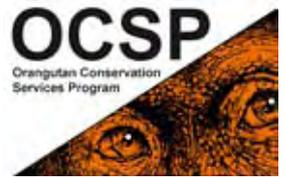


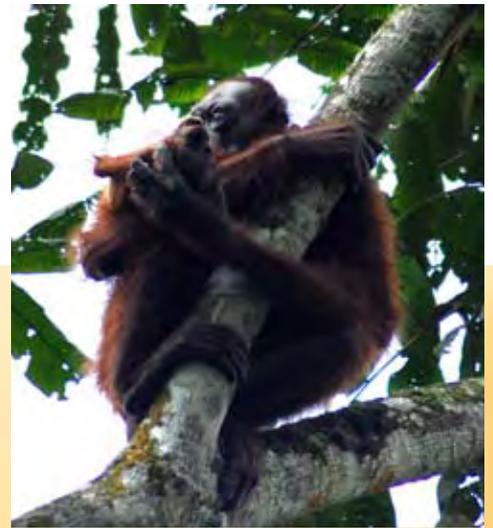


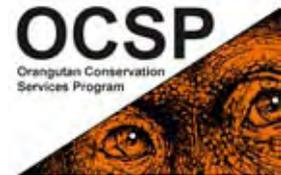
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# ORANGUTAN CONSERVATION SERVICES PROGRAM PSSF SITE THREATS

*Evaluation of Threats to Orangutan and Priority Interventions to abate these threats at PSSF Focused Sites in North Sumatra and East Kalimantan*





Cover photograph and right: **Fire in Kutai National Park, August 2009. Forest fires resulting from land clearing for agriculture by local communities cause considerable degradation of land and often destroy tree seed banks in the soil and prevent natural regeneration of vegetation and forest, thus leading to land conversion.**



Cover photograph insert: **Female orangutan with dead baby in Kutai National Park, August 2009.**



DONALD BASON / OCSP

PRIVATE SECTOR SUSTAINABILITY FACILITY

# PSSF SITE THREATS

*Evaluation of Threats to Orangutan and Priority Interventions to abate these threats at PSSF Focused Sites in North Sumatra and East Kalimantan*

August 2009

## ACKNOWLEDGMENTS

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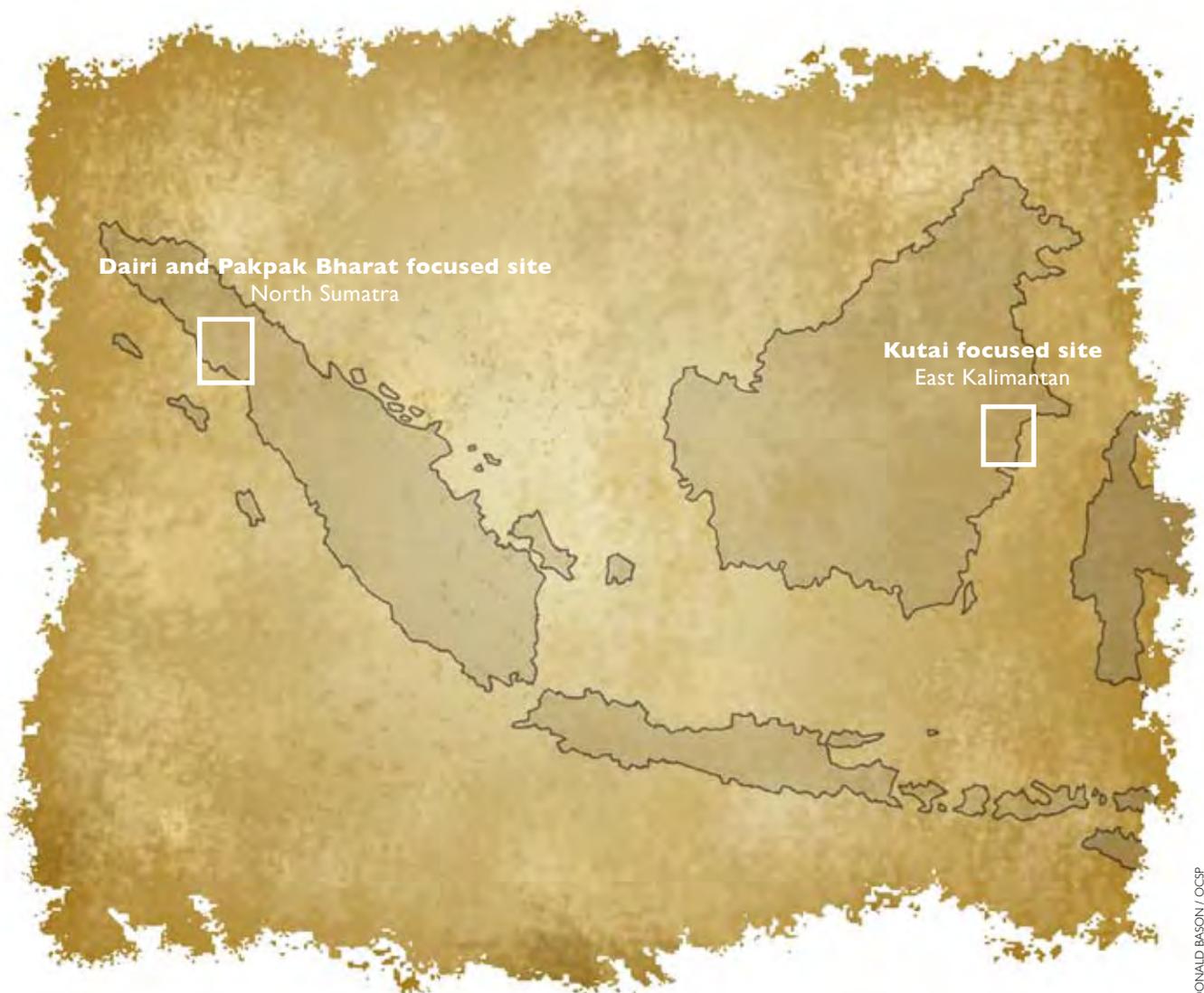
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## Glossary

# ORANGUTAN CONSERVATION SERVICES PROGRAM PSSF SITE THREATS

*Evaluation of Threats to Orangutan and Priority Interventions  
to abate these threats at PSSF Focused Sites in  
North Sumatra and East Kalimantan*



## Abbreviations

APL	<i>Areal Penggunaan Lain</i> (Other Land Use or No Forest Status)
BKSDA	<i>Balai Konservasi Sumber Daya Alam</i> (Provincial Office of the Directorate of Forest Protection and Nature Conservation within the Ministry of Forestry)
BMP	Best Management Practice(s)
CoW	Contract of Work
CSR	Corporate Social Responsibility
DAI	Development Alternatives, Inc.
ETM	Enhanced Thematic Mapper
EU	European Union
GIS	Geographical Information System
Gol	Government of Indonesia
HCVF	High Conservation Value Forest
HL	<i>Hutan Lindung</i> (Protected Forest)
HPH	<i>Hak Pengusahaan Hutan</i> (Forest Concession)
HP	<i>Hutan Produksi</i> (Production Forest)
HPP	<i>Hutan Pendidikan dan Penelitian</i> (Research & Educational Forest)
HPT	<i>Hutan Produksi Terbatas</i> (Limited Production Forest)
HTI	<i>Hutan Tanaman Industri</i> (Industrial Timber Plantation)
HWSA	<i>Hutan Wisata dan Suaka Alam</i> (Nature Reserve)
IBA	Important Bird Area
ICITAP	International Criminal Investigative Training Assistance Program
KBA	Key Biodiversity Area
KNP	Kutai Nasional Park
MCE	Multiple Criteria Evaluation
MoU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NGO	Non-governmental Organization
OCSP	Orangutan Conservation Services Program
PA	Protected Area
PELTHR	Project, Environmental, Land Tenure and Heritage Review.
PHKA	<i>Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam</i> (Directorate of Forest Protection and Nature Conservation within the Indonesian Ministry of Forestry)
PHVA	Orangutan Population and Habitat Viability Assessment
RSPO	Roundtable for Sustainable Palm Oil
PSSF	Private Sector Sustainability Facility
RTRWP	<i>Rencana Tata Ruang Wilayah Propinsi</i> (Provincial Land Use Plan)
SOP	Standard Operating Procedure
SUMUT	<i>Sumatera Utara</i> (North Sumatra)
TM	Topographic Map
U.K.	United Kingdom
USAID	United States Agency for International Development
UTM	Universal Transverse Mercator
WLC	Weighted Linear Combination



# Background

Forest loss is one of the main threats to ecosystem function in Indonesia. Survival of many threatened species, including orangutan (as well as rural human societies and their economic capacity), depend on sustainable use of forests. During the 1980s and 1990s, large tracks of forest were lost or severely degraded through conversion to agricultural land, repeated fires, and unsustainable harvest of timber. This was further exacerbated following decentralization in 1998, when forestry and plantation licensing came under district and provincial authority, leading to a significant increase in deforestation, both legal and illegal. This had significant adverse effects on the conservation of orangutans, other animals and plant species.

DONALD BAGON / OCSF

**Above: Land clearing north of Kutai National Park, September 2009.**

Unfortunately, the protected area (PA) network in Indonesia has been ineffective in safeguarding habitat of both orangutan and other wildlife, with significant forest loss occurring in the PAs (Jepson *et al.*, 2001). This is due to lack of effective management in the PAs, limited recognition of the environmental importance of the PAs by local communities, and a limited role given to local communities in the collaborative management of PAs.

An important challenge is the engagement of local communities in conservation. This requires empowerment through focused education, and involvement in the development of conservation planning and implementation - particularly in the enforcement of wildlife laws. Other issues that require attention for long term sustainable conservation are strengthening the justice system and developing alternative livelihoods. Greater political will is vital to ensure that forest conservation is implemented successfully in the long term.

Effective conservation planning at the landscape level requires consideration of many complicated biological, social and economic factors that encroach on the ecological integrity of a site (Sanderson *et al.* 2002). Integration of different land use practices is required to maximize the benefit to a majority of people, including parks, forestry concessions, indigenous management areas, agricultural zones and urban areas.

In this report, the analysis of global threats to orangutans will focus on proximal threats that can affect orangutans directly. Sources of threats (indirect or direct), such as weak governance, poverty, and legal constraints, are not discussed - although they will be evaluated in the long term. However, this threat analysis, coupled with a stakeholder and site analysis, will assist in identifying both strategic and tactical conservation interventions required to abate threats to orangutans in the focused sites. We selected two focused sites on the two Indonesian islands where there is orangutan habitat. These sites are the Kutai focused site in East Kalimantan and Dairi and Pakpak Bharat focused site in North Sumatra.

# Brief Description of Focused Sites

## Kutai focused site

This focused site is the area of Kutai National Park (KNP) and the adjacent set of concessions. The area included is outlined in Figure 1.

**History:** Kutai National Park, with an area of 198,629 ha, is a key biodiversity refuge in East Kalimantan. The park is a natural habitat for rare tropical flora and fauna, including a large number of endemic species. Its diverse vegetation types include coastal/mangrove forest, freshwater swamp forest, *kerangas* forest, lowland flooding forest, and *ulin/merantikapur* forest. It has one of the few extensive areas of protected mixed *Dipterocarpaceae* forest. Wich *et al.* (2008) found that KNP has a viable population of the orangutan subspecies (*Pongo pygmeus morio*) in its core area. However, our recent survey with The Nature Conservancy (TNC) found that the orangutan population was not limited to this core area, but is also located in surrounding concessions, including timber plantations where pure *Acacia mangium* are grown. Their presence in these concessions is a management problem since the bark from *Acacia* is a major food source, leading some timber companies to regard them as a common pest (Nardiyono *et al.* 2008).



DONALD BASON / OCSF

**Above: Male orangutan stripping bark from a tree, Kutai National Park, August 2009.**

**Box 1: Summary of orangutan conditions in the Kutai National Park focus site\***

Population size	Medium, population of 2,500 - 4,500.
Degree of threat	High: Three new districts formed; Bontang City near KNP; concession developments surrounding KNP; increased local village encroachment; and weak enforcement of wildlife laws.
Area	767,486 ha.
Legal status	Mixed: National Park (198,629 ha), Protection Forest (17,429 ha), Production Forest (326,940 ha) and No forest status (224,448 ha)
Uniqueness	KNP lowland forest area rich in vegetation structure and with expanses of <i>ulin</i> forest. Has 11 primate and > 300 bird species
Likelihood of measurable impact	Medium
Political will	Medium. Poorly supported by provincial government
Leverage	High. TNC and US Department of Justice's International Criminal Investigative Training Assistance Program (ICITAP) are active in the area as well as other organizations

\* includes Kutai National Park and surrounding concessions.

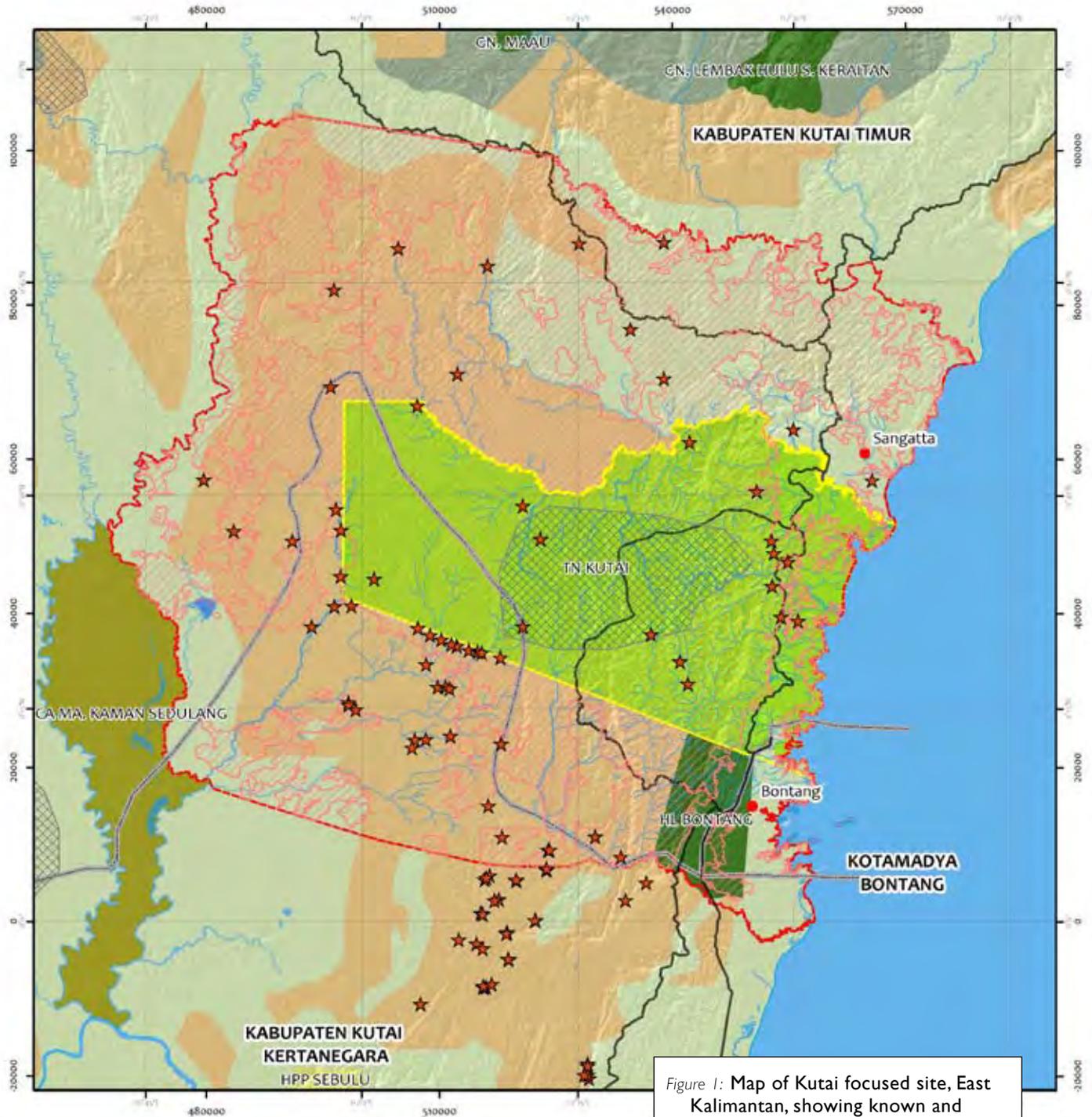


Figure 1: Map of Kutai focused site, East Kalimantan, showing known and predicted orangutan distribution and forest status.

