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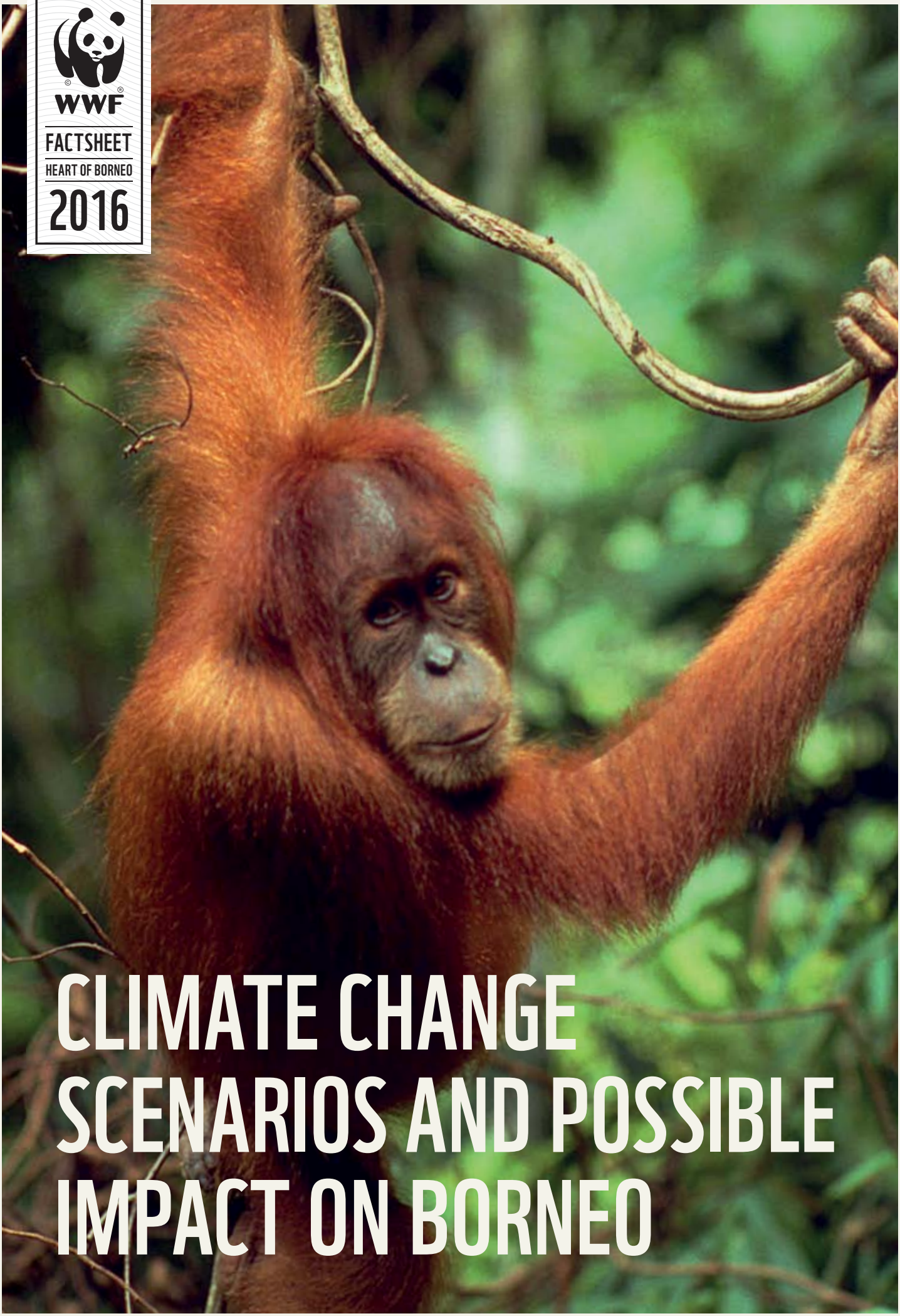
FACTSHEET

HEART OF BORNEO

2016



CLIMATE CHANGE SCENARIOS AND POSSIBLE IMPACT ON BORNEO

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WWF is one of the world's largest and most experienced independent conservation organisations, with more than five million supporters and a global network active in more than 100 countries.

