

Adaptive and carbon-financed forest management in the Tropical Rainforest Heritage of Sumatra



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Published by UNESCO Office, Jakarta 2011

A lush, dense tropical rainforest covering a hillside. The forest is composed of various types of trees, including a prominent tall tree with a light-colored trunk and a large, spreading canopy in the center. The foliage is a mix of vibrant greens, with some yellowish-green leaves visible in the foreground. The background shows a steep slope covered in more dense forest, extending to the top of the frame.

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BMU Project number: 09_II_008_IDN_M_Regenwaldschutz
Project title: Adaptive and carbon-financed forest management in the Tropical
Rainforest Heritage of Sumatra
Country of Implementation: Indonesia
Duration of project: October 2009 to December 2011



Contents

Introduction

- World Heritage sites and climate change
- Tropical Rainforest Heritage of Sumatra
- Major threats

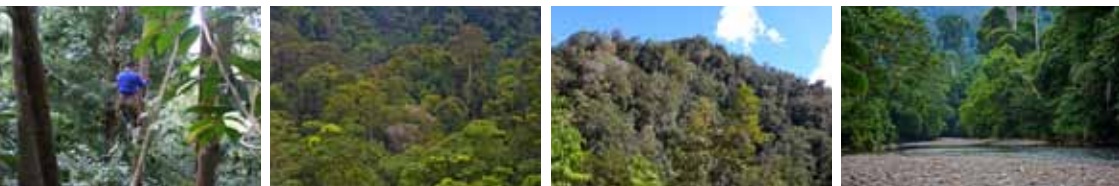
Project aims

Major achievements

- Developing mechanisms to predict the likely impacts of climate change, and to plan management and policy interventions accordingly
- Promoting carbon-financed forest protection
- Increasing the TRHS resilience to climate change

Conclusions and lessons learnt

World Heritage sites and climate change



UNESCO's natural World Heritage sites comprise a select list of outstanding sites that represent the common heritage of humankind and thus, need to be effectively conserved for the benefit of present and future generations. The iconic characters of World Heritage sites are important assets for raising public concern and enthusiasm and, therefore, for building up support to take preventive and precautionary measures for adapting to climate change.

As the conservation of World Heritage sites is regularly monitored and assessed, any adverse impact is systematically reported to the World Heritage Committee, which recommends appropriate corrective action. World Heritage sites are, thus, the ideal pilot sites to gather and disseminate information regarding the impacts of climate change and to develop innovative measures to mitigate and adapt to these impacts.



Tropical Rainforest Heritage of Sumatra

From coastal to sub-alpine forests, the Tropical Rainforest Heritage of Sumatra (TRHS) comprises all major ecosystems present on the Island of Sumatra. It was designated as a World Heritage site in 2004 and includes the three major national parks in Sumatra: Gunung Leuser, Kerinci Seblat and Bukit Barisan Selatan. These national parks located along the Bukit Barisan mountain range harbour exceptionally high and unique biodiversity and include important natural habitats for many endangered species in Sumatra. The TRHS hosts well over 10,000 different plant species (including species in the genera *Rafflesia* and *Amorphophallus*, respectively the largest and tallest

flowers in the world), over 200 species of mammals and 580 bird species, many of which are endemic. Because of its size the TRHS can still host ongoing ecological and evolutionary processes, which shape the development of terrestrial ecosystems on Sumatra. The TRHS provides essential ecosystem services including clean water supply, erosion, flood and micro-climate control, as well as soil fertility, and food provisioning. In addition, the TRHS is an area of exceptional importance in the fight against climate change as it constitutes a huge natural carbon sink. Degradation of this forest resource therefore contributes to the worsening of this global and pressing problem.



Gunung Leuser National Park

Established in 1982, Gunung Leuser National Park (GNLP) covers an area of 7,927km² and spans the North Sumatra and Aceh Provinces. It protects a wide range of ecosystems such as mountain forest, alpine woods, primary dipterocarp lowland forest, swamps, coastal forest and mangrove forest. The topography of the park is mostly mountainous. Forty percent of the area in the park is steep and over 1,500m, the highest peak reaching 3,466m, and only 12% of the park is below 600m. The park provides important ecological services to over four million people and is an exceptionally important habitat for many endangered species. It is home to 174 mammals including the Sumatran elephant, Sumatran tiger, Sumatran rhinoceros, Sumatran

orangutan, mainland serow, and leopard cat, as well as to 380 bird species. Efforts are currently undertaken to maintain elephant populations, to support orangutan rehabilitation and research, to establish ecological corridors and to build policy advocacy. UNESCO has been working in collaboration with Gunung Leuser National Park since 2004.





