2.2 THE VALUE OF HEART OF BORNEO'S ECOSYSTEMS AND BIODIVERSITY

What's in this chapter

- A qualitative picture of important, non-monetized values of the HoB
- Values discussed include biodiversity, ecosystem resilience in a changing climate, water-related ecosystem services, social values, micro-climatic regulation and carbon sequestration

Biodiversity

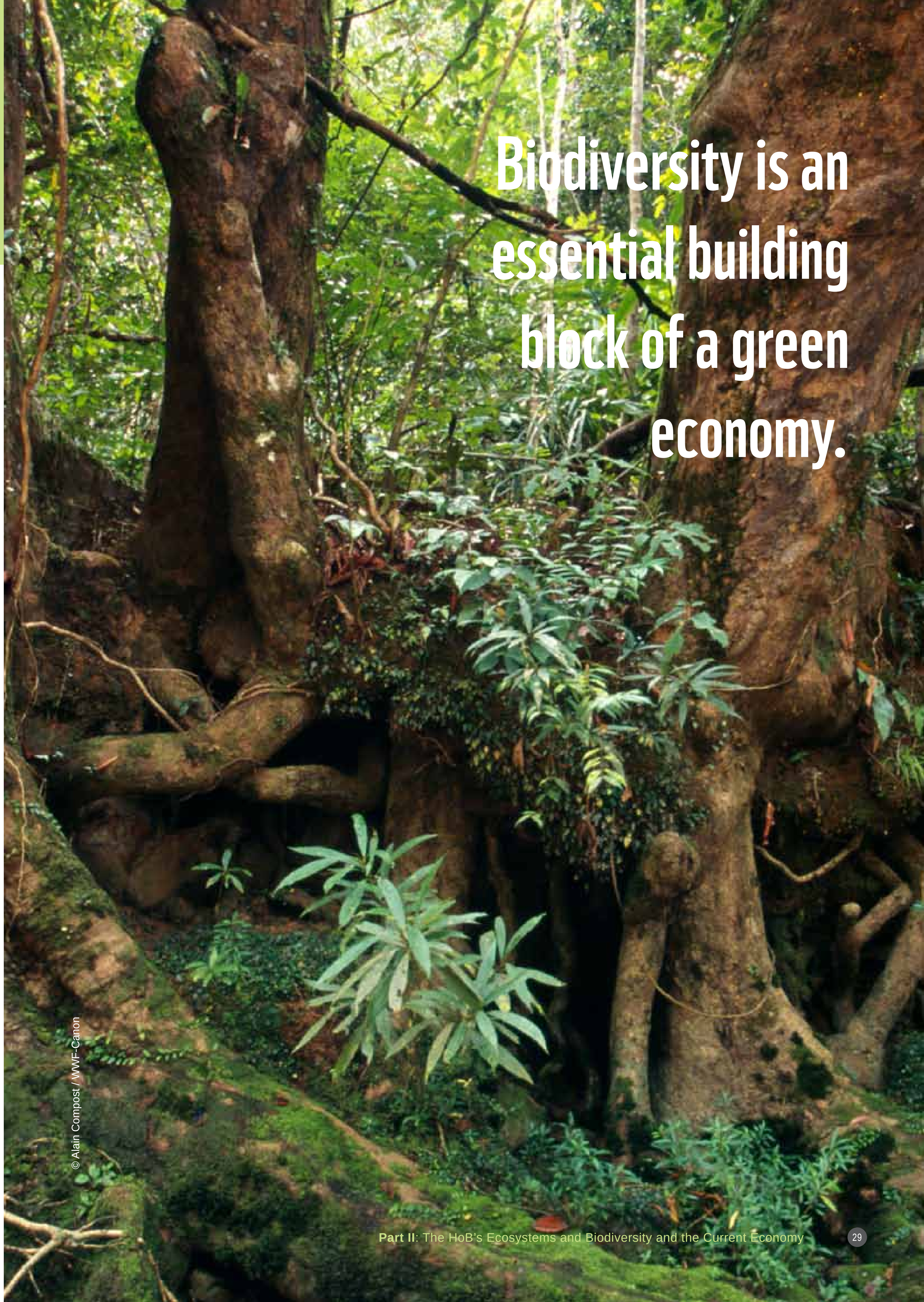
Borneo's biodiversity possesses unique intrinsic value; it encompasses the variety of ecosystems, natural communities, species, subspecies, populations and genetic resources found on the island. The HoB contains some of the world's most biodiverse forests, which are home to unique and charismatic species including pygmy elephants, orangutans, rhinoceros and clouded leopards. More than 350 species of birds, 150 reptile species and 15,000 flowering plant species are native to Borneo's forests. Many are found nowhere else on earth[6]. More than 600 new species of animals and plants have been discovered since 1995, indicating just how much remains to be learned about the animals and plants found in the HoB[7].

