WHC Nomination Documentation

File Name: 955.pdf **UNESCO Region: ASIA AND THE PACIFIC**

SITE NAME: Lorentz National Park

DATE OF INSCRIPTION: 4th December 1999

STATE PARTY: INDONESIA

CRITERIA: N (i)(ii)(iv)

DECISION OF THE WORLD HERITAGE COMMITTEE:

Excerpt from the Report of the 23rd Session of the World Heritage Committee

The Committee recalled that the Bureau at its twenty-third session requested the Centre to inform the Indonesian authorities of a number of aspects suggested by IUCN dealing with the management of the site, and in particular: (a) the priority need to continue the process of management planning for the Park with full involvement of the local stakeholders; (b) encouragement for the proposed establishment of a Foundation which would assist in the management of the Park; (c) possible twinning arrangement with the Wet Tropics World Heritage site in Australia; (d) appointment of a Park Director and support staff; (e) the concern over development projects that would affect the Park, for example the proposed Timika/Mapurajaya road and any expansion of mining activity towards the Park boundary so as not to conflict with Lorentz National Park's nomination as a World Heritage site. A letter from the Indonesian authorities was received noting their agreement with all of the above.

Several delegates and observers noted the issues of the mining concessions surrounding the site, the proposed 6% reduction of the site and the adjacent oil concessions as well as other potential impacts to the sites, such as road construction and visual impacts.

The Chairperson, in thanking the Committee for the extensive debate and consideration of the matter, suggested that the following points be transmitted to the State Party :

a.The Committee noted that as per the request of 25 October 1999 from the Indonesian authorities, an adjustment of approximately 150,000 hectares were made to exclude oil exploration concessions in the south-east corner of the Park. The Committee accepted this reduction in the size of the property and agreed with the new boundaries as submitted in Map C (see Annex V). The modified size of the site is now about 2.35 million hectares.

b.The Committee recognized the potential risks and threats as indicated in the IUCN evaluation and requested the State Party to consider these in actions concerning the site.

c.The Committee encouraged further action on the proposed Trust Fund that would assist in strengthening conservation in Lorentz National Park.

d.The Committee requested that a monitoring mission be undertaken to gauge progress three years after inscription.

The Delegate of Australia noted that his country still has not been officially informed about the suggestion of twinning arrangements between the Wet Tropics of Queensland and Lorentz National Park, but will be willing to co-operate if invited by the State Party.

The Committee decided to inscribe the site under natural criteria (i), (ii) and (iv).

The site is the largest protected area in Southeast Asia (2.35 mil. ha.) and the only protected area in the world which incorporates a continuous, intact transect from snow cap to tropical marine environment, including extensive lowland wetlands. Located at the meeting point of two colliding continental plates, the area has a complex geology with on-going mountain formation as well as major sculpting by glaciation and shoreline accretion which has formed much of the lowland areas. These processes have led to a high level of endemism and the area supports the highest level of biodiversity in the region. The area also contains fossil sites that record the evolution of life on New Guinea.

BRIEF DESCRIPTIONS

Lorentz National Park is the largest protected area in Southeast Asia (2.5 mil. ha.). It is the only protected area in the world which incorporates a continuous, intact transect from snow cap to tropical marine environment, including extensive lowland wetlands. Located at the meeting point of two colliding continental plates, the area has a complex geology with on-going mountain formation as well as major sculpting by glaciation. The area also contains fossil sites, which record the evolution of life on New Guinea, a high level of endemism and the highest level of biodiversity in the region.

1.b State, Province or Region: Irian Jaya Province

1.d Exact location: 4°0' S, 137°14' E

Submission for Nomination of

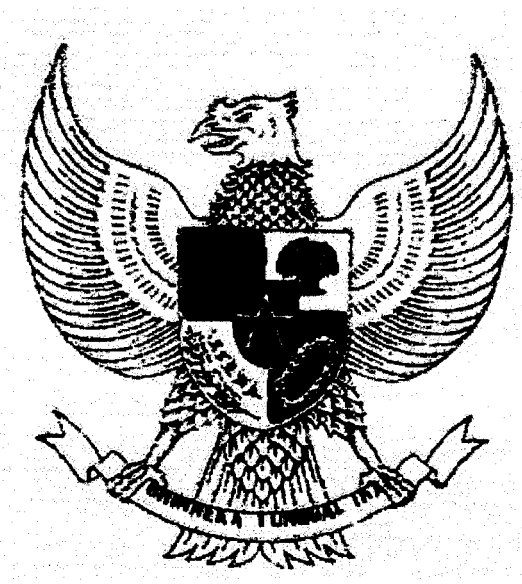
LORENTZ NATIONAL PARK

by the

GOVERNMENT OF THE REPUBLIC OF INDONESIA

to be included in the

WORLD HERITAGE LIST



September 1998

Submission for Nomination of

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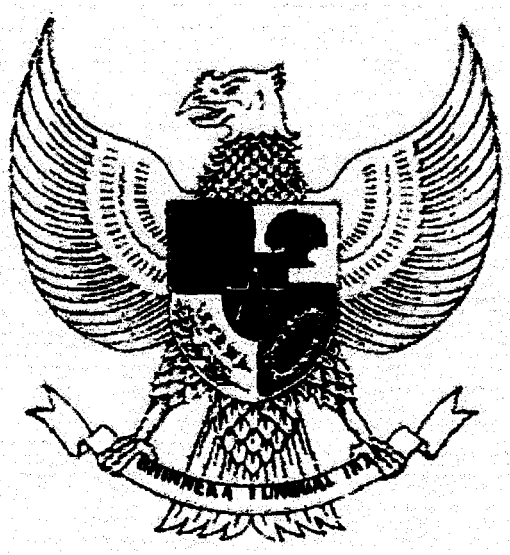

The Minister of Mines and Energy
Dr. Ir. Kuntoro Mangkusubroto

Jakarta, September 7 1998

Acknowledgements

The preparation of the Lorentz World Heritage Site Document was a collaborative effort of the Department of Forestry, Directorate for Nature Conservation (PHPA), World Wide Fund For Nature Indonesia, and UNESCO, coordinated by the Director General PHPA, Ir. Soemarsono.

Principle authors were Frank Momberg, Benja Mambai, Mark van der Wal, Hans van Noord and Lystia Kusumawardhani.

Scientific advice was given by Dr. Darrell Kitchener, Dr. Carey Jaeger, Dr. Tim Flannery, Dr. Steven Hill, Dr. Allen Allison, Dr. Carolyne Cook, Henk van Mastricht, Phillipe Delanghe, Hans D.Thulstrup, Ron Lilly, and Graham Usher.

PT. Freeport Indonesia and PT. Hatfindo provided extensive and important data from the 1997 biological surveys conducted in Freeport's 'Contract of Work' area.

Tim Flannery, Gerald Cubitt, Ron Lilly, and Dirk A. Schmidt had the courtesy to provide photos for the World Heritage Site nomination document.

UNESCO, WWF Netherlands, and the German Technical Cooperation (GTZ) / WWF Germany provided substantial funding for the preparation of the World Heritage Site nomination.

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FOREWORD

The principle of the convention concerning the protection of the world's natural heritage is the preservation of unique examples of natural wonders on this planet, which are of value to all humankind. The preservation and protection of these places should therefore not just be the duty of the nation but the responsibility of the international community as well. So far in Indonesia two National Parks have been recognised as World Heritage Sites, Ujung Kulon and Komodo.

Lorentz National Park is a very special part of our planet that contains the largest tracts of protected tropical rainforest in Asia and the Pacific. Its major feature is the exceptional range of habitats represented, from the glacier-covered Puncak Jaya or Carstenz Peak, Southeast Asia's highest peak, over alpine vegetation, montane forests, lowland everwet forests to freshwater swamps and coastal mangroves.

In fact there are thirty-four vegetation types in the reserve covering almost all major environments recognised in Irian Jaya. Its biotic richness and diversity is beyond compare. The Lorentz area has been rated by leading mammalogist as being the most important region for mammal diversity in Melanesia. Just two years ago Tim Flannery discovered a new species of tree kangaroo within the reserve. The National Park also features two endemic bird areas and contains one of the most extensive and important protected wetlands of Indonesia.

Equally important, Lorentz is home to 9 different tribal groups including the Asmat, known world-wide for their outstanding wood carving art. As the 'Ravenshoe Communiqué' issued during the first regional Southeast Asia-Pacific workshop for Word Heritage Managers underlined - recognising indigenous traditions and enhancing social welfare - is an integral part of the park's conservation management strategy.

As the Park is a representative cross-sections of the geology, topography and major habitats of that region of Irian Jaya it offers the future potential to study the major hydrological patterns, nutrient cycling, fire ecology, faunal movements and resource requirements, between and within an integrated system of near pristine ecosystems. Such studies will be important to an understanding of the natural environment of Irian Jaya and ultimately will be of immense value to the development of rational integrated management plans for the biota of Irian Jaya – both inside and outside protected areas.

1 SPECIFIC LOCATION

A) COUNTRY

Indonesia

B) STATE, PROVINCE OR REGION

Province	:	IRIAN JAYA
Districts	:	JAYAWIJAYA
		PANIAI
		MERAUKE (Southern Division)
		FAK-FAK
		MIMIKA
		ENAROTALI

C) NAME OF PROPERTY

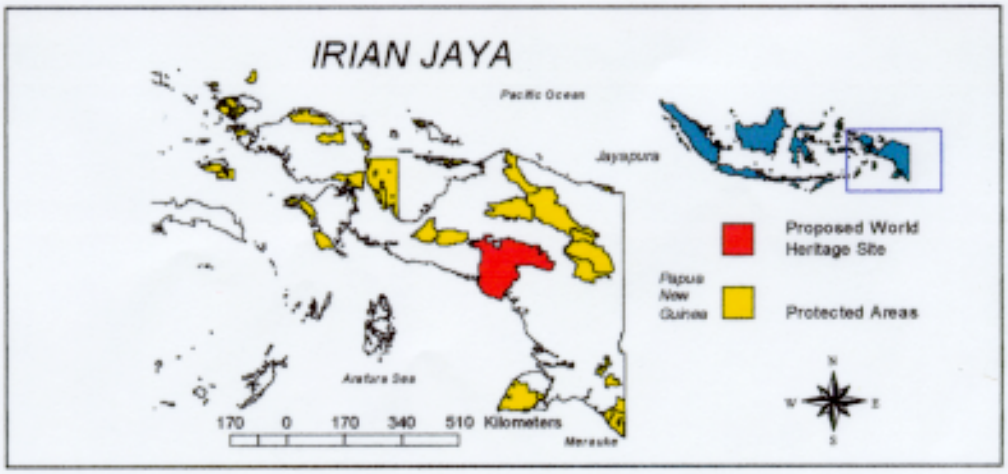
Lorentz National Park

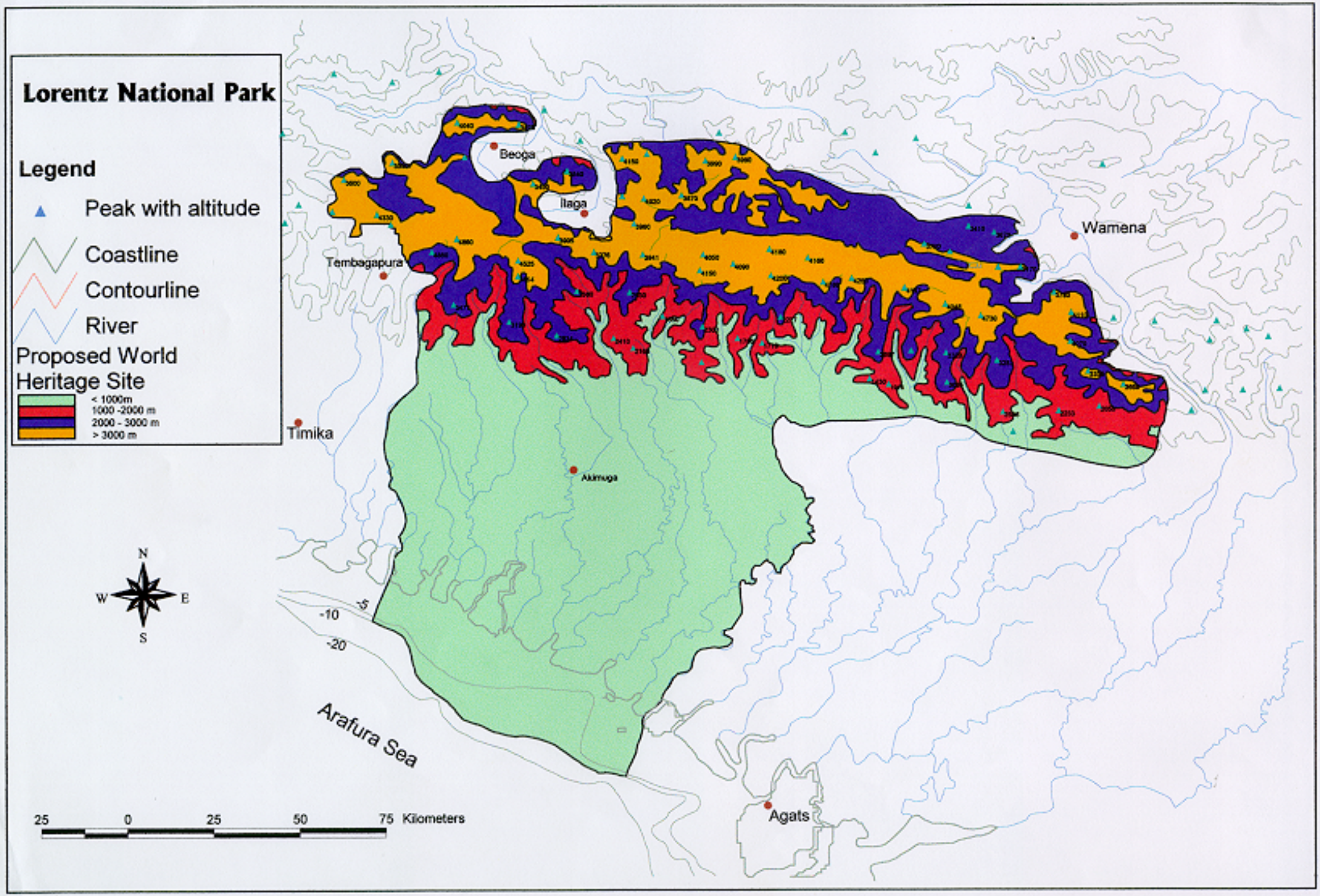
D) EXACT LOCATION ON MAP AND INDICATION OF GEOGRAPHICAL COORDINATES

The reserve is located roughly in the square given by the following coordinates.