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

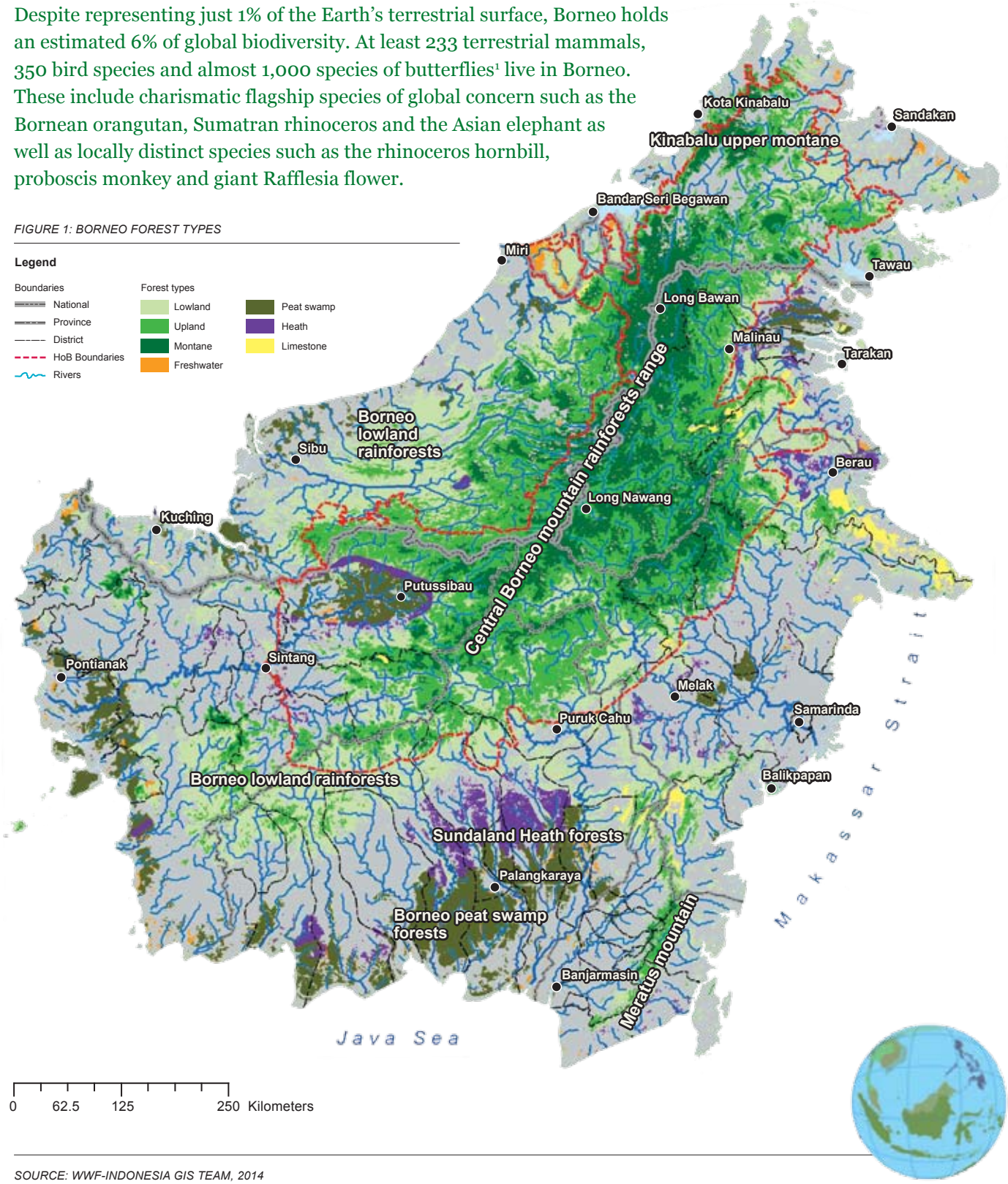
CLIMATE CHANGE SCENARIOS AND POSSIBLE IMPACT ON BORNEO

This document is a summary of the Borneo chapter of the climate change impacts study done by Naturalis Biodiversity Center

