malaysia's chief cash crops. The country is the world fourth largest exporter of natural rubber
- In 2016, Malaysia exported rubber amounting to US$3.4 billion
- Malaysia's natural rubber farms cover nearly 1.1 million hectares, with 0.7 million metric tons produced (FAOSTAT, 2018)
- Most rubber plantations are in the western plains of the Malaysian coastal regions
- In the southern part of Malaysia, Jahore state, is the largest producer of natural rubber



Source: Statista (2018)

Nearly 92% of rubber plantations in Malaysia are smallholder owned. However, there has been a noticeable decline in the size of these plantations. For instance, in 2010 rubber plantations accounted for about 1.01 million ha but in 2015 these plantations accounted for 0.99 million ha. Some researchers have pointed out that the decline in rubber plantations commenced with the discovery of synthetic rubber, which brought about poor price of natural rubber. As a result, some smallholders started converting their rubber plantations into oil palm farms (Olaniyi et al., 2013). This might explain why Malaysia is a net importer of rubber such that between 2010 and 2015, rubber imports increased by 6.3% as shown in Figure 5.

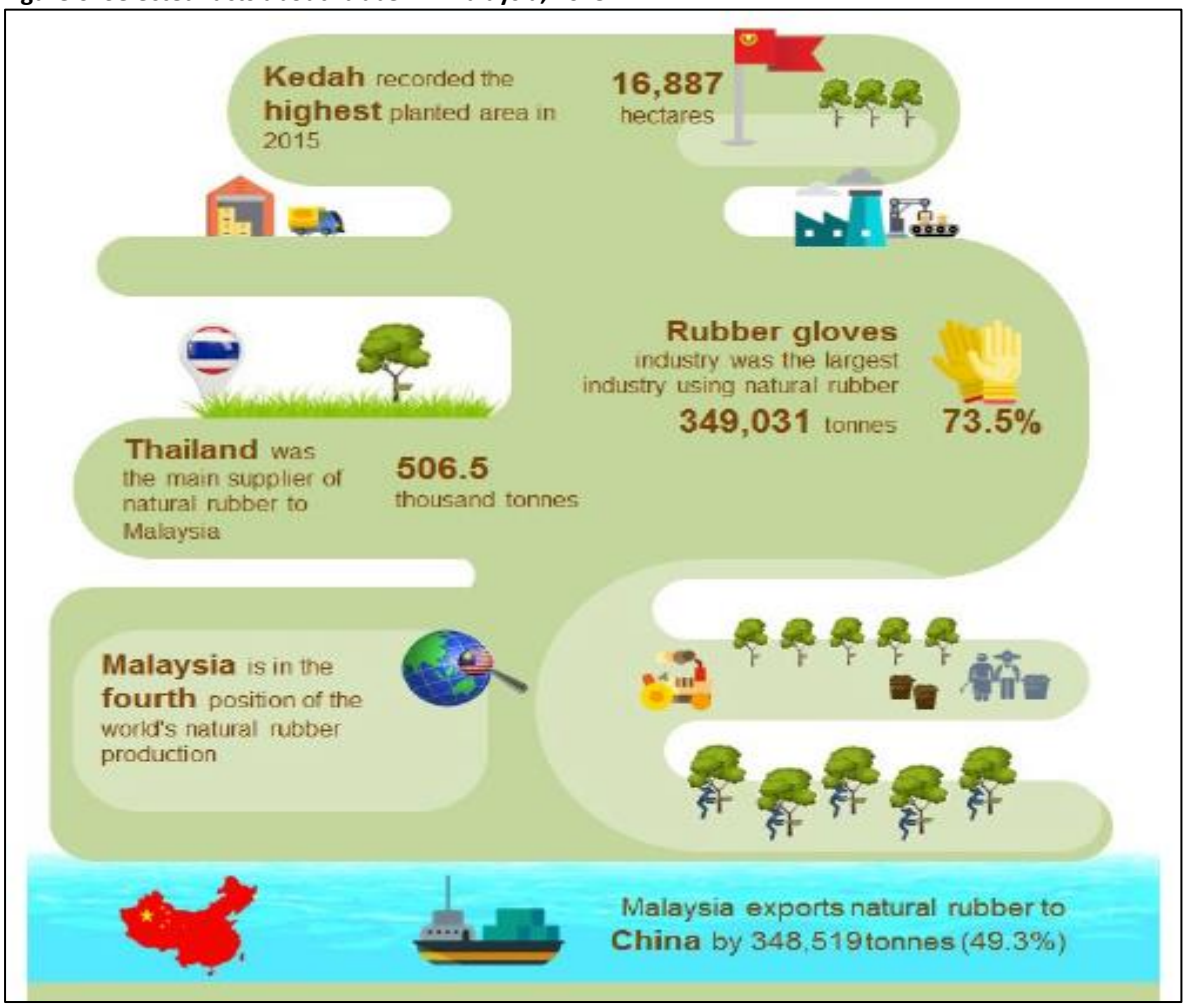
Figure 5: Annual rubber statistics in Malaysia, 2016



Source: Department of Statistics (2018)

Despite some noticeable declines in rubber plantations and increased rubber imports, predominantly from Thailand, the rubber industry is very well established in Malaysia. Rubber glove, tyre retreading and rubber hose for industrial use are some of the key sub-sectors in the downstream rubber sector. Of these, rubber glove is the largest industry accounting for about 73.5% of the rubber used in 2015 as shown in Figure 6.

Figure 6: Selected facts about rubber in Malaysia, 2015



Source: Department of Statistics (2018)

Rice is the most important staple food in Malaysia

Although sometimes regarded as inferior, rice is the most important staple food in Malaysia with per capita consumption of 82.3 kg in 2016 (GAIN Report, 2018). It is the third widely cultivated crop after oil palm and rubber (Izad, 2012). In 2016, the country produced 2.3 million metric tons from 0.7 million ha of land cultivated (FAOSTAT, 2018). According to the GAIN Report (2018), no expansion of planted areas for rice are expected in 2018/19 due to scarcity of land and competition for land from oil Palm, as such milled production of rice is projected to stagnate at 1.82 million tons. This situation is somehow different from what has been the norm previously. Notwithstanding some minor fluctuations in the 1980s and 1990s, generally, rice production and consumption in Malaysia have increased annually since the 1970s largely due to commercialization, involvement of the private sector and consolidation of smallholding through group farming (Rajamoorthy and Munusamy, 2015) as shown in Table 1.

Table 1. Rice production, consumption and ending stock growth in Malaysia (1970 – 2013)

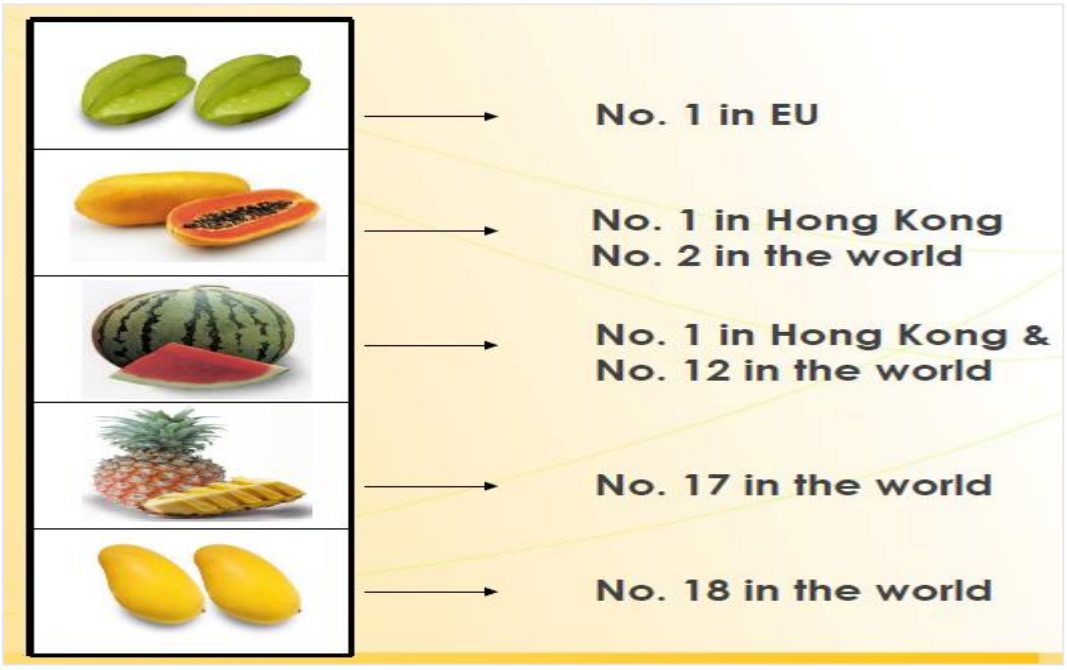
Year	Production	Average Annual growth rate	Consumption	Average Annual growth rate	Ending stock	Average Annual growth rate
	Tones	%	1000/tones	%	1000/tones	%
1970	914550		1345.00		305.00	
1975	1116190	4	1561.00	3	134.00	-15
1980	1318332	3	1500.00	-1	377.00	23
1985	1257970	-1	1520.00	0	320.00	-3
1990	1215065	-1	1490.00	0	235.00	-6
1995	1372584	2	1715.00	3	292.00	4
2000	1381662	0	1946.00	3	485.00	11
2005	1490015	2	2150.00	2	356.00	-6
2010	1588456	1	2690.00	5	733.00	16
2013	1685236	1	2775.00	1	668.00	-2

Source: Rajamoorthy and Munusamy (2015)

The domestically produced ST-15 long grain variety is the cheapest variety sold and most popular among Malaysians. On the other hand, imported rice such as Jasmine fragrant rice from Thailand is a favourite among upper income earners and those in urban areas, but costs twice the price of ST-15 rice (GAIN Report, 2018). **Although rice is grown throughout Malaysia, Peninsular Malaysia is the major producer followed by Borneo** (Fatah, 2017).

Apart from oil palm, rubber and rice, Malaysia grows a variety of other major crops such as cocoa, tobacco, coconut, pepper, fruits and vegetables. Interestingly, the average annual growth rates of most of these major crops have been on the decline, except for oil palm, fruits and vegetables (Fatah, 2017) which suggest that currently, the majority of Malaysian farmers are drawn towards cultivating oil palm fruits and vegetables. On the part of fruits, Malaysia has a very high potential in the production of papaya, star fruit, pineapple, melon, guava, jackfruit, banana, citrus and mango. The success story in fruit trade is as illustrated in Figure 7.