Latitude	:	04° 00' and 05° 15' S
Longitude	:	137° 14' and 138° 20' E
Area	:	2.505.600 Ha

E) MAPS AND / OR PLANS




Lorentz National Park
Legend
Peak with altitude
Coastline
Contourline
River
Proposed World Heritage Site
< 1000m
1000 -2000 m
2000 - 3000 m
> 3000 m
Beoga
Ilaga
Wamena
Tembagapura
Timika
Akimuga
Agats
Arafura Sea
-5
-10
-20
N
W
E
S
25 0 25 50 75 Kilometers

2 JURIDICAL DATA

A) OWNER

The Republic of Indonesia

B) LEGAL STATUS

The area was first given protected status by the Dutch Colonial Government in 1919, with the establishment of the Lorentz Nature Monument.
In 1978 it was established as a Strict Nature Reserve (Cagar Alam) by the Indonesian Government (44/Kpts/Um/1/1978), with an area of 2,150,000 hectares. In 1991 the area was listed as one of the sites with highest priority for conservation in Indonesia's National Biodiversity Action Plan. In 1996 WWF and the provincial department of forestry (Kanwil Kehutanan) proposed a revision of the reserve boundaries and change the status to become a National Park. The Director General for Nature Conservation and Forest Protection excepted this revision in July 1996. In March 1997 the Minister of Forestry declared the Lorentz area a National Park, that includes a western extension (Mt. Trikora, Mt. Rumphius, Lake Habbema area) and coastal waters. The total area of the Lorentz National Park is 2,505,600 hectares.

C) RESPONSIBLE NATIONAL AGENCY

Directorate General of Nature Conservation and Forest Protection (Ditjen. PHPA) under the Ministry of Forestry.

Address: Director General PHPA
Gedung Manggala Wana Bakti
Blok IV Lantai 8
Jl. Gatot Subroto
Jakarta 10270
Indonesia

Tel/Fax: (62) 21-5734818

D) COLLABORATING AGENCIES AND ORGANISATIONS

- World Wide Fund for Nature Indonesia
  Program (WWF-IP)
  P.O. Box 7928 JKSKM
  Jakarta 12079
  Indonesia

3 IDENTIFICATION

A) HISTORY

1. Recent history

The first to notify the world of the existence of the 'snow mountains' of the Lorentz area was the Dutch merchant Jan Carstenz in 1623. Carstenz had just navigated the southwest coast of New Guinea on his way to Australia, and was struck by the snow-capped mountains of inland Irian Jaya.
The first outsiders known to have actually penetrated what is now known as the Lorentz area were members of a Dutch scientific team led by Dr. H.A. Lorentz who explored inland to the summit of Mt. Mandala (Wilhelmina) in 1909.
An expedition of the Ornithologist Union of Great Britain visited the area just west of Lorentz in 1910-11. In 1912-13 the third South New Guinea expedition of the 'Indisch Comite voor Wetenschappelijk Onderzoek der Nederlandsche Kolonien visited the Wilhelmina peak again. At the same time Dr. Wollaston visited the Otakwa area in the park with the second British Expedition. In 1938 a mixed Dutch/American zoological expedition led by Mr. R. Archbold visited the northern slopes of Mt. Wilhelmina.
The 1939 Royal Dutch Geographical Society launched an expedition to the central mountain area of the Sudirman/Jayawiya range (the expedition was led by Le Roux). Many more expeditions and military recognition missions took place during the above-mentioned period. The one that has undoubtedly had the most impact on the area was the expedition led by the Dutchman Colijn. One member of the team was Dr. J.J. Dozy. He discovered the extreme rich copper and gold deposits in the Carstenz area. Dozy's report on his findings eventually led to a massive mining operation by PT. Freeport Indonesia.
Between World War II, and recent times, almost no scientific work has been conducted in the area. In 1996 and 1997 vegetation and wildlife biodiversity surveys were conducted in the area just west of the Lorentz NP as part of Freeport's reclamation project and environmental impact assessment (Amdal 1997).

2. Conservation effort

In 1919 the Dutch colonial administration established a nature reserve in the Lorentz area, but its area was only a fraction of what is contained in the current reserve. In 1956, the protected status was abolished due to conflicts with local people over unresolved land rights.
As Irian's current network of protected areas first began to be proposed in the 1970's by experts from the Indonesia's Directorate General of Forestry, IUCN, FAO and WWF, the importance of Lorentz was acknowledged once again and it was gazetted as a Strict Nature Reserve in 1978. Since being gazetted, Lorentz has continued to be a focus for conservation interest. The National Conservation Plan for Indonesia, which was published in 1981 jointly by FAO and UNDP,

listed Lorentz as one of the four protected areas in Irian of particular conservation importance. The listing was based on its size and the richness, diversity and representativeness of its flora and fauna. In 1987 the Provincial Government proposed to the Ministry of Forestry to submit Lorentz Nature Reserve for nomination as World Heritage Site. In 1990, the Directorate General of Forest Protection and Natural Resource Management formally approached the WWF Indonesia Program to request assistance in conducting research and designing a management plan. Although active in Irian Jaya since 1980, it was not until 1990 that WWF-IP assigned its first staff to work in Lorentz. The principle aim of WWF in Irian is, in close cooperation with the PHPA, develop and implement a park management system that will take into account the traditional land tenure and resource use systems of the tribal communities living within the park.

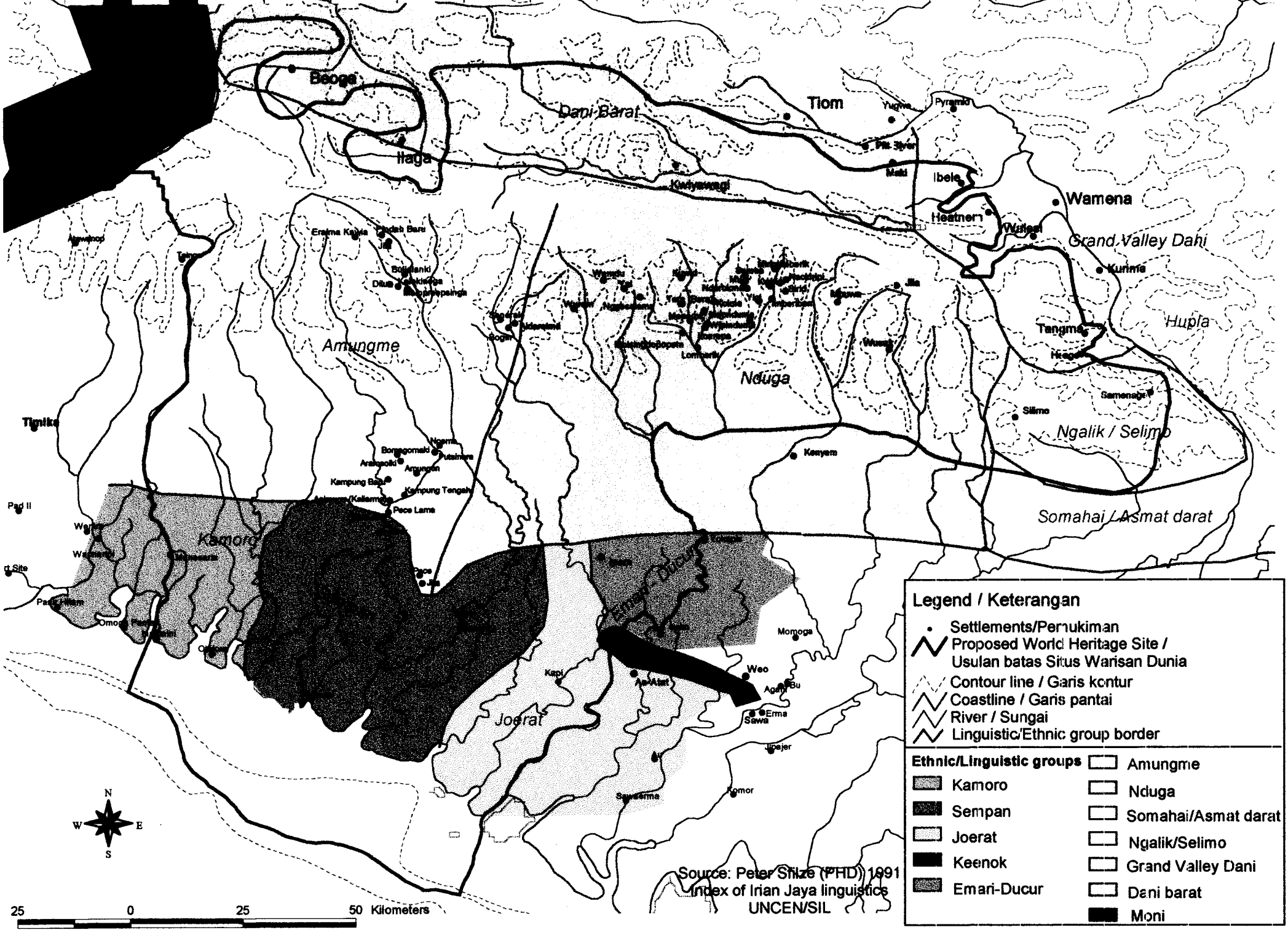
From 1990 onwards, WWF has started to gather basic social and human ecological information on the various tribal groups in the park as a first step in the process of developing the management plan. In October 1995 the WWF-Lorentz project opened an office in the capital city of Jayapura and started to develop a management plan. The gathering of biological and anthropological data had only just begun, when in January 1996 a group of scientists, including WWF and PHPA staff, were abducted in the North Eastern part of the reserve. Due to this event and the political unrest in the Lorentz area field surveys were restricted to the buffer zone and the Asmat area of the Park, for an uncertain time span.

Despite the hostage crisis, major conservation intervention commenced. PHPA and WWF, in cooperation with the regional government, have started a participatory resource mapping program to rationalize land use planning in the buffer zone and involve local people in boundary delineation, Park zonation, and buffer zone development. This has become possible since the status change from Strict Nature Reserve to National Park. The Minister of Forestry signed the decree declaring Lorentz as a National Park in March 1997.

B) DESCRIPTION AND INVENTORY

1. Cultural heritage: the people, their ways and their art.

The Park scores high both in biological and cultural terms. It is the home of eight tribal groups who have to a great extant maintained their traditional life styles. Most of the tribal groups could until very recently be described as Neolithic. The highland people Amungme (Damal), Western Dani, Nduga, and Ngalik pratice rotational agriculture of root crops, mainly taro and sweet potatos. Pigs are raised in large numbers and are regarded as sign of wealth and play an important role in rituals. The lowland people within the Park (Asmat, Sempan, Kamoro and a yet undescribed group called Somohai in the southern foothills close to the Baliem gorge) depend almost entirely on Sago (*Metroxylon sago*) as a food source, eating the processed pulp and 'farming' the larvae of the Capricorn beetle as source of protein from felled trees left to decompose.



Source: Peter Silze (PHD) 1991
Index of Irian Jaya linguistics
UNCEN/SIL

a) The lowland tribes

The Mimika and Asmat

The area of Lorentz National Park inhabited by Asmat and Mimika reaches from the shore of the Arafura Sea to the plains below the foothills of the Sudirman Range. A dense network of innumerable waterways, brooks, larger streams, and broad meandering rivers traverse these lowlands. Brackish swamps extend from river delta areas far into the interior, where they are replaced by freshwater swamps, and further inland by the rising plains against the foot hills covered in dense tropical lowland rainforest. Each of these area posses it's own characteristic flora and fauna, which provides an environment for hunters and gatherers with a total number of approximately 1000 Mimika and 1300 Asmat. The subsistence is based on sago gathering from the fresh-water swamps and vegetable gardening, hunting and fishing. The sago flour is an almost clear starch extracted from the pith of the sago palm (*Metroxylon spp*). Sago has the distinction of being the most efficient source of staple starch.

Plate 1: *Asmat with carved nose piece in the form of a flying fox. Photo courtesy* A. Smidt

While the Mimika and Asmat share the same environment and subsistence strategies, they differ in language and culture. The Mimika are divided in two linguistic groups, the Kamoro and Sempan. The Kamoro live in the southwestern corner of the park in the villages of Paworopa, Manasari and Otakwa. The Sempan live in the middle coastal part of Lorentz. The Asmat inhabit the southeastern part of the reserve. Two Asmat linguistic groups live within Lorentz National Park, Emari Ducur (Sumapero, Nakai, Au, Kapi, As-Atat) and Unir Siran (*Keenok*: Ipam, Esmapan,

Plate 2: *Sago grubs in a special bowl.*
Source: Smidt -Asmat Art.

Iroko, Jakapis), while the Joerat group lives east of the Park boundary around the villages Sawa and Erma.

For the Asmat, the sago palm is also the source of a very important ceremonial food, the larvae of the Capricorn beetle. These grubs are considered a great delicacy, and 30-40 days before a festival is due, many sago trees are felled and punched full of holes so that the beetles will lay their eggs in them. Just before the celebration the mature larvae are collected and eaten in great quantities out of specially carved wooden bowls.

The ceremonial life of the village revolves around the long men's house or '*jeu*'. The *jeu* is both a physical structure, and the basic unit of political affiliation. The *jeu* is a long, narrow, raised building, where community matters are discussed, ceremonies are planned and held and woodcarvings are made. The *jeu* is also the place where the world of the living meets the world of the dead and the contact between both worlds is kept alive.
Death holds a special meaning for the Asmat. Without death there is no life; the two are inextricably connected. Head hunting expeditions are a custom that was only very recently abolished by the Asmat tribes. The ceremonial life of the Asmat is chiefly aimed at appeasing the spirits of the dead. As part of this ceremonial cycle, and in keeping with the basic themes of Asmat culture - headhunting and ancestor worship - an impressive woodcarving art has developed. These carvings depict deceased ancestors and a variety of headhunting symbols: the praying mantis, the hornbill (*Rhyticeros plicatus*), and the palm cockatoo (*Probosciger aterrimus*).

To the Asmat, the tree trunk symbolizes the human body, the branches - arms, and the fruits being the equivalent of the human head. Fruits that have dropped on the forest floor symbolize human heads being chopped off in local warfare.