Biodiversity is an essential building block of ecosystems in general and underpins the food security of forest-dependent communities[8]. HoB's genetic resources and agro-biodiversity have long been used, cultivated, managed and modified by local people. More information on the importance of biodiversity for food security can be found in chapter 2.3 on the local forest-based enterprises and freshwater fisheries. While it remains difficult to calculate the total economic value of biodiversity, including ecosystems with a rich variety of species, there is little doubt that biodiversity is extremely important for the economies of both local and global communities. In addition to harboring genetic resources and economically valuable products, biodiverse ecosystems are valuable due to their greater resilience to climate change[9].


© Sugeng / WWF-Indonesia

To date, species biodiversity has been most severely affected by deforestation. Southeast Asia has the highest rate of deforestation of any major tropical region, and is projected to lose three quarters of its original forests and 42 per cent of its biodiversity known at the time of study by 2100[10]. Tree species richness in Borneo has been shown to be negatively associated with the intensity of logging activities; in addition, logged forests are often slow to regain their previous plant diversity[11].

Biodiversity forms the foundation of every ecosystem and of the ecosystem services on which humans depend.



© Alain Compost / WWF-Canon

Ecosystem resilience in a changing climate

Mohamed Jerome Robles, 37, Miri, Sarawak, Malaysia:
Mohamed has observed the impacts of a changing climate in Miri, Sarawak: "There does not seem to be a distinct monsoon season anymore. The rain is more frequent, random and certainly more intense…. now we are afraid of flash floods and strong winds which accompany the intense rains."