FORESTS AND BIODIVERSITY OF BORNEO

Despite representing just 1% of the Earth's terrestrial surface, Borneo holds an estimated 6% of global biodiversity. At least 233 terrestrial mammals, 350 bird species and almost 1,000 species of butterflies[1] live in Borneo. These include charismatic flagship species of global concern such as the Bornean orangutan, Sumatran rhinoceros and the Asian elephant as well as locally distinct species such as the rhinoceros hornbill, proboscis monkey and giant Rafflesia flower.

FIGURE 1: BORNEO FOREST TYPES



SOURCE: WWF-INDONESIA GIS TEAM, 2014

15,000 SPECIES

±1,000 SPECIES

350 SPECIES

233 TERRESTRIAL MAMMALS

Borneo contains 15,000 vascular plant species[2] of which 37% are endemic, as is found only in Borneo and nowhere else in the world.[3] The central mountain chain, the southern Meratus Mountains and the peat swamp forests harbor disproportionally many endemics.[4] Botanical diversity is highest in the northern lowland rain forests of Borneo[5]. Yet this diversity is very much under threat, predominantly caused by large scale deforestation.

The current levels of forest cover on Borneo only respresent a fraction of the historical extent. Although deforestation is not as severe as in other areas in Indonesia, such as that of Sumatra; from close to 100% in the 1900s, forest cover in Borneo dropped to 75% in the first part of the 20th century, and down to over 50% between the 1980s and 2014 (Figure 2). In 2012 the deforestation rate in Borneo was estimated at 3.2% per annum[6].

Compounded with the impact of climate change, this rapid rate of deforestation would further magnify and aggravate the already existing trends of decline in biodiversity and degradation of valuable ecosystems.