**LEGEND**

- Regency capital city
- Administrative boundary
- River
- Kutai landscape boundary
- Kutai National Park boundary
- Road
- Orangutan Distributions**
- PHVA (2004)
- Predicted
- Orangutan sighting

- Forest Status**
- Protected Forest (HL)
  - Nature Reserve (HWSA)
  - National Park
  - Production Forest (HP)
  - Research & Educational Forest (HPP)
  - Limited Production Forest (HPT)
  - No Forest Status (APL)

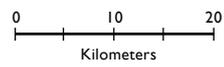


**Data Source:**

- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, and Sub-District, BAPPEDA East Kalimantan 2005
- Forest protection status, Ministry of Forestry
- Orangutan sighting, OCSF - TNC 2008

**Geographic Coordinate System**  
 Name: GCS WGS 1984, Datum: D WGS 1984, Spheroid: WGS 1984

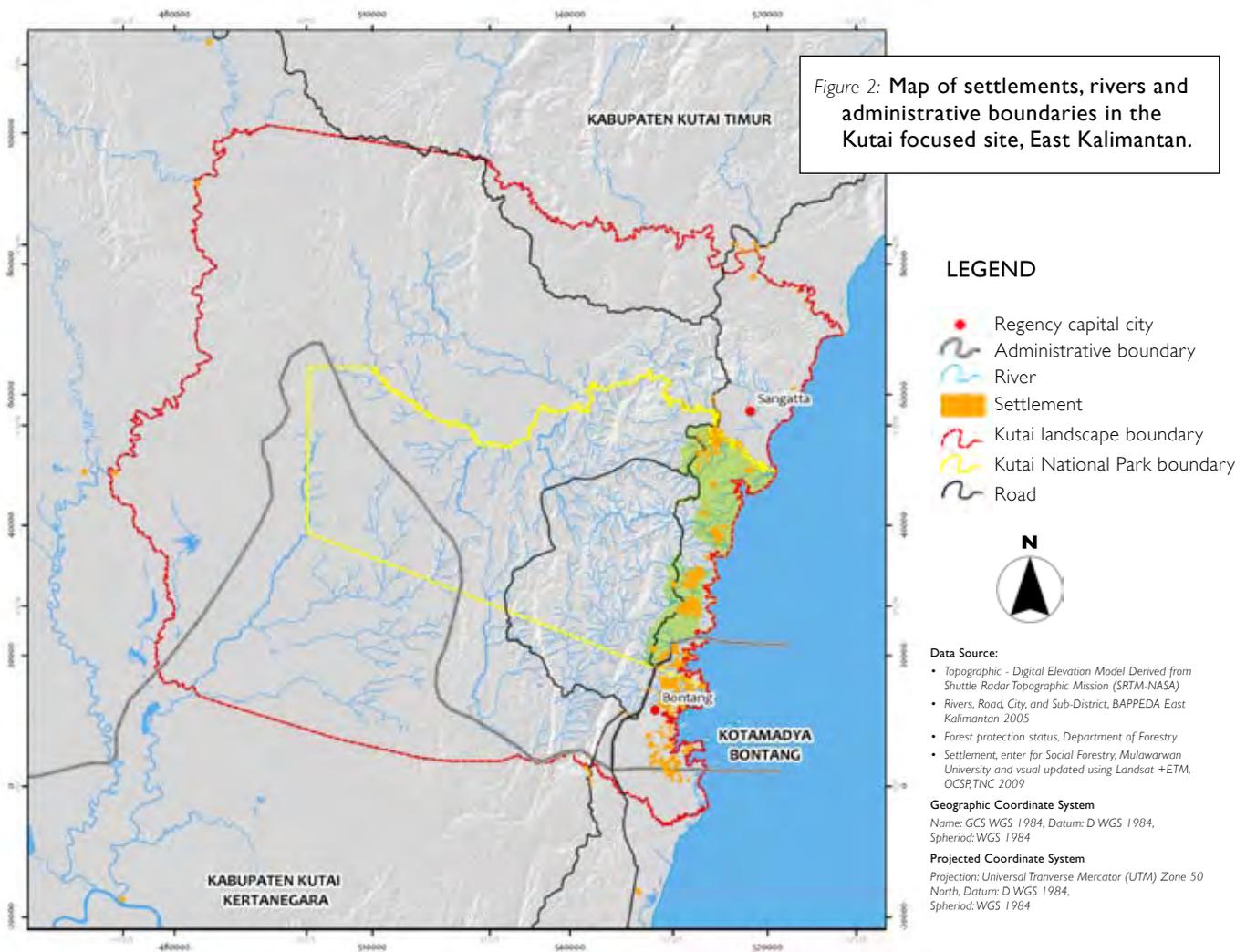
**Projected Coordinate System**  
 Projection: Universal Transverse Mercator (UTM) Zone 50 North, Datum: D WGS 1984, Spheroid: WGS 1984



In the 1930s, KNP was originally proposed as a nature reserve covering two million hectares of lowland dipterocarp forest, though due to economic pressures it was eventually reduced in size. KNP was formally established in 1982 and was reduced to its current size in 1995.

KNP has faced increased threats since decentralization began in 1998. Since then, new districts have been created and cities nearby have grown significantly. With the demise of the Suharto regime, greater authority was given to local governments. Newly formed districts began to challenge the central government, especially on issues related to forest conservation. Local government considers conservation to be both a concern of the central government and less important than local economic development.

KNP has long suffered from encroachment, illegal logging, illegal mining, forest fires, agriculture development, and "re-zoning" by officials to allow for coal mining. Nellemann *et al.* (2007) predicted that illegal logging and mining are the largest threats to KNP. Deforestation has replaced illegal pet trade as the biggest threat to orangutans in KNP. Currently, the orangutan population inside KNP is officially estimated at 600 individuals (Soehartono *et al.*, 2007 and Wich *et al.*, 2008), although recent surveys indicate that their numbers are much larger.



DONALD BASON / OCSF



**Encroachment:** Located between the cities of Bontang and Sangatta, KNP has suffered from human intrusions since its creation. Local governments have allowed communities to encroach inside KNP, recently exacerbated by local government funding a road connecting these two large cities, resulting in commercial and residential development alongside the road and further degradation of the adjacent forest (Figure 3). Encroachment has also led to an increase in illegal logging and mining, which KNP forest rangers do not have the capacity or resources to address. Further, inhabitants living inside KNP place limited value on the importance of forest and orangutan conservation. There have been several instances where people both inside and around KNP have captured, kept, and most likely traded baby orangutans.

Figure 3: Map of forest cover changes between 1990s and 2006 in the Kutai focused site, East Kalimantan.

**LEGEND**

- Regency capital city
- Administrative boundary
- River
- Kutai landscape boundary
- Kutai National Park boundary
- Road

**Forest Cover Changes 1990s - 2006**

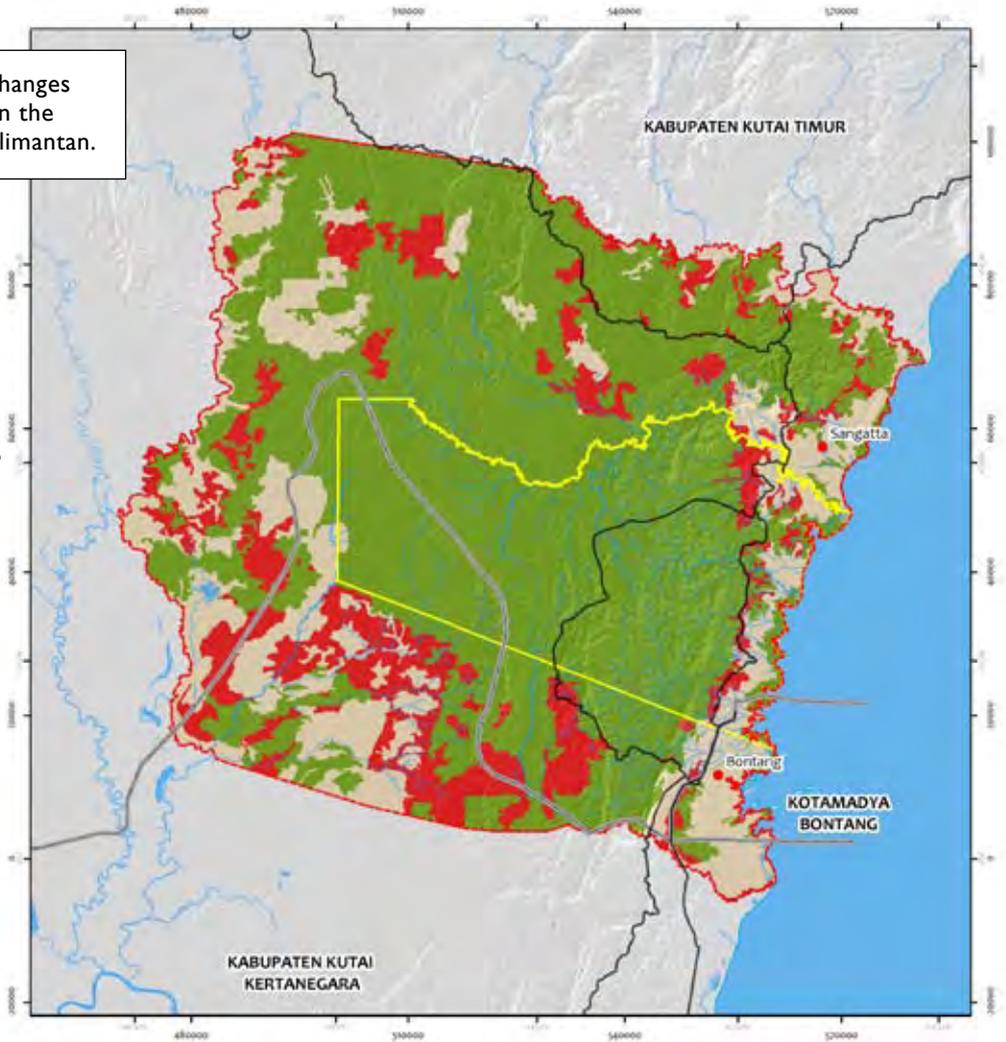
- Forest
- Non forest
- Deforestation

**Data Source:**

- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, and Sub-District, BAPPEDA East Kalimantan 2005
- Forest protection status, Department of Forestry
- Settlement, Center for Social Forestry, Mulawarman University and visual updated using Landsat +ETM, OCSF, TNC 2009

**Geographic Coordinate System**  
 Name: GCS WGS 1984, Datum: D WGS 1984, Spheroid: WGS 1984

**Projected Coordinate System**  
 Projection: Universal Transverse Mercator (UTM) Zone 50 North, Datum: D WGS 1984, Spheroid: WGS 1984



Right: Captive orangutan from KNP.



**Law enforcement:** Since decentralization, law enforcement efforts have decreased, leading to an increase in hunting and trading of wildlife. There are increasing reports of orangutans in captivity, indicating that illegal trade is still thriving.

**Companies:** Several extractive companies are located on the periphery of KNP (Figure 4). Many of these companies are involved in the multi-stakeholder group, Friends of Kutai (*Mitra Kutai*). They include concessionaires PT Badak (natural gas), PT Kaltim Prima Coal (coal), Pupuk Kaltim (fertilizer), PT Indominco (coal), and PT Surya Hutani Jaya (timber plantation). The USAID/OCSP Private Sector Sustainability Fund (PSSF) will capitalize on the existence of this group and help strengthen *Mitra Kutai* and the commitment of its members to KNP and conservation of orangutans.

The increase in concessions and their activities adjacent to KNP has facilitated roads and access into KNP, leading to an increase in hunting, wildlife trade, and illegal logging inside the park (Meijaard *et al.* 2005). Several cases have been reported where orangutan populations are found in pulp or palm oil plantations and have caused significant losses to these companies. These companies have begun to perceive orangutans as a liability. Two plantation concessions operating adjacent to KNP, PT Surya Hutani Jaya and Sumalindo Hutani Jaya have reported financial losses from orangutan damaged *Acacia* trees (Nardiyono *et al.* 2008). They currently are seeking advice from organizations, including OCSP, on how to handle this issue.



DONALD BASON / OCSP

**Above: Orangutan nest inside the Sumalindo Hutani Jaya plantation concession, where orangutans have caused considerable damage.**

**Below: Forest corridor within the same concession.**

The private sector has begun to realize that poor management of orangutan issues can have international impact. In an effort to manage these issues appropriately, both of these concessions contacted the Borneo Orangutan Survival Foundation to help capture and relocate the orangutans to KNP. So far, at least 44 orangutans have been relocated from these two concessions, but the cost of translocation is extremely expensive. The cost to rescue an orangutan is roughly \$1,000, plus an additional \$140 per month to rehabilitate and maintain an orangutan in captivity.

Two companies approached TNC, an OCSP partner, to provide recommendations on how to manage orangutan habitat in their plantations. TNC conducted surveys and provided their recommendations to the concessionaires. Surya Hutani Jaya accepted these recommendations, which included improving its buffer zone bordering KNP and rehabilitating riparian areas within the plantation. While the concessionaire's response was positive, conservation of orangutans requires a much broader landscape level approach, involving a network of additional conservation set-asides and further collaboration between the concession and KNP authorities, as well as the restoration of degraded forest within KNP.



DONALD BASON / OCSP

**Local Government:** Following earlier political reforms and decentralization, local government Law no. 22/1999 devolved greater authority to district governments. Generally districts measure success through economic growth rate and increased revenues. In East Kalimantan the main sources of income are oil, gas, coal mining, timber, and palm oil plantations. Consequently, local governments convert as much forest as possible to various concession sectors as a way to maximize revenues. Other interests, such as conservation or development of alternative income sources for local people, are rarely considered.