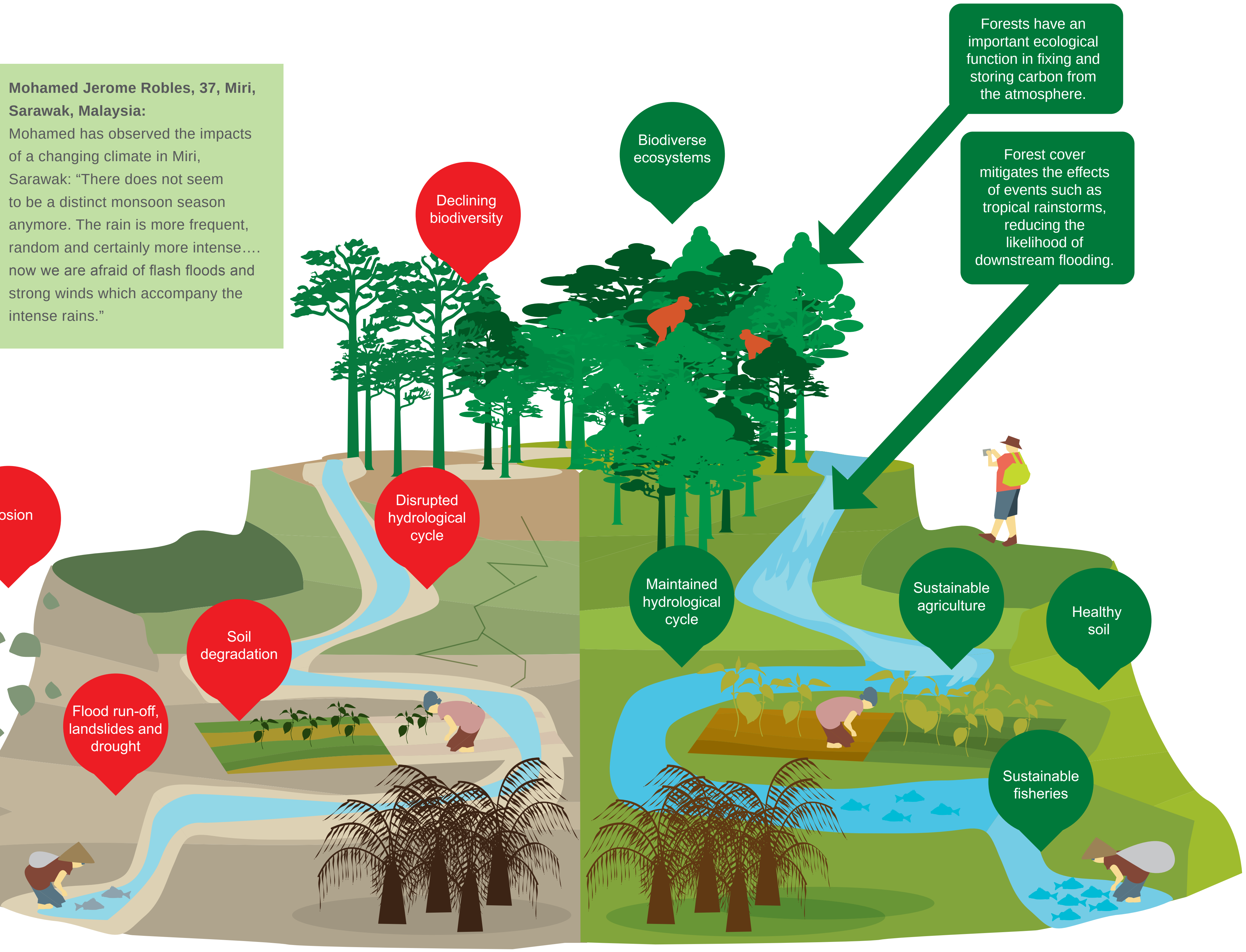


Figure 2.4: An economy that values natural capital has more resilience in a changing climate

In the face of climate change, Borneo is expected to experience sea level rise, extinction of species (especially marine and amphibian), increased risk of floods and forest fires, human health impacts, changes in agricultural yields and damage to infrastructure. Conservation and sustainable management in the HoB can help build resilience to climate change.

The resilience of an ecosystem can be described as its capacity to resist change and to recover following a disturbance[12]. Resilience to changing environmental conditions is determined by an ecosystem's biological and ecological resources, in particular: (i) the diversity of species, including micro-organisms, (ii) genetic variability within species (i.e. the diversity of genetic traits within populations of species), and (iii) the regional pool of species and ecosystems[13]. Resilience is further influenced by the size of the ecosystem in question: the larger and less fragmented, the more resilient. Finally, the condition and character of the surrounding landscape plays a role.

While climate change is predicted to affect surface temperatures in the tropics less than the global average[14], it is nevertheless expected to have undesirable economic and social impacts, particularly within more vulnerable segments of society, many of whose members depend heavily on ecosystem services and on biodiversity itself. Many tropical species are thermal specialists, adapted to a narrow range of temperature variation. A study of Australia's wet tropics found that significant changes in species richness occur with just one degree celsius increase in global temperature. With this change in temperature, areas of highland biodiversity remain largely intact, but lowland and mid-altitude species diversity declines[15].

Maintaining and restoring forest biodiversity promotes the resilience of forest ecosystems to human-induced pressures and is therefore an essential safeguard against expected climate change impacts. Ecosystems are more likely to withstand exposure to changing climate if they are healthy, meaning that their components (e.g. canopy species, understory species, pollinators, seed dispersers, top predators, etc.) and associated ecological functions (e.g. large enough for natural disturbance processes, seed dispersal, pollination, predator-prey relations, etc.) are intact.