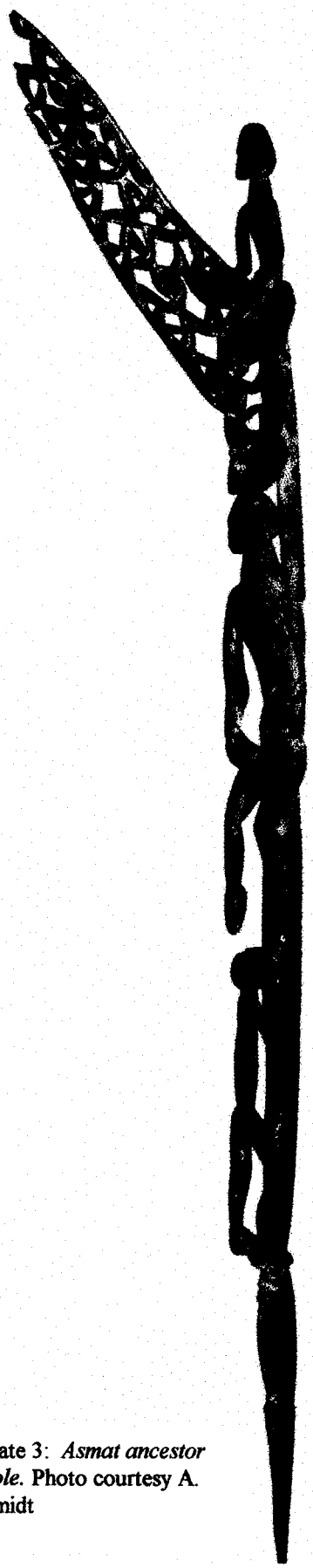


Plate 3: *Asmat ancestor pole.* Photo courtesy A. Smidt

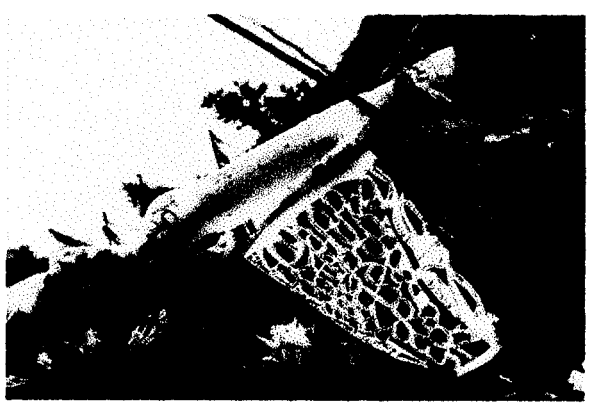
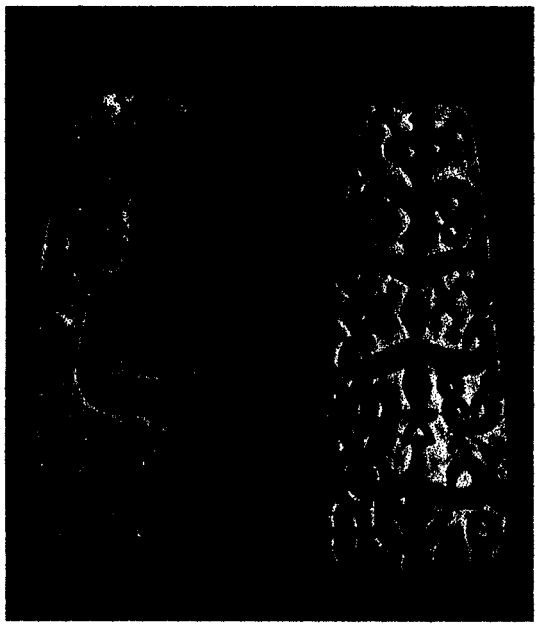


Plate 4: *Men carrying a bisj or ancestor pole. The openwork tsjemen, or "penis" of the bisj being most prominent in this photo.*



The Asmat woodcarver's art is a form of communication between the living and the dead, between the community of human beings and the complex and pervasive world of the spirits. In the extensive swamplands of the Asmat the spirits of the ancestors still live in the trees, and in fact, many birds, animals, and even the whirlpools and channels of the rivers have a spiritual life. The Asmat and their art depend heavily on their forest. The forest is part of them.

Plate 5: *Asmat shields from Sawa-Erma. Photo courtesy:* A. Smidt

Plate 6: *Jeu in the village of Kapi*
Source: WWF-Lorentz

Plate 7: *Bivak – Asmat camp site for hunting and sago collection.* Source: WWF-Lorentz

b) The highland tribes

The Nduga

The Nduga are one of the least known peoples in Irian Jaya. They live in the Central Highlands of Irian Jaya, on the southeastern slopes of the Sudirman range. Nduga daily life is based on rotational gardening, cultivating mainly taro and sweet potatoes, hunting and pig husbandry. The pigs are also used to fertilize the fallow lands. The main staple is sweet potatoes. As in other highland tribes, pigs play an important role in Nduga society.

Relationships between people, pigs, and gardens are regulated through rituals marked by large feasts, helping to maintain extensive areas in virgin forest and assuring adequate cultivation-fallow ratio in secondary forest.

Plate 8: Nduga sets a trap for wild pigs.
Source: WWF Lorentz (C73)

The Nduga live primarily in dispersed hamlets in and around the villages of Mapnduma, Ngeselema, Tangma, Sinak, Ilaga, Beoga, and Hitadipa. Although the women's huts are family homes the Nduga men spend most of their time in the exclusive huts for men.

Nduga language is still actively spoken by all of the Nduga people, and bears some resemblance to the Yali and Dani language. Teachers or staff of the Protestant mission only speaks Indonesian. The number of Nduga living within the borders of the Park is estimated at around 1500 people.

The Amungme (Damal)

The Amungme / Damal tribe is found in the Central Highlands, south and north of Mt. Jaya, spread out over at least 30 communities. Within the park, the Amungme tribal land borders with Sempan lands to the South, and the Nduga, Western Dani, and the Asmat lands to the East. The number of Amungme in the Park is estimated at around 2500.

Since the 1960s, the Amungme people of the Lorentz area have seen rapid changes come to their land and their lives, due to the initiation of a massive mining operation on their land (bordering the western perimeter of the Park) and more specifically on the mountains which are the sacred places of their ancestors who watch over them benignly or, if disturbed, with anger.

The Amungme also believe in another set of spirits, the *Tu-in* and *Tel-me*, who regulate human interaction with the land. These spirits receive the attention of the people and are the conduits through which the Amungme honor the land's fertility and seek to protect it from harm and degradation. Clearly the Amungme people feel closely linked to their ancestral land as do all the tribal groups in and around the reserve.

The Amungme rarely use land in the upper alpine regions (above 4000 m) as this area is considered sacred. The upper montane areas (3000-4000 m) are mainly used for hunting and gathering. Most of the time is spend in lower montane areas, with land above 1500m usually used for *Pandanus julianettii* orchards and *Colocasia esculenta* gardens. The *Pandanus julianettii* are a unique form of highland silviculture or agro-forestry.

Plate 9: Amungme harvesting 'buah merah' (Pandanus julianettii). C1

Amungme villages are usually found at elevations of 1000-2000 m above sea level, although they now also live, garden or hunt at even lower elevations in lowland rainforest, and on the plains (0-100 m). Although the Amungme still practice a periodic rotation of village areas which may occur every twenty years or so, as modern times have come, this settlement pattern has begun to change.

In the diet of the traditional highland Amungme, sweet potato forms the main staple, supplemented by taro, Pandanus fruits, animal husbandry (pigs, chicken, rabbits) and hunting. The pigs are kept in the women's house as the women have the responsibility feeding them (Cook 1995).

2. Natural heritage

a) Climate

Rainfall in the lowland area averages 3700 (3160-4100) mm/year, with no distinct wet or dry season, and on average between 100 and 150 rain days per annum. Western winds prevail between October and March, while the Eastern winds blow from April until September. The period from December until March is usually characterized by high waves in the coastal areas.
Daytime temperatures range from 29-32°C in the lowlands, to below freezing above the 4800m contour line. There is no appreciable annual fluctuation. Early morning snow on top of the summits of Mt. Trikora and Mt. Jaya, or even down to 3800m, occurs regularly, but permanent snow and ice is only to be found in the Mt. Jaya area. Daylight hours are nearly constant throughout the year (about

12 hours) due to the equatorial location. Relative humidity is high. In the mountain areas, cumulus cloud cover nearly always increases towards the early afternoon.
In the mountain areas, the weather conditions are more dependent upon the immediate topography. Rainfall in the higher valleys will, on average range between 3500 and 5000 mm/year.

b) Physical landscape

Both from an anthropological and from an ecological perspective the Park can basically be divided into two very distinct zones: the swampy lowlands and the high mountain area of the central cordillera. The central cordillera itself can be subdivided in the eastern part and the western part on the basis of geology and vegetation types, the north/south line at the height of approximately Kwiyawagi village being the dividing line.
The central mountain ranges are the southern portion of two colliding continental plates, which are causing the mountain range to rise. The lowering and rising of the sea level during the glacial and inter-glacial periods of the Pleistocene, along with continuous activity in the mobile belt which characterizes the contact zone of the two colliding lithosperic plates, has continued to promote the great biodiversity of the Island of New Guinea in general, and in the Lorentz area in particular. Large tracts of the mountain range, and especially the area formed by the traditional lands of the Amungme (or Amung) are rich in mineral deposits - especially gold and copper.
This is because molten rock was pushed up from deep below the surface of the earth through faults in the limestone deposits that had been created by the wrenching process of the uplift. After these, igneous and metamorphic rocks were formed, mineralized liquids dissolved part of the rock and replaced them with iron, copper, gold, and silver. The ore in the Sudirman range has relatively high percentages of these minerals.
Carstensz and Meren are two important peaks of the Jayawijaya Mountain Range that are still covered by ice caps. It is one of the very few equatorial highlands (Andes and Mt. Kenya, Kilimanjaro, Ruwenzori in Africa) that in its high altitude environment can keep the mass balance on ice formation.
Carstensz's summit consists of several peaks (Jayakesuma / *Carstensz Pyramid* 4,884 m, Ngga Pulu 4,862 m, Meren 4,808 m) that developed from Tertiary rocks (Miocene). This high area was still covered by wide ice caps (13 sq. km) in 1936. These ice caps melted down to an area of just 6.9 sq. km in 1972 and got further reduced to 3,3 sq. km until 1991. The remaining glacier is now (1997) divided in to three patches, the North Wall Firn, the Meren and Carstensz glacier with only 3 sq. km of ice left. Based on climatic data, a deficit mass balance will continue as the future trend.
The lowland area is a wide muddy plain, covered with virgin forest and intersected by countless winding rivers and streams. The largest of these rivers empty into the shallow Arafura Sea, which separates the island of New Guinea from Australia. Tides here reach five meters, and at their low ebb, wide mudflats appear along the coast. Because of this, and the unbroken flatness of the land, it is difficult to make out where the ocean ceases and the land begins. Even far

inland, the differences in high and low tide are noticeable on the rivers (thus the saltwater line goes deep inland), and travel is timed to incoming or outgoing tides.

Land Systems

The Regional Physical Planning Program for Transmigration (RePPProt 1986) provides the most detailed and useful classification system for Irian Jaya recognizing 9 physiographic types and regions with 13 major land systems.

Physiographic Types Land Systems	General Description
BEACHES	
Puting (PTG)	Coastal beach ridges and swales
TIDAL SWAMPS	
Kajapah (KJP)	Inter-tidal swamps of mangrove and Nipah
MEANDER BELTS	
Sapauwar (SPW)	Meander belts of large rivers crossing coastal plains
PEAT SWAMPS	
Pandago (PGO)	Permanently inundated swamps of coastal alluvial plains
Gambut (GBT)	Seasonally inundated swamps of coastal alluvial plains
Iwika (IWK)	Peat swamp-covered lower alluvial fans
ALLUVIAL VALLEYS	
Aimau (AMU)	Braided rivers, floodplains and included terraces
ALLUVIAL FANS	
Timika (TMK)	Coalescent alluvial fan plain
DISSECTED TERRACES	
Warba (WRB)	Old terraces and terrace remnants
Makirime (MKR)	Tilted old alluvial fans
Aimas (AMS)	Strongly dissected old terraces and fans
MOUNTAINS	
Kemum (KMM)	Steep-sided deeply dissected mountain ridges
ALPINE SUMMITS	
Kelabu (KLB)	Alpine peaks with bare rock and residual ice caps

Fig. 1: Land Systems in Lorentz National Park (RePPProt 1986)

c) Flora

Five altitudinal vegetation zones have been recognized within the Lorentz Park: lowland zone, montane zone, subalpine zone, alpine zone, and nival zone. Some of the zones are further divided into subzones. In the lowland zone, these subzones are based on physiographic types as defined by RePPProt (Table X). In the other zones, subzones are based on recognized changes in physiognomy and floristics. The zones and subzones are listed below (PT. Hatfindo 1997, based on Johns 1982; van Steenis 1934, 1959, 1972; Hope 1976a).

ZONE	SUBZONE	ALTITUDE (meter a.s.l)
Lowland zone	Beach subzone	0-4
	Tidal swamp subzone	0-1
	Meander belt subzone	0-25
	Peat swamp subzone	3-50
	Alluvial fans subzone	50-150
	Alluvial valley subzone	25-100
	Dissected terraces subzone	100-650
Montane zone	Lower montane subzone	650-1500
	Mid montane subzone	1500-2800
	Upper montane subzone	2800-3200
Subalpine zone	Lower subalpine subzone	3200-3650
	Upper subalpine zone	3650-4170
Alpine zone		4170-4585
Nival zone		>4585

Fig. 2: Vegetation Zonation (PT. Hatfindo 1997)

The Lowland Zone

The Beach Subzone (Puting Land System, 0-4m)

Beach systems occur along accreting coastlines where new sand is being deposited. The ridges may be up to 2 m in height. Sometimes linear swampy depressions or swales occur between adjacent ridges. Old beach ridges may occur inland and these commonly merge into gently undulating flats. The sandy soils are generally well drained, but low-lying parts become inundated during the wet season owing to a lack of surface run-off. The lithology is recent coarse alluvium (marine).

The vegetation of the beach ridges and flats ranges from pioneer herbaceous communities on the first beach ridge to tall mixed forests inland. The terrain is usually traversed by more or less permanently swampy depressions parallel to the ridges. The vegetation in the swales ranges from floating and submerged plants in their deepest parts, to swampy grasses, reeds, sago, palm, pandan, and swamp woodland in progressively shallower water. Mangroves are present in brackish swales within tidal reach. (PT. Hatfindo 1997)

Tidal Swamp Subzone (0-1m)

The tidal swamp altitudinal subsystem comprises of one land system, the Kajapah land system (KJP) consisting of inter-tidal swamps of mangrove and nipah palm. The muddy south coast of the Park houses important mangrove communities that are probably the most diverse in the world. The mangrove communities are also found well inland along the rivers; *Nypa fruticans* penetrates furthest inland.