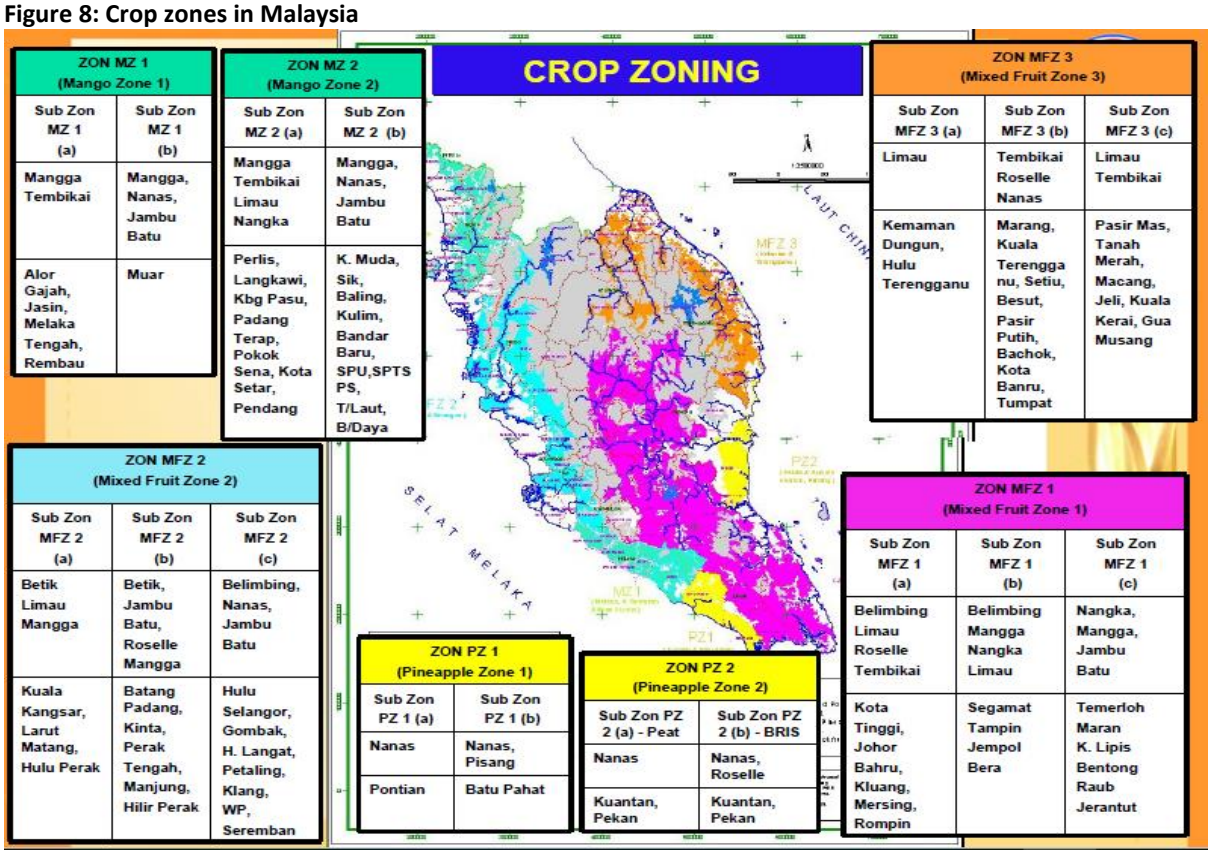
Figure 7: Malaysia's success in fruit trade



Source: Ministry of Agriculture (2009)

Fruits are grown in all the states of Malaysia but their concentrations tend to vary from one state to another. For instance, pineapples are predominantly cultivated in two regions, one in the south west and another in the south east as shown in Figure 8.

Figure 8: Crop zones in Malaysia



Source: Ministry of Agriculture (2009)

Malaysia's robust agri-food sector is supported by a rich in biological diversity and natural resources, tropical climatic conditions, enabling policies and institutional framework. However, **habitat loss and fragmentation are identified among key threats to biodiversity in Malaysia. Agriculture is among the key drivers to habitat loss, particularly forest ecosystems.**

Agriculture is driving its own demise

Agriculture is a key driver of environmental degradation. It is directly responsible for approximately 10 – 12% of global greenhouse gas (GHG) emissions and indirectly for roughly another 10%. It is the main driver of land use change and associated biodiversity loss, uses 92% of global fresh water and approximately 20% of primary energy.

Besides causing environmental damage, agriculture is, above all other industries, reliant upon a well-functioning environment. It is vulnerable to temperature extremes, water availability, atmospheric soil and water pollution, pest and disease outbreaks, biodiversity loss, tropospheric ozone, high winds, among others.

The global agricultural system is thus both a driver and a victim of environmental change.
Source: Gathorne–Hardy (2013, p. 37)

1.1 Challenges to biodiversity and agricultural landscapes in Malaysia

Malaysia is endowed with an extremely rich and very diverse biological resources. It is recognized as **one of the twelve mega diverse countries in the world, harbouring over 170,000 species of flora and fauna, accounting for 16% of the worlds classified species**. The country is rich in flora with conservative estimate of about 15,000 species of flowering plants and more than 1,000 species of ferns and fern allies. Malaysia is also rich in fauna, with 306 species of wild mammals; more than 742 species of birds; 567 species of reptiles; 242 species of amphibians; more than 449 species of freshwater fish; and it is estimated that there are 150,000 invertebrate species (NRE, 2006, MOA, 2012). Table 2 further illustrates the extent of known flora and fauna species diversity in Malaysia.

Table 2: Malaysia's known flora and fauna species diversity

Organisms	Total number of species
Mammals	306
Birds	742
Reptiles	567
Amphibians	242
Marine fishes	4,000
Freshwater fishes	449
Invertebrates	150,000
Flowering plants	15,000
Palms	536
Orchids	3,000
Fern and fern allies	2,012
Fungi	700
Mosses	832

Source: (NRE, 2006, MOA, 2012)

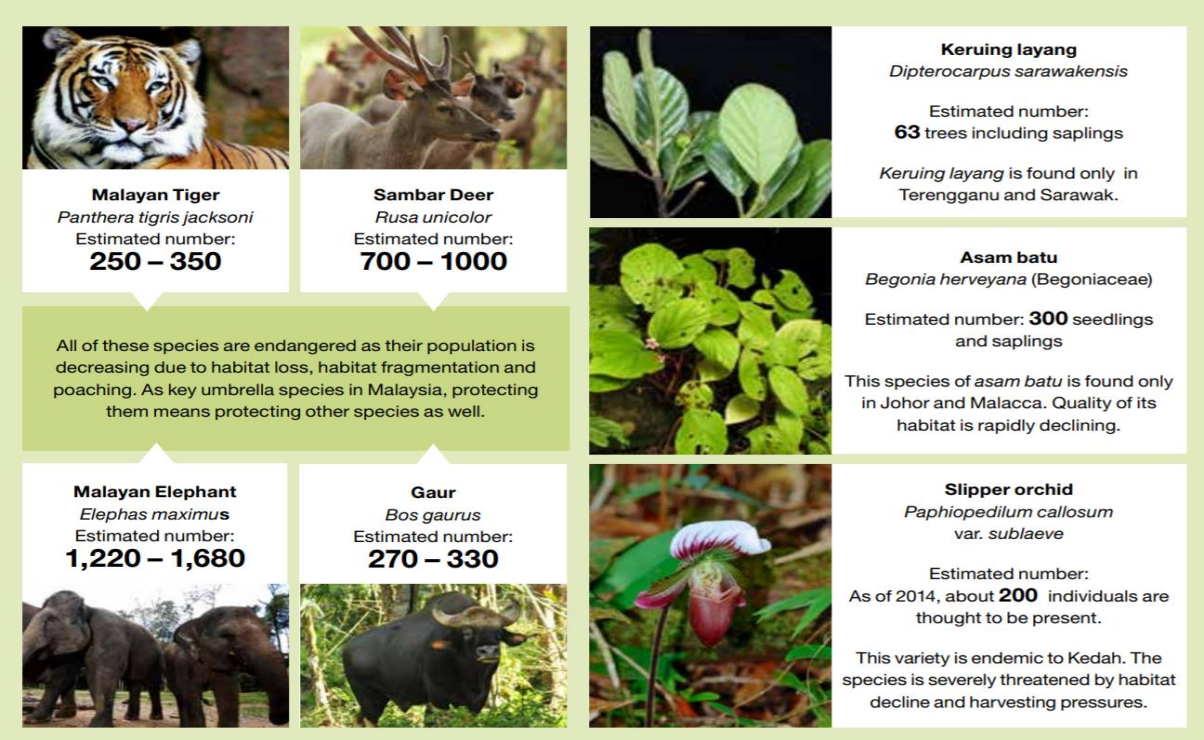
Malaysia forms part of the Sundaland biodiversity hotspot, the second most important hotspot in the world, consisting of a wide array of coastal, marine and terrestrial ecosystems (Myers et al., 2000). According to Conservation International, the Sundaland hotspot hosts about 25,000 plant species, 15,000 of which are endemic, and 2,795 vertebrate species, of which 1,103 are endemic. Vertebrate species, are estimated at about 769 bird species, (142 endemic), 380 mammals (172 endemic), 567 reptiles (243 endemic), 244 amphibians (196 endemic), and 950 freshwater fish species (350 endemic) (Conservation International, 2000).

Unfortunately, many of these iconic biological resources are increasingly under threat. **According to the 2012 World Conservation Union (IUCN) Red List[1] of threatened species, 686 plants and 225 animals in Malaysia are at risk of extinction and 256 are at least critically endangered, placing Malaysia third in the list of countries with the largest number of threatened species**, behind only Ecuador and the United States. The latest IUCN Red List[2] estimates threatened species in Malaysia at over 1,000. Selected endangered species of flora and fauna in Malaysia are highlighted in Figure 9.

Malaysia is one of the 14 tiger range countries, harbouring the Malayan Tiger (*Panthera tigris*) subspecies. In the 1950's, Malaysia was estimated to have 3,000 tigers, but unfortunately, its numbers have declined to just 250 – 340 in just over half a century[3].

[1] IUCN, 2012.IUCN Red List of Threatened Species. Version 2012.2. [online] Available at: http://www.iucnredlist.org
[2] IUCN Red List version 2017-1: Table 5 Last Updated: Nov 2017. Available at: http://www.iucnredlist.org/about/summary-statistics
[3] http://www.wwf.org.my/about_wwf/what_we_do/species_main/tiger/

Figure 9: Selected endangered species of flora and fauna in Malaysia



Source: Government of Malaysia (2015)

Habitat loss and fragmentation as well as poaching are identified as key threats to biodiversity in Malaysia (Government of Malaysia, 2015). Conversion of forest, wetlands, peatlands and other natural ecosystems to other land uses and degradation reduces the extent and quality of habitat, leading to a loss of biodiversity. Such challenges are not just unique to Malaysia but are rather widespread across the Southeast Asia region. It is estimated that Southeast Asia may lose three quarters of its original forests by 2100, and as a result up to 42% of its biodiversity (Sodhi et al., 2004). This is of great concern given that Southeast Asia is amongst the most biodiverse regions containing high levels of endemism.

Globally, food systems are now the source of 60% of terrestrial biodiversity loss, 33% of soil degradation and 61% of the depletion of commercial fish stocks (TEEB, 2015). While, sustainable development of the agricultural industry is a key focus of the national agri-food policy, coupled with a policy focus on protected area implementation (e.g. The National Forest Policy 1978, revised in 1992), has largely prevented the expansion of agri-food industry into forests systems. Presenbtly, it is estimated that **nearly 60% of the Malaysia is still covered with natural rainforest**, the only clear areas being along rivers, including some larger alluvial plains in the west of the peninsula, and where land has been developed for urban settlement or agriculture. However, land use change from agriculture remains a threat to forest ecosystems (NRE, 2014). For example, **in 1946 forests covered 77% of Peninsular Malaysia's total land area[4]. As of 2005 the forest cover had diminished to 44.6%**, with vast areas of **lowland forest converted to agriculture**, urban development and other uses. Land use change to development related activities has led to the **local extinction of several species in Peninsular Malaysia including the Javan rhinoceros** (Rhinoceros sondaicus), the green peafowl (Pavo muticus) and at least one timber tree (Shorea kuantanensis) (UNDP, 2014a).

[4] Peninsular Malaysia covers about 40% of Malaysia's land area and 60% is in Borneo

Malaysia is the second largest producer of palm oil after Indonesia, and **it is estimated that over half of palm plantations established since 1990 occurred in areas deforested** for this purpose (Koh and Wilcove, 2008). However, estimates for **the proportion of deforestation caused by the expansion of oil palm cultivation vary**. The Malaysian Government has maintained a net loss of 129 million ha of forest between 1990 and 2015. It is estimated that between 2010 and 2015 there was an annual loss of 7.6 million ha and an annual gain of 4.3 million ha per year. Thus, leading to **a net annual decrease in forest area of 3.3 million ha**. This comes in contrast to the EU Resolution estimate of 13 million ha forest loss (MPOC, 2017).