Borneo is expected to experience a variety of impacts related to climate change, including sea level rise, extinction of species (especially marine and amphibian), increased risk of floods and forest fires, human health impacts, changes in agricultural yields and infrastructural damage[16]. Healthy, intact forests are more likely to absorb and adjust to changing climates, as they have done for many millions of years. Primary forests are more resilient than modified natural forests or plantations. Increasing biodiversity in planted and semi-natural forests will increase their resilience and productivity (including carbon storage). Ecosystems that are degraded or are otherwise missing key components are more likely to unravel when faced with additional stresses associated with more intense and/or more frequent climate variability and disturbance.

In the face of such prospective changes, ecosystem resilience will support the economy and society by creating buffers. Economies, too, are more capable of withstanding changing conditions in the economic landscape when they are diversified. As virtually all economic sectors are linked to the environment in one way or another, sustainable landscape management in the HoB will support resilience within the economy.

Water-related ecosystem services

Rainforests such as those in the HoB provide important watershed services, such as provision of clean water, maintaining soil quality, reducing erosion, regulating overland flow, maintaining groundwater and preventing floods. These services regulate the availability and timing of water supplies downstream.

The rivers originating in the HoB provide water to 29 river basins, supporting households and economic sectors on an area of 54 million ha (more than 70 per cent) of the island of Borneo for the benefit of over 11 million people. The HoB ensures water security for an area almost 2.5 times its size. The loss of forests in its upstream ecosystems will therefore impact lives and livelihoods far downstream and well beyond the boundaries of the HoB itself.

Rainforests such as those in the HoB provide an important water management service by retaining soils, promoting groundwater and river replenishment and preventing floods.

Poor landscape management by some sectors—particularly unsustainable logging, unsustainable palm oil cultivation, expansion and irresponsible mining—results in a loss of these important ecosystem services, with impacts on other sectors and society at large. The impacts and costs to the economy and society related to loss of these ecosystem services are described in more detail in Chapter 2.4 below.