Joanna Ellison has conducted the only study of mangrove communities in the Lorentz area in the Ajkwa estuary (Southwestern buffer zone). Five distinct mangrove communities were identified:

- *Avicennia/Sonneratia* community: Seaward communities of lowest elevation consisting of Avicennia marina, Avicennia officinalis, Avicennia eucalyptifolia and Sonneratia caseolaris. These colonize new mud banks and inner bends of rivers.
- *Rhizophora*–dominated community: Rhizophora stylosa-dominated forest on outer bends of rivers. Rhizophora apiculata, Rhizophora mucronata and Bruguiera gymnorrhiza may also occur.
- *Bruguiera*-dominated forest: Consists of Bruguiera cylindrica, Bruguiera parviflora, Rhizophora apiculata, Rhizophora muronata, and Xylocarpus mekongensis of slightly higher elevations, north of the main Ajkwa estuary and inner bends of rivers. This community has the greatest area of mangrove forest in the Ajkwa area.
- *Nypa*-dominated forests: Nypa fruticans found on accreting banks in northern mangrove area.
- Landward Mixed Mangrove Forest: Diverse mangrove community on freshwater margin with *Rhizophora apiculata*, *Heritiera littoralis*, *Xylocarpus granatum*, *Pandanus sp.*, and *Nypa fructicans*.

(Ellison 1997)

Plate 10: *The Nypa/Sago belt in the Asmat lowlands.* Source: WWF-Lorentz

Meander Belt Subzone (0-25m)

The subzone consists of Sapanduwar Land System (SPW) with meander belts of large rivers crossing coastal plains. In this land system, bare land is continually being formed during floods by sedimentation and changes in river courses. The initial colonization of bare soil by pioneering plants is followed by a successional process in which species replace the pioneers until a mixed forest climax is reached. The mixed climax forest is similar in structure and floristic composition to the dryland lowland evergreen forest.

Peat Swamp Subzone (3-50m)

The lowland freshwater swamps are very extensive, reaching 50 kilometers inland in the western part and more than 80 km along the eastern boundary. The subzone comprises three land systems, Pandago, Gambut and Iwika. The Pandago Land System (PGO) consist of permanently inundated swamps of coastal plains, while the Gambut system (GBT) consists of seasonally inundated

peat at swamps of coastal plains. The Iwika Land System (IWK) consists of swamp-covered lower alluvial fans. The lithology is peat, subrecent fine mixed alluvium (riverine), and recent mixed alluvium (riverine).
The swamps contain a diversity of vegetation types, including open water, herbaceous vegetation, grass swamps, peat swamps, woodlands and swamp forests. Vegetation cover is dependent on the depth and quality of water, and drainage and flooding conditions. In relative deep water, plant growth begins with communities of free-floating aquatics. As the water becomes less deep, rooting water plants are able to establish themselves. Stagnant water becomes dominated by herbaceous communities of mainly sedges, herbs, and ferns, while grasses predominate in swamps with moving water. Shrubs and trees appear in shallower swamps, resulting in various savanna and woodland communities differing in height and density. Swamp forest is the final stage in the sequence (PT Hatfindo 1997).
These freshwater swamps which reach beyond the eastern Park boundary cover the entire Asmat area, combined with the southern lowlands of the Bird's head, the swamps of the north coast and the inland swamps surrounding the Idenburg and Rouffaer rivers contain the World's largest resource of Sago Palms, which form extensive Sago woodlands in shallow swamps that are well-supplied with fresh incoming water. *Pandanus*, a widespread genus, also occurs in pure and mixed stands of woodland swamps in brackish and frequently flooded areas. Other mixed swamp woodlands are dominated by trees such as *Carallia*, *Syzygium* and *Campnosperma* and intergrade into rich swamp forests which are frequently dominated by the above species, or are mixed with other trees such as *Terminalia*, *Alstonia*, *Barringtonia*, *Metroxylon sagu*, *Diospyros*, *Pandanus* and *Myristica* in deltaic regions (Paijmans, 1976; Womersley, 1978; Petocz 1989)

Alluvial Fan Subzone (50-150m)
The alluvial fans altitudinal subzone is located between the coastal swamplands and the terraces, at altitudes ranging from 50 to 150 m a.s.l. The subzone comprises of the Timika Land System. It consists of alluvial fan plains and resembles most closely the theoretical climax vegetation type for the area, topical dryland evergreen lowland forest. The lithology is subrecent coarse alluvium/colluvium and recent mixed alluvium. Except for two plots in Freeport's contract of work area no information is available on the lowland forest of the Park. The forest is extremely rich in species and contains many important timber species of Irian Jaya. The canopy is multilayered and irregular, generally 30-40 m high, with many emergents up to 50 m, while the forest understorey contains a scrub-and-herb layer, and supports a variety of climbers, epiphytes and ferns. Many of the trees are buttressed while others show a variety of air-root structures.
Dominant families include Annonaceae, *Apocynaceae*, *Burseraceae*, *Dipterocarpacae*, *Ebenaceae*, *Fagaceae*, *Leguminoseae*, *Meliaceae*, *Moraceae*, *Myrtaceae*, and *Sterculiaceae*. Typical tree species of the upper storey are *Pometia*, *Alstonia*, *Ficus*, and *Terminalia*, while lower-storey trees are *Garcinia*, *Diospyros*, *Myristica*, *Maniltoa*, and *Microcos* (PT Hatfindo 1997, Paijmans, 1976).

Alluvial Valley Subzone (25-100m)
This area is located along rivers between the 'terraces altitudinal subzone'. It comprises of the Aimau Land System. This land system consists of braided rivers, floodplains and included terraces. The lithology is recent coarse alluvium (riverine), or subrecent mixed alluvium (colluvial). The vegetation consists of a series of vegetation types running parallel to the river along a gradient from wet conditions to progressively drier conditions. Many vegetation types described for the alluvial fan subsystem occur in this subzone.

Dissected Terraces Altitudinal Subzone (100-650m)
This subzone comprises three land systems: Warba, Makrime, and Aimas. The Warba Land System consists of old terraces and terrace remnants. The lithology is subrecent mixed alluvium. The Makrime Land System consists of tilted old alluvial fans. The lithology is subrecent sands, grovels, and riverine clays. The Aimas Land System consists of strongly dissected terraces and fans. The lithology is subrecent medium and coarse alluvium (riverine).
The vegetation, which occurs mainly on podzolized soils, is 'heath forest' also referred to as 'kerangas forest' or 'Heidewald'. Three different forms of heath forest occur. Medium open heath forest on highly acidic soils derived from siliceous parent materials that explains the low stature and openness of the canopy. Ant house plants *Myrmecodia* and *Lecanopteris mirabilis* (fern) and carnivorous pitcher plants *Nephantes spp.* adapted to nutrient poor environment by either obtaining extra nutrients through ants or trapped insects in the pitchers are common. The open heath forest is dominated by *Casuarina, Dacrydium, Podocarpus, Tristania, Eugenia, Syzygium.* Medium to tall 'mossy' heath forest occurs on the upper part of the terraces near the base of the mountains, where the rainfall is higher and there is more mist due to more frequent cloud cover. The ground, tree trunks and branches are covered by dense growth of bryophytes. The dominant species here are *Dacrydium, Podocarpus, Tristania, Eugenia,* and *Syzygium.* Tree pandanus and climbing *Freycinetia spp.* are common. Canopy and emergent trees tend to be taller and have broader crowns than trees in the open heath forest type. In some pockets with temporarily to almost permanently waterlogged soils with impermeable soil layer a swampy form of heath forest occurs. On more fertile soils often associated with deposition of riverine materials mixed hill forest occur (PT Hatfindo 1997).

The Montane Zone (600-2300m)

The montane altitudinal zone comprises the Kemum Land System, which consists of steep-sided deeply dissected mountain ridges. This altitudinal zone is subdivided into lower montane subzone, mid-montane subzone, and upper montane subzone.

Lower Montane Subzone (600-1500m)
The subzone includes the foothills and lower montane slopes. The forest is very distinct from the surrounding zones. It is distinctly drier and has generally fewer terrestrial ferns and mosses than forests in the mid-montane zone. It differs from the alluvial forests in being lower and more closed; yet it contains most of the

same species. These forests form the most floristically rich zones of New Guinea and contain more than 80 genera and 1200 species of trees (Womersley, 1978). In the lower part of this subzone (below 1,000 m), the canopy is dominated by the same species which also occur in forests on the alluvial plain (mixed hill forest). With increasing altitude the forest canopy becomes more even in hight crown size and spacing. Tree ferns become more common in the shrub and lower tree layers, and herbs such as Elatostema, Begonia, and, on open sites, prominent orange-pink flowering Impatiens feature in the ground layer. Increasing humidity causes the forest to become richer in epiphytes, particularly mosses and ferns. The forest also becomes rich in species, and trees in the oak family – *Castanopsis and Lithocarpus*, The *Elaeocarpaceae – Elaeocarpus* and *Sloanea* - and the laurel family – *Cryptocarya* – become prominent (Pajimans 1976, PT Hatfindo 1997).

The Mid-Montane Subzone (1500-2800)

The mid-montane sub zone forest comprises of the Kemum Land System and is characterized by long slopes, spurs and ridges leading to the alpine summits
The vegetation types of the mid-montane subzone are mixed mid-montane forest, *Castanopsis* forest, *Notofagus* forest, Coniferous forest, mid-montane swamp forest, mid-montane sedge-grass swamp, mid-montane *Phragmites* grass swamps, mid-montane *Miscanthus* Grassland and succession on abandoned gardens.

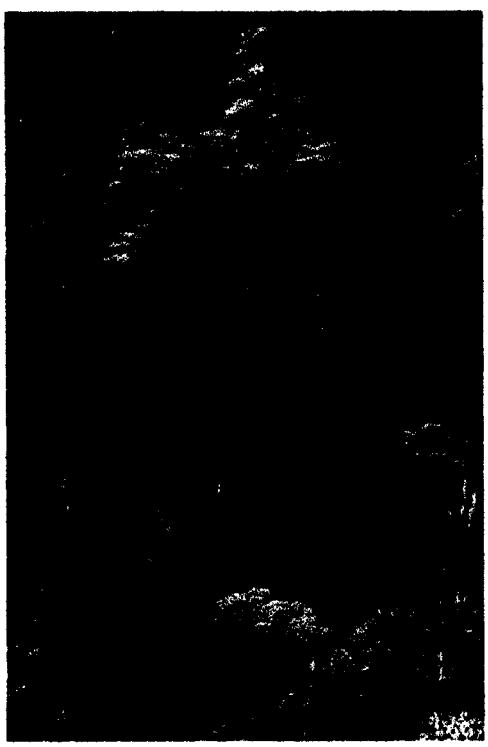


Plate 11: *Moss forest.* Photo courtesy Gerald Cubitt

In about 1500 m a.s.l. clouds tend to intercept the mountains. Overnight cloudy conditions are dominant, which start on most afternoons at about 4 p.m. This cloud cover results in very 'wet' vegetation. The trunks and branches of most trees are clothed with epiphytic ferns and orchids. The leaves of many species of trees are densely clothed with epiphyllous lichens and mosses, sometimes growing 3-4 cm tall on the surface of the leaves. Palms are rare, but terrestrial ferns, including tree ferns, are common in contrast to the lower montane forest. Therefore the mixed mid-montane forest in this altitude is also referred to as 'cloud' or 'mossy' forest. The main canopy tends to be 15-20 m in height, sometimes less on ridges. Frequent canopy trees belong to the family *Fagaceae*, *Lauraceae*, *Cunioniaceae*, *Elaeocarpaceae*, and *Myrtaceae*. Understorey trees include *Garcinia*, *Astronia*, *Polyosomo*, *Symlocos*, *Sericolea*, *Drimys*, *Prunus*, *Pittospermum*, and *Araliaceae*. (PT. Hatfindo 1997)

Notofagus has a very patchy distribution, often occurs in isolated groves on side slopes emerging 10-20 m above the surrounding mixed forest. Although present at lower altitudes, *Notfagus* mainly assumes dominance between 1000 - 3300 m. These forests are sometimes referred to as beech forest, and are often dominated by a few species of *Nothofagus* (*N. grandis* at lower altitudes, *N. pullei* at higher altitudes) Magnificent tall *Nothofagus* forests occur in the Baliem valley above 3000 m altitude (*e.g.* the Kwiyawagi area) (Paijmans, 1976).
Castanopsis accuminatissima forms almost pure stands on ridge crests and upper slopes between 500 m and 2300 m altitude. Mid-montane forests dominated by *Castanopsis* has dense and even canopy, an open shrub layer, a very sparse ground layer of herbs, and thick carpet of fallen leaves on the forest floor.
Coniferous forest occures above 2400 m. Conifers of the genera Podocarpus, Darycarpus, Papuacedrus, Phyllocladus, and Aracaria dominate the canopy and emergent tree layers. (Pajimans 1976)
Mid-montane swamp forest grows in small patches and bands fringing swampy intermontane basins occupied by grass or sedge swamp. The forest has a low and open canopy over a dense layer of small trees and shrubs, and a spares herbaceous ground cover. Most trees grow on hummocks separated by deep pools of water. Common trees include Syzygium and other Myrtaceae, Garcinia, conifers, Nothofagus spp. (Pajimans 1976)
Sedge grass swamps occur above 1800 m in swamps occupying intermontane basins, local depressions in valley floors, and seepage slopes, where either standing or slowly moving water is permanently or just above the surface. Sedges and grasses are usually low in some places up to 1 m high. One of the most common sedges is *Machaerina rubiginosa*, which occurs mainly between 1800 and 3000 m, often in pure stands. Characteristic grasses *are Arundinella furva* and species of *Ischne* and *Dimeria*, mainly between 1800 and 3000 m, and *Agrostis reinwardtii* from about 1800 to well over 3000 m. (Pajimans 1976, PT Hatfindo 1997)
Phragmites karka commonly forms pure stands in restricted seepage areas on slopes and on valley floors. Along rover banks, swamp margins and very shallow swamps it is often associated with *Miscanthus floridulus*.
Abandoned gardens are first invaded and soon covered by various weeds and grasses, including Ageratum, Stachytarpheta, Athraxon cilaris and Ischaeum polystachum. These are followed, usually within a year, by herbaceous and woody creepers and climbers, tree ferns, shrubs, and the grasses of Imperata cylindrica and Miscanthus floridulus. Absence of burning and rooting pigs favor Miscanthus (Walker 1966) and, provided there is no gardening, young secondary forest develops via a Miscanthus dominated stage. On the other hand, repeated burning results in a more or less stable grassland initially dominated by Imperata (Robbins 1963).

Subalpine Zone

In Lorentz National Park the subalpine zone occurs from 3200 m to 4170 m, and is subdivided into the lower subalpine zone from 3200 m to 3650 m and the upper subalpine zone from 3650 m to 4170. All alpine zones are located within the Kelabu Land System, which consists of alpine peaks with bare rocks and

residual ice caps.

The Subalpine Zone

The subalpine zone is defined by the occurrence of subalpine forests, intermixed with other vegetation types. Unlike other mountain ranges in PNG a tall shrubland occurs between 3900 m and 4170 m in the Sudirman range, and may indicate milder conditions or more suitable soils in Irian Jaya.