Other studies have also established the link between the expansion of oil palm cultivation and deforestation. For example, a recent remote sensing study by Vijay et al. (2017) using a subset of plantations in 20 countries showed that 45% of oil palm plantations in Southeast Asia came from areas that were forests in 1989. **In Malaysia, the percentage area from deforestation between 1989 and 2013 was estimated at 40%.** A substantial proportion of the suitable oil palm planting area in Malaysia is now utilised. This raise concerns that any future oil palm expansion might lead to similar past trends in deforestation, **particularly in Sarawak, where the provincial government is promoting plantation expansion**; whereas initiative to protect significant areas of forest is being promoted in the "Heart of Borneo" (Vijay et al., 2017).

Peatlands conversion to agriculture could further exacerbate biodiversity loss. For example, an analysis of official land use data **in Peninsular Malaysia showed that 222,000 hectares of oil palm was on peatlands by 2006, which is equivalent to 9.5% of the total oil palm area, and over one third of the total area of peat**. This represented an increase of over 18,000 hectares (or 3% of total peatlands) from 2002 (Wetlands International, 2010). **For the whole of Malaysia, about 36% of peat soil areas are used for agriculture**. Peninsular Malaysia has the highest proportion of its peat soil under agriculture (44%), Sabah and Sarawak have similar proportions of peat soils under agriculture (33%). Koh et al. (2011) also estimated that the observed conversion of peat swamp forest to oil palm plantation could have resulted **in the loss of 1% of Borneo's biodiversity, 3.4% in Sumatra, and 12.1% in Peninsular Malaysia.**

To address the situation, Malaysia is making strides towards protecting its biodiversity and ecosystem services. Within the oil palm sector, green agriculture practices are being promoted through national level and internationally accepted certification schemes, including the Malaysian Sustainable Palm Oil (MSPO) standards and Roundtable on Sustainable Palm Oil (RSPO).

1.2 Malaysia's Path towards Inclusive Sustainable palm oil Policies

In 2017, Malaysia celebrated 100 years anniversary since commercial oil palm planting started in 1917. Today palm oil production has grown, accounting for 39 % of world palm oil production and 44% of world exports. It also contributes nearly 43% to agricultural GDP and a source of employment to more than 1 million Malaysians (Malaysian Palm Oil Certification Council, 2017). Being among the top world producers of oil palm, Malaysia has a key role to play in fulfilling its sustainability initiatives.

1.2.1 Malaysian Sustainable Palm Oil (MSPO) Policy

In January 2015, the Government launched the Malaysian Sustainable Palm Oil (MSPO) standards. It is a voluntary standard aimed at helping small and medium-sized Malaysian growers and processing facilities to operate sustainably. It has been made mandatory by the end 2019[5].

It encompasses seven principals including the conservation of environment, natural resources, biodiversity and ecosystem services. It also emphasizes a need to introduce best practices to enhance productivity and raise income levels of small farmers, as well as lack of suitable land for further expansion of planted area Figure 10.

Figure 10: MSPO Standards: 7 Principles

Source: Malaysian Palm Oil Certification Council (2017)

MSPO allows Malaysian palm oil to be certified independently from palm oil produced in other countries and offers less strict compliance criteria in terms of sustainability compared to the RSPO. **Malaysia has committed towards full implementation of MSPO standards to ensure the supply of Certified Sustainable Palm Oil (CSPO) covering the entire Malaysian palm oil supply chain by end 2019**.

[5] https://certifications.controlunion.com/en/certification-programs/certification-programs/mspo-malaysia-sustainable-palm-oil

Besides, many large companies subscribe to the **Roundtable on Sustainable Palm Oil (RSPO)** – which is an internationally accepted voluntary certification scheme. The RSPO was established in 2004 and was developed through a multi-stakeholder partnership. Current **certification by RSPO in Malaysia is estimated at over 3.4 million tons of oil palm production, nearly four times that of MSPO at 0.8 million tons** (Malaysian Palm Oil Certification Council, 2017).

Furthermore, **Malaysia has enforced the zero open burning in oil palm plantations** to reduce the annual incidents of transboundary haze since 2006. This is in accordance with the zero open burning policy which was adopted in April 1999 by the ASEAN Environment Ministers and also reiterated in the 2002 ASEAN Agreement of Transboundary Haze Pollution (Barthel et al., 2018).

Malaysia has also developed a number of policies, legislations and national plans targeting the conservation of biodiversity and promoting more sustainable landscapes. These include **the National Policy on Biological Diversity (NPBD),** National policy on the Environment (2002); The Wetland National policy (2004); the National physical Plan; the National Forestry Policy (1978, revised 1993)[6]; National Policy on Climate Change (2010)[7]; the National Water Resources Policy[8]; the National Agrifood Policy[9] and National Action Plan for Peatlands[10]; the National Tiger Action Plan for Malaysia, 2008-2020[11]; the National Land Code Act 2003[12]; Protection of Wild Life Order, 2003[13]; Agricultural Pests and Noxious Plants Act 1976[14]; Forest Enactment 1994[15]; Wildlife Protection Ordinance, 1998[16]; Protection of New Plant Varieties Act No. 634 of 2004[17]; A detailed outlined of some of these initiatives and policies is provided in section 2.0.

1.3 TEEB Implementation in Malaysia: Promoting biodiversity and sustainability in the agriculture and food sector project

4. To complement the Malaysian Government's initiatives for agriculture sustainability and biodiversity conservation, the United Nations Environment (UN Environment), with the support of the European Union (EU), launched a four-year project for "Promoting biodiversity and sustainability in the agriculture and food sector in Malaysia.

5. This project is in line with the Cancun Declaration[18] adopted at the 2016 December CBD COP13 in which governments commit to mainstream biodiversity across all sectors. The project would contribute to integrating biodiversity values into national accounting and reporting systems and will encourage sectors that depend or have an impact on biodiversity to adopt integrated approaches for its conservation and sustainable use. In addition, and in line with the Declaration,

[6] http://www.nre.gov.my/ms-my/PustakaMedia/Penerbitan/National%20Action%20Plan%20for%20Peatlands.pdf
[7] http://www.nre.gov.my/sites/climatechange/pages/policies-and-action-plans.aspx
[8] http://www.nre.gov.my/en-my/Water/Pages/default.aspx
[9] http://www.kada.gov.my/en/web/guest/dasar-agro-makanan-negara
[10] http://www.nre.gov.my/ms-my/PustakaMedia/Penerbitan/National%20Action%20Plan%20for%20Peatlands.pdf
[11] https://www.loc.gov/item/2012330624/
[12] https://www.informea.org/en/legislation/national-land-code-validation-act-2003. Assessed Nov 2017
[13] https://www.informea.org/en/legislation/protection-wild-life-amendment-schedules-order-2003. Assessed Nov 2017
[14] https://www.informea.org/en/legislation/agricultural-pests-and-noxious-plants-act-1976-no-167-1976. Assessed Nov 2017
[15] https://www.informea.org/en/legislation/forest-amendment-enactment-1994. Assessed Nov 2017
[16] https://www.informea.org/en/legislation/wildlife-protection-ordinance-1998. Assessed Nov 2017
[17] https://www.informea.org/en/legislation/protection-new-plant-varieties-act-no-634-2004. Assessed Nov 2017
[18] http://www.cbd.int/cop/cop-13/hls/Cancun%20Declaration-EN.pdf

the project will contribute to supporting sustainable production and consumption throughout value chains, the safe and sustainable application of technologies, and the phasing out of harmful incentives and strengthening of positive incentives.

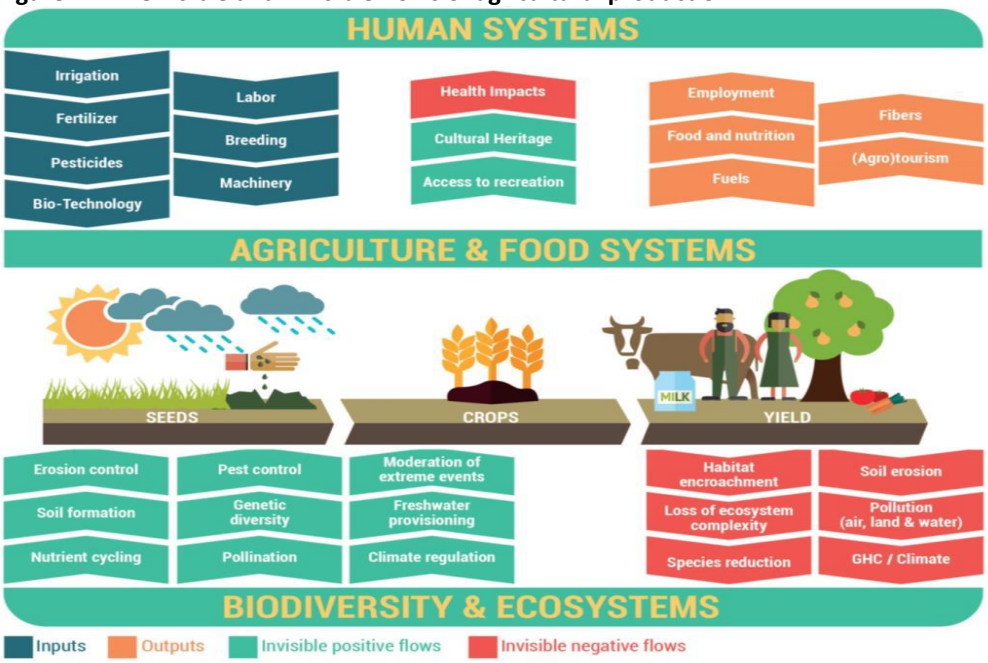
6. **The overall objective of this project is to protect biodiversity and contribute to a more sustainable agriculture and food sector with well-functioning ecosystems**. This will be achieved by:
   - developing and applying instruments to capture the value of ecosystems services across the entire life cycle in the agri-food and the non-food agricultural raw material sectors;
   - identifying intervention options protecting biodiversity and promoting well-functioning ecosystems and by direct engagement with farmers, agri-businesses, government, and civil society (including consumers).

7. The TEEBAgriFood Framework[19] will be used to assess the sectors for the EU Partner countries in scope. The focus in this action is capturing the value of ecosystems services, protecting biodiversity and promoting well-functioning ecosystems of the framework. The action aims to be comprehensive, from farm to fork (i.e. across the entire value chain). The Framework allows decision-makers (regulators, agri-business and farmers) to see explicitly any trade-offs that arise through the application of different measures, as compared with Business-As-Usual (BAU).

8. The rationale for the development of the TEEBAgriFood Evaluation Framework, is to provide a comprehensive and universal framework that captures all the positive and negative impacts and externalities across the entire agri-food value chain. It is a frame of reference that can enable us to answer the question "what we should value, and why?" It can be used to evaluate a policy question, a business question or an accounting question[20]. The TEEBAgriFood schematic (Figure 11) below provides a visual illustration of some of the impacts and externalities that might be omitted were we not to apply a holistic and comprehensive evaluation framework.