Data Source:

- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, and Sub-District, BAPPEDA East Kalimantan 2005
- Forest protection status and Forest Concession Types, Ministry of Forestry Republic of Indonesia
- Mining Contract of Work (CoW), Ministry of Energy and Mineral Resources

Geographic Coordinate System

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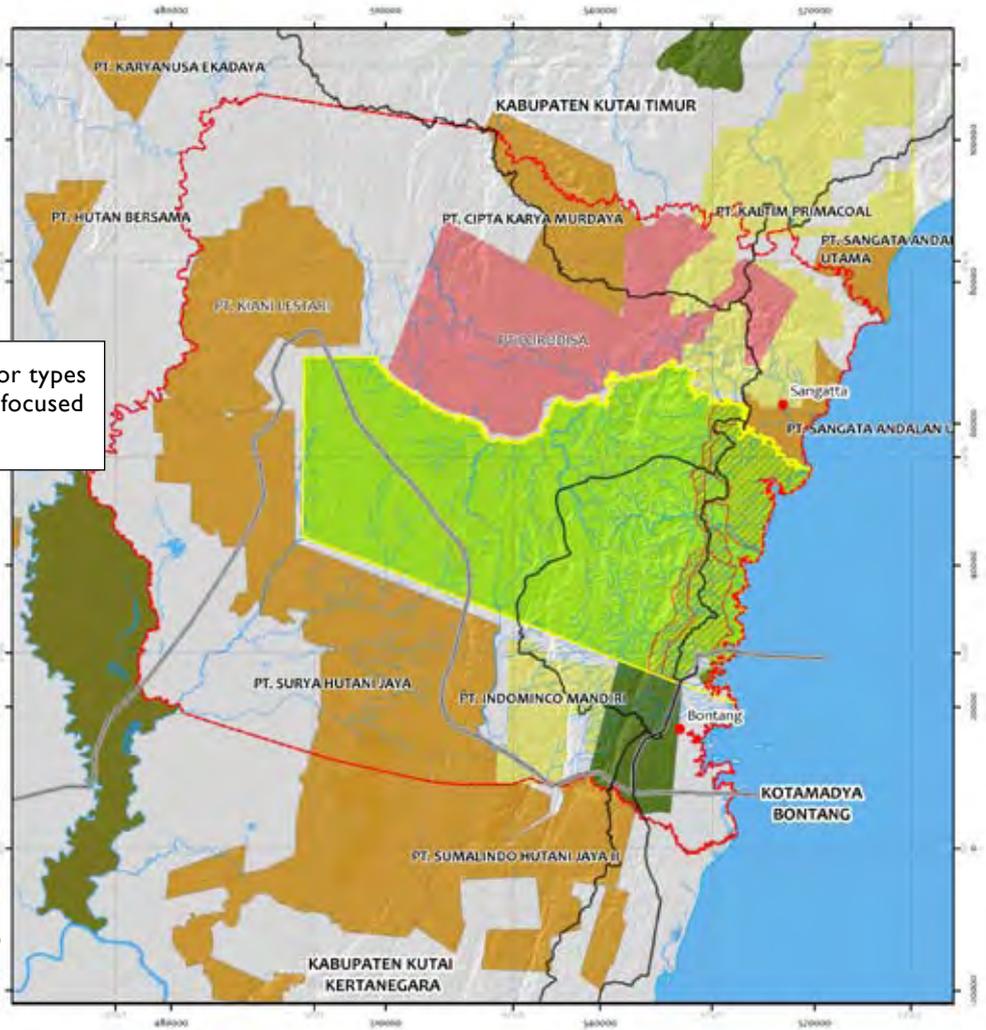
Projected Coordinate System

Projection: Universal Transverse Mercator (UTM) Zone 50 North, Datum: D WGS 1984, Spheroid: WGS 1984

Figure 4: Map of concession sector types in and adjacent to the Kutai focused site, East Kalimantan.

LEGEND

- Regency capital city
  - ~ Administrative boundary
  - ~ River
  - ~ Kutai landscape boundary
  - ~ Kutai National Park boundary
  - ~ Road
- Forest Status**
- Protected Forest (HL)
  - Nature Reserve (HWSA)
  - National Park
- Concession Types**
- Industrial Timber Plantation (HTI)
  - Natural Forest Concession (HPH)
  - Mining
  - Proposed area conversion into APL



**Site specific strategy and conservation plan:** Recognizing that enforcement issues are a key problem in KNP, OCSP has engaged ICITAP to increase the capacity of enforcement officers and KNP management infrastructure. KNP has become ICITAP's national geographic focus and pilot for its environmental crimes project. The site conservation plan developed by TNC, OCSP, and ICITAP focuses on collaboration with local concessionaires to increase *in situ* conservation efforts, increasing and improving law enforcement efforts, and developing outreach campaigns to increase public awareness.

Right: Neil Makinuddin – OCSP’s East Kalimantan coordinator, Chris Fong – OCSP’s Private Sector Sustainability Facility Advisor, and Gatut Supriadi from the Sinarmas Forestry Group, discuss the proposed forest corridor within the Sinarmas concession to help protect orangutans.



DONALD BASON / OCSP

## Dairi and Pakpak Bharat focused site

The area of this focused site is defined by the administrative boundaries of Dairi and Pak Pak Bharat as outlined in Figure 5.

**History:** The Dairi-Pakpak Bharat forest block is a natural habitat of rare tropical flora and fauna including a large proportion of endemic species, including the Sumatran Tiger (*Panthera tigris*), orangutan (*Pongo abeli*) and Serow (*Capricornis sumatraensis*). A 2004 Population Habitat and Viability Assessment (PHVA) estimated an orangutan population of about 130 individuals but only recorded orangutans in the general region, based in Batuardan and Dolok Simbelin. A more recent survey (Suci *et al.* 2009) suggests a minimum orangutan population of 267 individuals, with the Dairi-Pakpak Bharat forest block in Siranggas being an important North Sumatra sanctuary area for orangutan. These areas are predicted to be a hybrid zone for *Hylobates lar* in Sumatra, a northern species, and *H. agilis*, a southern species. Even though it is not identified as an important bird area (IBA) itself, the focus site is surrounded by four IBAs.



DONALD BASON

**Above: The Dairi-Pakpak Bharat forest block is believed to contain one of the last remaining wild Sumatran Tiger populations.**

**Box 2: Summary of orangutan situation in Dairi and Pakpak Barat focus site**

Population size	Medium, population of < 267.
Degree of threat	High: Land conversion stimulated by land-use reallocation policies. Exacerbated by in-migration from North Sumatra.
Area	335,107 ha.
Legal status	Mixed: Production Forest (23,686 ha), Limited Production Forest (122,830 ha), Protected Forest (101,297 ha), Nature Reserve (5,704 ha) and No forest status (81,642 ha).
Uniqueness	Dairi-Pakpak Bharat forest block a mixture of lower and upper montane forests with potential primate hybrids present. Surrounded by 4 important bird areas. Largest area of forest in SUMUT.
Likelihood of measurable impact	Medium.
Political will	Medium. Ministry of Forestry will soon establish Forest Management Unit (Kelompok Pemangku Hutan).
Leverage	Medium. OCSP funded model conservation village program. Conservation International developed organic coffee agriculture program near Siranggas Nature Reserve.

The Dairi-Pakpak Bharat forest block was previously managed by the Dairi district, but since 2003, it was divided to become Dairi and Pakpak Bharat districts. Some parts of the Dairi-Pakpak Bharat forest block (Batu Ardan Protected Forest and Sিকেহকিকে Nature Reserve) are identified as key biodiversity areas in Sumatra by Conservation International (CI-IP, 2007). Viewed together, *Zoogeographic Divisions and Eco-Floristic Sectors* identified in Sumatra by MacKinnon (1982) and Laumonier (1992), provide some insights into potential sub-biogeographic boundaries in Sumatra. Dairi and Pak Pak Bharat districts appear to be situated on the boundary for fauna, and less so for flora, and separate can referred to as the northern and

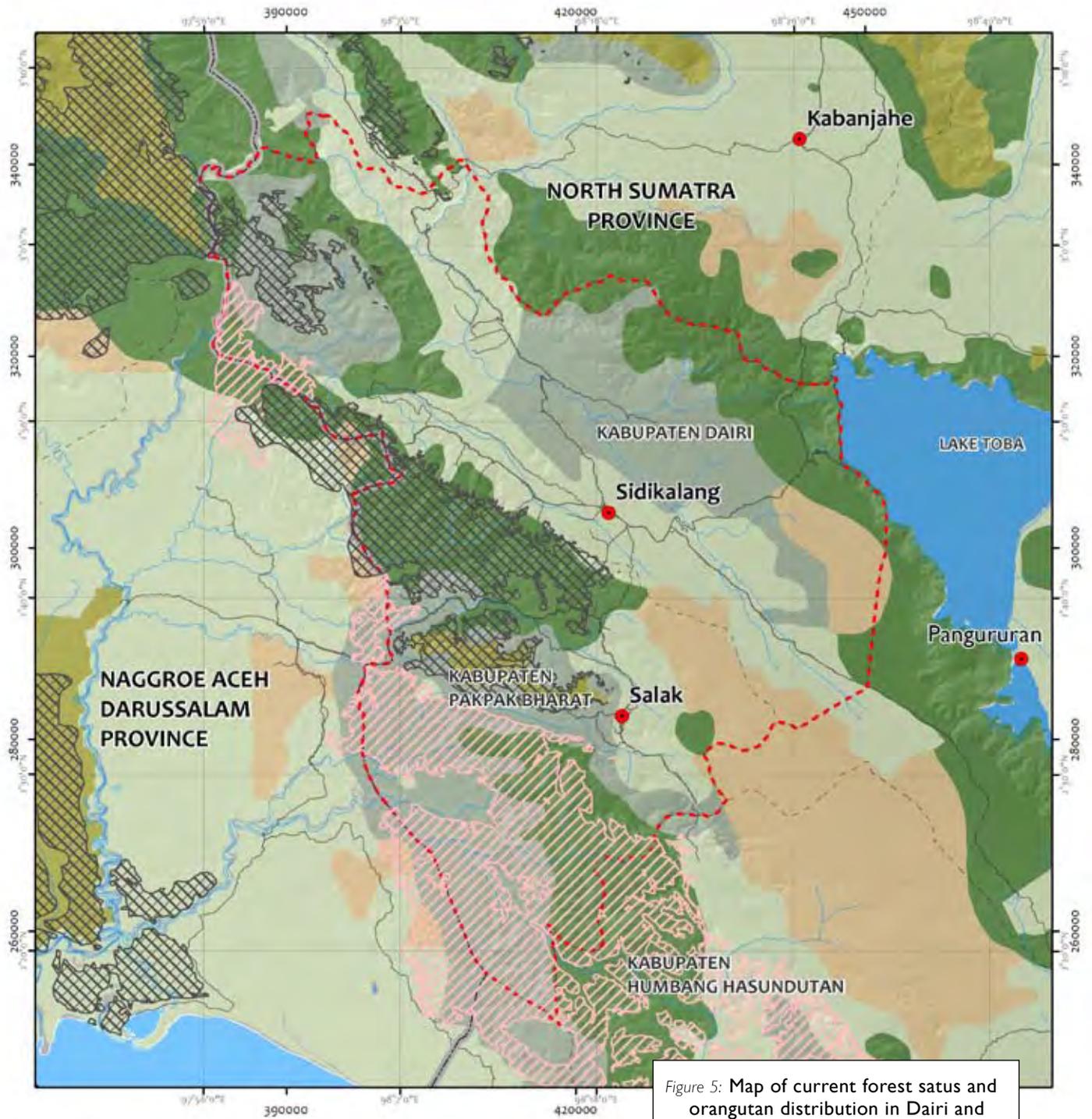
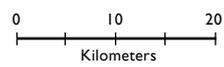


Figure 5: Map of current forest status and orangutan distribution in Dairi and Pakpak Bharat focused site, North Sumatra.

**LEGEND**

- Regency capital city
- Administrative boundary
- ~ River
- Dairi and Pakpak Bharat landscape boundary
- ~ Road
- Orangutan Distributions**
- PHVA 2004, updated (Suci et al., 2009)
- Predicted

- Forest Status**
- Protected Forest (HL)
  - Nature Reserve (HWSA)
  - Limited Production Forest (HPT)
  - Production Forest (HP)
  - No Forest Status (APL)



**Data Source:**

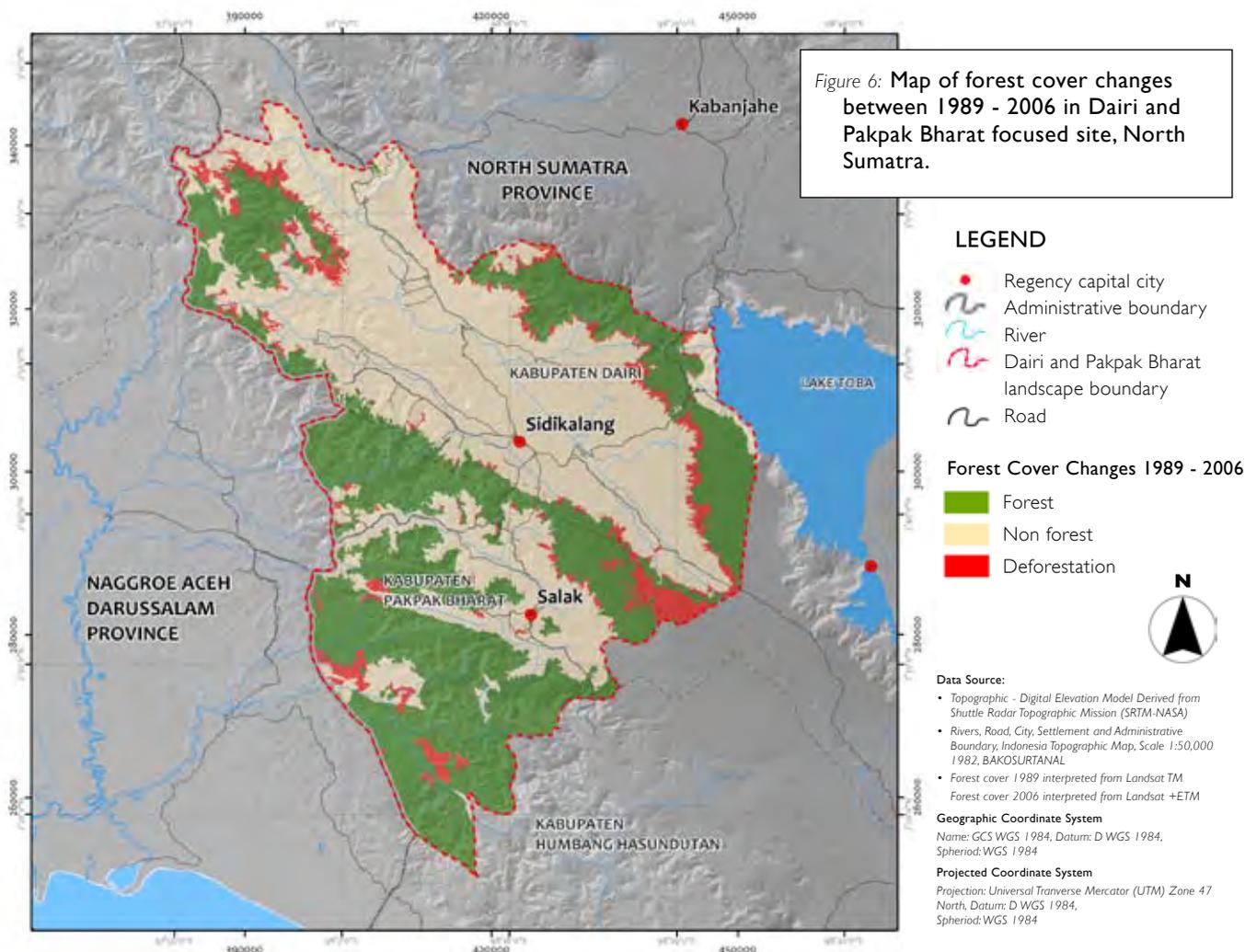
- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, Settlement and Administrative Boundary, Indonesia Topographic Map, Scale 1:50,000 1982, BAKOSURTANAL
- Orangutan distribution update: Atmoko, S.S.U, Azwar, Gondarisan, Mekidit, A., Nuzuar, Sulityo, N. and Thoha, A.S. 2009. Survei sebaran orangutan di Blok HL Batu Ardian dan SM. Siranggas+, Kabupaten Dairi dan Pakpak Bharat, Sumatera Utara

**Geographic Coordinate System**  
 Name: GCS WGS 1984, Datum: D WGS 1984, Spheroid: WGS 1984

**Projected Coordinate System**  
 Projection: Universal Transverse Mercator (UTM) Zone 47 North, Datum: D WGS 1984, Spheroid: WGS 1984

southern Toba Lake biogeographic units. As such, these two districts appear to be at an important biogeographic interface that when investigated more closely, may contain unique elements of Sumatran biological diversity. This forest block is also an important catchment area for some cities in North Sumatra and Aceh (Salak, Panguruan, Dolok Sanggul, Singkil and Subusalam), as well as for two important hydroelectric power plants (PLTA Asahan and PLTA Lae Renun).