The lower subalpine forest is floristically poor. The forest in this zone has a closed canopy, which reaches to 10 m in height, with emergents up to 15-m. *Rapanea sp.*, *Dacrycarpus compactus* and *Papuacedrus papuas* tend to be dominant species. Characteristically, there is a thick epiphytic moss layer on branches and the ground, but relatively few epiphytic plants or woody climbers (lianas). The transition from lower subalpine forest to upper subalpine forest occurs at 3,650 m on Mt. Jaya. Several tree species were rare or absent above this altitude, and the structure of those remaining become progressively lower and multi-trunked, with the exception of Dacrycarpus compactus which persits as straight-boled emergents even up to 3900 m. Near the forest limit, the forest is dominated by Ericaceae and Epacridacaeae.

Other vegetation forms in this high altitude are mires and wet sedgelands, tree fern tussok grasslands, *Gleichenia bolanica* shrublands (Mt. Trikora) and vegetation of open rocky slopes.

Plate 12: *Tree ferns near lake Habbema.* Photo courtesy: Frank Momberg, 1997

Subalpine Grassland: The tussok grass *Deschampsia klosii* is common on deep well-drained soils. Species of Monostachya, Poa, Festuca, and Danthonia dominate on shallow soils and poorly drained sites. Part of these grasslands is anthropogenic as a result from repeated fires by local people. In the absence of fires some grasslands eventually revert to subalpine forest. Shrub grasslands include species of *Coprosma, Drimys, Olearia, Pittosporum, Rapanea, Rhododendron, and Vaccinium.*

A variety of seral or very restricted communities occur on old landslides, rock fans, in the mouth of caves and on the generally dry beds of swallowed streams. Of special importance are crustose lichen communities, which are the initial colonizers of rock surfaces.

The Mires: Mt Jaya and the Mt Trikora area has a wet, cold climate and large areas of flat or gently sloping country in addition to soaring cliffs. Mire communities cover much of this in a mosaic presumably reflects differences in water supply and drainage. (Hope et al. 1976, Mangen 1993, PT Hatfindo 1997)

Geomorphology and Flora of Glacial Lakes at High Altitude

The following paragraph is based on the biodiversity survey report by PT. Hatfindo (1997). The lake basins exhibit glacial features, although some may occupy the sites of enclosed depressions in karst landscape of pre-glacial times. Echo soundings showed that lake bottoms were often 'soft' and in the process of infilling by delta encroachment. Nearly all the lake basins are underlain by limestone of high purity, and although some are in depressions completely underlain by limestone of high purity, and, although some are in depressions completely underlain by clay tills, any of the lakes might become emptied from below as a result of solution weathering of bedrock. Surface streams are relatively important only on the most recently glaciated bedrock, on thick clay till or between lakes situated very closely together and lake being directly downhill from the other. Many of the lakes therefore are without surface outlet, inlet, or both of these. The source of lake water varies and this is reflected in physical and biological aspects of the lakes.

The youngest lakes are those closest to the retreating ice fronts. Most of these are found in the upper Merren Valley at about 4.250 m elevation and are less than 70 years old. Because of the lens of rock-flour on the side and bottom, these bedrock can hold water, despite being surrounded and partly subjected to underground drainage. The lakes are formed in a zone of glacial erosion, where the Meren glacier excavated bedrock weaknesses in the floor of the valley. The morphology of the lakes may also reflect preglacial and pre-neoglacial karst landscape features now scraped clear of soils and partly plastered with rock-flour and glacial cobbles; all of these keep some of the drainage on the surface. The lakes of the Lower Meren Valley lie in moraine basins and are probably some 70 to 1,000 years older than those in the Upper Merren valley. Lake Biru and Ketal occupy the upper tread of the Lower Meren Valley (4,020 m). They lie in enclosed compressions in glacial till, but are not dammed back by moraine ridges. Lake Biru lies directly beneath the steep bedrock valley step, which marks the boundary between bedrock, and till on the floor of the valley. The lakes represent the area where ice stagnated below the valley step during retreat. Lake Biru is rather large for a kettle, however, and is probably at least partly a legacy of rotational slip of the glacier below the valley step. Bedrock appears as an outcrop at the foot of the step between lake Ketel and lake Hijau but, for the most part, the step is plastered with till incised by the creek draining lake Ketel towards Lake Hijau. This lake is dammed by one of the ridges in the complex of end moraines at the limit of neo-glacial advance. The inlet stream below the valley step fans out, probably reflecting the braided pattern of the glacifluvial drainage which causes sedimentation and encroachment into the lake along the whole of the eastern shore

The lakes north of the high valley the Northwall fall into two groups. Lake Dugungdugu and Rochiman (4,150 m) are close to the wall, face north, and had the same bottom temperatures. The basins are mainly in bedrock on the sandy members of a breached anticline. The area was probably deglaciated by 9,000 BP (before present) and is outside the limits and is outside the limits of neoglacial advances. However, increased icefalls from the Noordwand Firn during neoglacial times would have effected water temperatures and sedimentation rates at lake Dugundugu and, as a result, lake Rochiman also. Ice avalanche boulder tongues on the southern shore have reduced the size and

probably depth of Lake Dugungdugu, and the eastern shore has been progressively altered by delta and vegetation encroachment. Lake Rochiman is out of reach of avalanche debris and has probably not altered in size since deglaciation. These basins appear to be largely glacially excavated although the pre-glacial karst landscape may have contributed.
Lake Larson and Senewe (3,975 m) occupy basins in a much larger enclosed depression of limestone, which may represent the base of a pre-glacial karst landscape. The stream between the two lakes, almost certainly perennial, flows across till, outwash gravels, and bedrock. Both lakes have some surface influence streams, but there is no surface effluent to this drainage. It is very likely that the resurgence, and main influent stream for lake discovery (227 m below), carries water mainly derived from the Larson and Senew basins. This water would thus past north-west of lake Senewe under the much weathered grike-covered surface forming the lowest part of the depression rim. Lake discovery occupies the lowest part of a larger enclosed depression in limestone which is mantled with till and glacifuvial deposits up to the lowest part of its rim; the latter also was once scoured by ice and is now traversed by well developed grikes. The lake Discovery effluent disappears in a sink in the stream bed close to the lake.
Ice retreated from the lake Discovery basin between about 14,000 and 10,000 years ago, and hence lake Discovery appears to be the oldest lake investigated by Hope et al. (1976). Much of the basin has been infilled, partly by glacifluvial material. Lower down the valley the basins of Ijomba have all but completely infilled during the past 14,000 years or so.
The lakes are inhabited by phytoplankton and zooplankton. The plankton species and associations are listed for each lake in the annex.

Alpine Zone

The alpine zone lies between 4170 m and 4585 m a.s.l. The alpine peaks with bare rock and residual ice caps are part of the Kelabu Land System. The alpine vegetation includes all the communities growing above the tall shrub limits. These are grasslands, heath and tundra. Some extend to lower altitude in exposed or recently deglacieted areas, so that "alpine" cannot be defined in terms of all vegetation above a given altitude. The following section is taken from PT. Hatfindo's "Vegetation Types, Successions, and Reclamation Planning at High Altitudes on Mt. Jaya" (1997).

Short Alpine Grassland (Grassberg 4200 m)
This community is composed of scattered tuft grasses and occasional small tussocks, growing with scattered shrubs to 40 cm tall. The dominant grasses are *Agrostis reinwardtii, Deyeuxia brassi, Anthoxantium angustum, Monostachya oreoboloides*, and *Poa callosa*. The ground is covered by bryophytes and lichens especially *Rhacomitrium crispulum, Frullania reimersii, Cetraria* spp. and *Thamnolia vermicularis*. Scattered scrubs are common but never higher than 40 cm. The most common shrubs are *Styphelia suaveolens, Tetraolopium ericoides*, and *Rhododendron correoides*.

Alpine Tussock grassland

Deschampsia klossii forms dense packed tussock grassland on deep well-drained soils from 4,000-4,500 m on Mt. Jaya. Shrubs such as Styphelia suaveolens lie within the tussock, together with many herbs, notably Papuzilla laeteviridis and the minute fern Cystopteris sp. Wade and Mc Vean (1969) have noted a similar absence of alpine tussock grassland above 4,270 m on the cooler weather aspects of Mt. Wilhelm. Hope (1976) suggests that this be also due to neoglacial disturbances rather than climatic limits. The closed alpine tussock grassland may well be the climax community for the alpine area.

Tetramolopium Klossii - Rhacomitrium Heath

The areas affected by the last neoglacial advance are stony moraine fields that have been exposed by a steady ice retreat over the past 120 years. *Tetramolopium klosii* heath occupies the zone which has been free of ice for more than about 30 years and thus extends in the Merren Valley between 3,950 m and 4,200 m, and in New Zealand Pass (where the ice advance was restricted) between 4,250 and 4,450 m. *Tetramolopium klosii* grows as scattered low shrubs to 30 cm, rooted in a moss carpet of *Rhacomitrium crispulum, Bryum cf. rugicollum* and *Distichum capillaceum. Styphelia suaveolens* and *Vaccinium cf. coelorum* grow a prostate or creeping shrubs, with increasing frequency on the oldest moraines. ***This community has not been described before in New Guinea: its habitat is apparently almost entirely restricted to Mt. Jaya.***

Dwarf Shrub Heath

This community occupies ridge crests and slops above 4,200 m and outside the area affected neoglacial advance. It consists of a shrub mat up to 20 cm in depth, largly composed of *Styphelia suaveolens, with Tetramolopium klosii, Tertamopolium piloso-villosum,* and very occasionally *Coprosma brassii* and sterile *Senecio sp.* shrubs. *Deschampsia klosii* and *Monostachya oreobolides* occupy gaps in the heath, together with the ubiquitous *Geranium* cushions, *Epilobium detznerianum* and *Parahebe wanderwateri.*

Dry Alpine Tundra

The most recent moraines at 4,230 m to 4,600 m have been exposed by steady ice retreat over the last 30 years and are being colonized by mosses and a very few herbaceous species able to grow in the alkaline mineral soil. As the snouts of the glacier retreat, *Epilobium detzneriatum* appears within a few months. After 12 month small cushions of *Distichum capillaceum, Bryum cf. rugicollum* and *Scleranthus singuliflorus* start to develop, initially on flat areas of fine sediments. Tufts of *Deschampia klosii* can also become established. Although tussocks are not formed, the tufts become robust and common within a few years, and mats of *Epilobum cf. prostratum* and *Rhacomitrium crispulum* become very extensive. Other herbs, such as *Sagina sp., Keysseria wollastonii* and *Pilea sp.* start to appear in rock crevices. Poa wisseli forms common tufts to 15 cm.

This community is seral to *Tetramolopium klossii* heath, at least at altitudes of less than 4,500 m. There is thus some doubt about naming it 'alpine tundra' since this structural name now has climatic climax connotations and has been criticized for its use in equatorial areas. Wade & Mc Vean describe a similar

community on Mt. Wilhelm, but Hope (1973) has shown that the 'alpine tundras' are restricted to the area affected by an erosive episode which was probably linked to the last neoglacial period. However, bryophytes, very scattered tuft grasses and the few other herbaceous species in these communities do provide a tundra-like vegetation, which owes its origin not only to extremely cold wet conditions but also to long-term variation in climate.

Wet Alpine Tundra

The extremely free draining limestone moraines at high altitude provide little opportunity for the accumulation of shallow water, and surface streams are intermittent. The Yellow Valley has a very flat floor crossed by numerous low moraines. Behind some of these and in a few rock basins a continuos moss mat supports a few herbaceous species to give a community, which appears analogous to the Mt. Wilhelm Wet Alpine Tundra described by Wade and MacVean (1969). The major moss, which is tentatively identified as *Breutelia aristifolia*, is caked in limestone silts washed-in periodically from the surrounding till. In it grow small cushions of *Gnaphalium breviscapum*, *Geranium-potentilloides var. alpestre* and *Ranunculus spp.* Sedges are scattered to common, with occasional stunted tufts of *Deschampsia klossii.* This community occurs at the relative low altitude of 4,250 m, and is surrounded by *Tetramolopium* heath. Again its status as true alpine tundra can be questioned. It can also be regarded as a Mire community, which could under present climatic conditions, could proceed to short grass bog if sufficient time and more impermeable soils were present.

Nival Zone

The nival zone consists of the ice and snow cover on peaks greater than 4585 m. The following section is referring to from PT. Hatfindo Prima's 'Vegetation Types, Succession and Reclamation Planning at High Altitudes on Mt. Jaya, Irian Jaya Indonesia' (PT Hatfindo, 1997).

Cyrovegetation on the Glaciers of Mt. Jaya

The cyrovegetation of Mt. Jaya is described by Kol and Peterson (1976), while Peterson (1976) describes the englacial lakes where some cyroassociations occur. The cryovegetation is found growing on ice and snow in the nival zone. The following account is extracted from Kol and Peterson (1976) and Peterson (1976).

The lower parts of the Meren and Carstenzs Glaciers appear rough and dirty to the casual observer, by contrast to the white snow and pale blue ice in the crevasses. The ice surface is pitted like rough concrete, by contrast to the white snow and pale blue ice in the crevasses, especially on gentle slopes, and the pits and cracks are full of dark specks or small black flakes. Scattered across the ice are pools and englacial lakes similar to those noted by Colijn (1973). They vary from a few centimeters to 10 m across, are up to 4 m deep and contain very clear water in which scattered black mats several centimeters in diameter rest on the ice bottom or float across the top. The discoloration of the ice surface is to a large extent due to colonies of algae that occupy this cold, moist habitat to form

a cryovegetation. The most extensive growth occurs in the ice ablation area. Previous studies have reported changes in the albedo resulting directly from cryovegetation. Corte (1970) found that at the time of maximal annual growth, cryovegetation on snow a Cape Spring, Argentine Antarctica, produced increased snow melting, resulting in an irregular surface with holes and cracks. Similarly, Gerdel and Drouet (1968) reported increased snow melting resulting from cryovegetation on snowfields at Thule, Greenland. Black ice associations appear to be unique to Mt. Jaya and they possibly have a great influence on the ablation rate of the Meren and Carstensz glaciers.
PT. Hatfindo explains the growth of black and yellow-brown algae associations with physical rather than chemical differentiation of habitats. Although the explanation seems logical (large ice crystals and more horizontally oriented surfaces support discrete, dense black colonies) it does not answer whether not higher nutrient availability due to debris and dust emission by the adjacent mining operation leads to excessive growth of Algae that may increase ablation. In temperate freshwater ecosystems cryoplankton is used for the indication of water quality. *Chlamydomas* indicates very polluted waters (class III), *Nostoc* medium pollution (class II) in the northern temperate hemisphere. Both genera are represented in the black ice associations, although the species differ from the Northern Hemisphere. Clearly nutrients such as NH4 and Ca ions foster rapid vegetative growth (e.g. Chlamydomonas). Disposals of nutrient rich dust and debris would more likely take place on horizontal surfaces, where indeed the largest crytoassociations occurs. (Strassburger et al. 1991). According to PT Hatfindo the pH and total hardness measurements on the ice, snow, and surface melt water are low (pH 4 to 5, Pallin Test 2015 PPM). The concentrations of specific minerals were too low to be detected with the methods used. More research is needed to answer the question of the potential impact of dust and debris emission on the glacier ablation.