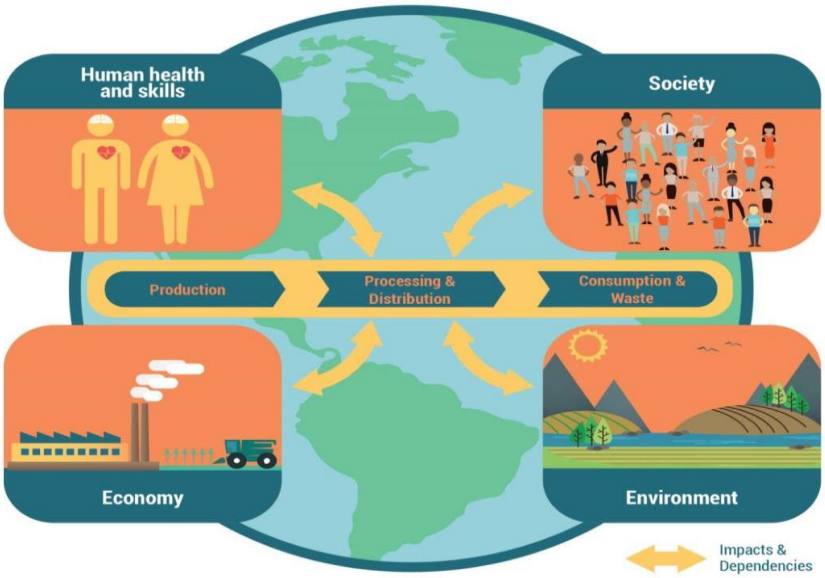
[19] The current published version of the Evaluation Framework can be found here: http://www.teebweb.org/agriculture-and-food/#framework. The Framework that is to be published in the upcoming TEEBAgriFood 'Foundations' report is an evolution of this previous version but retains the same core components. The 'Foundations' report is due to be published in Q1 2018 and thus the Framework will be finalized before the current EC Partnership Instrument project is contracted.
[20] For more details, see Chapter 3 in the TEEBAgriFood Interim Report: http://www.teebweb.org/publication/teebagfood-interim-report/

Figure 11: The visible and invisible flows of agricultural production



The schematic in Figure 11 above refers to the impacts and dependencies that occur within the farm-gate, but the Evaluation Framework looks at inter-linkages across the value chain, and trade-offs across capital stocks in the eco-agri-food systems complex. This is illustrated in the schematic below (Figure 12).

Figure 12: The eco-agri-food systems complex



9. The project builds on the momentum of the international TEEB initiative[21], TEEB country studies[22], TEEB for Agriculture and Food[23] and on national interest.
10. It also builds on on-going UN Environment/TEEB initiatives in Malaysia. TEEB will work closely with:
    - The UN-REDD which recently launched the Tropical Landscapes Finance Facility amidst great interest from government and the private sector. The UN-REDD is also linked with the EU REDD Facility and we will seek representation from this initiative in the Malaysia project steering committee.
    - The Natural Capital Protocol, and links will be made to ensure representation from those firms which have already committed to Protocol on the project meetings.
    - BIOFIN[24] is a global partnership developed to improve biodiversity management through sound financing and economic thinking. BIOFIN works directly with Finance and Environmental ministries in 30 countries helping them to understand how to use finance solutions to maintain ecosystems and the services they provide, and Malaysia is part of this partnership.

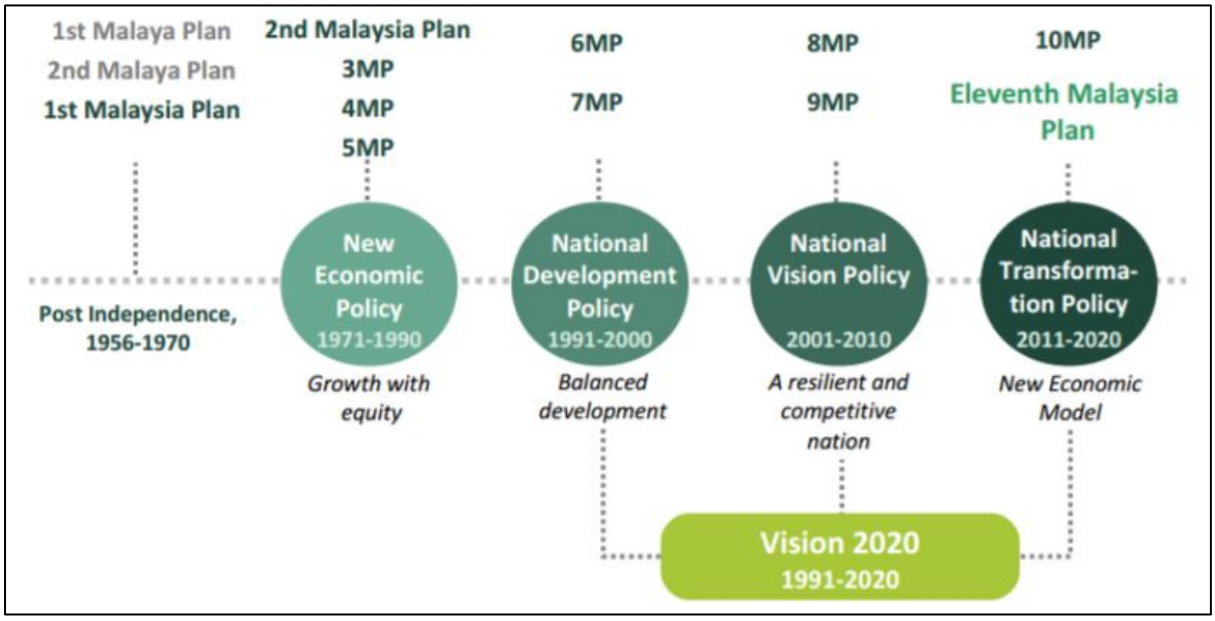
Beyond these specific country links, there are complementarities between this project and initiatives providing guidance and opportunities in this space including FAO-OECD Guidelines on Responsible Supply Chains; the BioTrade initiative managed by UNCTAD[25]; the Intergovernmental Science- Policy Platform on Biodiversity and Ecosystem Services (IPBES)[26]; ESMERALDA[27] (Enhancing ecoSysteM sERvices mApping for poLicy and Decision mAking); FAO assessment/Platform on mainstreaming biodiversity in agricultural sectors[28] and DG Research and Innovation initiatives such as FOOD 2030[29].

[21] http://www.teebweb.org/
[22] http://www.teebweb.org/areas-of-work/country-studies-home/
[23] http://www.teebweb.org/agriculture-and-food/
[24] http://www.biodiversityfinance.net. Assessed Nov 2017
[25] www.biotrade.org
[26] http://www.ipbes.net/
[27] http://www.esmeralda-project.eu/
[28] http://www.fao.org/biodiversity/en/
[29] http://ec.europa.eu/research/conferences/2016/food2030/index.cfm

2 Overview of national objectives in agriculture and biodiversity

Malaysia's economic planning follows the 2020 Vision Plan launched in 1991. The 2020 Vision Plan considers Malaysia a fully developed country across six different aspects: economic, political, social, spiritual, psychological, and cultural - by the year 2020. The Vision 2020 has been realised through a series of **National Policies and five-year plans called Malaysia Plan (MP)**, each with different development priorities as shown in Figure 13.

Figure 13: Malaysia's Vision 2020 (1991-2020)



Source: Government of Malaysia (2015)

The current National Policy, called the **National Transformation Policy, 2011-2020,** is people centred and pursues the New Economic Model, which sets the goal of becoming a high-income economy that is both inclusive and sustainable. The **National Transformation Policy, 2011-2020 is being realised through the 10th and 11th Malaysian Plans. The Eleventh Malaysia Plan (2016-2020), called "Anchoring growth on people"**, is the final leg in the journey towards realising Vision 2020. It builds upon the great strides made in the last half decade and is seen as a fulfilment of the Government's commitment to a vision of growth that is anchored on the prosperity and wellbeing of its rakyat. The Eleventh Plan is based on the theme "anchoring growth on people" and has six strategic thrusts as follows:

Six strategic thrusts

- Enhancing inclusiveness towards an equitable society
- Improving wellbeing for all
- Accelerating human capital development for an advanced nation
- **Pursuing green growth for sustainability and resilience**
- Strengthening infrastructure to support economic expansion
- Re-engineering economic growth for greater prosperity

The policy emphasizes **green growth** that is resource-efficient, clean, and resilient. The green growth strategy aims to significantly **reduce greenhouse gas emissions; improve conservation of terrestrial and inland water, as well as coastal and marine areas including its ecosystems; intensified the conservation of natural resources, including biodiversity and promote sustainable consumption and production practices**. It is seen as a reinforced commitment to green growth to ensure that Malaysia's precious environment and natural endowment are conserved and protected for present and future generations (Government of Malaysia, 2015, Observatorio Asia Pacifico, 2016).

1.4 The Eleventh Malaysian Plan and the Agro-food sub-sectors

In the Eleventh Malaysian Plan (2016-2020), **the agriculture sector, namely the agro-food and industrial commodity sub-sectors will be transformed and modernized into a high-income and sustainable sector**. This sector is expected to grow at 3.5% per annum, contributing 7.8% to GDP in 2020. Industrial commodities will contribute 57% and agro-food 42.4% to the total agriculture value added in 2020. Efforts will be focused on ensuring food security, improving productivity, increasing skills of farmers, fishermen, and smallholders, enhancing support and delivery services, strengthening the supply chain and ensuring compliance to international market requirements. The development of the sector will also take into account the impact of climate change on sustainability of agricultural practices. Special focus will also be given to the industrial commodities smallholders to further boost productivity through the infusion of modern technologies with the aim of reducing labor dependency as well as addressing low commodity prices through income stabilizing measures. Seven strategies have been identified to spur the growth of the agriculture sector.

- **Strategy 1: Improving productivity and income of farmers, fishermen, and smallholders** by accelerating adoption of ICT and farming technologies, preserving and optimizing agricultural land, and intensifying R&D&C in priority areas;
- **Strategy 2: Promoting training and youth agropreneur development** through collaboration across agencies and the private sector to modernize farming techniques and nurture agribusiness start-ups;
- **Strategy 3: Strengthening institutional support and extension services** by streamlining extension services and encouraging advisory services from the industry and academia;
- **Strategy 4: Building capacity of agricultural cooperatives and associations along the supply chain** by vertically integrating the supply chain for selected crops, enhancing management skills, and pooling resources for promotion and exports;
- **Strategy 5: Improving market access and logistics support** by strengthening logistics and enhancing access to domestic and international marketplaces;
- **Strategy 6: Scaling up access to agricultural financing by** restructuring and providing a more flexible payment mechanism as well as increasing sustainability of financing mechanisms for replanting programmes; and
- **Strategy 7: Intensifying performance-based incentive and certification programmes by** encouraging farmers to get certified, and prioritizing certified farms for incentives and support.

Source: Dardak (2016)

Within the agriculture sector, the Eleventh Malaysian Plan serves to fulfil the policy objectives and strategies of the **National Agro-food Policy (2011-2020**), building upon previous plans and policies. The National Agro-food Policy (2011-2020), has as a key policy objective to "**tackle the issue of sustainable agriculture and the competitiveness of the agro-food industry with food safety and nutrition aspects along its value chain"**. Table 3 shows the evolution of agricultural policy in Malaysia.

1.5 The evolution of agricultural policy in Malaysia

The agricultural policies in Malaysia can be forked into two eras: the policies before independence (1948 -1957) and after independence (1957-2020). **Since independence, Malaysia has formulated four agricultural policies, namely the National Agricultural Policy 1, 2, 3 (NAP1-3) and the National Agro-food Policy**. Table 3 summarizes the four agricultural policies, including their objectives and strategies, implemented in Malaysia since independence in 1957.