Kerinci Seblat National Park

Kerinci Seblat National Park (KSNP) extends across four provinces in Sumatra (West Sumatra, Jambi, Bengkulu and South Sumatra). It was established in 1999, it is the largest park in Indonesia and spans approximately 13,300km². Most of the park is mountainous with several peaks over 2,500m and includes the southern part of the Bukit Barisan mountain range. The park boasts seven forest types: lowland, hill, sub-montane, lower montane, mid-montane, upper montane and sub-alpine. The different forest types in the park support over 4,000 plant species, 144 mammals, 300 bird species (including 17 out of 20 of Sumatra's endemic birds). It also harbours endangered and critically endangered species such as the Sumatran tiger, rhinoceros, elephant, muntjac (an endemic deer species) and ground-cuckoo as well as the Malayan tapir, the Malay

sun bear and the Sunda clouded leopard. In addition, this protected area functions as an important water catchment area providing water for agriculture to much of southern Sumatra. The traditional (adat) concept of land use management is being promoted within the buffer zone and in specially designated village forests (Hutan Desa).





Bukit Barisan Selatan National Park

Bukit Barisan Selatan National Park (BBSNP), the third largest protected area (3,560km²) in Sumatra, extends 150km along the southern portion of the Bukit Barisan mountain range, spanning the Lampung and Bengkulu provinces. Gazetted as a game reserve since 1932, the park was established in 1982. BBSNP contains more lowland forest than any other protected area in Sumatra. The topography of the park ranges from coastal plains and lowland rainforest to mountains, which reach about 1,800m. BBSNP contains many critically endangered large mammal, such as the Sumatran elephant, the Sumatran tiger and the Sumatran rhinoceros; though the latter is unfortunately declining very rapidly. Other resident species include the Sunda clouded leopard, the Malayan tapir, sambar deer, barking deer, wild boar, gibbons

and the Sumatran hare. The area in the park surrounded by agricultural land is facing the greatest protection challenges. The park provides an enormous range of economic and ecological benefits, maintaining biodiversity and water quality for surrounding rivers and lakes, serving as the primary watershed for southwest Sumatra.





Major threats

Climate change

Sumatran forests are extremely vulnerable to the threats of climate change and their loss is also a massive contributor to such climate change. The loss of forest in Sumatra between 1990 and 2000 led to the emission of 5.5 billion tons of CO₂. Mountainous regions are likely to be especially affected due to their vulnerability to warming processes, as are tropical rainforests where precipitation is significantly declining. Climate change has already led to extreme events including droughts, water shortages, crop failures and forest fires. Such events can have devastating effects on forest ecology and cause irreversible changes in the species composition. The loss of biodiversity due to climate change in particular in the TRHS will be commensurately great unless it is attenuated through timely conservation, adaptation and carbon-financed forest management efforts. However, expected climate change impacts on the economic, social and cultural spheres of society will raise conflicts over farmable land. Crop failure and draught will push farmers to encroach into the TRHS and adjacent forested areas, resulting in increased

deforestation and biodiversity loss, adding further to the vicious circle of climate change.

The predicted scenarios are all likely to impact Indonesia's biodiversity and ecosystems, including the TRHS which itself encompasses a wide range of ecosystems. Adverse effects include:

- Increased temperatures and atmospheric CO₂ concentrations will affect individual species and whole ecosystems.
- Growing season of plants is lengthening, and plant and animal ranges are shifting pole-ward and upward in elevation.
- Invasion of alien species increasingly impacts upon indigenous species with the help of increased temperatures and atmospheric CO₂ concentrations.
- Composition and configuration of biotic communities is likely to be changed because of climate-change induced species range shifts and extinctions.
- Drastic changes in land-sea interactions are likely to occur.