Kol and Peterson (1976) found the following species of algae growing on the various ice and snow areas on Mt. Jaya:

Species / Associations	Black Ice	Black Lake	Yellow-brown Ice	Red Ice	Yellow Snow	Red Snow
Chlamydomonas antarcticus	-	+	-	+	-	+
Chlorosphaera antarctica	-	+	+	+	+	+
Scotiella antarctica	-	+	+	+	+	+
Scotiella nivalis	+	+	+	+	+	+
Scotiella novegica var carstenszis	-	-	+	-	+	-
Mesotaenium begrenii	+	+	+	+	+	+
Nostoc fuscesens var Carstenszis	+	+	+	+	-	-

Fig. 3: Glacier Algae, Mt Jaya (Kol & Peterson 1976)

Crytovegetation also occur in englacial lakes that occupy enclosed depressions in the glacier surface. Kol and Peterson (1976) determined that the cryovegetation plays a role in initiating depressions that form englacial lakes. Black colonies showed an increase in temperature over the surrounding ice and water from 1.2°C to 7.5°C. This heat content was probably the result of

incoming radiation, since metabolic heat would be insufficient to raise and hold the temperature of the colonies 1 to 7°C higher than the surrounding (Frogg 1967).
The algae are most prolific in hollows in the bottoms of deeper lakes. The temperature inside the colonies was above 0°C and as much as 4°C during the daytime. Absorption of radiation by the algae led to a marked thermal gradient from the surface (0°C) to the bottom (≈ 2 to 4°C). Only rarely did surface freezing occur overnight. The heat generated is apparently dissipated into the meltwater and glacial ice. According to PT Hatfindo a very minor amount if mineral matter can be seen on the bottom of some of the lakes, but not enough to account for what should be regarded as the biological equivalent cryconite holes. These cyrovegetation lakes are the largest reported. Further detailed micrometeorological, glacioclimatic should be mounted to fully understand the complex causes for glacial ablation.

d) Fauna

Birds
Within the Park 46 restricted range birds were recorded. In the highlands of the Lorentz Park 6 species are endemic to the Snow *Mountains (Pengunungan Sudirman)*, such as the Mountain Quail (*Anurophasis monorthonyx*), the Snow Mountain Robin *(Petroica Archboldii)* and the Long-Tailed Paradiagalla Bird of Paradise (*Paradigalla caruneulata*). 26 species are endemic to the Central Papuan Ranges EBA (Endemic Bird Area) while 3 species are endemic to the South Papuan lowlands EBA. The Lorentz NP conserves extensive areas of the key habitats of these two EBAs and secures the biodiversity of the Central Dividing Range and the South Irian lowlands.
Protected species comprise of 30% of the total avifauna. Globally threatened birds, of which at least ten species are found in the area, include the Southern Cassowary (*Casuarius casuarius*), Southern Crowned Pigeon (*Goura scheepmakeri*) and Pesquet's parrot (*Psittrichas fulgidus*) found in the lowlands. Vulnerable and threatened birds of the mountains include Salvadori's Teal (*Anas waigiuensis*) and other subalpine waterfowl, the rare Snow Mountain Robin (*Petroica archboldi*), Archbold's Bird of Paradise and Mc Gregor's Bird-of Paradise (*Macgregoria pulchra*). Globally threatened habitat specialists include the Papuan Whipbird and the Yellow-breasted Bird of Paradise. Waterbirds and migratory species still require additional studies. (Bas van Baalen 1997)

Mammals

Plate 13: Long-beaked Echidna. Photo courtesy: Tim Flannery

Plate 14: *Newly discovered tree kangaroo (Dendrolagus sp.)*. Photo courtesy: Tim Flannery.

Mammals include the only two monotremes known outside of the Australian continent; the Short-beaked Echidna (*Tachyglossus aculeatus*) and the Long-beaked Echidna (*Zaglossus bruijnii*), - both spiny anteaters -; at least four species of cuscus; several species of tree kangaroo (*Dendrolagus* spp) and one species of Dasyuridae which is often referred to as the marsupial 'Tiger cat' (*Dasyurus albopunctatus*). Recently discovered new species are the 'Dingiso' tree kangeroo (D. mbaiso),

The Lorentz NP is valued by leading experts in mammology as being the most important region for mammal diversity in the Melanesia. Yet because of its inaccessibility, the fauna has remained very poorly known.

Amphibians and Reptiles

Little is known about the diversity of amphibians - the basic data set stems from 1914 - yet experts estimate the park to house about a 150 species of amphibians and reptiles. 90 species have been collected during a survey in 1997 in the contract of work area of PT. Freeport. Only one species was recorded from the subalpine zone, a new undescribed species of lizard, *Lobulia* sp. nov.

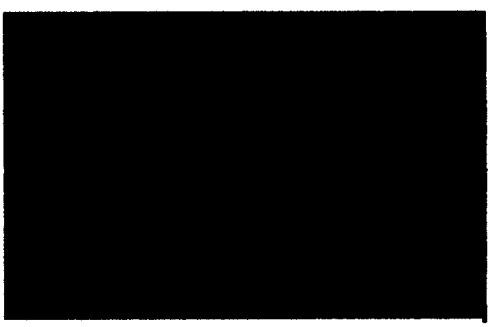


Plate 15: Crocodylus novaeguineae. Source: WWF-Lorentz

Amos nothing is known about the ecology of the rare protected Bohlen's phyton (Morelia boelini). This snake is endemic to New Guinea and throughout the

island only known from very few scattered locations, notably in the Sudirman Range within Lorentz NP restricted to an altitude between 1000 and 2000 meter. The species is listed in CITES Appendix II.

Plate 16: *Bohlens Python.* Photo courtesy: Ron Lilley

The rare Fly River Turtle, *Carettochelys insculpta*, reaches the western limits of its recorded occurrence in Lorentz National Park. This Turtle is listed in the 1996 IUCN Red List. The Fly River Turtle is threatened because of hunting for its meet and egg collection for local consumption as well as commercial trade.

Two species of crocodiles (*Crocodylus porosus* and *C. novaeguineae*) occurring in the park are of particular concern because of hunting pressure and trade. (Allison, 1997)

Fish

The combined lowland forest and peat swamp zones in Lorentz NP with extensive river networks, oxbow lakes, and freshwater swamps provide the richest habitat for the diverse and largly endemic ichtyofauna of Southern New Guinea. It is estimated that more than 100 species of freshwater fish species occur within the park. During a survey by PT. Freeport in 1997 of the Ajkwa River which is impacted by tailings disposal just west of the National Park 78 species were recorded. Catfishes, rainbow fishes, gobies, and gudgeons are particularly prominent. During this survey two new species were recorded for the first time, a cardinal fish (*Glossamia*) and gudgeon (*Oxyeleotris*). In addition a new blue-eye (*Pseudomugil*) was collected in 1995 (Hortle, 1997).

The 'Jardine's Baramundi' or 'Arowana', *Scleropages jardinii* is a protected species near to threatened endemic in the southernmost lowlands. It is a herring-like fish with fossil forms dating back more than 75 million years to the Eocene (Munro, 1967). It has been recorded just recently for the first time (January 1998) in Lorentz National Park (Momats River) where a company trading caught it with 'Aruwana'. This is so far the western-most record of its occurrence. The species is economically important for local consumption and ornamental fish trade.

C) PHOTOGRAPHIC AND CINEMATOGRAPHIC DOCUMENTATION

1. WWF-Indonesia Program [Jakarta], the WWF Coordination Office and the WWF-Lorentz project offices all have got a limited number of slides and prints of the area. Amongst it material from Gerald Cubit, Alain Compost, and Tim Flannery.
2. Yayasan Sejati, a Jakarta based NGO with a focus on indigenous peoples has got many hours of, unedited, footage on specifically the tribal peoples in/around Lorentz. They have also got an extensive slide library - 600 slides on the vegetation of the area alone.
3. The Bishop of Asmat [based in Agats - Irian] has probably got the best documentation on the Asmat people and their art worldwide.
4. The Missionary Aviation Fellowship [MAF, based in Sentani/Jayapura and Wamena] has got many (aerial) shots of the highland environment and many shots of everyday live in the highlands. The collection is in the hands of their various employees.
5. The International Committee of the Red Cross [ICRC, Jakarta office] has got unique footage of the tribal people in the Highlands.
6. PT. Freeport Indonesia [Jakarta and Timika offices] has extensive footage - including aerial photograpy of the glacier area.

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4 STATE OF CONSERVATION

A) DIAGNOSIS

The Park, with an area larger than 2,5 million hectares, is an almost 90% pristine, unspoiled wilderness, which is unique even for this part of the world. No other wilderness area in Indonesia or Papua New Guinea can match the size and quality of this particular reserve. It is of greatest significance that the Park protects an integrated slice of Irian Jaya, which ranges from major lowland ecosystems through mid altitudes to alpine ecosystems. As such is does not only represent most of Irian Jaya's habitats and its species diversity, but also protect those species that require moving along an altitudinal gradient throughout the year.

B) AGENT RESPONSIBLE FOR CONSERVATION AREAS

The Ministry of Forestry, Directorate General of Nature Conservation (PHPA).

C) MEANS FOR PRESERVATION

With the declaration as Lorentz National Park the Ministry of Forestry will establish a technical implementation unit (National Park Management Unit – *Balai Taman Nasional*) that has substantial funding and staffing for the management of the park.
The Government of Indonesia has already declared the area a Strict Nature Reserve (Cagar Alam) as early as 1978. This status did not allow any human activity within the reserve other than scientific research and education; despite tribal people have inhabited the area for at least 5000 years. As local communities continue to depend critically on natural resources within the reserve, the Regional Forestry office (Kanwil Kehutanan) and WWF have proposed to change the status to a National Park. The Ministry of Forestry approved this proposal and Lorentz was declared a National Park in March 1997. The National Park status allows the acknowledgement of community resource rights by delineating use zones.

1. Stakeholder Participation and Recognition of Indigenous Traditions

The provincial and district governments, NGO's, local community representatives (Amunge/Lemasa, Asmat/Lembaga Adat Asmat, Dani/Yayasan Bina Adat Walesi), as well as private sector industries (Freeport Inc., Djayanti Group) are strongly supporting the establishment of a World Heritage Site. All major stakeholders participated in a Lorentz National Park planning workshop and agreed that the Lorentz NP should be managed as a World Heritage Site that respects the social and cultural values of local communities living within the park. Community-based conservation and active participation of local people is an important component of the Lorentz National Park management strategy.

Plate 17: Community mapping training. Source: Frank Momberg 1997

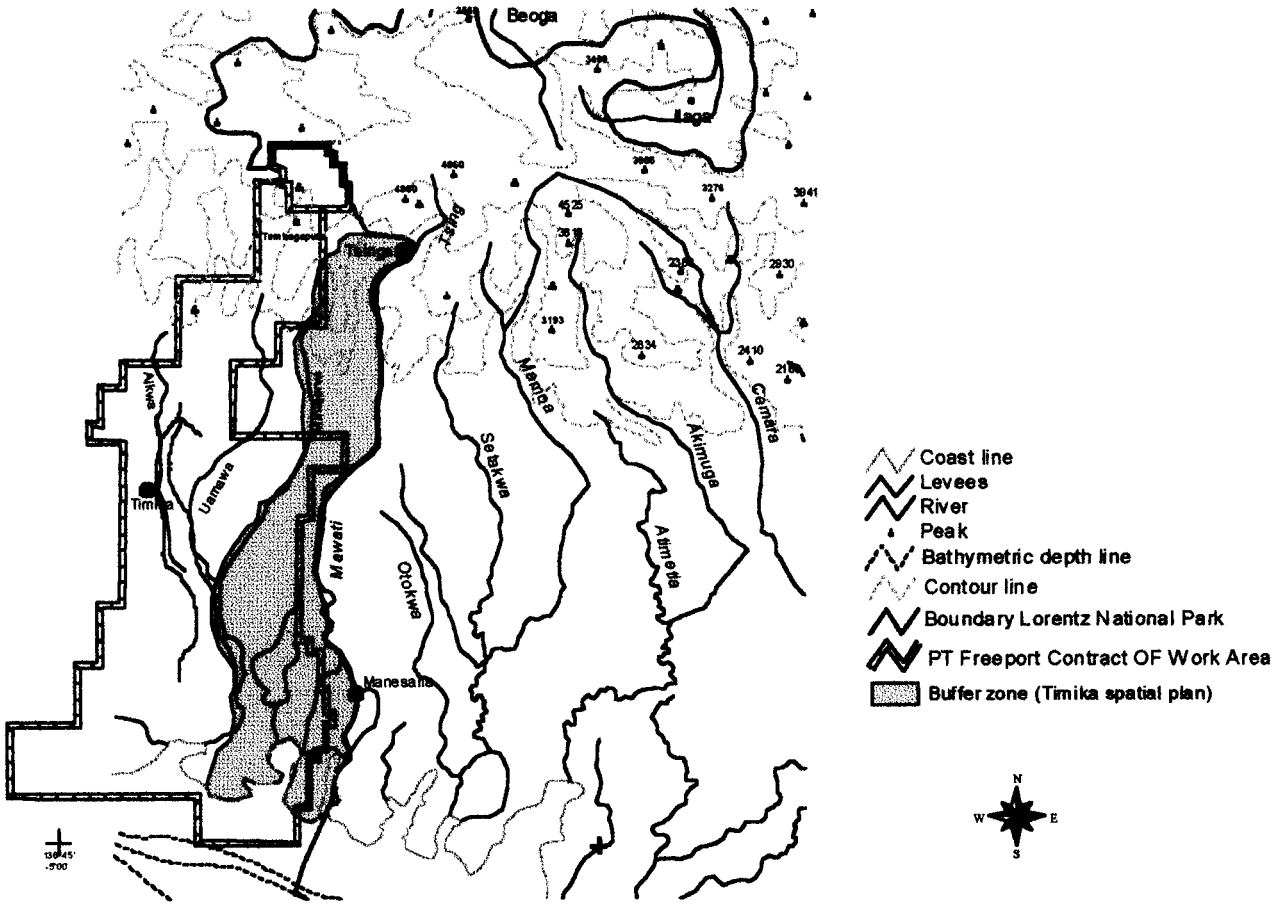
Traditional resource rights will be mapped in co-operation with local communities and designated as traditional use zones in the National Park Management Plan. Within the buffer zones the district governments have made a commitment to include areas with community resource rights in the district and provincial spatial plans. The WWF Lorentz project has signed a Memorandum of Understanding with the provincial government (Bappeda) to facilitate mapping of community resource rights and spatial planning for the buffer zones of Lorentz National Park.