Table 3: Agricultural policies in Malaysia (1957 - 2020)

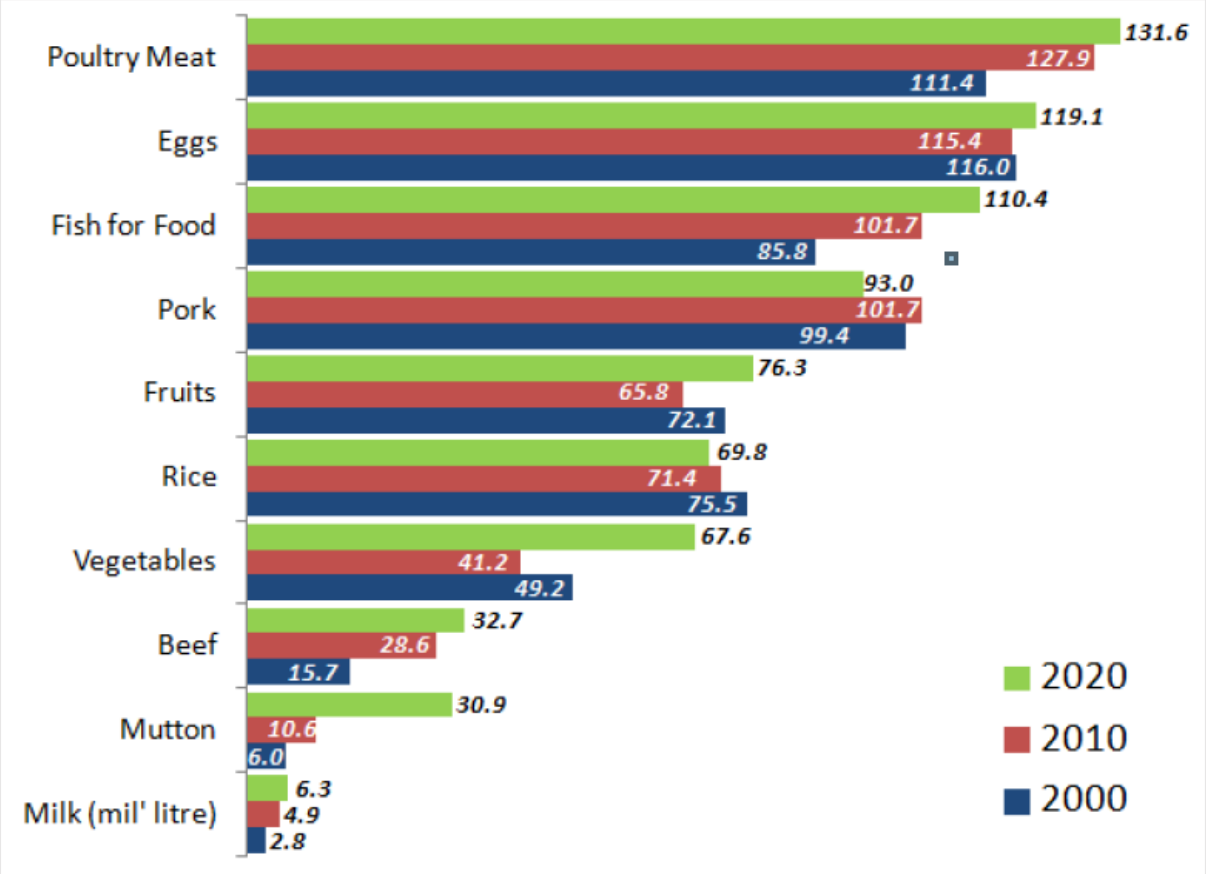
Agricultural policy	Policy Objectives	Strategies
First National Agricultural Policy (1984-1991)	• Modernize and revitalized the agriculture sector • Maximize income through optimal utilization of resources in the sector • Increase food production for local market such as rice, vegetables, fruits & poultry	• Investment in institutional building • New land developments for oil palm and cocoa • In-situ development to resolve uneconomic farm size and low productivity among small holders
Second National Agricultural Policy (1992-1997)	• Further strengthen and enable agriculture sector to contribute substantially to the economic growth of Malaysia • Enhance productivity, efficiency and competitiveness • Increase land areas for oil palm • Develop agro-based industry • Accelerate the transformation of the sector into a dynamic and commercialized sector	• Promotion of resource use optimization to diversify out of export crop cultivation into other activities • Development of agro-based industries to generate more off-farm opportunities for smallholders • Enhancement of R&D to overcome the production process, labor and other constraint in the sector • Greater participation of the private sector in the agriculture sector • Human resource development
Third National Agricultural Policy (1998-2010)	• Enhance food security • Increase productivity and competitiveness of the sector • Deepen linkages with other sectors • Create new sources of growth (after the 1997 Asian Financial Crisis) • Adopt sustainable development, utilization and management of natural resources	• Adoption of cluster-based agro-industrial development • Tackling the problem of resource constraints and promotion of sustainable agriculture • Creation of a large production base for agriculture and forestry
National Agro-food Policy (2011-2020)	• **Tackle the issue of sustainable agriculture and the competitiveness of the agro-food industry with food safety and nutrition aspects along its value chain**	• Development and upgrading of agriculture infrastructure • Improvement in the quality and safety of food by expanding the compliance of standards

	• Reform and transform the agro-food industry to become a more modern and dynamic industry	• Development of human capital to ensure sufficient skill labour force in the agricultural sector

Sources: Dardak (2015), Izad (2012), Ministry of Agriculture (2009)

It is worth pointing out that the **post-independence agricultural policies have been formulated with closely linked let alone evolving objectives**. For instance, the NAP1 was established to address the issue of rural poverty and imbalance of income between the commercial and traditional farmers. The NAP2 was an extension of the NAP1, aimed at addressing the challenges faced by the agricultural sector, especially in meeting the demand for agro-food products in the domestic and global markets. The NAP3 was a revised version of the NAP2, formulated as a response to the effects of the 1997-1998 Asian Financial Crises (AFC) and the liberalization of the financial markets to Malaysia's economy. Finally, **the National Agro-Food Policy stood on the foundations of NAP3, formulated to address challenges in domestic and global markets to ensure sustainable production for food security and safety** (Dardak, 2015). Enhancing food security has been an underlying objective cutting across all the four agricultural policies. Consequently, since the year 2000, Malaysia has witnessed tremendous improvements in production of a number of key food commodities as shown in Figure 14.

Figure 14: self-sufficiency level of key food commodities in Malaysia, 2000-2020 (%)



Source: Dardak (2015)

Despite improvements in food production, Malaysia continues to be a net importer of food with annual imports of $13 billion. For instance, in 2016, Malaysia's total imports of consumer-oriented and edible fishery products were $7.1 billion. Imports of this category from the United States were

$492 million, about 7% of market share. China is the major supplier with imports at $1.4 billion, representing 19% of the market share. India took the second spot with imports worth of $727 million (10%), followed by Thailand (9%), New Zealand (8%) and Australia (7%) (GAIN Report, 2017).

The Agricultural Support Policy

Since independence, Malaysia has actively and deliberately employed various policy instruments to support the agriculture sector, particularly in the rural areas. According to Mustapha (1983), **by the 1980s, the most important instruments of public policy affecting the incentive structure of agriculture were subsidies on inputs and output, taxes on imports and other direct and indirect taxes, agricultural credit, guaranteed minimum prices (GMP) for agricultural products, and the provision of drainage and irrigation as well as other agricultural facilities and services, including extension, research and marketing**, all of these affecting, primarily, the smallholder sector. For instance, a rice price subsidy was introduced in 1980 at the rate of 165 RM per ton and raised to 248.10 RM per ton in 1990 with the intention to improve farmers' income to at least above the then poverty line of 300 RM per month (Fatah, 2017).

Three decades down the road, the agricultural support policy is still pursued in Malaysia. For instance, **in 2014, the government of Malaysia allocated RM2.4 billion for continuation of subsidies and incentives in the agricultural sector**. The allocation included subsidies for fertilizers, seeds and rice prices, production incentives and increasing paddy rice price subsidies and incentives for fishermen. To increase productivity and produce agricultural products of high demand, the government allocated RM634 million under the National Key Economic Areas (NKEA). Among the projects underlined were rice planting, fish cage project, seaweed project, swiftlet project, high-value herbs projects, vegetable planting and fruits for the export market. In accordance with the provisions provided for agricultural development, support programs such as loan schemes with low interest rates were also increased to promote and encourage entrepreneur development (Borneo Post, 2013). **In 2017, the government provided RM1.3 billion to boost padi production and help the farmers; RM510 million in subsidies and incentives for rubber tappers; and RM260 million as cost of living allowance for the fishermen** (FMT, 2017).

However, some researchers have criticised the Malaysian agricultural support policy. For instance, Jan (2011) argues that agriculture subsidies have created unintended consequences and should be reformed, if not removed. He contends that agricultural subsidies contribute to what he calls a harmful "subsidy mentality." He therefore suggests that there should possibly be a switch from direct subsidies to agriculture vouchers that could be exchanged for agricultural inputs, thereby leaving it up to farmers to decide which seed, fertiliser, pesticide and other technologies to purchase. He envisages that such a policy reform would have considerable advantages over the current system.

1.6 The National Strategies and Action Plans on Agricultural Biodiversity Conservation and Sustainable Utilization

Other initiatives being undertaken within the agri-food sector include **the National Strategies and Action Plans on Agricultural Biodiversity Conservation and Sustainable Utilization**. This is seen as an important step in mainstreaming the Convention on Biological Diversity (CBD) objectives into the development of the agriculture sector in Malaysia. It also underscores the Malaysian Government commitment and recognition of the important of biodiversity in shaping the agricultural sector over the years. The Government of Malaysia recognizes the huge potential biodiversity holds as a reservoir of future food, natural gene bank harbouring the key ingredients for developing new varieties for better yield and also to meet the potential impacts of climate change (MOA, 2012).

The Bug That Helped Malaysia Save $10 Billion

Details Published on Tuesday, 23 February 2016 10:24

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African palm oil weevil or its scientific name Elaeidobius kamerunicus was introduced in 1981 for local palm oil pollination

AT a glance, this is just any ordinary bug.

This African palm oil weevil or its scientific name Elaeidobius kamerunicus played a part in helping Malaysia to save a staggering $10 billion!

Speaking at the UN biodiversity meeting at the Kuala Lumpur Convention Centre Monday, Prime Minister Datuk Seri Najib Tun Razak said when the oil palm industry was still at its infancy, the government opted to import the four-legged bug from Cameroon to be part of the plantation labour in 1981.

The weevil played the role in pollinating trees, a chore previously done manually -- which was undoubtedly time-consuming and ineffective.

Introduction of the weevil to the process, led to a significant increase in palm oil production and ultimately saved costs. Between 1982 and 2015, the 'kerching' saved totalled at a whopping US$10 billion!

Source: Awani (2016)[30]

The National Strategies and Action Plans on Agricultural Biodiversity Conservation and Sustainable Utilization compliments the Malaysia's National Policy on Biological Diversity (NPBD), which serves as a national blue print for the implementation of CBD objectives and for the overall biodiversity management in the country.

[30] http://www.malaysiandigest.com/news/596309-the-bug-that-helped-malaysia-save-10-billion.html

1.7 The Eleventh Malaysian Plan and Green Growth for sustainability and resilience

In the Tenth Malaysia Plan, 2011-2015, **environmental sustainability was recognised as integral part of a comprehensive socio-economic development plan**. It included measures **to address issues of climate change, environmental degradation, and sustainable utilisation of Malaysia's natural endowment**. Table 4 shows the key highlights of some of the milestones achieved during the Tenth Plan.