Major threats to forest conservation in these districts are agriculture encroachment, land use changes that lead to forest degradation, and illegal logging. The overall extent of forest change is shown in Figure 6. Future land conversion will be determined by current land-use reallocation policies, especially in Pakpak Bharat, where the majority of the district is apportioned as forest and a small part is allocated for development. The main external factor affecting reallocation of land-use comes from granting concessionaires extra land for plantations. Recently, North Sumatra has had a shortage of land allocated to development. Also a factor is the increase in forest fires, resulting from land clearing for agricultural development by local communities, which are prevalent in Dairi-Pakpak Bharat. Infrastructure development, especially planned road development through continuous forest will fragment forests and their biological diversity, especially orangutans. Wildlife poaching and trading occurs in Dairi-Pakpak Bharat, specifically for the Sumatra Tiger, orangutan and Serow. OCSP reports that these illegal activities are not conducted by local communities but by an organized group of hunters from elsewhere.



**Encroachment:** Based on GIS interpretation of 1989 and 2006 Landsat images, the distribution of forest and non-forest was identified for Dairi-Pakpak Bharat landscape. A change analysis also identified the areas that had been converted over this 17-year period. Population pressures from settlements adjacent to forested areas will stimulate further land conversion. The greatest threat to this landscape is in-migration from other areas in North Sumatra, since it is easy to obtain land from local custom authorities (the distribution of which is represent by the map of Dairi-Pakpak Bharat settlements in Figure 7). Migrants often request forested land from local leaders, if they agree, require only a symbolic custom ceremony to transfer ownership of such land.

Figure 7: Map showing settlement areas in the Dairi and Pakpak Bharat focused site, North Sumatra.

**LEGEND**

-  Regency capital city
-  Administrative boundary
-  River
-  Dairi and Pakpak Bharat landscape boundary
-  Road
-  Settlement



**Data Source:**

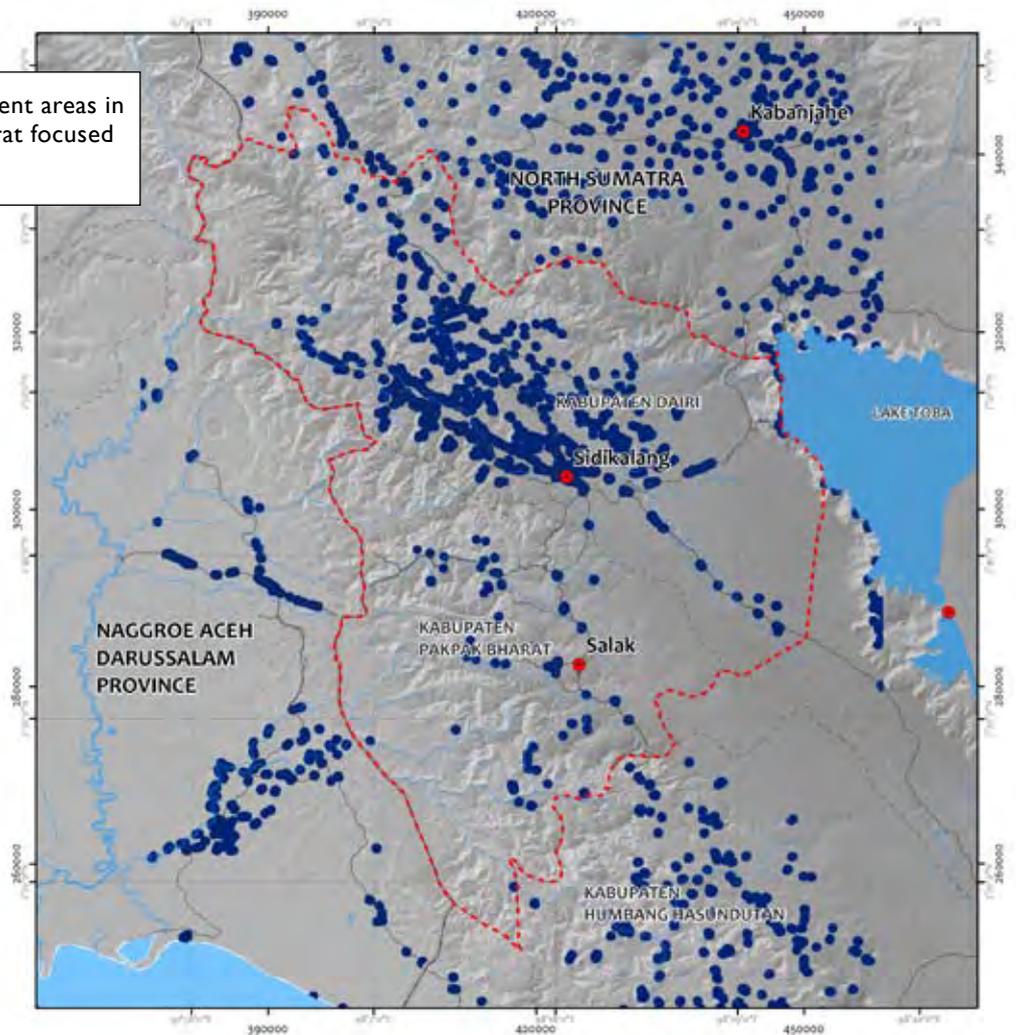
- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, Settlement and Administrative Boundary, Indonesia Topographic Map, Scale 1:50,000 1982, BAKOSURTANAL

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**Projected Coordinate System**

Projection: Universal Transverse Mercator (UTM) Zone 47 North, Datum: D WGS 1984, Spheroid: WGS 1984



Dairi-Pakpak Bharat communities use a significant amount wood for fuel and this increases the degradation to the forests margins. for the fuel is for household use as well as for to distill the perfume oil from Patchouli (*Nilam*) leaves, which is exported overseas. The patchouli plant is productive if it is planted only three times at one site. Thus, patchouli cultivation is a form of 'swidden' farming and requires constant felling and clearing of forests, leaving behind degraded land.

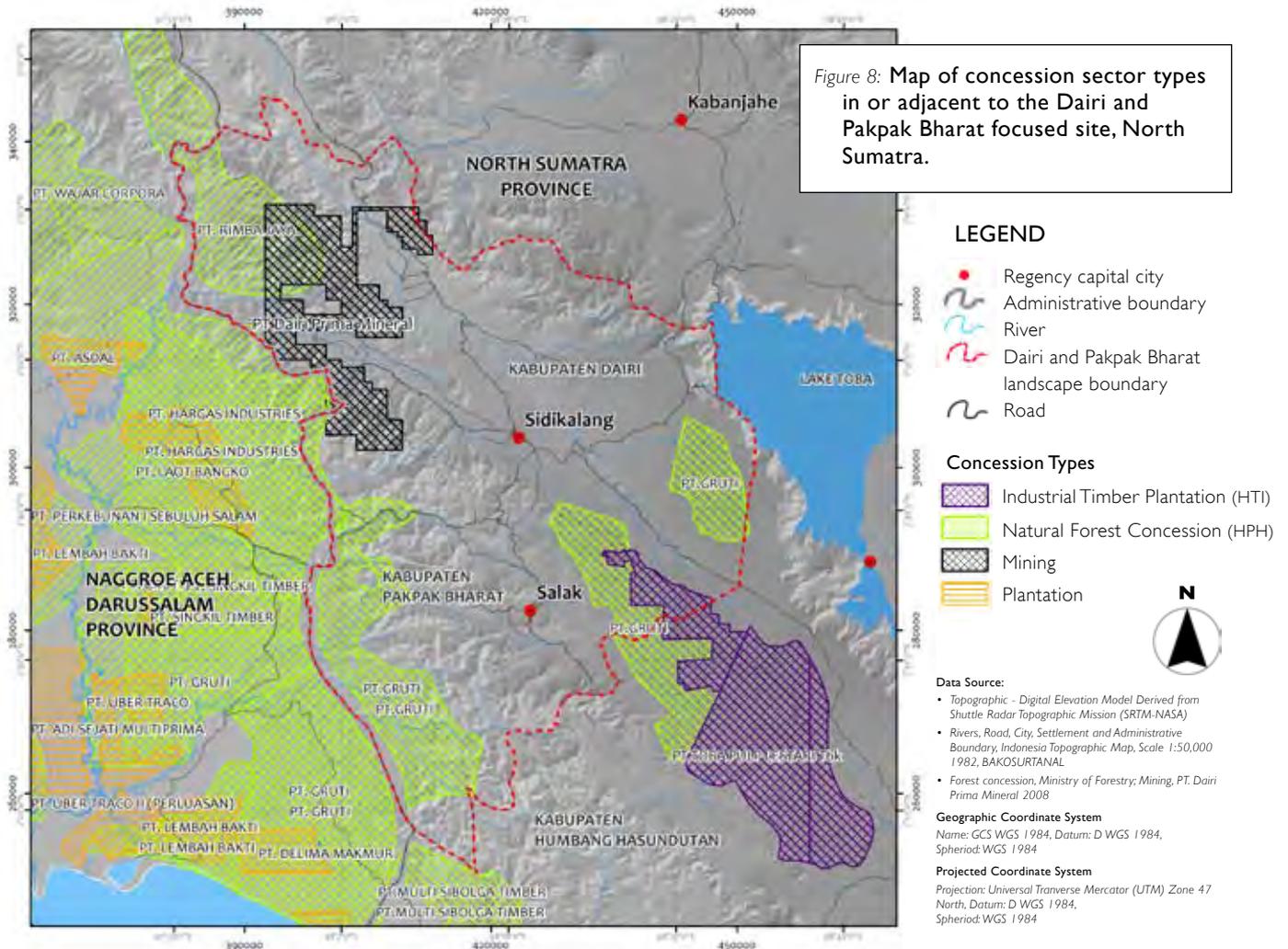
**Left: Population pressures from settlements adjacent to forested land in the Dairi-Pakpak Bharat area often lead to land conversion.**

**Law enforcement:** Since decentralization, law enforcement efforts have decreased resulting in an increase in illegal activity, such as hunting and trading of wildlife, and human encroachment in forests. There are increasing reports of orangutans in captivity, indicating that illegal trade is still thriving. In Dairi-Pakpak Bharat, the OCSP Pusaka consortium grantees confiscated three orangutans from villagers that live nearby the project area. Neither Dairi and Pakpak Bharat districts have a forest ranger based in their districts, which leads to inadequately enforced wildlife protection laws.

**Companies:** Several extractive companies are located inside and on the periphery of this forest block (Figure 8).

**Timber concession:** PT Gruti owns the only timber concession in Dairi-Pakpak Bharat forest block through a permit based on the Ministry Decree No. 596/Kpts-VI/99. This permit has expired and PT Gruti has formally requested an extension of this permit. At this time, they have ceased their field activities in all three concession blocks (Block 1 in west Pakpak, Pakpak Bharat - 28,601 ha; Block 2 in east Pakpak Pakpak Bharat - 18,891 ha; and Block 3 in Kabupaten Dairi - 9,646 ha).

**Pulp and Paper Timber Concession:** There are no pulp and paper timber concessions in these two districts, but there is one in a nearby district. It is in the southern part and is owned by PT Toba Pulp Lestari, who have requested additional land that would expand their operations into Dairi-Pakpak Bharat.



**Mining Concession:** PT. Dairi Prima mining, a joint venture company between PT. Aneka Tambang and Herald Resources Ltd from Australia, has a concession from the Ministry of Mining and Energy to mine zinc and lead in Dairi. Due to the area's protected forest status, PT. DPM must conduct their operations in a closed pit system



**Above: Conservation International has developed an organic coffee agriculture program near the Siranggas Nature Reserve.**

**Plantation Concession:** Since the elevation of this area is mostly >800m above sea level, there are no palm oil plantations. However, since the mid 1980s a ginger plantation of 1,700ha owned by PT Agro Citra Wahana Mas Gemilang (ACWGM) has used this area for their operations, but has recently collapsed due to conflict with local communities. PT Tunggal Menara Jaya (Kec. Siempat Rube, Pakpak Bharat) and PT Wahana (Kec. Berampu, Dairi) operate coffee plantations.

**Local Government:** After political reform and decentralization, the local government Law no. 22/1999 devolved greater authority to the district government. This action encouraged the partition of existing districts, including Dairi. In 2003, this district was divided into two separate districts, Dairi and Pakpak Bharat districts. This division did not take into account environmental factors, as it left almost 80% of the Pakpak Bharat district with forest status, with the remainder set aside for development. In Dairi most forests have been converted as the local government has tried to convert as much forest as possible to development through re-allocation of land, without considering other interests such as conservation or developing income for local people through sustainable use of natural resources.

**Site specific strategy & action plan:** Recognizing the threats to this forest block, OCSP conducted a target driven conservation actionable plan exercise. OCSP deployed a senior Indonesian ecologist to establish ecological and environmental information, which included identification of major biodiversity values and biological 'hotspots', threats, both current and future, and the enabling environment for implementation of conservation activities. This was combined with identification of a possible set of conservation targets and a spatial analysis of threats to these targets. This document will guide the preparation of a conservation action plan for this focus site (Manullang 2009).



**Above: Orangutan pre-survey dialogue and sketch map discussions with communities in the Dairi Pakpak Bharat focused site.**

OCSP will try to establish a land council for these two districts. This will be a multi-stakeholder group focused on enabling open discussion of issues related to rational land use planning and implementation. Members of this council, assisted by OCSP, will conduct several activities including integrated spatial planning, establishment of best management practices throughout these districts, improvement of relationships between private/public actors, identify environmental management mechanisms, and establish a mechanism to monitor and evaluate agreed upon voluntary practices.