HISTORICAL EXTENT OF FOREST COVER

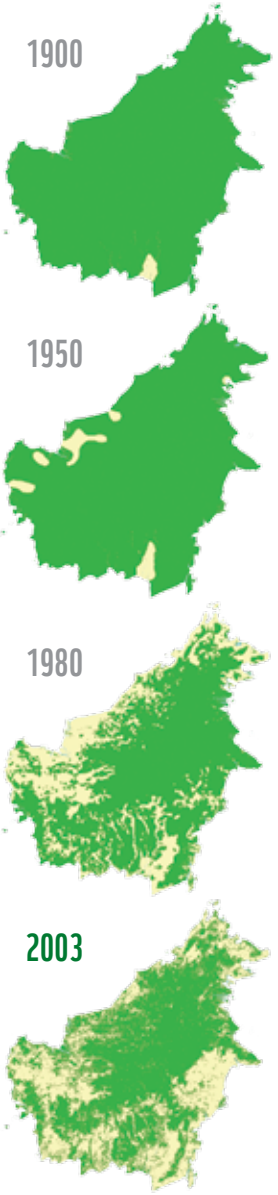
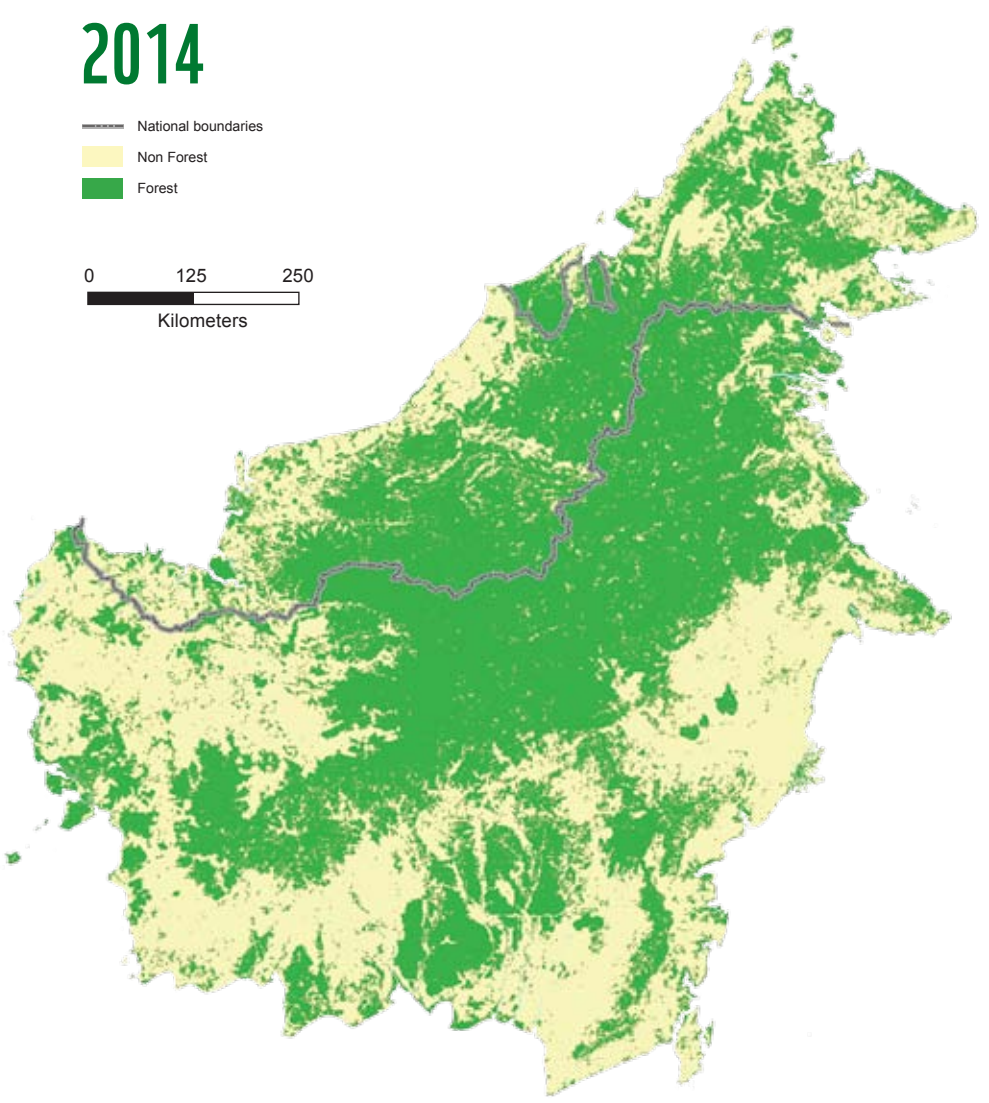


FIGURE 2: MAPS OF 2003 AND 2014 BASED ON MODIS ANALYSES

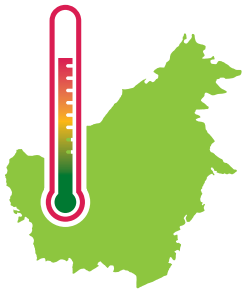


SOURCE: WWF-INDONESIA GIS TEAM

BIODIVERSITY DECLINE

A palm oil plantation being established in East Kalimantan in 2007. Compounded with the impact of climate change, this rapid rate of deforestation would further magnify and aggravate the already existing trends of decline in biodiversity and degradation of valuable ecosystems.

FOCUS OF THE STUDY — FUTURE CHANGES



This study conducted by the Naturalis focusses on future climate conditions and its possible consequences for the island of Borneo.[7] While the study comprises three components, this factsheet only deals with component number 1 on Relative future climate change on Borneo, and component number 3 on possible consequences of climate change for three iconic flagship species on Borneo — hornbill, orangutan and proboscis monkey.