Table 4: Highlights Tenth Malaysia Plan, 2011-2015: Achievements

1. **In 2009, Malaysia set a voluntary target of reducing the greenhouse gases (GHGs) emission intensity of its Gross Domestic Product (GDP) by up to 40% compared to 2005 levels by 2020. BY the end of 2013, Malaysia had already achieved a 33% reduction.**

2. **Forest cover has increased from 56.4% in 2010 to 61% in 2014.**

3. **Various conservation initiatives were also undertaken including;**
    - **gazetting 23,264 Hectares of forest gazetted as Permanent Reserved Forest under the Central Forest Spine;**
    - **nearly 2,509 hectares of mangroves and other suitable species were planted to protect coastlines against wave actions and coastal winds;**
    - **Crocker Range Park in Sabah listed as Man and Biosphere Reserves by UNESCO.**

Source: Government of Malaysia (2015)

The Eleventh Malaysia Plan builds upon the initiatives launched in the Tenth Plan to address issues in environmental protection, climate change and biodiversity and continues to strengthen the nation's resilience to natural disasters, and **charts a paradigm shift towards green growth**. **Two principal outcomes have been set for the Eleventh Plan.**

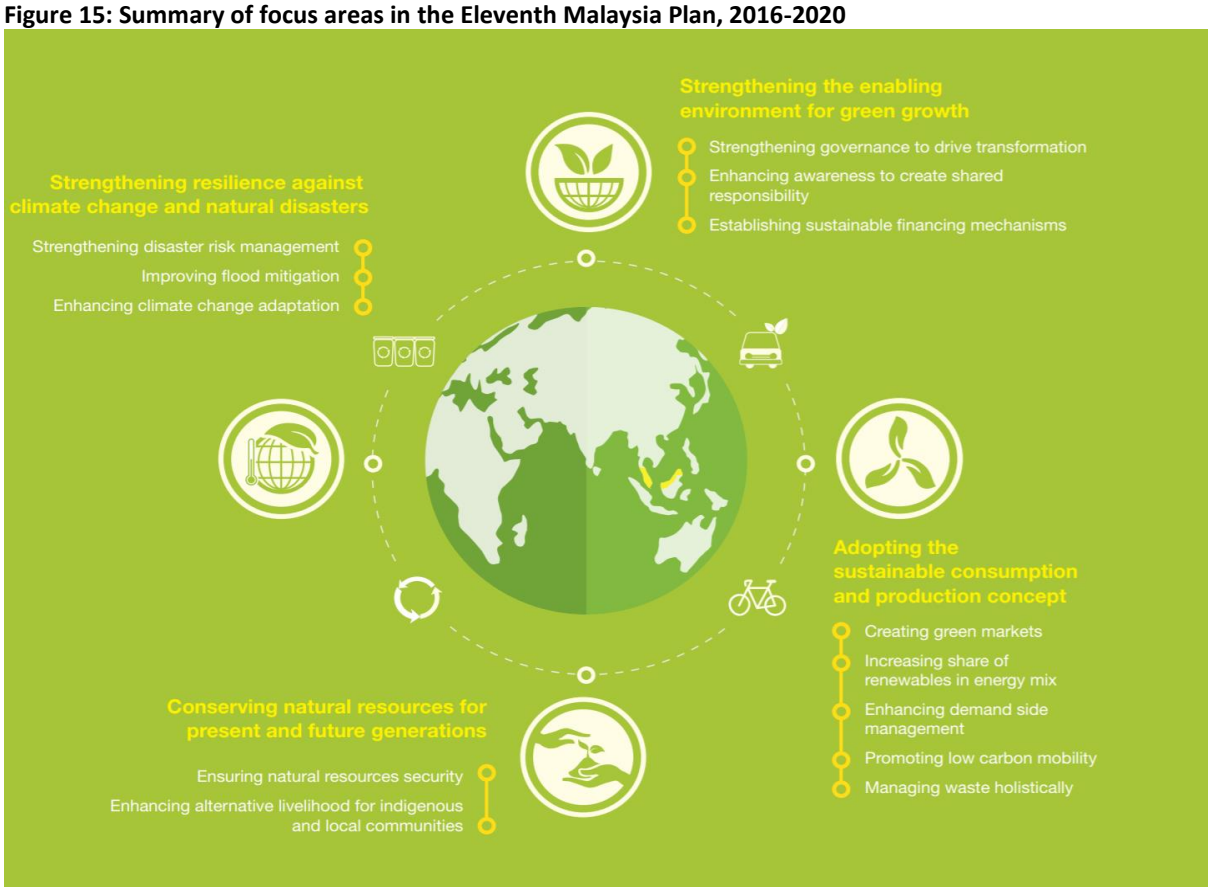
1. **To reduce GHGs emission intensity of GDP by up to 40% compared to 2005 levels by year 2020**, in line with the voluntary target announced by the Prime Minister at the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change in 2009, and

2. **To conserve at least 17% of terrestrial and inland water areas, as well as 10% of coastal and marine areas** as protected areas in line with the Aichi Biodiversity Targets.

To achieve green growth, the Government has four key focus areas each with a set of strategies as outline below and in Figure 15.

- Focus area A: Strengthening the enabling environment for green growth
- Focus area B: **Adopting the sustainable consumption and production** concept
- Focus area C: **Conserving natural resources** for present and future generations
- Focus area D: Strengthening resilience against climate change and natural disasters

Figure 15: Summary of focus areas in the Eleventh Malaysia Plan, 2016-2020



Source: Government of Malaysia (2015)

Thus, the Eleventh Malaysia Plan compliments and helps operationalize Malaysia's commitment to the United Nations Convention of Biological Diversity (CBD) and related Aichi Biodiversity Targets.

1.8 The National Policy on Biological Diversity (NPBD) 2016-2025

In 1994, Malaysia became party the United Nations Convention of Biological Diversity (CBD). **In 1998, Malaysia developed its first National Biodiversity Strategies and Action Plan (NBSAP) which is known as the National Policy on Biological Diversity (NPBD).** It serves as a national blue print for the overall biodiversity management in the country as well as to fulfil its obligations under the Convention (UNDP, 2014b).

In Malaysia, **the NPBD** provides a general and overarching strategies and action plans with the **vision of transforming Malaysia into a world centre of excellence in conservation, research and utilization of tropical biological diversity by 2020**. **The current NPBD 2016-2025 specifies 5 national goals and 17 national biodiversity targets** to be implemented by all segments of stakeholder and society as outlined in Table 5.

Target 3 of the NPBD 2016-2025 emphasize mainstreaming of biodiversity conservation into national development planning and sectoral policies and plans by 2025. **Under its Target 4, the NPBD aims to ensure that agriculture production and fisheries are managed and harvested sustainably** (Table 5).

Table 5: The National Policy on Biological Diversity (NPBD) 2016-2025: Goals and Targets

Goals	Targets
Goal 1: We have empowered and harnessed the commitment of all stakeholders to conserve biodiversity.	**Target 1:** By 2025 more Malaysians are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably. **Target 2:** By 2025, the contributions of indigenous peoples and local communities, civil society and the private sector to the conservation and sustainable utilisation of biodiversity have increased significantly.
Goal 2: We have significantly reduced direct and indirect pressures on biodiversity.	**Target 3: By 2025, biodiversity conservation has been mainstreamed into national development planning and sectoral policies and plans.** **Target 4: By 2025, our production forests, agriculture production and fisheries are managed and harvested sustainably.** **Target 5:** By 2025, tourism is sustainably managed and promotes biodiversity conservation.
Goal 3: We have safeguarded all our key ecosystems, species and genetic diversity.	**Target 6:** By 2025, at least 20% of terrestrial areas and inland waters, and 10% of coastal and marine areas, are conserved through a representative system of protected areas and other effective area-based conservation measures **Target 7:** By 2025, vulnerable ecosystems and habitats, particularly limestone hills, wetlands, coral reefs and seagrass beds, are adequately protected and restored. **Target 8:** By 2025, important terrestrial and marine ecological corridors have been identified, restored and protected. **Target 9:** By 2025, the extinction of known threatened species has been prevented and their conservation status has been improved and sustained. **Target 10:** By 2025, poaching, illegal harvesting and illegal trade of wildlife, fish and plants are under control and significantly reduced. **Target 11:** By 2025, invasive alien species and pathways are identified, priority species controlled and measures are in place to prevent their introduction and establishment. **Target 12:** By 2025, a comprehensive biosafety system inclusive of a liability and redress regime is operational to manage potential adverse impacts of modern biotechnology on the conservation and sustainable use of biodiversity and human health.

	Target 13: By 2025, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives is adequately conserved.
Goal 4: We have ensured that the benefits from the utilisation of biodiversity are accrued equitably to all.	**Target 14:** By 2025, Malaysia has an operational Access and Benefit-sharing (ABS) framework that is consistent with the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their utilisation.
Goal 5: We have improved the capacity, knowledge and skills of all stakeholders to conserve biodiversity.	**Target 15:** By 2025, capacity for the implementation of the national and subnational biodiversity strategies, the CBD and other related Multilateral Environmental Agreements (MEAs) has significantly increased. **Target 16:** By 2025, knowledge and the science base relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are significantly improved and applied. Target 17: By 2025, there is a significant increase in funds and resources mobilised for the conservation of biodiversity from both government and non-government sources.

Source: Ministry of Natural Resources and Environment (2016)

Other related policies include the **National Forestry Policy**, endorsed by the National Forestry Council in 1978. The key **objectives are to conserve and manage the nation's forest** based on the principles of sustainable management and **to protect the environment** as well as **to conserve biological diversity, genetic resources and to enhance research and education**.

Additionally, **the National Policy on the Environment 2002**, integrates the three elements of sustainable development, namely economic development, social and cultural development, and environmental conservation. The Policy aims to achieve:

- **A clean, safe, healthy and productive environment** for present and future generations;
- **The conservation of the country's unique and diverse cultural and natural heritage** with effective participation by all sectors of society; and
- **A sustainable lifestyle and pattern of consumption and production** (Department of Wildlife and National Parks Peninsular Malaysia, 2008).

Other related plans and initiatives aimed at protecting biodiversity and ecosystem services include the **Central Forest Spine Master Plan (CFS).** It was conceptualized in 2005 under the first National Physical Plan (NPP) and implemented under the Tenth Plan to **link up 4 major forest complexes in Peninsular Malaysia with a network of ecological or green corridors to create one contiguous, forested wildlife sanctuary**. Related to this is the **National Tiger Conservation Action Plan (NTCAP), 2008-2020** which

aims to conserve the national emblem of Malaysia[31]. The goal for 2020 is to **actively manage at least 1000 tiger populations at carrying capacities** across the three landscapes within the Central Forest Spine and connected with functioning corridors[32].

In addition, beginning with the Chior Wildlife Reserve in 1903, **Malaysia has established an extensive network of protected areas** for the conservation of natural habitats, species and genetic diversity. According to WWF-Malaysia, **by 2013, the number of protected areas had grown to 444, covering a total area of 4,125,895.1 ha**. Out of which the terrestrial and marine protected areas accounted for 10.8% and 1.1%, respectively[33].

At regional level, **Malaysia joined Indonesia and Brunei in the "Heart of Borneo" initiative which was jointly initiated in 2007 to conserve about 200,000 sq. km of forests**, about 30% of which was in Malaysia (Vijay et al., 2017).

3 Case studies of agricultural impacts in Malaysia

Malaysia is making significant strides towards protecting and conserving its natural habitats, species and genetic diversity and promoting sustainable practices across the sectors of the economy. This is evidences by a suite of well-intended national policies and strategic plans, coupled with market and regulatory instruments discussed above. However, **mainstreaming biodiversity and ecosystem values into the agri-food value chain is still work in progress**. For example, sustainable development of the agricultural industry is a key focus of the national agri-food policy and other related policies, and has largely prevented the expansion of agri-food industry into forests systems. However, land use change from agriculture remains a threat to forest ecosystems. A few case studies are outlined below, highlight potential costs of unsustainable agriculture sustainable practices in Malaysia.

Case Study 1: Oil palm and rubber plantations driving land use change and ecosystem services

With a 440-km main stream length, **Pahang watershed is the largest watershed in Peninsular Malaysia**. About 2/3 of the surface area is dominated by tropical rainforest.