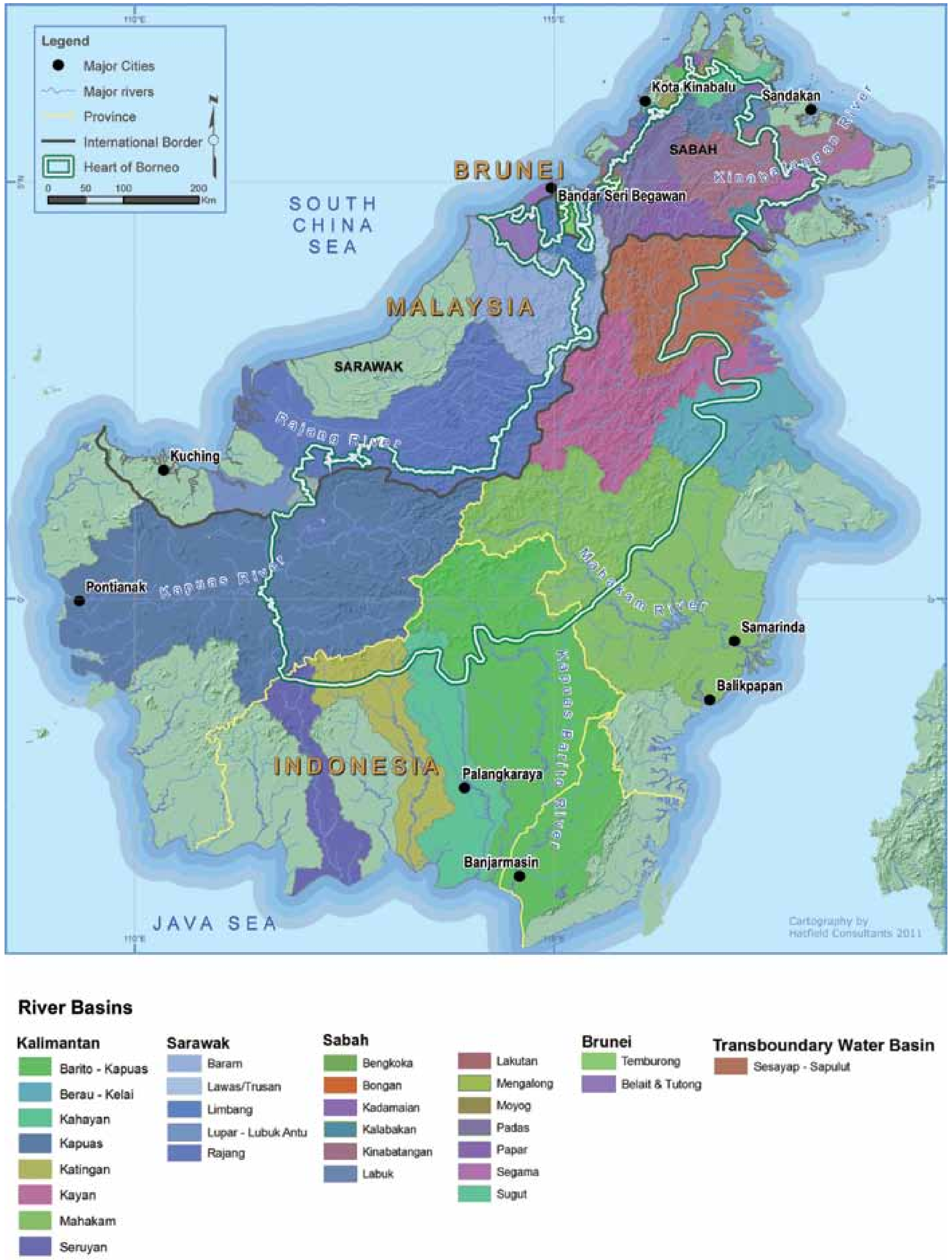


Figure 2.5: River basins originating in the Heart of Borneo[17]

Social value of forested ecosystems

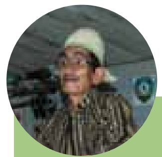
The aesthetic, cultural, spiritual, heritage, enjoyment and educational value of the HoB may be grouped together under the heading of social value of natural capital. Several ethnic and sub-ethnic groups collectively known as Dayak are important beneficiaries of these values, as their culture and way of life is shaped by the forest; as a result, they both are impacted by changes in the forest ecosystem as well as have impacts on it.

There is an innate social connection between the Dayak and their forests, which goes well beyond the latter's importance for subsistence and also beyond the designation of certain land as 'sacred' sites. For centuries, the Dayak have managed the forests, rivers and wetlands of their customary land, claimed individual and collective tenure rights, used and traded forest products, hunted wildlife, cleared agricultural land by engaging in cyclical practices like swidden and wet-rice cultivation, developed agroforestry regimes and agreed on regulations for how to sustain the sources of their livelihoods. Traditionally, individual claims to land were established by cutting trees or clearing forest. The right to use agricultural land, such as rice fields and gardens, have been passed on to successive generations and remembered by the community[19].

An important social value of the forest is the centuries-old traditional knowledge associated with the use of forest products and resources. The genetic resources and agro-biodiversity of the HoB have been used, cultivated, managed and modified by local people. This rich tradition—codified in language, plant names, local pharmacopeia and recipes—has made possible the identification and recognition of the uses of plants and other organisms for food and medicinal purposes. Traditional knowledge represents a social value which has not yet been assessed nor valued by markets, resulting in foregone benefits for the holders of such knowledge. Traditional knowledge associated with agricultural methods and exploitation of wild plants has long helped indigenous and local peoples cope with extreme weather conditions and environmental change, and can therefore help guarantee future food security and make agriculture more resilient to the effects of climate change. Traditional methods include using local plants to cure diseases and control pests, as well as choosing and breeding crop varieties which can tolerate extreme conditions such as drought and floods. The use of these traditional crops and practices, and associated knowledge of uses of biological diversity, are the foundation of resilience among human communities living in the HoB forests.