1. RELATIVE FUTURE CLIMATE CHANGE

METHODOLOGY

The study merges the values of 19 variables (annex) on temperature and precipitation into one dataset. From this analysis, two scenarios were calculated for the years 2050 and 2070:

- Optimistic climate change scenario; with an increment of 2°C at 2050/2070 (see figures 3.1A and 3.1B)
- The worst case scenario, a 4°C warmer world at 2050/2070 (see figures 3.2A and 3.2B)

These two scenarios are then compared to the current situation (as baseline and noted as zero change) and which therefore indicate the relative level of change. As shown in the maps, the level of change ranges from zero change (dark green) to the minimum levels of changes (green) and to the maximum levels of change (red).

FINDINGS

"CLIMATE CHANGE WILL OCCUR ALL OVER BORNEO & NOT A SINGLE PLACE WILL STAY UNAFFECTED"

From these two scenario analysis over the two time periods of 2050 and 2070, the highlights of these findings are as follows:

- The 2°C scenario indicates that climate change will occur all over Borneo with the impacts ranging from relatively low to medium levels. Not a single place will stay unaffected. Even worst, the 4°C increment scenario shows stronger levels of climate change. In the long term, by 2070, the whole island will be seriously affected.
- Under the 2°C scenario, climate change stabilises after 2050, with no prediction of further change. In contrast, under the 4°C scenario, climate change further increases between 2050 and 2070.
- At the landscape level, relatively big changes are predicted for the south-eastern Meratus Mountains under both scenarios of 2°C and 4°C.
- In the 4°C scenario, and to a lesser extent in the 2°C scenario, the areas that are most influenced by climate change will be the central and southern parts of the central mountain range. The impact extends into the lowland regions.
- In the 2°C scenario, the regions that are least impacted are the coastal areas of West Kalimantan, Sabah and East Kalimantan. Under the 4°C, these areas would be strongly affected.

FIGURE 3.1A LEVELS OF CHANGE IN 2050 FOR THE 2°C INCREASE SCENARIO

FIGURE 3.1B LEVELS OF CHANGE IN 2070 FOR THE 2°C INCREASE SCENARIO

FIGURE 3.2A LEVELS OF CHANGE IN 2050 FOR THE 4°C INCREASE SCENARIO

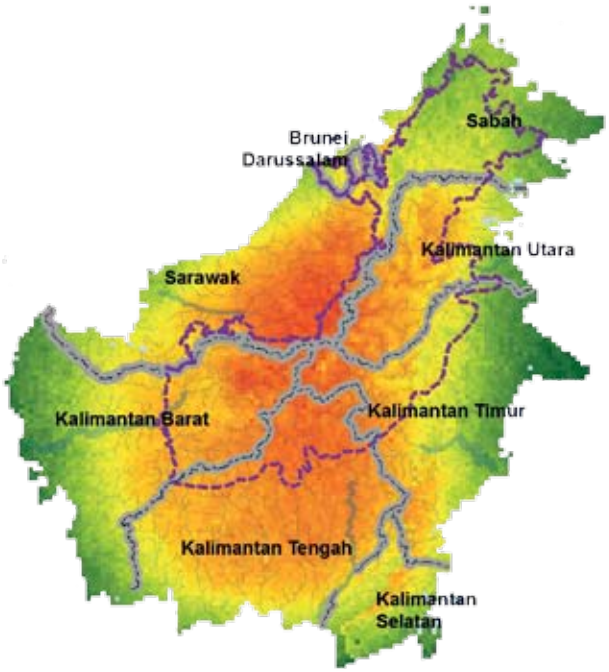
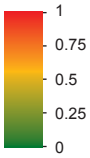


FIGURE 3.2B LEVELS OF CHANGE IN 2070 FOR THE 4°C INCREASE SCENARIO

Legend:

Boundaries: National Province HoB

Annually:



SOURCE: WWF-INDONESIA GIS TEAM

2. THE POSSIBLE CONSEQUENCES OF CLIMATE CHANGE FOR THREE REPRESENTATIVE FLAGSHIP SPECIES OF BORNEO

METHODOLOGY

Climate change is expected to have a lot of consequences on species. In this study only a limited number of species were modelled. As such, the analysis should only be seen as an illustration.

It should also be noted that results are based on extrapolation. The research assumes the species can adapt to novel climatic circumstances. However, there is no certainty that species can actually adapt for we lack knowledge on how they will react to changing circumstances. Nonetheless, using the method of extrapolation it is assumed that the species can cope with new circumstances.