Figure 16: Pahang Watershed

Source: Foo and Hashim (2014)

From 2000 to 2010, Pahang Watershed has experienced an increase in commercial plantation and built-up area. During this period **over 62,000 ha of primary forest and over 4,000 ha of secondary forest were converted to plantation crops** with higher commercial values such as oil palm and rubber or construction to broaden residential and industrial areas. **Oil palm land increased by over 33,000 ha and that of rubber plantations by over 20,000 ha** as shown in Table 6**.**

[31] The Malaysian Conservation Alliance for Tigers (MYCAT) was developed the Department of Wildlife and National Parks Peninsular Malaysia (DWNP) in collaboration with Malaysia's NGOs. Available at: https://www.mesym.com/en/projects/national-tiger-conservation-action-plan-ntcap/
[32] https://www.mesym.com/en/projects/national-tiger-conservation-action-plan-ntcap/
[33] http://www.wwf.org.my/about_wwf/what_we_do/forests_main/forest_protect/

Table 6: Land Use Changes from 2000 to 2010

General Land use	2000	2005	Changes	2010	Changes
	Area(ha)	Area(ha)	Area(ha)	Area(ha)	Area(ha)
Forest	2,505,801	2,298,612	-207,189	2,235,976	-62,636
Secondary Forest	55,864	105,177	49,313	100,885	-4,292
Oil Palm	230,365	392,341	161,976	425,381	33,040
Rubber	22,776	27,199	4,423	47,386	20,187
Built-Up Area	15,971	9,019	-6,952	18,128	9,109
Wetland	2,339	811	-1,528	5,224	4,413
Mix cultivation	35	68	32	302	235
Total (Area)	2,833,151	2,833,227		2,833,281	
Annual soil loss(ton/year)	**2,993,061**	**2,478,559**		**14,211,170**	

Source: Foo and Hashim (2014)

Forest **conversion to agricultural land led to an increase in erosion and the amount of soil loss had increased from 3m ton/year in 2000 to 14m ton/year in 2010**. Among the land use features, forest produced least amount of soil loss, while a significant amount could be attributed to oil palm and rubber plantations.

Foo and Hashim (2014), further **estimated the total ecological service values and goods (ESVG) for each landscape features across 11 indicators of ecosystem services** from 2000 to 2010 as shown in Table 7**Error! Reference source not found.**. The ESVG estimates are a partial indicator of ecosystem services value since only 11 indicators were used. The **ESVG for oil palm was the highest at 1,202 USD/ha/year** followed by forest and secondary forest. The **cost of soil loss due to erosion was estimated at 6 USD/ha** (Table 7).

Table 7: Ecology Service Values and Good in Watershed for 2000, 2005 and 2010

Ecology Service Values And Goods											
	Ecological Services							Ecological Goods				
Landscape Features	water supply #	Erosion Contol #	Waste Treatment #	Carbon Stock *	Carbon Sequestration *	Recreation #	Cultural and Artistic info #	Food Production #	Raw Materials #	Medical Resources *	Ornamental Resources *	Total Rate (USD/ha)
tropical primary forest	8	245		8	8	112	2	108.24	330	50	250	1121.4
tropical secondary forest	8	245		6	6	112		32	330		250	989
oilpalms	2								1200			1202
rubber	2								77			79
wetland		96.7						204				300.71
Built-up area												0
Mix cultivation								54				54
soil loss due to erosion(ton / year)												6

Source: Foo and Hashim (2014)

The total annual sum of ESVG and cost of soil loss was calculated for each land use as shown in Table 8. The **ESVG for tropical primary forest were highest at about US$ 2.8 billion/year in 2000, but**

declined to US$ 2.5 billion in 2010. The **annual ESVG for oil palm increased from about US$ 0.3 billion in 2000 to US$ 0.5 billion in 2010** and that of **rubber from US$ 1.2 million to 3.7 million in 2010.**

Conversely, the **annual cost of soil loss increased from US$ 17 million in 2000 to US$ 85 million in 2010.**

Table 8: Ecology Service values and goods (ESVG) for Pahang Watershed

	US$/Year			
General Land use	**2000**	**2005**	**2010**	**Net Change (2005-2010)**
Tropical primary forest	2,809,603,939	2,577,295,662	2,507,065,216	-70,230,446
Tropical secondary forest	55,249,480	104,020,283	99,775,067	-4,245,216
Oil palm	276,899,248	471,594,116	511,307,642	39,713,526
Rubber	1,799,282	2,148,722	3,743,459	1,594,737
Built-up area	-	-	-	-
Wetland	703,239	243,869	1,570,859	1,326,990
Mix cultivation	1,916	3,646	16,312	12,666
Annual cost of soil loss(ton/year)	17,958,366	14,871,354	85,267,020	70,395,666
Net value of total Ecology Services and Goods	**3,126,298,738**	**3,140,434,943**	**3,114,951,858**	**-25,483,085**

Source: Foo and Hashim (2014)

When the soil loss is accounted for, the overall ESVG began to show losses for about US$ 26 million/year in 2010. The increase in soil loss was closely linked to the landscape development that was conducted in the watershed. Across all land use categories, forest produced the least soil loss at less than 10 ton/ha/year. **The study further demonstrated that although oil palm had the highest commercial values compared to other land uses, the gains brought by oil palm was still insufficient to cover losses in the overall estimated ESVG due to the forest clearance and soil degradation.**

Case Study 2: The value of foregone ecosystem services from mangroves in Southeast Asia under a baseline scenario for the period 2000 – 2050: The cost of policy inaction

Mangroves[34] provide a number of valuable ecosystem services that contribute to human wellbeing, including provisioning, regulating habitat and cultural services (TEEB, 2010, Brander and Eppink, 2012). Yet, mangroves throughout the world face a number of threats, including pollution, deforestation, fragmentation, and sea-level rise (Giri et al., 2011). The key drivers underlying these threats include increasing populations, development in coastal areas and climate change. Mangroves are being converted to other land uses such as aquaculture ponds, urban developments, agriculture and infrastructure. In Southeast Asia there has been large scale conversion of mangrove forests to shrimp farms (Barbier et al., 2011). Malaysia is not an exception.

[34] The mangrove biome dominates tropical and sub-tropical coastlines between latitudes 32°N and 38°S and covers approximately 22 million hectares. Around 28% of global mangroves are located in Southeast Asia with Indonesia alone accounting for 25% (Barbier et al., 2011).

Malaysia's mangroves are the third largest in the Asia-Pacific region. The **Matang Mangrove Forest**, covering 40,000 hectares of land on the western coast of peninsular Malaysia, **is considered one of the best-managed mangrove forests in the world**. It became fully protected in 1906[35]. Despite this, a remote sensing study to detect threats to **Matang Mangrove Forest** by the Centre for Collaborative Innovation (2016), found that the forest **showed changes to about 8,000 hectares of its area between 1993 and 2011 due to erosion, conversion to dryland forest, agriculture and construction of shrimp ponds.** On the other hand, the forest also gained almost 3,000 hectares of newly planted mangroves.

At a national level, a scoping study by the **ASEAN TEEB (2012)** predicted a change in Mangrove area by 220, 000 ha by 2050 under a **"business-as-usual" scenario** as shown in Table 9**. The ASEAN TEEB further provides an estimate of the the value of lost mangrove ecosystem services over the period 2000 – 2050 under a "business-as-usual" scenario**. Their estimate represents the benefits foregone by not maintaining the stock of mangroves or equivalently the cost of policy inaction to conserve this stock of natural capital.

Table 9: Change in mangrove area and value in Southeast Asia by country 2000-2050

			(2007 US$ Prices)		
Country	**Mangrove area in 2000 (ha; 000's)**	**Change in mangrove area 2000-2050 (ha; 000's)**	**Total value change (US$/annum; millions)**	**PI 95% Low (US$/annum; millions)**	**PI 95% High (US$/annum; millions)**
Malaysia	**699**	**-220**	**-279**	**-228**	**-330**
Indonesia	4,329	-1,656	-1,728	-1,239	-2,241
Myanmar	338	-80	-50	-36	-64
Vietnam	254	-90	-48	-33	-64
Thailand	250	-25	-36	-32	-41
Philippines	102	-6	-11	-10	-12
Cambodia	54	-4	-2	-1	-2
Brunei	16	-1	-4	-4	-4
Total	**6,042**	**-2,082**	**-2,158**	**-1,582**	**-2,759**

Source: Brander and Eppink (2012)

At a country level, the annual value of foregone mangrove ecosystem services in 2050 followed the pattern of loss of area, with Indonesia expected to suffer the highest losses; US$ 1.7 billion per year with a 95% prediction interval of US$ 1.2 – 2.2 billion**. Malaysia was estimated to suffer the second highest losses in mangrove ecosystem service values; US$ 279 million per year** with a 95% prediction interval of US$ 228 – 330 million. The estimated foregone annual benefits in 2050 for the ASEAN region as whole are US$ 2.2 billion (95% prediction interval US$ 1.6 – 2.8 billion). Assuming a linear time profile of these losses between 2000 and 2050, the present value of the stream of lost ecosystem services is US$ 40 billion using a 1% discount rate and US$ 17 billion using a 4% discount rate. These losses are substantial when compared to the gains from mangrove conversion. For example, the

35 http://www.researchsea.com/html/article.php/aid/9643/cid/2/research/technology/centre_for_collaborative_innovation__cci_-ukm/remote_sensing_maps_threats_to_malaysia__s_mangroves.html

current gross value of marine aquaculture in Southeast Asia is approximately US$ 1 billion per year (Brander and Eppink, 2012).

Case Study 3: Land use change and GHG emissions in meeting the biodiesel blending target in the transportation sector

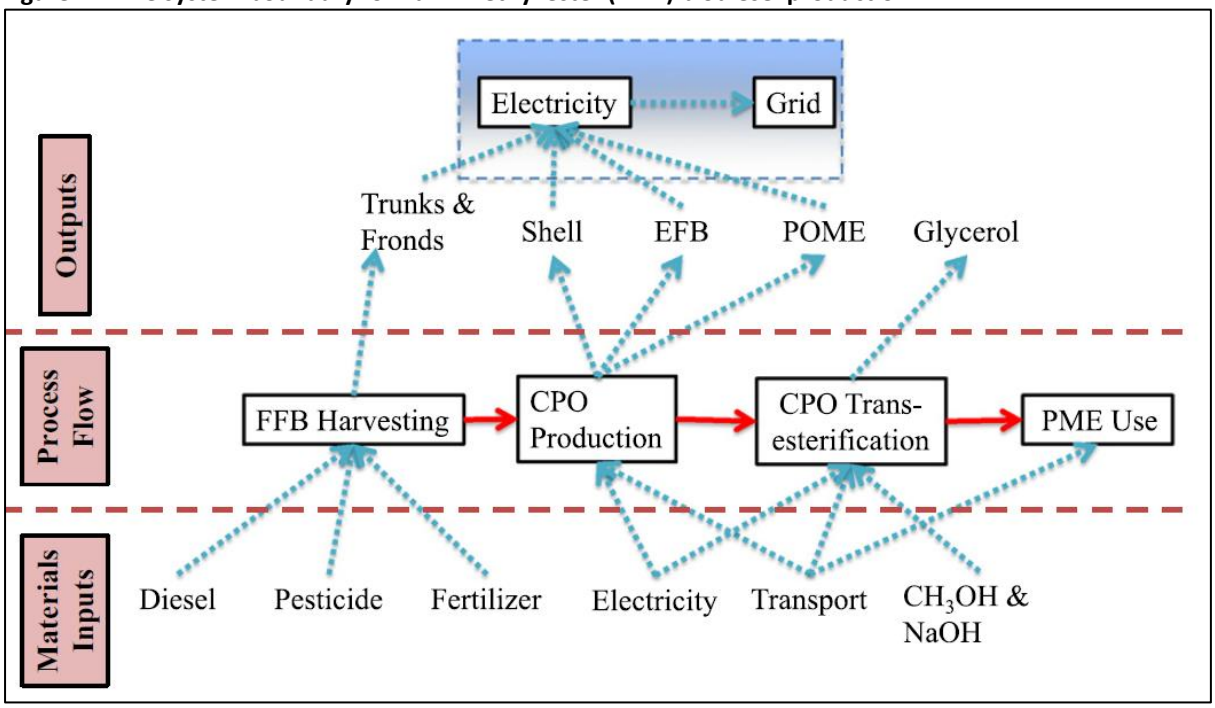
Malaysia's transportation sector accounts for 41% of the country's total energy use. The country was expected to become a net oil importer by 2011. To encourage renewable energy development and relieve the country's emerging oil dependence, in 2006 the government mandated blending **5% palm-oil biodiesel in petroleum diesel** under its National Biofuel Policy. The initial plan was to initiate B5 (5% biodiesel blend) in 2008, but it only began in 2011 in selected states with full online implementation only achieved at the end of 2014. With growing crude palm oil (CPO) stocks and declining prices, **the government further increased CPO quantity blended for biodiesel which led to the B7 (7% blending) mandate in 2015**. To promote domestic consumption of biodiesel, **the Eleventh Malaysia Plan (2016-2020) included a B15 transport mandate by year 2020** for the on-road sector albeit with no details on implementation (USDA, 2017).