Other threats to the TRHS

The site of the TRHS itself and its adjacent forests are under immense pressure by other anthropogenic stresses: illegal logging, agricultural and settlement encroachments, forest fires, poaching, illegal mining and unsustainable exploitation. They may pose in the short term a greater threat to their existence than climate change itself, as well as reduce the forests natural resilience to climate change impacts. Approximately 5 million ha of forest were lost in Sumatra during the decade 1990-2000. This yearly rate of 2.5% has likely increased. Disturbance by human activities in core conservation areas is minimized if there are well-managed buffer zones. However, across the World Heritage cluster, these buffering forests have been lost or degraded, creating tremendous pressure on the TRHS. Local stakeholders are opting for short-term economic profits,



generated by unsustainable activities like logging and oil palm plantations, instead of engaging in carbon-financed forest management schemes and in the maintenance of ecosystem services. Increased human-wildlife conflict around the border of the park is another potential threat to this property as well as the invasion of alien species. *Merremia peltata* (Convolvulaceae) in the Bukit Barisan Selatan National Park, for example, is a serious challenge to park management and causes extensive native tree mortality.





Project aims

The goal of this project is to enhance the integrity of the TRHS through innovative and replicable climate change mitigation and adaptation measures and the development of carbon-financed forest management schemes. The project objectives are to develop mechanisms to predict the likely impacts of climate change and to plan management and policy interventions accordingly. This project also aims to promote the development and the implementation of carbon-financed forest protection schemes in pilot sites bordering the TRHS. Finally, this project tackles some of the most urgent anthropogenic threats which reduce the natural resilience of this site to climate change, such as encroachment and poaching.

Piloting an approach to predict climate change impacts to improve management, while raising capacities and promoting alternative management strategies, gives this project a strong adaptive component. Reducing emissions through mechanisms of avoided deforestation and ecosystem restoration, both mitigate the impacts of climate change, while also providing an incentive to protect forests.

To fulfil these aims, UNESCO has worked with international and local NGOs, through the generous support and cooperation of the Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany (BMU).



Major achievements

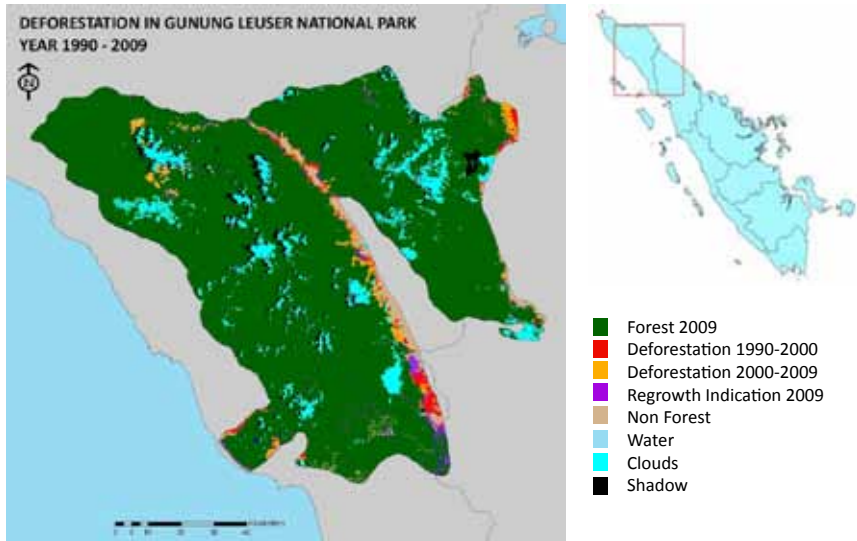
1. Developing mechanisms to predict the likely impacts of climate change and to plan management and policy interventions accordingly

This comprehensive programme was aimed at assessing and monitoring climate change impacts, piloting adaptation measures and promoting and developing carbon-financed forest management schemes within the TRHS.

Digital maps for forest cover and deforestation in the TRHS

Forest cover and loss in 1990, 2000 and 2010 was mapped across all of Sumatra based on time series medium resolution (30m Landsat) satellite imagery. It was validated with high resolution satellite imagery and ground checking. In remote sensing, ground checking is used to relate

ground surface features to features visible in images or aerial photos. A time series of forest cover and loss across the region was therefore obtained. The data was then compiled on an interactive CD-ROM, together with explanatory notes, political and protected area boundaries and topographic data.