Also this model is limited to climatic changes; it does not calculate for other external influences. Other variables - such as interactions with other species, the availability of food and prey species, or the accessibility of suitable habitats - that might influence the distribution or abundance of the species were not taken into account. Case studies to make corrections for these variables can be made after the identification of areas with suitable climatic conditions for a species to survive.

The calculation of the species is displayed using three colours:

- White = Species occurs in this area and could remain also in the future.
- Red = Species presently occurs in this area. Taking only climatic changes into account, it will disappear in 2050 and/or 2070.
- Green = At present, species does not occur in this area, but could exist there in 2050 and/or 2070 taking only climatic changes into account.
- Black = The species never occured in this area

FINDINGS

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Rhinoceros hornbill

At present the distribution of rhinoceros hornbills covers the entire lowland rainforest areas of Borneo[8]. The highest density of the species can be found in the Malaysian state of Sabah.

All future climate change projections under the 2°C scenario predict little changes in the range of the Rhinoceros hornbill, with the exception of the north west part of Borneo. By 2020, under the 4°C scenario however, the species is predicted to go absent in large parts of the island.

"BY 2020, UNDER THE 4°C SCENARIO HOWEVER, THE SPECIES IS PREDICTED TO GO ABSENT IN LARGE PARTS OF THE ISLAND "

© MARTIN HARVEY / WWF-CANON

"ITS RANGE EXPANSION IS PREDICTED TO DECREASE SIGNIFICANTLY"

Proboscis monkey

At present, proboscis monkeys are mainly found along the coast and in the peat swamp areas of Borneo. It should be noted that the distribution of the proboscis monkey is related to the vegetation of the Borneo mangrove, swamp and peat swamp forest. Proboscis monkeys are extremely selective in their food sources. In the mangroves, they only eat the leaves and unripe fruits of a few species. These conditions are not included in this model because it does not take into account external influences other than climate change.

The influence of future distribution of proboscis monkey is predicted to be highest when future seasonal temperatures drop. As temperatures are expected to rise due to climate change, it is expected that the proboscis monkey's expansion range will increase accordingly. However, proboscis monkey has very restricted diet or food preference. If the species they depend on for food do not expand their range, proboscis monkey may not be able to adapt to climatic change.[9]

"ORANGUTAN SPECIES APPEARS TO BE VULNERABLE TO FUTURE CLIMATIC CHANGES"

Orangutan

At present, orangutans are mainly found on the southern and northern parts of Borneo.

Future distribution of orangutans is predicted to be influenced mostly by seasonal rainfall patterns. Predictions show that orangutan would be absent from areas with lesser rain during the dry season. This would be the drier eastern and western parts of Borneo.

Much of present orangutan habitats would be affected by decreasing rainfall under the 2°C and 4°C scenarios. Orangutan species appears to be vulnerable to future climatic changes. The prediction is that its range would significantly reduce in the future, even when we assume the orangutan can adapt to new climatic circumstances (extrapolation).