To meet these blending targets **future expansion of the palm-oil industry** will be required. Thus, bringing in an inevitable challenge of balancing between biodiesel production, preserving the supply of palm oil used as food and environmental protection.

To assess the potential impact of meeting a 5% biodiesel blending target, a study by Hassan et al. (2011) assessed potential impacts on land use change and **GHG emissions using a life-cycle assessment (LCA) approach.**

The system boundary included all major inputs and outputs for oil-palm cultivation to produce FFB (FFB harvesting), FFB milling to produce CPO (CPO production), conversion of CPO to PME (PME production), and the use of PME (PME use) as shown in Figure 17.

Figure 17: The system boundary for Palm methyl ester (PME) biodiesel production



Source: Hassan et al. (2011)

Five different land types were modelled including: peat forest, primary forest, secondary forest, grassland and degraded land. These land types were chosen based on current land use by Malaysian oil palm plantations. According to the Government of Malaysia National Forestry Act 1984 (Amendment 1993) forests that are converted to economic activities be replaced with reforested areas of approximately the same size (Government of Malaysia, 1993). Therefore, the impact of directly converting primary and secondary forests to palm-oil production and replacing them with reforested areas was modelled.

It was estimated that about 340 million litres of PME would be needed to achieve the 5% target. Depending on the land type, it was estimated that **between 87,000 and 110,000 ha of land for to plant oil palm trees plantations** would be required to meet the 5% biodiesel blending target. **As of 2010, this was equivalent to about 2–2.6% of the total oil-palm plantation area in Malaysia**.

The land requirements for each planting case including total and feasible areas available for each land type is shown in Table 10. Feasible lands were identified as land located close to existing oil palm plantations to effectively share infrastructure. Table 10 shows that **there is not enough land classified as feasible to reforest the 87,000 ha of forest converted to oil-palm plantations**. Land classified as feasible would be insufficient to obtain the minimum possible GHG emissions in meeting the 5% PME mandate. This could be achieved by planting of oil palm trees on a combination of various land types.

Table 10: Land requirements and available land to meet the 5% biodiesel share in the fossil diesel transportation sector

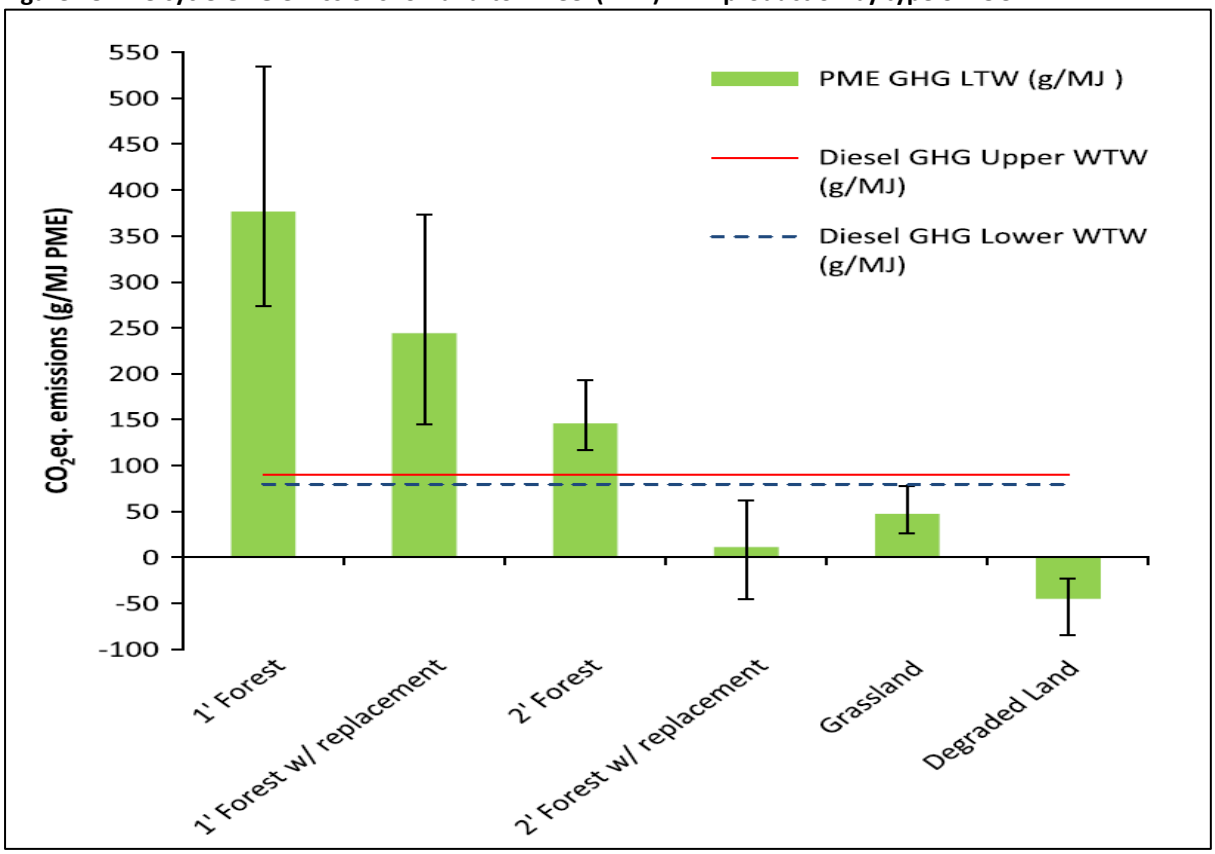
	Land area ('000 ha)		
Planting on a single land type	**Required**	**Available**	**Feasible ('000 ha)**
Peat forest	87	1,500	8
Primary forest	87	18,000	180
Primary forest with replacement	Primary forest: 87 Land for reforestation: 87	Primary forest: 18,000 Grassland: 330 Degraded land: 41	Primary forest: 180 Grassland: 50 Degraded land: 28
Secondary forest	87	4,400	220
Secondary forest with replacement	Secondary forest: 87 Land for reforestation: 87	Secondary forest: 4400 Grassland: 50 Grassland: 330 Degraded land: 41	Secondary forest: 220 Degraded land: 28
Grassland	96	330	50
Degraded land	110	41	28

Source: Hassan et al. (2011)

Figure 18 shows the GHG emissions associated with meeting the 5% biodiesel target for each planting case if there were enough feasible land for each case. The level of emissions expected in obtaining the 5% biodiesel target is dependent on the choice of land brought into production.

Incorporating LUC effects in the life cycle model (the five land types and two forest replacements) results either in net GHG emissions or net capture depending on the land type brought into production. Planting oil palm trees on peat forest land results in GHG emissions of between 225 and 3300 g CO2-eq/MJ PME (not shown in Figure 18**Error! Reference source not found.** for scaling purposes). Planting on primary and secondary forests, as well as grasslands release between 270 and 530 g CO2-eq/MJ, 120 and 190 g CO2-eq/MJ and 26 and 77 g CO2-eq/ MJ PME, respectively. However, planting on secondary forests with replacement of the forest results in a range of emissions from 60 g CO2-eq/MJ to the capture of 46 g CO2-eq/MJ PME. Planting on degraded land results in a capture of between 23 and 85 g CO2-eq/MJ PME. These results show that producing PME on specific lands could result in lower life cycle GHG emissions than diesel fuel if the land use is restricted to certain types of land.

Figure 18: Life cycle GHG emissions for land-to-wheel (LTW) PME production by type of LUC*



Source: Hassan et al. (2011)

*The lower and upper bound of the error bars represent the 90% credible interval from the Monte Carlo simulation

However, if other impacts of land conversion to palm oil plantations are accounted for, including ecosystem services and biodiversity, the opportunity cost of land conversion could be higher. Although limited in scope and with a key focus on palm oil, the case studies investigated reveal the potential for complex trade-off between social- economic and environmental objectives in the Malaysia's agri-food systems.

4 Conclusion

Over the past few decades, Malaysia has transitioned from an agriculture-based economy to an industrial and service-based economy. Though the agricultural sector has declined in relative importance, it remains the mainstay of the economy. Sustainable development of the agricultural industry which is a key focus of the national agri-food policy.

Since independence, Malaysia has formulated four agricultural policies, namely the National Agricultural Policy 1, 2, 3 (NAP1-3) and, from 2011, the National Agro-food Policy. Food security and maximization of income particularly amongst rural farmers have been some of the key objectives of all these policies. Various policy instruments have been employed to support the agriculture sector, particularly in the rural areas. The most important instruments of public policy affecting the incentive structure of agriculture have been subsidies on inputs and output, taxes on imports and other direct and indirect taxes, agricultural credit, guaranteed minimum prices (GMP) for agricultural products, and the provision of drainage and irrigation as well as other agricultural facilities and services,

including extension, research and marketing, all of these affecting, primarily, the smallholder sector. Despite improvements in food production, Malaysia continues to be a net importer of food with annual imports of $13 billion as of 2018 and income inequalities between the urban and rural areas still exist.

In addition, to **biodiversity conservation**, **sustainable agriculture production is also emphasized under the current National Policy on Biological Diversity (NPBD) 2016-2025. The NPBD is Malaysia's National Biodiversity Strategies and Action Plan (NBSAP). I**t serves as a national blue print for the overall biodiversity management in the country as well as to fulfil its obligations under the Convention on Biological Diversity, to which Malaysia became a party in 1994. The NPBD, National Agro-food Policies, National Forestry Policy, coupled with related policies on protected area implementation, have largely prevented the expansion of agri-food industry into forests systems. However, land use change from agriculture remains a threat to ecosystems and biodiversity.

The case studies investigated reveal the potential for complex trade-off between social- economic and environmental objectives in the Malaysia's agri-food systems. Research into this area is still evolving, with an evaluation of possible trade-offs mainly focused at farm level and mainly targeting the palm oil development. **More comprehensive analysis of potential social- economic and environmental trade-offs is generally constrained by the complexity of the agri-food value chains and data availability**. However, an understanding of these trade-off is crucial for the effective implementation of the Malaysian Government sustainable agriculture initiatives.

The UN Environment TEEB project on "Promoting biodiversity and sustainability in the agriculture and food sector in Malaysia" complements the Government green growth initiatives by **highlighting several trade-offs made in land-use decisions and mainstreaming the values of biodiversity and ecosystem services values in decision-making**._____plus the new 12th MP that emphasize on agriculture economy

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