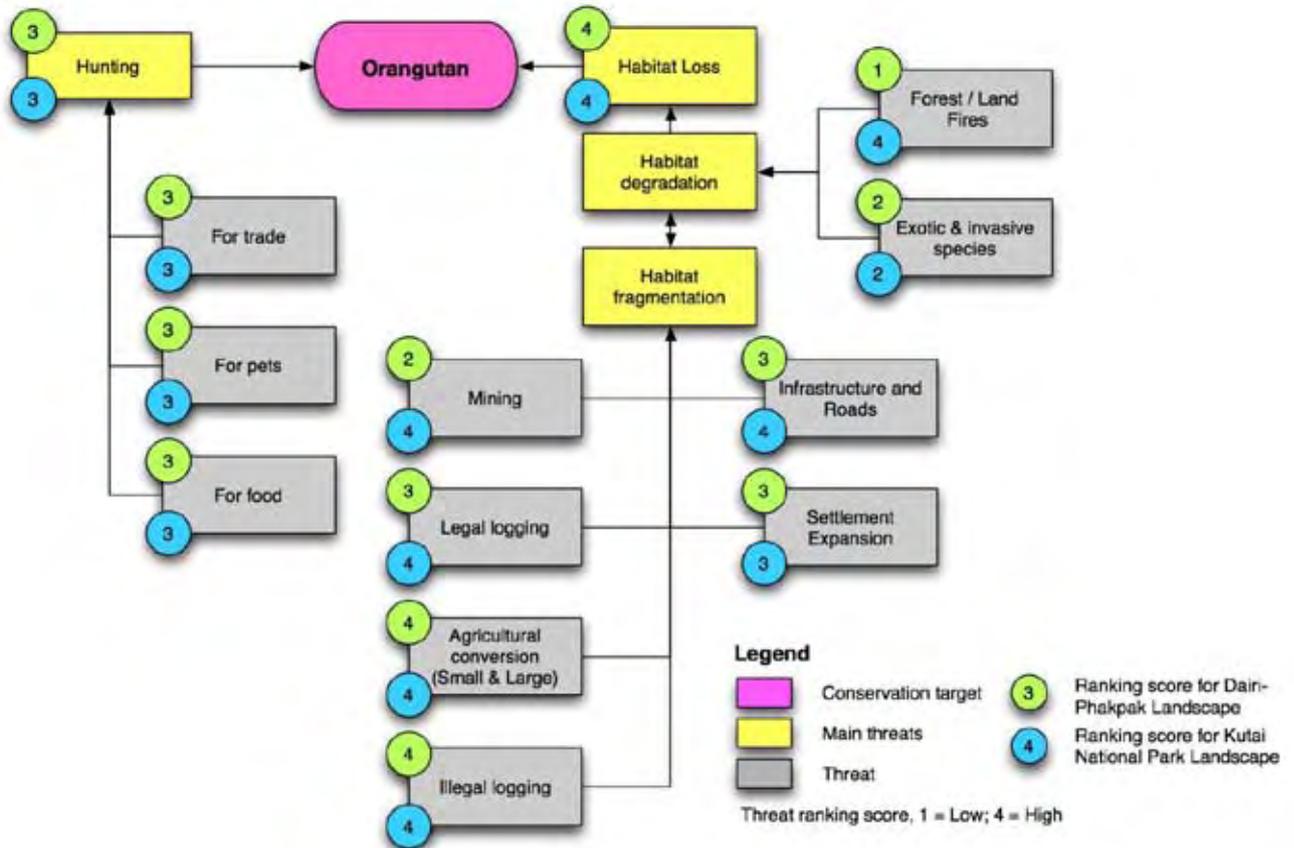
*The orangutan population inside KNP is officially estimated at 600 individuals, but surveys conducted by OCSP in two timber plantations on the park's southern border found an orangutan population of over 2,500 animals. In the Dairi-Pakpak Bharat forest block there is an estimated orangutan population of 267 individuals although some surveys indicate that orangutan numbers may be larger.*

# Overview: Global Threats to Orangutan

Several approaches to orangutan conservation have not been as successful as they might have been. Generally there has been insufficient coordination and sharing of information and expertise between the institutions involved in orangutan conservation. In some instances, these institutions actively compete against each other. OCSP strives to present a clear message on behalf of several actors by focusing on the two most critical issues to orangutan conservation: prevention of forest conversion and hunting.

These two principal threats emerge clearly in an analysis that ranks level of threats at both focused sites of Kutai and Dairi-Pakpak Bharat districts (see below).

Figure 9: Global ranked threats to orangutan in PSSF focused sites.



## Nature of threats

The major threats facing orangutans are similar in both Kutai and Pakpak Bharat, including habitat conversion, degradation and logging, both legal (more seriously in Kutai) and illegal. However, both land degradation and logging lead to land conversion, which is the largest problem facing conservation. In both focus sites, hunting is a moderately serious threat. In Kutai, mining is also considered a serious threat.

**Land conversion:** Land conversion is increasing through land use reallocation policies, especially in the Pakpak Bharat focus site. The majority of the lands in this district have forest status with less land allocated for development. Requests from concessionaires for plantation expansion are the main external factor that effects reallocation of land for development. This is especially true in North Sumatra where there has recently been a shortage of land allocated plantation development.

**Hunting:** Wildlife poaching and trading occurs in Dairi-Pakpak Bharat, especially for the Sumatra Tiger, orangutan and Serow. OCSP reports that these illegal activities are not conducted by local communities but by an organized group of hunters from elsewhere. Field surveys conducted by TNC and OCSP found some evidence of wildlife poaching, specifically for orangutan in areas bordering KNP. However, quantitative information documenting this poaching is limited.

**Forest fires:** Resulting from land clearing for agriculture by local communities, fires are prevalent in Dairi-Pakpak Bharat, but these are not as serious as those that occur in Kutai, where they cause considerable degradation. In Kutai, these fires often destroy tree seed banks in the soil and prevent natural regeneration of vegetation and forest, which leads to land conversion.

**Infrastructure development:** Planned road development through continuous forest threatens to seriously fragment forests and their contained forest biological diversity, especially orangutans.

**Settlement and population pressure:** At edges of forested areas population pressures stimulate land conversion. The major factor of population pressure is caused by in-migration in both of the PSSF sites. Migrants come from Sulawesi in KNP, while in Dairi-Pakpak Bharat they mostly come from other parts of northern Sumatra.

**Firewood extraction:** Wood taken from forests by local communities for fuel use steadily degrades marginal forests in these focus sites. In Dairi and Pakpak Bharat this is exacerbated by fuel use for distillation of perfume oil from the Patchouli (*Nilam*) plant, which is exported.

**Patchouli cultivation:** In Dairi and Pakpak Bharat, Patchouli cultivation is only productive if it is planted no more than three times at one site. Because of this, Patchouli cultivation is a form of 'swidden' farming and requires constant felling and clearing of forests, leaving behind degraded land.

**Mining:** Mining operations have enormous potential to harm the environment through direct clearing of forests and from effluent flows into rivers in these areas. In addition to PT. Dairi Prima Mining which mines lead (*tima hitam*) in Dairi, OCSP has identified other small miners moving into the area, such as PT Bintang Lapan and Triple 8, who mine near Malum village, Pakpak Bharat. Coal miners are the prevalent mining operators in the Kutai focus site. There are at least two large-scale mining operations in this area, PT Kaltim Prima Coal and PT. Indominco.



**Above: Small sawmill inside KNP. Local governments have allowed communities to encroach inside KNP resulting in degradation of the forest and an increase in illegal logging. Further, inhabitants living inside KNP place limited value on the importance of forest and orangutan conservation.**

DONALD BASON / OCSP



*The ability of the orangutan conservation actors to abate the two principle threats to orangutan, land conversion and hunting, will determine the possible survival of this species in the wild.*

*OCSP will use this analysis and baseline information to develop and implement tailored programmatic activities at these focus sites.*



*Utilization of satellite-derived maps and GIS analysis as decision making tools for conservation are commonly used to identify threats to biodiversity.*

# General Approach to Spatial Analyses

Available spatial data in the PSSF focus sites provides important, and often is the only fine-scale information on forest, land and watershed conditions. The use of satellite-derived maps and GIS analysis as decision making tools for conservation is common (Gould 2000), especially when identifying threats to biodiversity within eco-regions and ecosystems (Dinerstein *et al.* 1995).

In this study, we limited our analysis to spatial data that reflected key ecological functions (e.g. watersheds, forest cover), complexity of utilization (e.g. number and variety of concessions, land conversion, roads, villages, etc) and administrative boundaries. For the Kutai focus site, our analysis covered 767,486 ha of land, including area in three kabupaten: Kutai Timur, Kutai Kertanegara and Bontang. For the Dairi and Pakpak Bharat focus site, an area of 335,107 ha was analyzed.

We used a GIS-based approach and applied multiple criteria evaluation (MCE) to identify threats to ecosystem integrity and orangutans in the PSSF focus sites. This approach's strength stems from the accuracy of the spatial data sets and the weightings accorded to the parameters that reflect the importance of various threats. These weightings resulted from data collected from selected scientific journal and outputs of group discussions involving individuals with excellent on the ground experience. When possible, existing spatial data sets were updated using remote sensed imagery. Since available spatial data sets came from a wide range of agencies (Table 1), there was often variable data quality, accuracy, and map projections. To maintain consistency, we standardized all data sets using a common reference system and spatial extent, as well as applying a raster analysis. Consequently, some vector layers were rasterized and all data-set were re-sampled into a spatial resolution of 100 m and geo-referenced with Universal Transverse Mercator projection (UTM). With Zone 50 North and 47 North, respectively, for Kutai and Dairi and Pakpak Bharat focused sites. We used ESRI ArcGis 9.3 with Spatial Analyst Extension (ESRI, Redlands, USA) to process these analyses.

## Approach to spatial analyses in focused sites

**Methodology:** Different spatial information can be applied when analyzing threats to biodiversity, native species such as the orangutan, and ecosystem integrity (Appendix 1). Due to the lack and inconsistent quality of the data, our analysis was based on four groups of data. These groups include: physical (elevation and slope); biological (forest cover and orangutan distribution, both known and predicted); areas of general high biodiversity and conservation value; and degree of accessibility (distance from roads, settlements and concessions areas).

Since these factors do affect or threaten the conservation of orangutan equally, there was a need to rank their impact. For example, proximity to concession types is not as large a threat to the orangutans as is the extent of canopy cover. Con-

sequently, when using an MCE approach a weighted linear combination (WLC), or loading factors approach, was established for each threat predictor layer (Table 2). This process is essential as it determines how individual factors will contribute relative to each other on a final composite threat map. For example, the deforestation threat type is ranked a high 3 while the sub-category of areas that are still forested is 1. Thus, the loading factor for forested areas is  $3 \times 1$ , or a very low 3 on this scale. Settlement generally has a lower impact than deforestation (2). However, for the sub-category "Within settlement and radius buffer 0 – 500 m from settlement border" a ranking of 3 was given. Therefore, the threat rank for this sub-category is  $2 \times 3=6$ , which is moderately high on this scale.

Table 1: GIS spatial data available for use in the threat analysis

Layer name	Source	Processing/Comment
Rivers	Topographic Map, Scale 1:50,000, Bakosurtanal	Distance layer evaluated using GIS
Roads	Topographic Map, Scale 1:50,000, Bakosurtanal	Distance layer evaluated using GIS
Settlements	Topographic Map, Scale 1:50,000, Bakosurtanal. SFM Mulawarman University and Landsat ETM+ for Kutai Landscape	Distance layer evaluated using GIS
Forest cover 1990s	Landsat TM	Unsupervised and visual interpretation of Landsat TM for 1990-1991 for Kutai landscape and 1989 for Dairi and Pakpak landscape
Forest change 1990s – 2006s	Landsat TM, ETM+, Global Land Cover 2008	Based on overlay map forest cover 1990s and 2006-2007 interpretation.
Mining concession	Contract of Work (CoW) maps, Department of Energy and Mineral Resources Mining	Digitized and Rasterized, Distance layer evaluated using GIS
Forest concessions	Indonesia Ministry of Forestry	Rasterized, Distance layer evaluated using GIS
Land suitability for agriculture and plantations	Land System and Land Suitability by RePPProt	Rasterized
Digital Elevation	Shuttle Radar Topographic Mission – NASA	Slope layer derived

Table 2: Loading factors applied for each major orangutan threat type sub-category in Dairi and Pakpak Bharat and Kutai Focused Sites

Threat Type	Threat Type Sub-category	Loading factors	Comments and Assumptions
Deforestation	Converted Forest	9	Higher forest cover affords superior orangutan habitat.
	Non Forest, but not converted	6	
	Forest	3	
Settlement	Within settlement and radius buffer 0 – 500 m from settlement border	6	Settlements are related to access to forest and that threats diminishes with increasing distance from settlements.
	Radius buffer 500 – 1000 m from settlement border	4	
	Radius buffer > 1000 m from settlement border	2	
Road network	Radius buffer 0 – 500 m from road network	6	Roads are major sources of access to forest and that threat diminishes with increasing distance from roads
	Radius buffer 500 – 1000 m from road network	4	
	Radius buffer > 1000 m from road network	2	
Mining	Within Contract of Work (CoW) area	9	Mining CoW tend to degrade orangutan habitat and that threat diminishes with increasing distance from CoW boundaries.
	Radius buffer 0 – 1000 m from CoW border	6	
	Radius buffer > 1000 m from CoW border	3	
Forest concession	Within Forest Concession block	9	Concessions tend to degrade orangutan habitat and that threat diminishes with increasing distance from concessions
	Radius buffer 0 – 1000 m from Forest Concession block border	6	
	Radius buffer > 1000 m from Forest Concession block border	3	
Forest status	APL (Others uses)	9	Forests classified for development (APL) are more likely to degrade orangutan habitat than those that are more protected.
	HPT,HP, HK (Production forest)	6	
	HSA,HL (Protected forest)	3	
Land suitability for agriculture/ plantation	Accumulation of crop type 12-17	9	Land designated higher for crops (12-17) are more likely to result in orangutan habitat being degraded and converted than those with a lower accumulation score (0-5)
	Accumulation of crop type 6-11	6	
	Accumulation of crop type 0-5	3	

In developing a map for biodiversity and conservation values in the focus sites, we created a GIS framework that included spatial information related to orangutan distribution maps and proxy areas considered important for biodiversity (Appendix 2). These themes were successfully developed by OCSP and partners to identify areas of high biodiversity and conservation value in northern Sumatra, with the development of a single strategic conservation spatial plan (Hardiono & Kitchener 2009). For the Kutai focus site, we developed a similar map using the above mentioned approach. However, due to lack of available spatial data from this area, we had difficulty developing 8 themes from the 12 listed in Appendix 2. The factors were treated as contributing equally to biodiversity and conservation values in this focus site (Figure 10). For Dairi and Pakpak, we updated the orangutan distribution based on reports from Hardiono & Kitchener (2009) (Figure 11).

Figure 10: Map of biodiversity & conservation values in Kutai focused site.