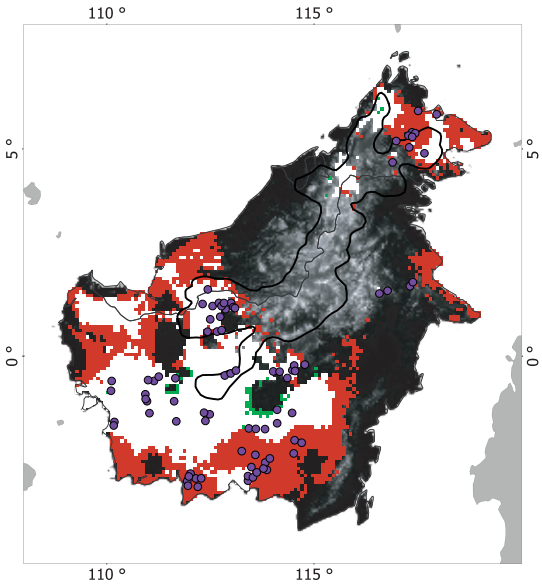

FIGURE 4.1A ORANGUTAN HABITATS WITH THE 2 DEGREES TEMPERATURE RISE SCENARIO – 2050

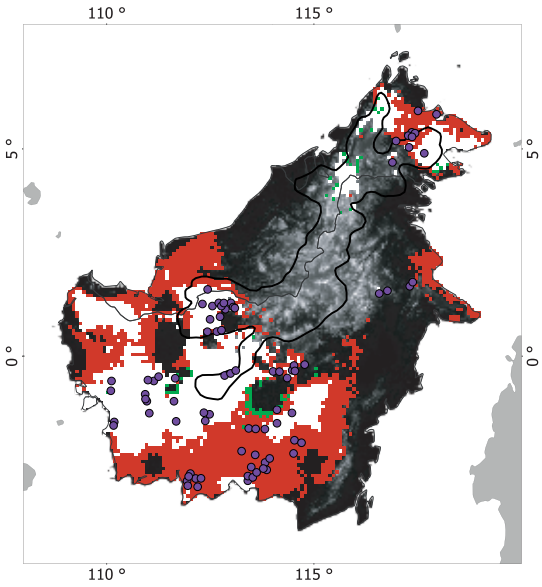

FIGURE 4.1B ORANGUTAN HABITATS WITH THE 2 DEGREES TEMPERATURE RISE SCENARIO – 2070

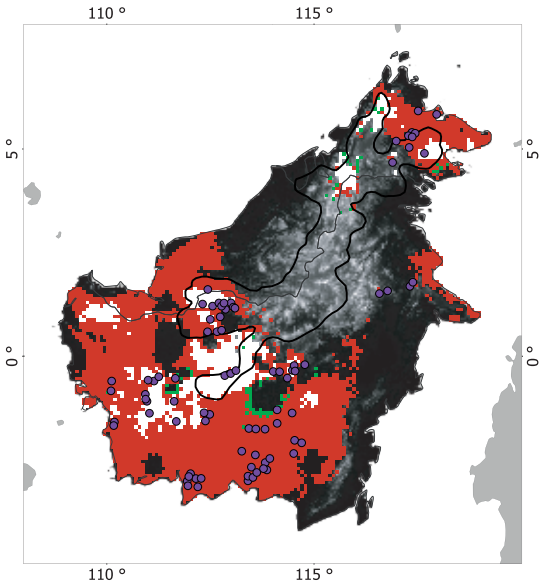

FIGURE 4.2A ORANGUTAN HABITATS WITH THE 4 DEGREES TEMPERATURE RISE SCENARIO – 2050

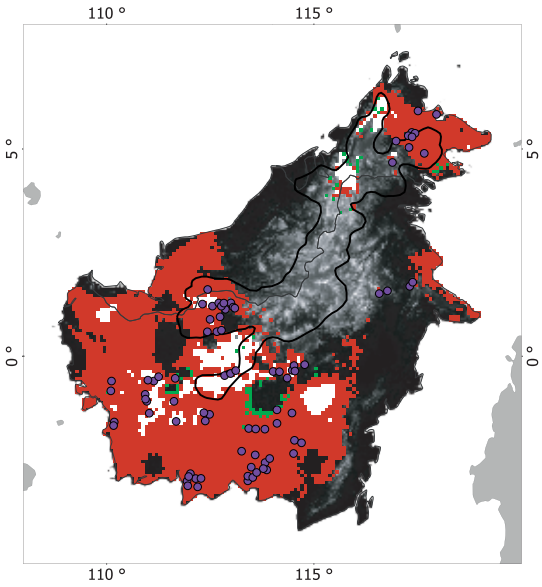

FIGURE 4.2B ORANGUTAN HABITATS WITH THE 4 DEGREES TEMPERATURE RISE SCENARIO – 2070

Legend: Collection | Stable | Loss | Gain | The species never occured in this area

SOURCE: NATURALIS STUDY

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RECOMMENDATIONS

The global community must strive to ensure that global warming remains below a 2°C rise to mitigate its impacts on Borneo. If the global warming raises above 4°C, the impact is catastrophic with the disappearance of orangutan across vast areas.