There are costs associated with the loss of social value of the HoB forest. These include:

- costs generated by expanding agribusiness, timber exploitation and mining in customary lands, which limit access to resources by local residents;
- costs associated with an increase in local social conflicts over land and resources, including increased transaction costs and the value of the resources destroyed in the process;
- costs and impacts associated with people suddenly being deprived of their main sources of livelihoods, including increases in poverty, and the additional social spending that government needs to allocate to provide for the increased number of poor;
- opportunity costs—not fully replaced by benefits from alternative forms of employment in plantations, etc.—imposed on local residents who must forego benefits related to extraction, harvesting and trade of non-timber forest products (NTFPs), when their customary lands are exploited by enterprises owned and run by outsiders, and;
- costs related to the 'exploitation' of landscape beauty and cultural values of the HoB for ecotourism purposes by outside investors, particularly in cases where only a small portion of economic returns generated are retained at local level and where local people do not control businesses.



© WWF-Indonesia

Anye Apui, Customary Chief of Hulu Bahau, Malinau, East Kalimantan, Indonesia[18]

'Timber is gold, but this is not the kind of gold that is good for us. I want to protect the forest in my area, as the forest is life for Dayak people.'

Regional and micro-climate regulation

Well-managed forests result in cooler surface temperatures under extreme weather conditions and help regulate micro climates. Although efforts have been made to assign an economic value to this service in both urban areas[20] and within ecosystems[21], its importance is not regularly taken into consideration when considering the economic value of intact ecosystems. Nevertheless, the climate regulation function of forests provides significant benefits to the economy and people of Borneo.

According to climate change predictions, HoB ecosystems will experience a host of impacts which may endanger the area's economic productivity. Maintaining consistent micro-climatic conditions, such as moisture levels and air and soil temperature, is important to ensure ecosystem resilience to such change. Changes currently underway in the HoB are disrupting and simplifying complex ecological structures and functional linkages, reducing the capacity of the system to disperse and absorb energy and resulting in impaired provision of ecosystem services, as well as increased local warming[22].

Carbon sequestration for global climate change mitigation

Carbon is stored in two major terrestrial 'pools': plant biomass and soils. Vegetation in the HoB absorbs carbon dioxide from the atmosphere through photosynthesis and stores it in the form of organic matter in plant and root biomass. These organic materials partially decay over time, and soil organic matter forms a large carbon pool, especially in peatlands, but also in other soils. Plant biomass and soil thus provide an important carbon sequestration, or storage, service that helps to mitigate climate change. In soils, this carbon pool provides the added services of increasing nutrient and water retention capacity and protecting groundwater from contamination[23].

Globally, deforestation and forest and peatland degradation result in significant greenhouse gas emissions. Deforestation and forest degradation account for up to 18 per cent of global greenhouse gas emissions, more than the entire global transportation sector and second only to the energy sector[24]. In light of growing concerns about climate change, the carbon storage and ongoing sequestration functions of forests are beginning to acquire a financial value.

HoB's ecosystems store immense quantities of carbon and play an important role in carbon sequestration. Based on above ground biomass only, across the three countries, the HoB landscape stores an estimated 3.2 billion tonnes of carbon (11.8 billion tonnes of CO_2 equivalent, henceforth 'CO_2e'), of which 52.1 million carbon (191.1 million tonnes of CO_2e) are found in Brunei, 2.4 billion carbon (8.9 billion tonnes of CO_2e) are in Indonesia and 754.7 million tonnes of carbon (2.8 billion tonnes of CO_2e) are in Malaysia (Figure 2.6)[25].

Rich tropical forest resources in the HoB can benefit from mechanisms such as the programme being developed under the United Nations Framework Convention on Climate Change (UNFCCC) to compensate developing countries for reducing emissions from deforestation and forest degradation (REDD+). REDD+ is meant to provide financial benefits to government, companies and local communities

HoB forests play a role in regional and micro-climate regulation. Current land conversion and economic activity such as monoculture plantations simplify the complex structures and linkages in the forest ecosystem, with a direct impact on the ecological functions it performs.

to improve forest management. REDD+ is considered one of the more promising instruments to stimulate changes in the economy and the restoration and maintenance of the HoB's natural capital.