Table 18: Mapping customary lands. Source: Frank Momberg 1997

2. Timika Area Development Project

Associated with the contract of work area of PT. Freeport Indonesia, the Indonesian government is promoting other private sector investments and government sponsored development projects, such as the development of a new town, infrastructure, transmigration, agriculture, and industries. To minimise any potential impact at Lorentz National Park, the provincial government in cooperation with PT Freeport Indonesia have developed a spatial plan that directs all development away from the Park, and creates a large buffer zone along its western boundary. The area development project has already started being implemented according to the spatial plan.

WESTERN BUFFER ZONE (TIMIKA SPATIAL PLAN)



D) DEVELOPMENT OF PLANS FOR THE REGION

The existing claims on the area of other agencies than those of the Directorate General of Nature Conservation stem from earlier times (the 60's for the Freeport mine, now excluded from the Park area, and prior to 1991 when a new law was signed, prohibiting mining inside National Parks).
Potential threats to the integrity of the Park are mining, forest concessions and road construction. A minor and localised threat comes from uncontrolled tourism developments in the Lake Habbema area (this high altitude swampland is extremely vulnerable and needs a high amount of protection). Uncontrolled hiking will inevitably lead to severe degradation of the fragile moss/fern ecosystem, and to a depletion of the scarce woody vegetation, because the cold will force guides and travellers to cut firewood. Trekking tourism to Mt. Jaya has already had a severe ecological impact due to littering and firewood collection.
In August and September 1997, an extraordinary drought caused by El Nino has led to severe forest fires starting from small-scale land clearings by local farmers effecting at least 6,000 ha within the Park.

1. Mining.

Current exploration concessions pose a serious potential threat in the future as further mineral prospecting is underway throughout the northern mountain range within the park. Great concern must be felt about the consequences of discovery of further mineral deposits in the area. The severe environmental impact can be studied at the Freeport's contract of work area at the western boundary of the Park.
Based on Law No.5, and the joint decree from the Ministry of Forestry and Mines & Energy 1989 and 1991, presently any mining is prohibited inside national parks.
If the present legislation were to be changed, and the Government of Indonesia adopted a "Balancing of Scales" policy in case of a rare mineral deposit of extreme high value, extra cautious measures would have to be taken to minimize the environmental impact.
According to the Ministry of Forestry, in an area of such universal importance as Lorentz National Park, no surface mining, no tailing disposal, no milling, and no infrastructure development should be permitted within the Park.

2. Road construction

Three road schemes overlap with the Lorentz National Park:

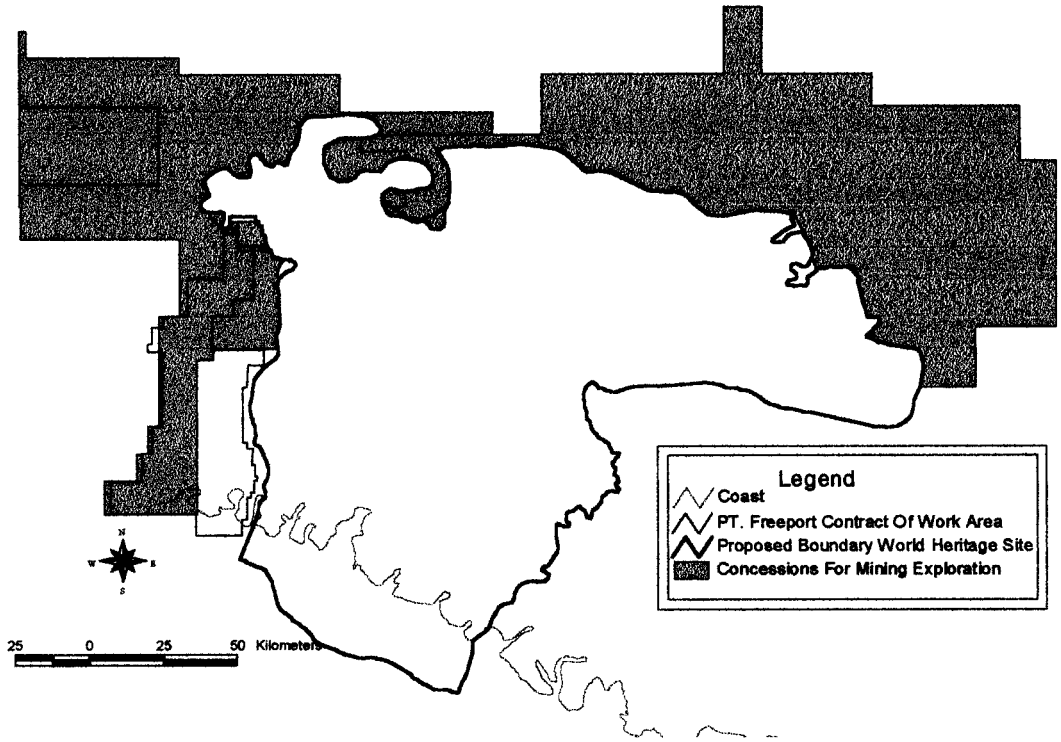
- The road from Wamena via Lake Habbema to Kwyawagi, just south of the northern park boundary [inside the Park boundaries]. The construction of the road, which is already in an advanced stage, is an extremely difficult piece of engineering, at high altitude along very steep ridges. This has caused several patches of severe erosion in very sensitive habitat types (upper montane and subalpine forests). The road passes the extremely sensitive habitat of Lake Habbema at only a few hundred meters distance.

Plate 19,20: *Erosion along newly constructed road Wamena – lake Habbema.* Photo courtesy: Julie Campbell 1995

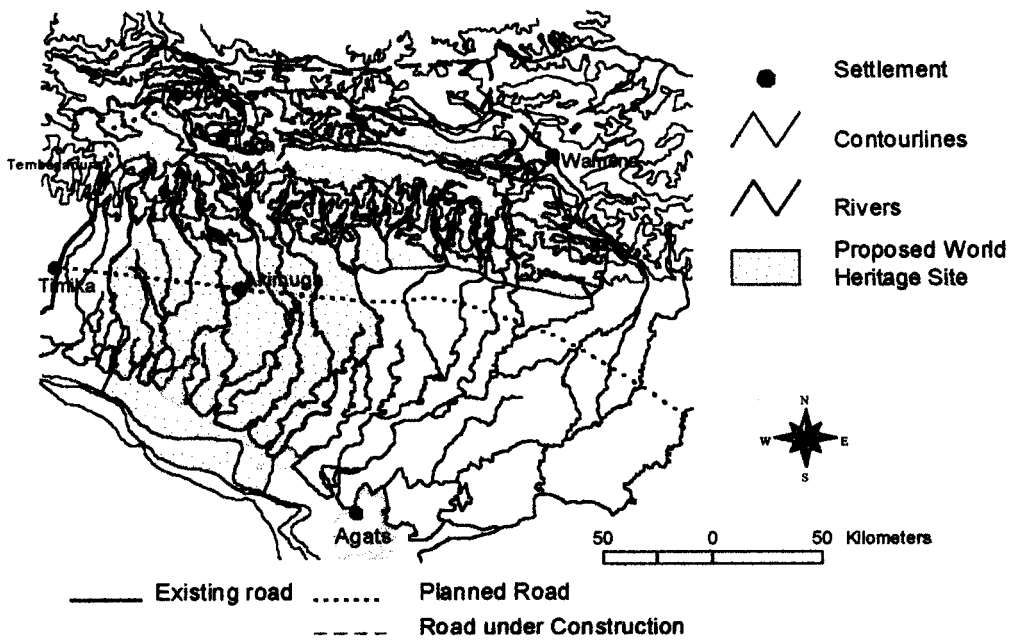
- The planned inter-kabupaten road from Timika to Merauke [via Agimuga] will effectively cut the Park in half, east west wise, and will seriously endanger the integrity of the Park. This road currently only exists on the drawing board, and there is still an opportunity to have a constructive dialogue with the responsible sectoral agencies. During the stakeholder-planning workshop for the Park in 1997 the provincial government and the district governments agreed that this road would have a severe environmental as well as social impact, and is actively seeking alternative solutions. The road plan linking Freeport's mine site to the Trans Irian Highway would make a southern highway unnecessary.

- Since 1997 a new road plan exists, linking Freeport's mine site to Beoga and the Trans-Irian Highway. The road would open access to the fragile alpine habitats of Mt. Jaya with high potential environmental impact (e.g. alteration of drainage patterns and hydrology, poaching, introduction of exotic flora & fauna, uncontrolled tourism and firewood collection). The provincial government in cooperation with Freeport will explore alternative road plans. Roads that cut through the reserve should be put on hold before the Director General for Forest and Nature Conservation (PHPA) has approved the management plan for Lorentz National Park.

Map 5: *Mining exploration concessions*



Map 6: *Road development*



3. Forest fires

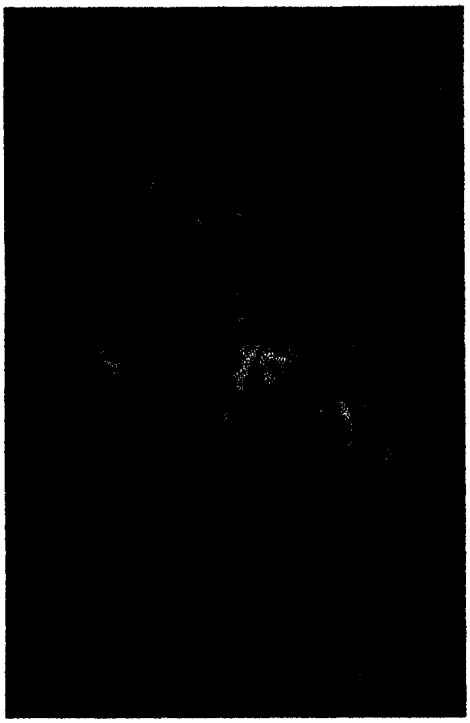


Table 21. Burning *Pandanus* tree along the road to lake Habema, August 1997. Source: Benja Mambai

The extreme dry season of 1997 due to El Niño resulted in catastrophic forest fires in the Indonesian archipelago, and some fires also affected the Park. Although Lorentz was much less affected then other protected areas between August and November 1997 at least 6,000 ha of forest were burnt, but probably much larger areas have been affected. An accurate estimation of the remote fire sites is extremely difficult. The haze caused by the fires induced respiratory problems and reduced air access to remote airstrips. To sketch the scale of the disaster, in November 1997, the haze of these fires partly contributed to reduced visibility in Darwin, North Australia, about 500 kilometres south of the fire spots in Irian and Papua New Guinea.

A major food shortage among the highland communities, as an accompanying effect of the drought and related night frost in the highlands, overshadowed the fire and haze problem. The harvest of the staple food of the communities, the sweet potato, failed completely and, combined with a water shortage induced a severe famine. The people rely entirely on sweet potato and hardly have any food stocks. Reports mentioned the adverse effects of the haze and fires to secondary food sources such as taro and pandanus. Moreover Malaria occurred for the first time in the highlands up to 5000 feet.

Small-scale forest fires are a natural phenomenon of the mountain forest ecosystem, and are therefore a natural hazard with a regular recurrence. Forest fires normally do have a function as they remove, for instance, excess litter, open the canopy and allow the germination of certain tree species. The recent fires, however, are abnormal by their scale and are thought to be related to the extreme El Niño climatic phenomenon, which effected the climate of the Pacific region. Under such extreme conditions, slash-and-burn practices of the local communities can have devastating effects, as it is much more difficult to control these man-induced fires.

It is, therefore, thought to be necessary to include the forest fire issue as an integral part of the Park management, to raise the awareness about the causes and impacts of the forest fires to all those involved. The local communities live in such a close relation to natural resources that they are extremely sensitive to hazards as prolonged drought and forest fires. They should be actively involved in future mitigation efforts.

4. Hunting and Trade of Protected Species

Local use of bird species does not appear at present to have a significant impact on populations, as many of the traditional game birds can be still seen along the Tembagapura – Timika road. This could change rapidly as the human population increases both in the Timika and Wamena area. On the markets of Timika and Wamena many caged protected birds are traded such as Crowned Pigeon, Eclectus parrots and Black-capped Lories. Plums of bird-of-paradies are traded in significant amounts. Although bird capturing for trade (legal or illegal) may not be a problem at present, restricting trade is urgent, as the market for birds can expand rapidly. Attempting to control the trade much later may prove to be very difficult, especially if more and more people become economically dependent on the bird trade as a source of income. (Bas van Baalen 1997)

Traditional hunting in the alpine area has led to local extinction of tree-kangaroos and edchinas, which are easy prey. The hunting pressure on mammals is also very high in the lowlands close to Timika. Wallaby, bandicoot and cuscus populations are shrinking due to hunting for subsistence and sale on Timika's 'Pasar Baru' market. Regulating hunting seems inevitable to maintain viable populations. (Flannery 1998, Kitchener 1997)

Freshwater turtles and snakes (especially Bohlens Phyton), hunted for local consumption and trade, are vulnerable to local extinction. Special protective measures should be considered when assessing the social/cultural changes likely to accompany increased human populations in the Timika area and the Baliem valley. (PT. Harfindo 1997, Mambai 1997)

5. Introduction of Exotic Species

Four fish species introduced in the Timika area. Walking Catfish, Tilapia (*Oreochronis mossambica*), Climbing Perch, and Snakehead (*Channa striata*) are among the most notorious pests as far habitat degradation and out-competing native fishes for space and food resources. Snakeheads are particularly harmful, as they are voracious predators of not only fishes, but also frogs, crustaceans, snakes, and insects. The surveys By PT Hatfindo (1997) conducted in the Kuala Kencana area indicate a general reduction in fish numbers and diversity. The consequences of introduced fishes are most likely irreversible. Once these pests are established, they are virtually impossible to eliminate. Considering the large population of the Timika area and the ongoing transmigration program the problem is bound to get worse.