RECOMMENDATIONS:

- Deforestation should be halted and disturbed natural forests should be given the chance to recover and rehabilitated where possible. Forest fires spread mainly in disturbed forests.
- Forest fires should be stopped through strict law enforcement and awareness campaigns to avoid the burning of natural vegetation for land clearing.
- Fast action should be enabled in case of fire. For example; train fire-fighting squads and provide adequate equipments.
- Landscape connectivity and contiguous forest corridors should be maintained or developed to link existing species habitats; for example, a very high priority is the connnectivity of habitats at lower elevations to final species refugia at cooler elevations.
- Climate change analysis should be taken into account in spatial planning processes.

ANNEX

Table 1. Bioclimatic variables derived from monthly minimum and maximum temperatures and monthly precipitation values.

	Description
bio01	Annual Mean Temperature
bio02	Mean Diurnal Range (Mean of monthly (max temp - min temp))
bio03	Isothermality (BIO2/BIO7) (*100)
bio04	Temperature Seasonality (standard deviation *100)
bio05	Max Temperature of Warmest Month
bio06	Min Temperature of Coldest Month
bio07	Temperature Annual Range (BIO5-BIO6)
bio08	Mean Temperature of Wettest Quarter
bio09	Mean Temperature of Driest Quarter
bio10	Mean Temperature of Warmest Quarter
bio11	Mean Temperature of Coldest Quarter
bio12	Annual Precipitation
bio13	Precipitation of Wettest Month
bio14	Precipitation of Driest Month
bio15	Precipitation Seasonality (Coefficient of Variation)
bio16	Precipitation of Wettest Quarter
bio17	Precipitation of Driest Quarter
bio18	Precipitation of Warmest Quarter
bio19	Precipitation of Coldest Quarter

ENDNOTES

1. Otsuka, K. (2001) *A field guide to the butterflies of Borneo and South East Asia*. Hornbill books, Kota Kinabalu
2. Roos, M. C., P. J. A. Keßler, R. S. Gradstein, and P. Baas. 2004. Species diversity and endemism of five major Malesian islands: diversity-area relationships. *Journal of Biogeography* 31:1893-1908.
3. van Welzen, P. C., J. W. F. Slik, and J. Alahuhta. 2005. Plant distribution patterns and plate tectonics in Malesia. *Biologiske Skrifter* 55:199-217.
4. Raes, N., M. C. Roos, J. W. F. Slik, E. E. van Loon, and H. ter Steege. 2009. Botanical richness and endemicity patterns of Borneo derived from species distribution models. *Ecography* 32:180-192.
5. Raes, N., M. C. Roos, J. W. F. Slik, E. E. van Loon, and H. ter Steege. 2009. Botanical richness and endemicity patterns of Borneo derived from species distribution models. *Ecography* 32:180-192.
6. WWF, *Environmental Status of the Heart of Borneo,* 2014.
7. The report entitled *Climate change scenario's and possible impact on Borneo* can be obtained via WWF-Netherlands: Hans Beukeboom, Senior Advisor Landscapes and Species, *hbeukeboom@wwf.nl*
8. No maps included since habitat of hornbill is shown over most of Borneo.
9. No maps included since habitat of Proboscis Monkey is mostly confined to mangrove forests on river banks. This ecosystem will not reallocate because of climate change.

BORNEO FOREST FACTS

PAPER FROM RESPONSIBLE SOURCES

3rd LARGEST

Borneo is the third largest island on the planet.

FORESTS LOSS

About half of Borneo's natural forests have been lost and losses continue at a rapid pace.

850,000

Between 1985 and 2005 Borneo lost an average of 850,000 hectares of forest every year. If this trend continues, forest cover will drop to less than a third by 2020.

75.5 MILLION

East Kalimantan alone is believed to lose over €75.5 million a year in business tax revenue due to illegal logging and illegal timber processing.

WWF

Why we are here

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

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