The REDD+ scheme is expected mainly to financially value forest carbon in cases where governments or specific projects can implement changes in land use management practices that reduce expected carbon emissions or increase carbon sequestration. Parts of the HoB landscape include forested areas zoned for clearance and development. These have a financial value in the REDD+ scheme. Forest and soil degradation in the HoB also occurs in legally protected areas, which may be encroached upon due to poor governance[26]. However, these do not seem to be financially valued in the current scheme. Strategic land and protected area management interventions in these areas could contribute to achieving national GHG emission reduction targets and be eligible for payments under REDD+ financial schemes (Box 2.1 below, illustrates how specific interventions on land allocated for development of forestry in Indonesia's HoB Strategic National Area can contribute to national emission reduction targets).

An economy that fully values natural capital would recognize HoB's ecosystems for the many goods and services they provide to society, not only for the benefit of global climate change mitigation.

Box 2.1: Potential contribution of the HoB Strategic National Area to reduction of emissions in Indonesia[27]

A rapid assessment of potential land management interventions indicates that HoB forests within the HoB Strategic National Area (KSN HoB[28]) in Indonesia could potentially contribute to Indonesia's action plan to achieve emission reductions RAN-GRK[29] by avoiding emissions of 941.7 million tonne of CO_2 equivalent (Mt CO_2e).

At a conservative carbon price of US$2/tonne, the total value is US$513.2 million or US$51.3 million/year over 10 years.

INTERVENTION 1: Safeguarding forested palm oil concessions by prioritizing palm oil development on degraded lands
According to oil palm permit data[30], there are 359,355 ha of palm oil concessions within the HoB in Kalimantan which are in forested landscapes, two thirds of which are located in West Kalimantan Province. Prioritizing oil palm development on already degraded land and safeguarding these forests would avoid emissions of 134.7 Mt CO_2e (36.7 million tonnes of Carbon (MtC)).

INTERVENTIONS 2 AND 3: Protecting and restoring inactive logging concessions
Many inactive logging concessions in Kalimantan retain operations licenses but do not have a harvesting permit or are no longer active. These concessions are at risk of illegal logging, degradation, and fire without the active management provided by a Forest Management Unit (FMU). Many of these logging concessions have natural secondary forest, albeit in a degraded condition. The average biomass in t/ha was estimated for these concessions to identify the inactive concessions that are a priority for protection based on their natural capital. Criteria used to assess the inactive logging concessions in Kalimantan based on biomass included: potential restoration - low biomass < 150 tonnes/ha; potential restoration – medium biomass 150-200 tonnes/ha; potential protection – biomass > 200 tonnes/ha.

- Based on logging permit data in the HoB and assuming carbon sequestration of forests with a biomass > 200 tonnes/ha is 180 tonnes of carbon/ha, protecting 464,700 ha of forests currently under inactive logging concessions could lead to avoided emissions of 307 Mt CO_2e.
- There are 13,700 ha of inactive logging concessions with forest biomass between 150-200 tonnes/ha in the HoB part of East Kalimantan. If this area were restored, an additional one million tonne of carbon would be sequestered, or 4Mt CO_2e emissions avoided after 15 years. Assuming that this area sequesters 73,800 tonnes/year or 5.4 tonnes/ha/year, it could sequester an additional 738,000 tonne of carbon (2.7 Mt CO_2e) by 2020.
- In HoB West Kalimantan, 53,000 ha has forest biomass below 150 tonnes/ha. Restoring this area would sequester an additional six million tonnes of Carbon (22.1 Mt CO_2e) after 25 years. Assuming that this area sequesters 241,000 tonnes/year or 4.5 tonnes/ha/year, this area could sequester an additional 2.4 MtC (8.8 Mt CO_2e) by 2020.

INTERVENTION 4: Successful implementation of FSC certified logging concessions
There are 448,000 ha of FSC certified logging concessions in the HoB, with an average biomass of 144 tonnes of carbon/ha. If these were to successfully apply FSC certification by 2020, they could sequester an additional 13.8 MtC (50.8 Mt CO_2e) over 10 years.

INTERVENTION 5: Certifying all non-FSC concessions
There are four million ha of logging concessions which are currently not FSC certified. If these were to become certified, they could sequester an additional amount of 119.2 MtC (437.4 Mt CO_2e) over 10 years.