Climate change impact assessment and identification of key locations for carbon-financed forest management schemes

A vulnerability assessment of the TRHS landscape was obtained by analysing time series climatological data, by reviewing existing literature on the response of biodiversity to climatic change and by analysing deforestation risk and altitude differences. This activity focused on data concerning potential climate change scenarios and on the potential impacts of these scenarios. Based on a Geographical Information System (GIS) database created under climate change impact assessment, a map of high potential for the development of carbon-financed forest protection schemes was generated. Such areas typically met a number of

criteria, including: existing forest cover under state or private ownership, predicted high rates of deforestation, areas forming continuous forest blocks with larger protected area forests and areas functioning as biological corridors between larger protected forest blocks.

Legal and policy assessment for climate change adaptation and carbon financing in the TRHS

Reviewing existing laws relating to climate change adaptation and carbon financing in Indonesia is essential to support the implementation of REDD+ related activities such as carbon trading. Comprehensive identification and clustering of these laws and regulations have resulted in a synopsis of the carbon financing legal requirements within the



TRHS landscape. This component of the project also focused on the best practice and necessary institutional arrangements for the creation of local state-owned companies (BUMD) responsible for managing local carbon trade projects. The following steps are being taken in order to support Kaur District in the drafting of a local regulation (Peraturan Daerah/PERDA) for the establishment of carbon trade projects:

1. A draft regulation has been written in collaboration with the government
2. The draft regulation is being approved through a public consultation process at the local parliament
3. The regulation will then be legalised by the Head of District and disseminated to the public

With the help of UNESCO and the Wildlife Conservation Society (WCS) legal team, the Kaur District has identified an appropriate company to start implementing REDD+ related activities such as carbon trading, the Kaur Perdana Corporation (established under Local Regulation No. 17, 2006).

Developing climate change monitoring

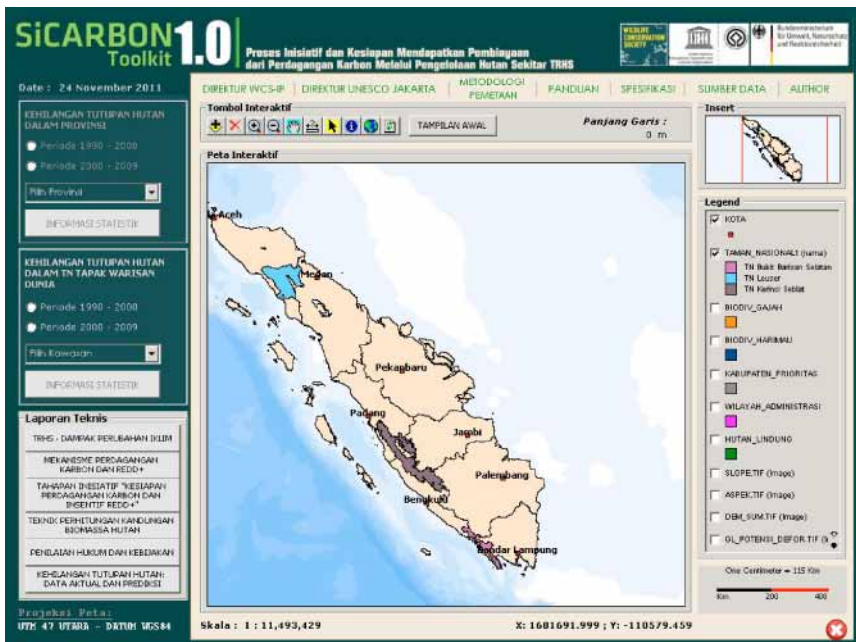
In collaboration with the Indonesian Institute of Sciences (LIPI), UNESCO has developed a simple methodology to monitor climate change using data loggers for temperature and precipitation in several locations around the park as well as arthropods as bio-indicators. Currently, no monitoring system to assess climate change and its impacts exists. The development of a monitoring system embedded with a capacity training programme was needed in order to enhance stakeholder knowledge and awareness in the context of climate change impacts and risk assessments, management responses, adaptation planning and monitoring. This monitoring system has provided a preliminary set of data for each national park and the first resources and tools, which are needed to lead onto the establishment of a longer term and more refined monitoring programme, helping national park authorities and local government develop solutions to mitigate climate change.