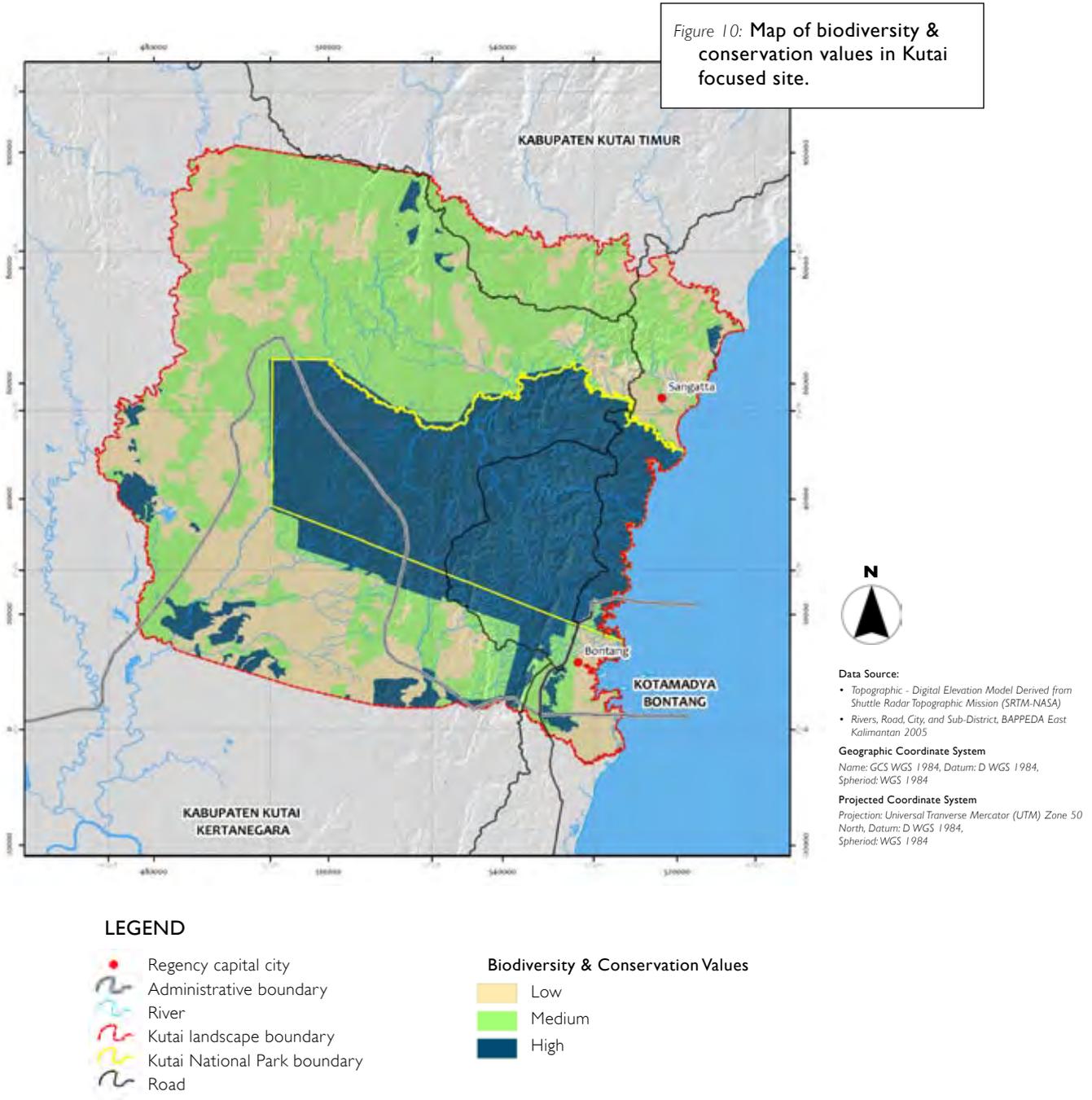


Figure 11: Map of biodiversity & conservation values in Dairi and Pakpak Bharat.

**LEGEND**

-  Regency capital city
-  Administrative boundary
-  River
-  Dairi and Pakpak Bharat landscape boundary
-  Road

**Biodiversity & Conservation Values**

-  Low
-  Medium
-  High



**Data Source:**

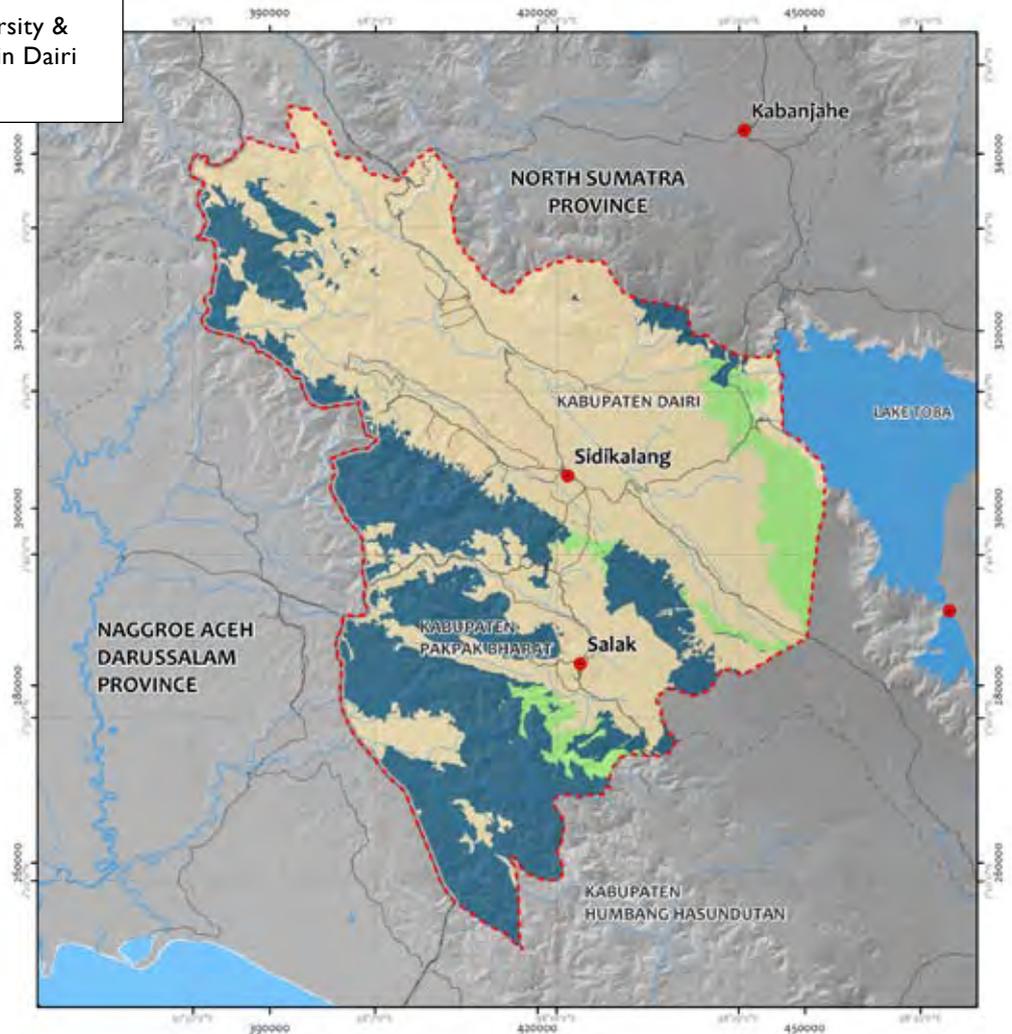
- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, Settlement and Administrative Boundary, Indonesia Topographic Map, Scale 1:50,000 1982, BAKOSURTANAL

**Geographic Coordinate System**

Name: GCS WGS 1984, Datum: D WGS 1984, Spheriod: WGS 1984

**Projected Coordinate System**

Projection: Universal Transverse Mercator (UTM) Zone 47 North, Datum: D WGS 1984, Spheriod: WGS 1984



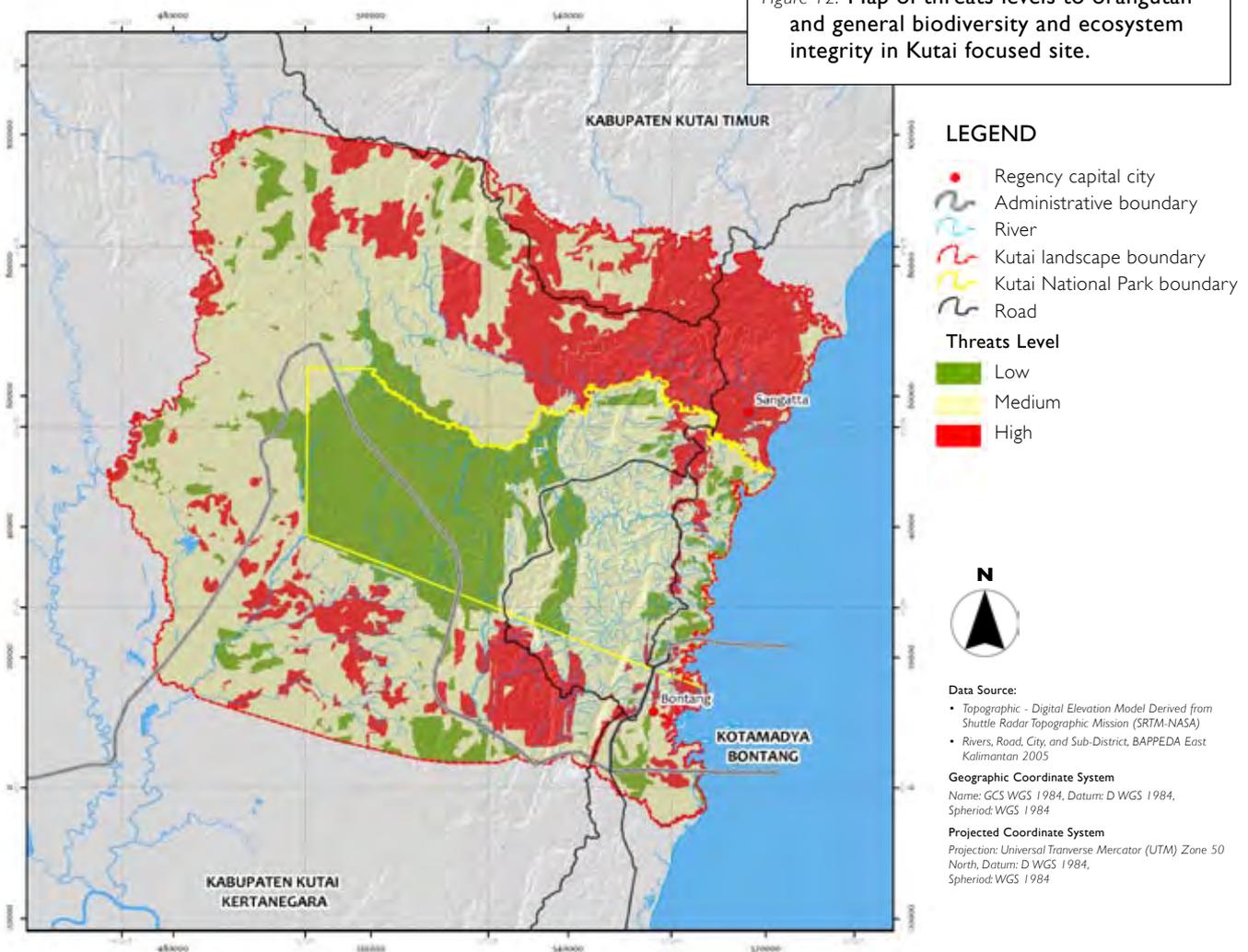
**Result and discussion**

Initially, we faced challenges in locating good quality spatial data at the landscape or semi-landscape scales for the Kutai focus site. Despite ongoing work on remotely sensed monitoring of forest cover by TNC and OCSP (the data only covers only 60 % of the Kutai focus site), it was difficult to apply this work when classifying current forest cover. Consequently, current forest cover spatial themes had to be updated and needed some applied general interpretation. Imagery collected over several years was used for some areas, but due to lack of recent good quality satellite imagery for the Kutai landscape, and the difficulty to differentiate between the various grades of forest disturbance, we define forest cover as all forests from primary forest (of which there is nearly none left in the landscape) to open-canopy (>30% canopy cover) forest areas. Further work is presently being undertaken to differentiate more accurately between primary, secondary, and degraded forest - keeping in mind that all these forests can regenerate to ecologically high value forests if well managed and protected. This latest work analysis of forest cover by OCSP indicates that of all the forest areas in inside Kutai National Park, approximately 26% was still in an ecologically good condition in 2007/2008. It is recommended that alternative new imagery is used with good quality coverage, such 2.5-meter resolution SPOT imagery or at least 15 m resolution ASTER

imagery. In addition, the development of a good spatial geo-database for the Kutai focus site would be beneficial for future GIS and spatial planning work. The availability of quality spatial data was not an issue for the Dairi and Pakpak Bharat focus site, since OCSP has conducted intensive spatial analysis of this area.

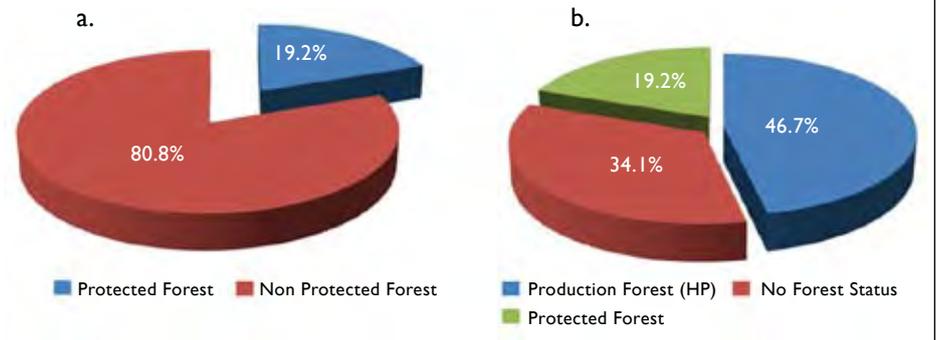
**Threats analysis:** Overall, the threat analysis for the two focus sites revealed interesting trends. The areas that are most threatened are shown in Figures 12 (Kutai) and 14 (Dairi and Pakpak Bharat). The presence of access networks (e.g., roads) and extensive natural resources extraction concessions (e.g. forest concessions) contribute significantly the high level of threat in both focus sites. Settlements in these sites appeared to be minor threats. However, we postulated that a finer-scale analysis, that incorporates various settlement-related parameters, such population density and ethnic distribution, may indicate that settlements are a more important threat. Some studies in Sumatra found that an increase in settlements and road networks are the major causes of deforestation in southern Sumatra (Kinnaird *et al.* 2003 and Gaveau *et al.* 2007). This supports the need for further detailed analysis.

Figure 12: Map of threats levels to orangutan and general biodiversity and ecosystem integrity in Kutai focused site.



In Kutai, approximately 80% (612,033 ha) of land was categorized with a medium to high level of threat - mostly in non-protected areas (65%, Figure 13a). None of these areas are located in land with forest status (Areal Penggunaan Lain - APL, Figure 13b). The threats analysis map revealed that the greatest threats outside

Figure 13: Percentage of medium to high threats level to orangutan and general biodiversity and ecosystem integrity in Kutai focused site.



KNP were from two large coal-mining concessions, PT. Kaltim Prima Coal and PT. Banpu Indominco. Both of these concessions are adjacent to important orangutan habitat in KNP (Figure 12). This is not surprising, as most of the coal mining companies in this area use open pit mining methods, which use a detonation of the coal followed by heavy excavation of upper layers to mine the coal. Only 37% of forest concession areas were categorized as having medium to high threats, as only a few areas maintain cover with forest or highly degraded forest according to our forest cover interpretations.