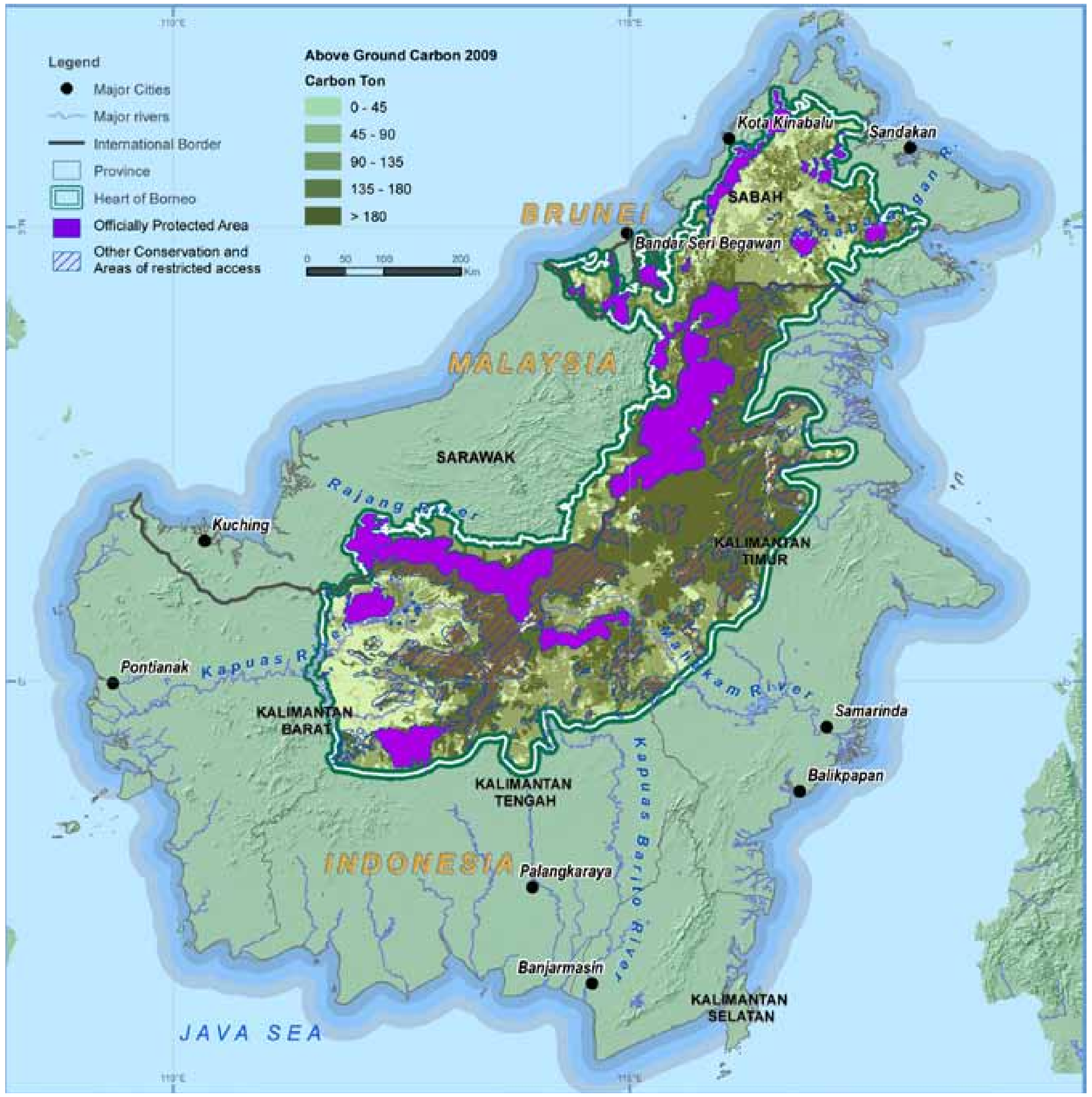


Figure 2.6: Above ground carbon stock in the HoB—not financially valued in the current economy