2. Promoting carbon-financed forest protection

Carbon toolkit

The innovative UNESCO/WCS toolkit is the first interactive CD conceived to inform and support local government in the establishment of carbon trading projects in Indonesia. It summarises many of the data generated and research conducted through other activities of this project and has three major components. The first is a GIS-like interface to help prioritise areas with the most potential for carbon trade. In this section of the toolkit maps can be overlapped (deforestation risk or climate vulnerability maps, keystone or endangered species distributions, etc.) to allow for systematic and well-informed prioritisation processes. The second

section discusses the legal requirements for the establishment of carbon-financed projects. The third section includes considerations on the establishment of state-owned limited liability companies to manage carbon-financed projects as well as valuable information on other issues concerning the practical implementation of carbon trade in Indonesia. Also, it has been created keeping in mind that Hutan Lindung (conservation forest) is the most likely type of forest that will be eligible for carbon trade. This toolkit has been distributed to 12 districts surrounding the TRHS and has met very encouraging feedback.





3. Increasing the TRHS resilience to climate change

Community-based restoration of the Gunung Leuser National Park

The restoration programme of the Besitang section of the Gunung Leuser National Park (GLNP) takes place in the SPTN VI Sei Betung Resort in collaboration with the Orangutan Information Centre (OIC) and KETAPEL (Kelompok Tani Pencinta Leuser). KETAPEL is a group of local farmers set up as a result of this project who serve as in-field supervisors for programme activities. The objectives of the restoration programme are to rehabilitate areas which had been degraded as a result of illegal agricultural encroachment by working with local communities, thus reinforcing the

national park buffer zones and engaging in sustainable alternative livelihoods. In order to start the forest restoration process, the initial removal of illegally planted oil palm trees is necessary. Subsequently, organic fertilization and manual weeding are required to increase seedling survival success. Community members including local village women have developed seedling nurseries in the village of Halaban to support this programme. As a result, 22 hectares of degraded GLNP land have been replanted with 22,000 seedlings of indigenous forest tree species, all of which were cultivated locally.

In addition to contributing to global emission reduction this programme has helped to reduce the risk of further encroachment in surrounding areas through increased field presence as well as locally alleviate problems associated with climate change. Indeed, positive changes in the micro-climate are already being detected (lower temperature, fewer droughts, etc.). Moreover, the replanted forest already hosts a range of populations of endangered species including a resident wild elephant herd. Available habitat is thus increased for this and other species which improves their overall resilience against the effects of climate change. In addition to forest rehabilitation, the project provides sustainable

alternative livelihoods for people living adjacent to this area. In addition to recovering valuable natural ecological services which had been lost to forest clearing and monoculture agricultural development (such as soil fertility and water storage capacity) the local people benefited financially and educationally through training and the development of agroforestry schemes. Importantly, there was a significant mindset shift amongst the community members: many of those previously responsible for illegal encroaching of national park now understand its value and are involved in the restoration process. This reinforces the security of the programme and thus the conservation of the park.





Collaborative forest management in the Kerinci Seblat National Park

This component of the project aims to increase the capacity of forest edge communities to protect and manage their customary forest estate in perpetuity, and secure legally-recognized rights to these areas to reduce threat of forest conversion. Specifically, the project targeted the forest estate in Kerinci Seblat National Park (KSNP) buffer zone in Merangin District, Jambi Province, which faces both threats of large-scale clearance for commercial plantation concessions, and incremental ‘mosaic’ deforestation as natural forest is converted for agriculture, such as coffee plantations.

To fulfil this aim UNESCO cooperated with Fauna and Flora International (FFI), which has been active in the Kerinci Seblat landscape since 1995. FFI, in collaboration with local partner, Lembaga Tiga Beradik (L-TB), focused on development of strategies and capacity of forest edge communities to secure legal

rights and responsibilities to sustainably manage their customary forest estate. The project enabled intensive engagement with 6 buffer zone villages, including supporting these communities to prepare Hutan Desa (village forest) proposals.

These activities made an important and timely contribution to wider efforts to reduce rates of deforestation and increase local capacity to sustainably manage forest in KSNP and buffer zone forest within Merangin District. Merangin District Government ultimately supported 17 formal proposals for Hutan Desa to the Ministry of Forestry in Jakarta in May 2010. The Hutan Desa approach is supporting the District to establish an alternative management framework for the remaining forest estate, reducing the threat of wholesale forest conversion for commercial plantations and also building community commitment and capacity to protect their forest estate for the future.