Figure 14: Map of threats levels to orangutan and general biodiversity and ecosystem integrity in Dairi and Pakpak Bharat.

**LEGEND**

- Regency capital city
- Administrative boundary
- River
- Dairi and Pakpak Bharat landscape boundary
- Road

**Biodiversity & Conservation Values**

- Low
- Medium
- High



**Data Source:**

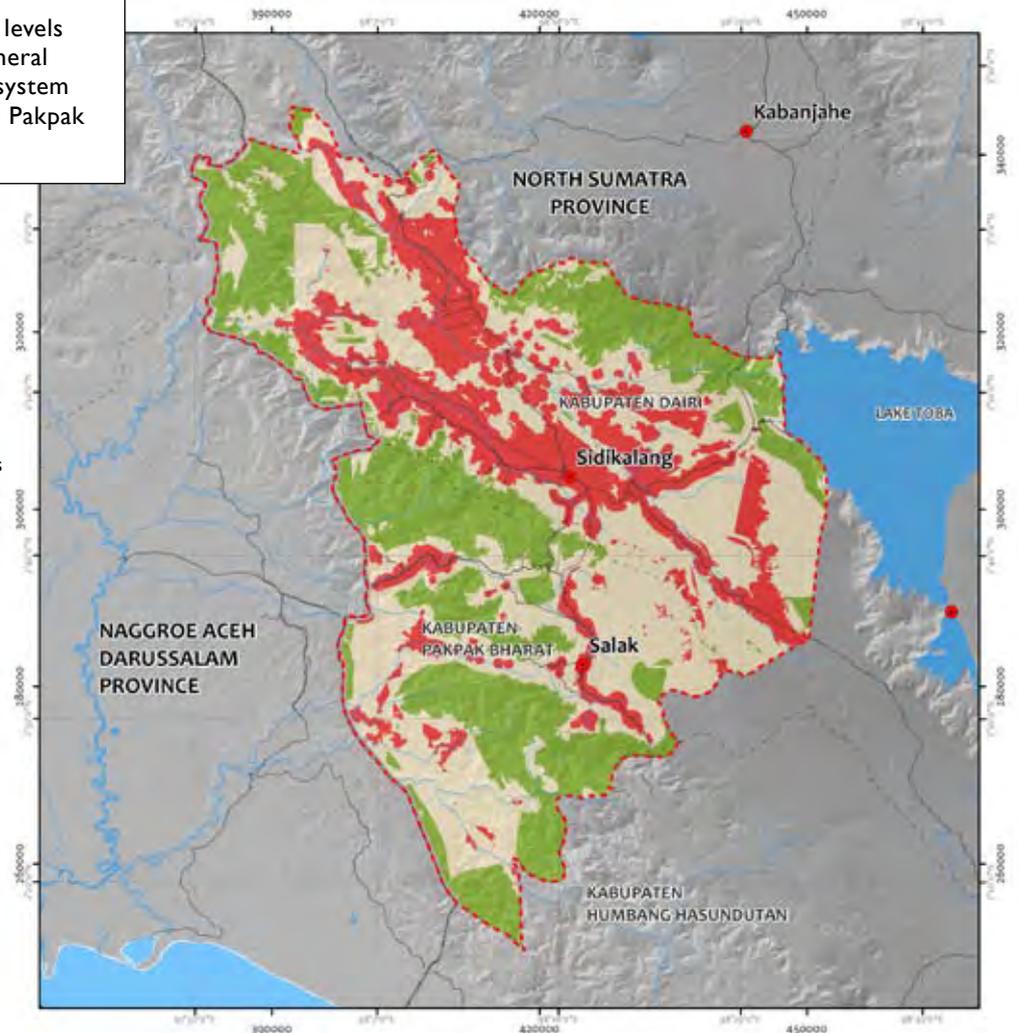
- Topographic - Digital Elevation Model Derived from Shuttle Radar Topographic Mission (SRTM-NASA)
- Rivers, Road, City, Settlement and Administrative Boundary, Indonesia Topographic Map, Scale 1:50,000 1982, BAKOSURTANAL

**Geographic Coordinate System**

Name: GCS WGS 1984, Datum: D WGS 1984, Spheriod: WGS 1984

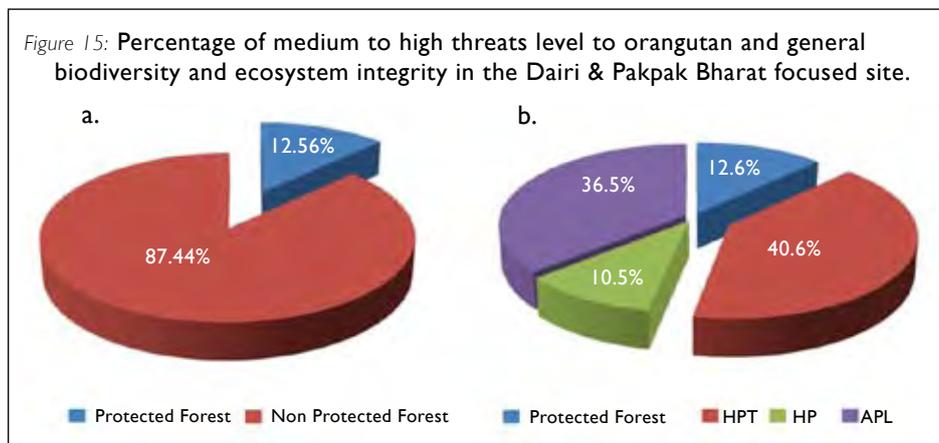
**Projected Coordinate System**

Projection: Universal Transverse Mercator (UTM) Zone 47 North, Datum: D WGS 1984, Spheriod: WGS 1984



The total area of the Dairi and Pakpak Bharat focus site is about 335,107 ha of land, of which some 224,289 ha (67 %, Figure 15a) is predicted to have a medium to high level of threat. Most threats were in non-protected areas (87.4%); with forest production areas (HPT & HP) contributing 51%; non-forest status areas (APL), 36.3%; and protected forests, 12.2% (Figure 15b). Threat maps showed that the potential areas of threat were not just from inside the protected areas but also from inside production forest area. In general, forest production areas are part of forest concessions and non-forest concessions such as the PT. DPM (Dairi Prima Mineral) mining company in the Dairi district and the forest estate (HTI, PT. Toba Pulp Lestari) in Dairi & Pakpak Bharat district and PT. Gruti in Pakpak Bharat district. The protected forests in several areas have potential threats similar to the area near the mining concession boundary as well as HPH and HTI mentioned above.

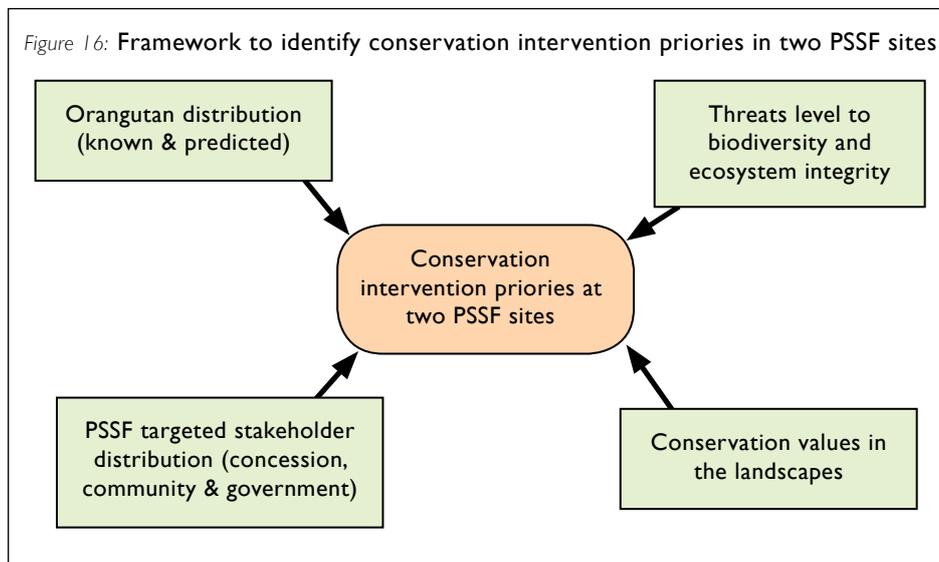
Figure 15: Percentage of medium to high threats level to orangutan and general biodiversity and ecosystem integrity in the Dairi & Pakpak Bharat focused site.



### Priority areas for conservation intervention

To evaluate areas requiring priority conservation interventions, we merged the map of these threats with the map of areas of highest conservation & biodiversity values. Areas with both high threats and high conservation values are a priority for conservation interventions. Two other factors, the PSSF targeted concessions and orangutan distribution (known & predicted, Figure 16), were also considered.

Figure 16: Framework to identify conservation intervention priorities in two PSSF sites

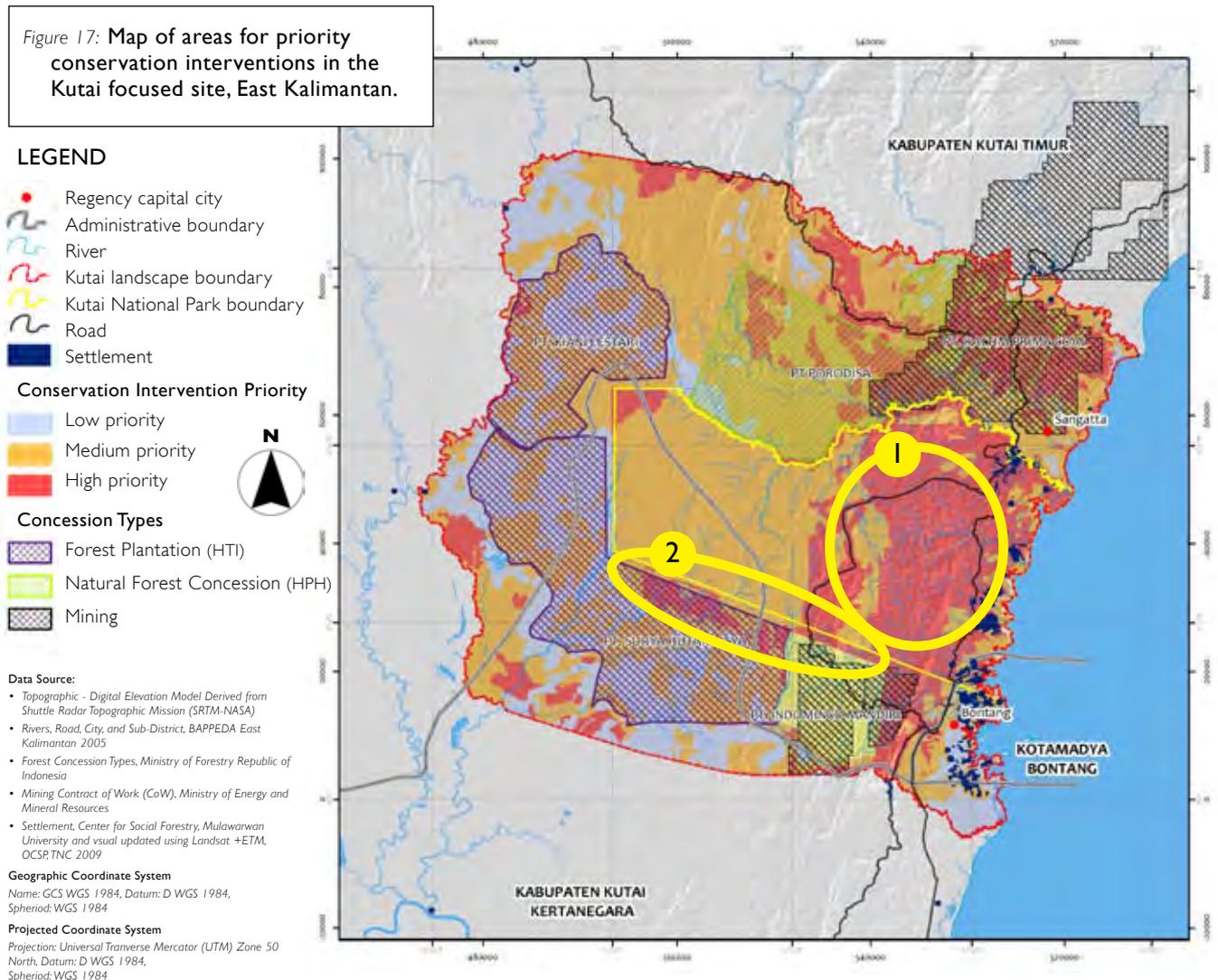


These were the results from this analysis, including both areas and priority actors for conservation activities and the development of partnerships. These are highlighted with numbered yellow circle. Development of a conservation action plan will need to be tempered with practicalities of working on the ground, including costs, stakeholder support, accessibility, and the possibility of effectively abating the threat.

**Kutai focus site:** In the Kutai focus site, most of the potential conservation intervention areas were inside KNP and in some buffer areas between KNP and adjacent concessions (Figure 17). We recommend the following two areas for highest priority interventions:

- I. **Inside KNP** - the focus should be alongside the Trans-Kalimantan road network that crosses the park. This area has suffered the most serious encroachment in this focus site. This has happened due to the easy access to the heavily forested areas by the lowland roads, coupled with an uncertain local political situation, which allows for vandalism. Immigrants have been attracted to this area, especially the Bugis tribal people from neighboring Sulawesi (Vayda & Sahur 1996). In addition, the threat of coal mining in these areas is significant. Our data gathered from The Ministry of Mineral Mining and Energy confirms that at least 7 companies have requested permits to mine in this area. When we over-

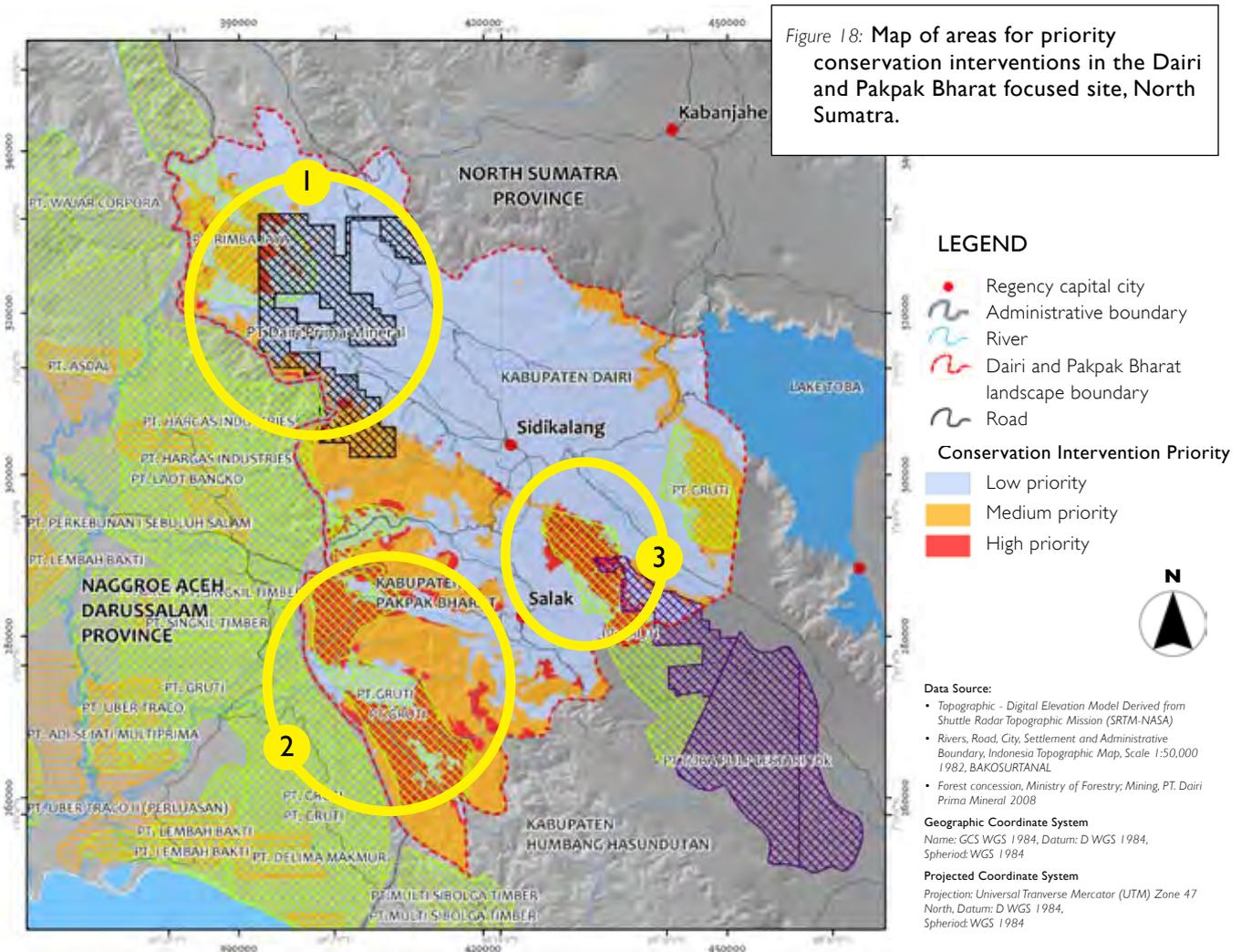
Figure 17: Map of areas for priority conservation interventions in the Kutai focused site, East Kalimantan.



laid with the draft of KNP zonation map, we found most of these locations are inside of rimba zone. According to Ministry of Forestry regulation, Number: P.56/Menhut-II/2006, regarding guidelines to develop national park zonation, it stated that only limited activities that allowing inside of this zone. To conduct massive intervention and adopt the criteria of zonation in this regulation, we plan to propose the revision of this zonation draft and allocate these areas as rehabilitation zone in this revision.

2. **To the south of KNP** - in the area adjacent to the forest estate (HTI) company, owned by PT. Surya Hutani Lestari and the coal mining company, owned by PT. Indominco Mandiri. This bordering zone, as well as the area that connects Hutan Lindung Bontang with KNP is crucial to maintain to protect the integrity of orangutan habitat in the focus site. The degraded areas of this buffer zone bordering these concessions need to be rehabilitated to ensure connectivity with the source areas. These interventions are necessary and confirmed by recent surveys that show that these border areas have a high density of orangutan nests (Nardiyono *et al.* 2008)

**Dairi and Pakpak Bharat focus site:** The three (3) areas for priority interventions in this site are spread out (Figure 18).



These areas are:

1. **PT. Dairi Prima Mining, the mining company concession** - surrounds Sinar Pagi, Dolok Simbelin hills (Register 69). This area has isolated orangutan habitat that needs focused conservation interventions. PT. DPM should be encouraged to develop a conservation management action plan to protect specific areas that should be set aside for conservation or be managed appropriately, with focused goals to reduce impact logging. The entire concession should adopt the OCSP Best Management Practices guide, recently developed for natural forests.
2. **HPH PT.Gruti concession** - in the Sibagindar subdistrict and the area surrounding Register 71 Sikulaping, in west Pakpak Bharat District. While the HPH PT.Gruti still has a permit, they have not been harvesting or developing a work plan. A focused conservation intervention would be to advocate that this concession should not be auctioned again to HPH and for the land to be re-classified as Hutan Lindung.
3. **HTI PT.Toba Pulp Lestari concession** - is in Adian Tinjoan Mountain (Register 67), and part of Dairi & Pakpak Bharat districts. For the last 10 years, this concession has been clearing land to develop a eucalyptus tree plantation. While orangutans are not found in this concession, our interpretation of satellite imagery shows that forest exploitation in the concession is uncontrolled and rapid, particularly in the last two years.

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# Appendix I

Major threat categories	Source of threat	Actor(s)	Probable area of threats
Deforestation	Legal forest conversion	<ul style="list-style-type: none"> <li>Forestry dept.</li> <li>Mining dept.</li> <li>Public works dept.</li> <li>Concessionaires</li> </ul>	<ul style="list-style-type: none"> <li>Conversion Forest (Kawasan Hutan)</li> <li>Areas where licenses granted</li> <li>Areas with natural resources</li> </ul>
	Illegal' forest conversion	<ul style="list-style-type: none"> <li>Encroachers</li> <li>Small scale local entrepreneurs</li> <li>Traditional agriculture with 'swidden'</li> </ul>	<ul style="list-style-type: none"> <li>Suitable land for agriculture or plantations</li> <li>Bordering densely populated areas</li> <li>Locations with natural resources</li> <li>Bordering areas where agricultural land scarce</li> <li>Close to access roads</li> <li>Relatively flat land</li> </ul>
	Forest conversion in traditional land ( <i>Tanah Ulayat</i> )	<ul style="list-style-type: none"> <li>Adat members</li> </ul>	<ul style="list-style-type: none"> <li>Within <i>tanah ulayat</i></li> </ul>
Degradation	Harvesting of natural resources	<ul style="list-style-type: none"> <li>Locals</li> <li>Small scale local entrepreneurs</li> <li>IPK holders</li> <li>Hunters</li> <li>Fuel wood collectors</li> </ul>	<ul style="list-style-type: none"> <li>Areas with natural resources</li> <li>Bordering densely populated areas</li> <li>Near hunting tracks</li> <li>Near streams / rivers</li> </ul>
	Agriculture below forest canopy	<ul style="list-style-type: none"> <li>Local farmers</li> </ul>	<ul style="list-style-type: none"> <li>Suitable land for agriculture</li> </ul>
	Wildfires	<ul style="list-style-type: none"> <li>Plantation developers</li> <li>Local farmers</li> <li>Hunters</li> <li>Fishermen</li> <li>Transients</li> </ul>	<ul style="list-style-type: none"> <li>Near land clearing operations</li> <li>Near farms</li> <li>Along hunting tracks</li> <li>Near roads &amp; access ways</li> <li>Near settlements</li> <li>Near rivers / streams</li> </ul>
Pollution	Bad management practices	<ul style="list-style-type: none"> <li>Mining</li> <li>Concessionaires</li> <li>Households</li> <li>Farmers (fertilizers, poor animal husbandry etc)</li> </ul>	<ul style="list-style-type: none"> <li>At concession sites</li> <li>Water &amp; river banks downstream</li> <li>Perimeter of settlement</li> </ul>
Wildlife Crimes	Hunters	<ul style="list-style-type: none"> <li>Local hunters</li> <li>Organized syndicates</li> <li>Concessionaires</li> </ul>	<ul style="list-style-type: none"> <li>Plantations</li> <li>Near farms</li> <li>Bordering densely populated areas</li> <li>Close to access roads</li> <li>Relatively flat land</li> </ul>

### Ideal framework to map areas of potential threats to orangutan and its habitat in Dairi & Pakpak Bharat\* and Kutai National Park landscape\*\*.

GIS layers (& availability) required to map threats	Available maps required for optimum analysis	Integrated map of threat areas
<ul style="list-style-type: none"> <li>• Forest status / kawasan hutan &amp; perairan (Yes)</li> <li>• Concessionaires / forestry, plantation &amp; mining (Some)</li> <li>• RePPPProt Landsystem (Yes)</li> <li>• Land cover (To be developed)</li> <li>• Forest Cover (Yes, 2006)</li> </ul>	<ol style="list-style-type: none"> <li>1. Forest status weighting</li> <li>2. HPH distance modelling</li> <li>3. HTI distance modelling</li> <li>4. Plantation distance modelling</li> <li>5. Mining distance modelling</li> <li>6. Forest change map</li> </ol>	Map of threats level in the landscape, prediction model base on data availability and visibelelity in two targeted landscapes sites
<ul style="list-style-type: none"> <li>• RePPPProt Landsystem (Yes)</li> <li>• Settlement location (Yes)</li> <li>• Population number (To be collected)</li> <li>• Road network (Yes)</li> <li>• Landcover (To be developed)</li> <li>• Forest Cover (Yes, 2006)</li> </ul>	<ol style="list-style-type: none"> <li>1. Land suitability map</li> <li>2. Settlement distance modelling</li> <li>3. Ratio of density population</li> <li>4. Road distance modelling</li> </ol>	
<ul style="list-style-type: none"> <li>• Traditional land (partial)</li> <li>• Land cover (To be developed)</li> <li>• Forest Cover (Yes, 2006)</li> </ul>	<ol style="list-style-type: none"> <li>1. Tanah Ulayat weighting</li> </ol>	
<ul style="list-style-type: none"> <li>• RePPPProt Landsystem (Yes)</li> <li>• Settlement locations (Yes)</li> <li>• Population number (To be collected)</li> <li>• Road Network (Yes)</li> <li>• Land cover (To be developed)</li> <li>• Forest Cover (Yes, 2006)</li> <li>• Fauna habitat (No)</li> <li>• Hunting track (No)</li> <li>• Elevation (Yes)</li> <li>• Stream / river (Yes)</li> </ul>	<ol style="list-style-type: none"> <li>1. Stream/river distance modelling</li> <li>2. Landcover weighting</li> </ol>	
<ul style="list-style-type: none"> <li>• RePPPProt Landsystem (Yes)</li> <li>• Geology (Yes)</li> <li>• Soil (Yes)</li> <li>• Elevation (Yes)</li> </ul>	<ol style="list-style-type: none"> <li>1. land suitability map</li> </ol>	
<ul style="list-style-type: none"> <li>• Forest status / kawasan hutan dan perairan (Yes)</li> <li>• Concessionaires / forestry, plantation &amp; mining (Some)</li> <li>• Landcover (To be developed)</li> <li>• Forest Cover (Yes, 2006)</li> </ul>	<ol style="list-style-type: none"> <li>1. HPH distance modelling</li> <li>2. HTI distance modelling</li> <li>3. Plantation distance modelling</li> <li>4. Mining distance modelling</li> <li>5. Road distance modelling</li> </ol>	
<ul style="list-style-type: none"> <li>• Concessionaires / forestry, plantation &amp; mining (Some)</li> <li>• Stream / river (Yes)</li> <li>• Settlement locations (Yes)</li> <li>• Land cover (To be developed)</li> <li>• Forest cover (Yes, 2006)</li> <li>• Plantations (Yes)</li> </ul>	<ol style="list-style-type: none"> <li>1. HPH distance modelling</li> <li>2. HTI distance modelling</li> <li>3. Plantation distance modelling</li> <li>4. Mining distance modelling</li> <li>5. Landcover distance modelling</li> <li>6. Settlement distance modelling</li> </ol>	
<ul style="list-style-type: none"> <li>• Settlement locations (Yes)</li> <li>• Streams /rivers (Yes)</li> <li>• Elevation (Yes)</li> </ul>		

\*Area included in boundaries of Kabupaten

\*\* Area included in TNK plus areas of concessions abutting TNK

## Appendix 2

**Framework to map areas of high biodiversity value at a landscape scale in Kutai focus site and Dairi and Bharat focus site.**

Areas with important biological species or proxy for biodiversity	GIS layers availability		Sources	
	Kutai	Dairi & Pakpak	Kutai	Dairi & Pakpak
Orangutan distribution (Known & Predicted)	•	•	PHVA, 2004 and Prediction, from forest elevation	PHVA, 2004 ; Prediction, from forest elevation, Survey Suci <i>et al.</i> 2009
Conservation protected areas	•	•	Ministry of Forestry	
Forests	•	•	Forest cover 2006 derived from Landsat +ETM	
Areas of high wilderness	•	•	Wilderness index map	
Areas of strategic conservation importance	•	•	Kitchener, <i>et al.</i> 2002	Hardiono & Kitchener, 2009
Key watersheds	•	•	Kitchener, <i>et al.</i> 2002	Hardiono & Kitchener, 2009
Key Biodiversity Areas (KBAs)		•	n/a	Key Distribution Maps CI, 2006
Habitat richness		•	n/a	Hardiono & Kitchener, 2009
WWF Ecoregions	•	•	Olson, D.M. and E. Dinerstein. 1998	
Unique Eco-floristic regions		•	n/a	Laumonier, Y. 1997
Birdlife International Important Bird Area (IBAs)	•	•	Birdlife International 2009	Birdlife International 2009
Unique zoogeographic regional areas		•	n/a	MacKinnon <i>et al.</i> 1996

# Glossary

**Biodiversity:** The variation of life at all levels of biological organization, usually within a given ecosystem or region. Biodiversity is often used as a measure of the health of biological systems.

**Conservation Forest:** Forest that is designated for wildlife or habitat protection, usually found within national parks and other protected areas.

**Conversion Forest:** Forest that is designated for clearance and permanent conversion to another form of land use, typically a timber or estate crop plantation, such as oil palm.

**District:** Local government administrative unit. This administrative level is below the province level.

**Deforestation:** The permanent removal of forest cover and conversion of the land to other uses.

**Forest Degradation:** May be generally defined as a reduction in tree density and/or increased disturbance to the forest that results in the loss of forest products and forest-derived ecological services. Common causes of forest degradation include selective felling, fuel wood collection, road building and shifting cultivation.

**Landsat:** The Landsat Program is a series of Earth-observing satellite missions jointly managed by NASA and the U.S. Geological Survey. Since 1972, Landsat satellites have collected information about Earth from space. This science, known as remote sensing, has matured with the Landsat Program. Landsat satellites have taken specialized digital photographs of Earth's continents and surrounding coastal regions that can be used to develop detailed maps.

**Landscape:** Spatially heterogeneous geographic areas characterized by diverse interacting patches or ecosystems, ranging from relatively natural terrestrial and aquatic systems such as forests, grasslands and lakes to human-dominated environments including agricultural and urban settings.

**Limited Production Forest:** Forestry Department designation for forest that is allocated for low-intensity timber production. Typically limited production forest is found in mountainous areas where steep slopes make logging difficult and uneconomical.

**Logging Concession:** An area of natural forest designated for selective harvest under license.

**Production Forest:** Forestry Department designation for forest that falls within the boundaries of a timber concession. Under good management, harvesting levels are balanced by planting and re-growth so that the forest will continue to produce wood indefinitely.

**Protection Forest:** An official designation by the Indonesian Ministry of Forestry for forest that is intended to serve environmental functions, typically to maintain vegetation cover and soil stability on steep slopes and to protect watersheds.

**Spatial planning:** An interdisciplinary and comprehensive approach that includes all levels of land use planning and is directed towards a balanced regional development and physical organisation of space according to an overall strategy.

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