Maintaining healthy tiger populations at landscape level; a key performance indicator in climate change adaptation and mitigation

In its efforts to implement adaptive measures and reduce non-climatic threats to the Tropical Rainforest Heritage of Sumatra, the Wildlife Conservation Society (WCS) and UNESCO focused on the Sumatran tiger. As a top predator the Sumatran tiger plays a crucial role in the ecology of the Bukit Barisan Selatan National Park (BBSNP) and its surrounding landscape. When these top predators are absent, prey populations increase disproportionately affecting the functioning of forest ecosystems, often negatively. By mitigating human-tiger conflicts, raising public awareness regarding tigers and contributing to law enforcement efforts to protect tiger habitat, the project addresses important climate change challenges such as maintaining carbon sinks and functioning ecosystems.

Responding to the increase in the frequency of tiger attacks in the TRHS due to habitat loss and dwindling prey caused by climate change drivers, a Wildlife Response Unit (WRU) was set up, consisting of Ministry of Forestry staff, local community representatives, and WCS-IP technical staff. The aim of the WRU is to monitor and provide a rapid response to threats and human-wildlife conflicts in and adjacent to the BBSNP. The WRU has patrolled over 300km, mitigated 6 tiger conflicts, trained 25 representatives of villages that endure regular human-tiger conflict and installed nearly 70 enclosures to protect livestock from tiger attacks, thereby securing local livelihoods. The unit's ability to respond in a very short time-frame to conflicts has helped to significantly reduce the loss of livestock and improve human security, thereby generating strong community support for tiger conservation in the Bukit Barisan Selatan (BBS) landscape. The project also supported a



number of wildlife crime investigations in collaboration with law enforcement agencies to track tiger and wildlife traders in the BBS landscape. The first ever prosecution for tiger possession took place in Indonesia during this project, following the seizure of four live Sumatran tigers.

The project also responded to requests from the BBSNP management authorities to assist in facilitating the process of reclaiming the national park land from illegal agricultural encroachers. The area, which was once tiger habitat, has been heavily degraded due to the illegal encroachers. After an initial awareness

campaign, a joint law enforcement activity involving the BBSNP, the West Lampung District Police, WCS, WWF and the Rhino Patrol Unit (RPU) seized a total area of 9,689 hectares of illegal coffee in the national park. From a climate change adaptation perspective, the currently highly degraded area, once reforested, will constitute an important buffer for the remaining primary forest as well as a potential habitat for tiger recovery. The eviction of the encroachers has also helped to halt the enlargement of future encroachment and therefore crucial in reducing future carbon emissions from deforestation and degradation.



Conclusions and lessons learnt

This project was successful at three levels. First, it led to improved environmental management policies. Indeed, the project achieved remarkable results in its goal to fight climate change by providing climatic and forest coverage data to park management authorities, by raising capacities of local government, national park staff and local communities, and by engaging with local government to set up prerequisites for financing forest protection via carbon trade. It piloted new mitigation and adaptation measures by developing monitoring mechanisms, by supporting local communities in restoring damaged ecosystems and by supporting the establishment of new collaboratively

managed forests (Hutan Desa). This project addressed important non-climatic threats including encroachment and poaching. It provided direct benefits to local and national stakeholders by enhancing the resilience of the TRHS ecosystems and by encouraging alternative forest management strategies, thus maintaining available ecosystem services and attenuating likely climate change effects. The project also benefited global stakeholders by contributing to the protection of this World Heritage site, and by sharing lessons learnt with other World Heritage sites affected by similar challenges.



Second, this project demonstrated that important and necessary policy level changes can be made to implement REDD+ related activities in Indonesia. Here, collaborative efforts between government, national park authorities, the UN and the NGOs were successful. This shows that with continued support national park authorities are ready to take the necessary action to fight the major causes of deforestation and forest degradation related carbon emissions.

Finally, the components implemented in this project are innovative and highly relevant to the major climate change issues faced by many countries globally. Subsequently, this project has an extremely high potential for replicability

particularly in other Indonesian REDD+ pilot provinces (Central Sulawesi, Papua, Central Kalimantan) as well as in other countries. It is particularly relevant to those regions located in the tropical forest-rich areas of the world which are among the most vulnerable areas to climate change effects.

UNESCO remains strongly committed to helping the government of Indonesia respond to the challenges posed by the increasingly important threat of climate change. In particular, UNESCO will continue to reach out to its wide network of partners and develop innovative solutions to support Indonesia in reducing carbon emissions.





Sei Betung - Gunung Leuser National Park



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