5 JUSTIFICATION FOR INCLUSION ON THE WORLD HERITAGE LIST

A) NATURAL PROPERTY

The Lorentz National Park, Indonesia's largest conservation area, is generally recognized as one of the last vast wilderness areas of Southeast Asia. It is marked in the IUCN Conservation Atlas of Tropical Forests (1990) as having an extremely high conservation value. Large tracts of undisturbed wilderness areas are becoming extremely rare in SE Asia. The size in itself being the largest protected area in Southeast Asia and in the Pacific, makes Lorentz NP a unique reserve in the region. Most recently the 'International Workshop on Conservation Priority Setting for Irian Jaya' (Conservation International - Biak - Irian - January 1997) attended by a large group of internationally acknowledged scientists on New Guinea ranked the Lorentz National Park extreme high for global biodiversity conservation. Lorentz has always scored highest among protected areas in Irian Jaya for its uniqueness and representativeness of biodiversity and ecosystems (Department of Forestry and FAO/UNDP 1977, Schulze-Westrum, WWF in 1978, MacKinnon 1980, FAO, 1981, RePPProt 1986, Mitchell 1987, Petocz 1989). According to the National Biodiversity Action Plan (1993) Lorentz is a 'top priority site for terrestrial biodiversity conservation' (IUCN 1990) and a 'key site for conservation of biological diversity in wetlands' (Silvius et al. 1986).

Lorentz National Park stretches from the equatorial glaciers of the highest mountains in Southeast Asia through a complete spectrum of alpine, subalpine, lowland, and swamp forests to the coastal mangroves of the Arafura Sea.

The wetland areas in the reserve, which are part of the largest swamp areas in the world, are expected to meet several of the Ramsar criteria, and house several species on the IUCN Red Data List (Annex 2).

Mangroves:	301,500 ha
Peat swamp :	351,750 ha
Freshwater Swamp Forest :	335,000 ha

Source: Data base Wetlands International Indonesia Program

With the declaration as a National Park, a large area of shallow coastal waters (224,975) has been included, consisting of mudflats and seagrass beds which are an important feeding ground for endangered turtle species such as the Green Turtle (*Chelonia mydas*) and the Hawksbill Turtle (*Eretmochelys imbricata*).
The intertidal mud flats are important for migratory bird species such as the Australian Pelican, migrant waders and waterfowl from Australia (July–August) and Siberia (October–March).
This area has been classified as highest priority for conservation for fisheries

and the protection of biodiversity (Indonesia Marine Conservation Data Atlas 1984) producing nutrients together with the mangrove zone for one of the richest fishing grounds in the World, the Arafura Sea.
Despite the uniqueness of the area, ecological information is relatively scarce. As far as biodiversity is concerned, there is only an indication of the richness some of the major groups.

1. Criterion I: "Outstanding examples representing significant major stages of earth's history".

Huge alluvial coastal plains to the south and a rugged central mountain range characterize the Lorentz area. It has a complex geological structure due to the interaction of the Australian and Pacific plates. The highest peaks of the range and the southern slopes are formed by a 'platform' of mixed origin. It comprised part of the Australian continental crust and part of the Paleozoic basement of the Tasman orogen; both unconformably overlaid by sediments aging from the Carboniferous to the Holocene. The southern floodplains are formed by alluvium of Neogen and Quaternary age, whereas the southern slopes and foothills are characterized by a thick sequence of rocks aging Silurian or Devonian to Permian, all more or less metamorphosed. Clay-slates or shales, sandstones, conglomerates and volcanics form these deposits. The highest parts of the mountain range are constituted by a 2000 m thick sequence of sedimentary rocks comprising limestones intermingled with marls and sandstones, all deposited in a transgressive/regressive or open marine environment.

a) Examples of the earth's geological history

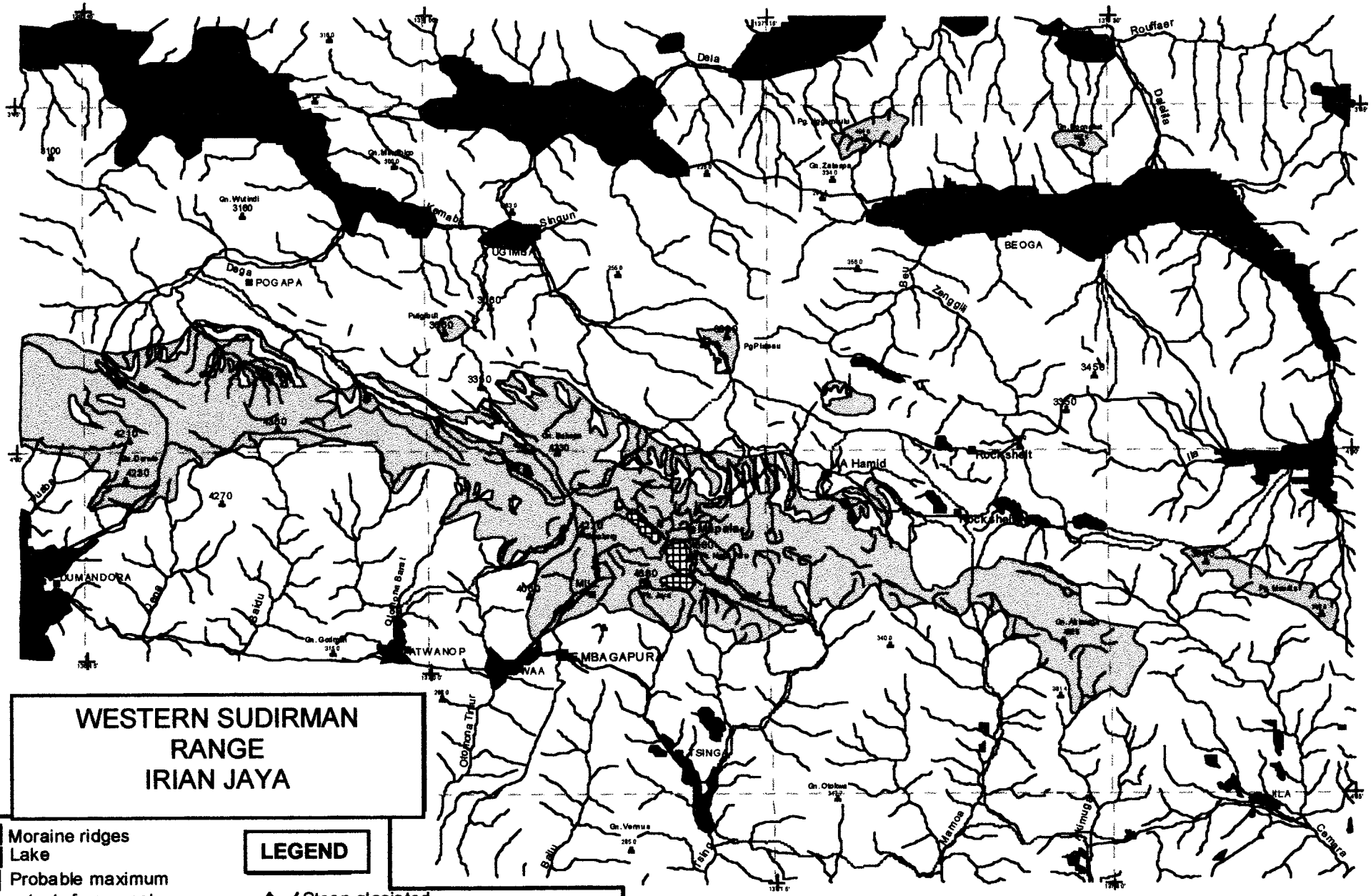
Mount Trikora (4730 m) in the northeastern part of the reserve:
In general we can say that from the Baliem Grand Valley to the highest parts of the Snow Mountains, sandstones are alternating with limestones. Extensive Karst areas occur in the East Baliem Valley and numerous sinkholes may be seen in the higher parts of Mt. Trikora. The summit itself shows a similar alternation of hard and soft rocks, strongly folded during the late tertiary orogenic activity. From south to north we observe a succession of synclines and anticlines all more or less overturned to the north and submitted to strong glacial erosion. The lithology is mainly limestones, marls and sandstones.

At the northeastern border of the broad Baliem valley, the landscape is modeled by the chemical erosion of the of the limestone rocks present, resulting in a considerable extent of karst landforms. Large dolines alternate with rather steep pyramidal hills. Numerous caves due to very active underground drainage are

Plate 22: *Baliem river swallet near Kwyawagi, one of the largest underground rivers in the world.* Photo courtesy: Tim Flannery

typical for the northeastern part of the Baliem. The villages and gardens of the Dani occupy some of the huge dolines. These karst landforms can be seen even at higher altitudes between 3100 and 3200 m. A second element in this landform modeling is the pronounced glacial erosion that occurred during the Pleistocene glaciation. Traces of glacial activity are prominent all over the area north of the summit. Glaciers have probably been descending north until reaching a huge intra-montane basin at 3000-3100 m. Three major elements have to be considered: northernmost we distinguish a huge 8-10 km long by 3 km wide basin containing Habbema lake. This water surface is situated at 3,225 m altitude in an area dominated by pale grayish sandstones alternating with limestone ridges with many medium sized sinkholes, reminding of the doline karst from the Baliem valley. To the south, a limestone ridge of 100 m in height separates the Habbema valley from another broad upland basin, the Baliem-Wamena river valley, between 3000-3100 m.

Most of the rivers draining the waters of the north slopes of Mt. Trikora converge into this basin and later on flow either east or north-west. Those running eastward can be considered as the source rivers of the Wamena river, which flows into the Baliem river near the town of Wamena. Those running westward will join with the waters coming from lake Habema and will later be the Baliem river. This intramontane basin may thus be considered as the main watershed of the area.



WESTERN SUDIRMAN RANGE IRIAN JAYA

LEGEND

- Moraine ridges
- Lake
- Probable maximum extent of youngest Pleistocene Glaciation
- Agricultural use
- Possible glacigenic deposits of earlier glacial phases
- Glacier
- Steep glaciated headwalls
- Major track
- Minor track
- Road
- River
- Peak
- Settlement
- Major town
- Rock shelter

Source : Gunung Es, Balkema, Rotterdam, 1973 (Map I)

5 0 5 10 15 20 25 Kilometers

N
W E
S

A number of valleys extending north from the summit of Mt. Trikora show typical glacial erosion features. Very prominent lateral moraines with ridges more than 100 m high are present as far down as 3200 m. The typically U-shaped valleys show many glacially smoothed lateral rock faces and overdeepened swampy basins mostly covered by grasslands.

Plate 23: *Glacier at Puncak Jaya (5030 m) - Sudirman mountains.* Photo courtesy Gerald Cubitt.

The Carstensz peak in the extreme northwestern part of the reserve: The rugged crest of the Carstensz peak is made up of limestone. These limestones, which are of Miocene age, have been elevated to 5000 meters above sea level over the last 10 million years.

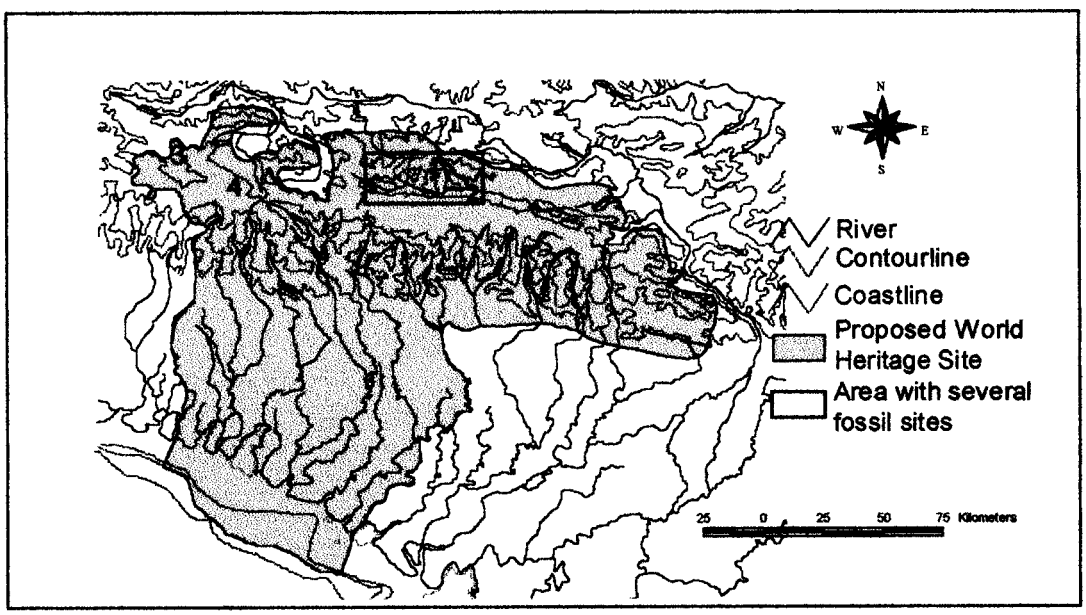
b) Examples of record of life

- The north part of the very summit of Mt. Trikora has layers of foraminiferal limestone with *Alveolina* as fossil content. These benthal fossils testify to a shallow carbonate platform faces of Eocene age. At the foot of the 'False Peak' old landslides expose layers crowded with macrofossils such as big oysters (*Austria* sp.), brachiopods (*Terebratula* sp., *Neithea* - subgenus *Neitheopsis*), and sea urchins (*Cidaris* sp.). These latter fossils indicate that these layers are quite older than the summit, i.e. being of upper Cretaceous age.

- The central northern area of the Park has extensive fossil deposits which are of international importance and which are in urgent need of research and protection. The known fossil deposits of international importance are marked below.

Kelangurr Cave is the type location for *Protemnodon hopei*, a large extinct walaby (approximately 40 kg) from the Pleistocene era. This macropodid was an inhabitant of subalpine grasslands and periglacial areas. Remains have been found in sediments in both Kelangurr Cave and the West Baliem River, Kwiyawagi area. At both localities its remains are plentiful. The sediments of the Baliem River have also yielded a diverse small mammal assemblage, which may be associated with the large mammals. These include *Phalanger sericeus, Stenomys niobe, Mallomys gunung, Thylogale* sp, and *Thylogale christenseni* (the latter two species are both small wallaby). In the sediments of both localities mentioned, the remains of the largest mammal of the sub-alpine grasslands, *Maokopia ronaldi* - a large panda-like marsupial, are also common.

Bones where also recovered from Milik, Kimagi, and Potoyu caves. The bones appear to represent a variety of ages, from about 60.000 to a few hunderd years old. Milik Cave has a deposit of extraordinarily well preserved fossil bones of extinct species.
Since the locations are relatively accessible, more research is urgently needed and samples need to be secured for Natural History Museums in Indonesia and abroad.



Map 8 **Important** *fossil locations.*

① *Kelangurr Cave [Kwiyawagi area, altitude approximately 2950 m]. International important fossil location for ice age mammals.*

② *Fossil localities for ice age mammals and plants [2800 m]*

③ *Billingeek rockshelter. Fossil site for Holocene mammals [3700 m]*

④ *Mapala rockshelter. Holocene fossil record [4000 m].*

Both Mapala rockshelter, Billingeek rockshelter and the Kelangurr Cave house the remains of the extinct Thylogale christenseni, a tiny wallaby, associated with a fauna typical of subalpine grassland or tundra. It has been suggested that their extinction probably coincided with the introduction of the dog in to the area.

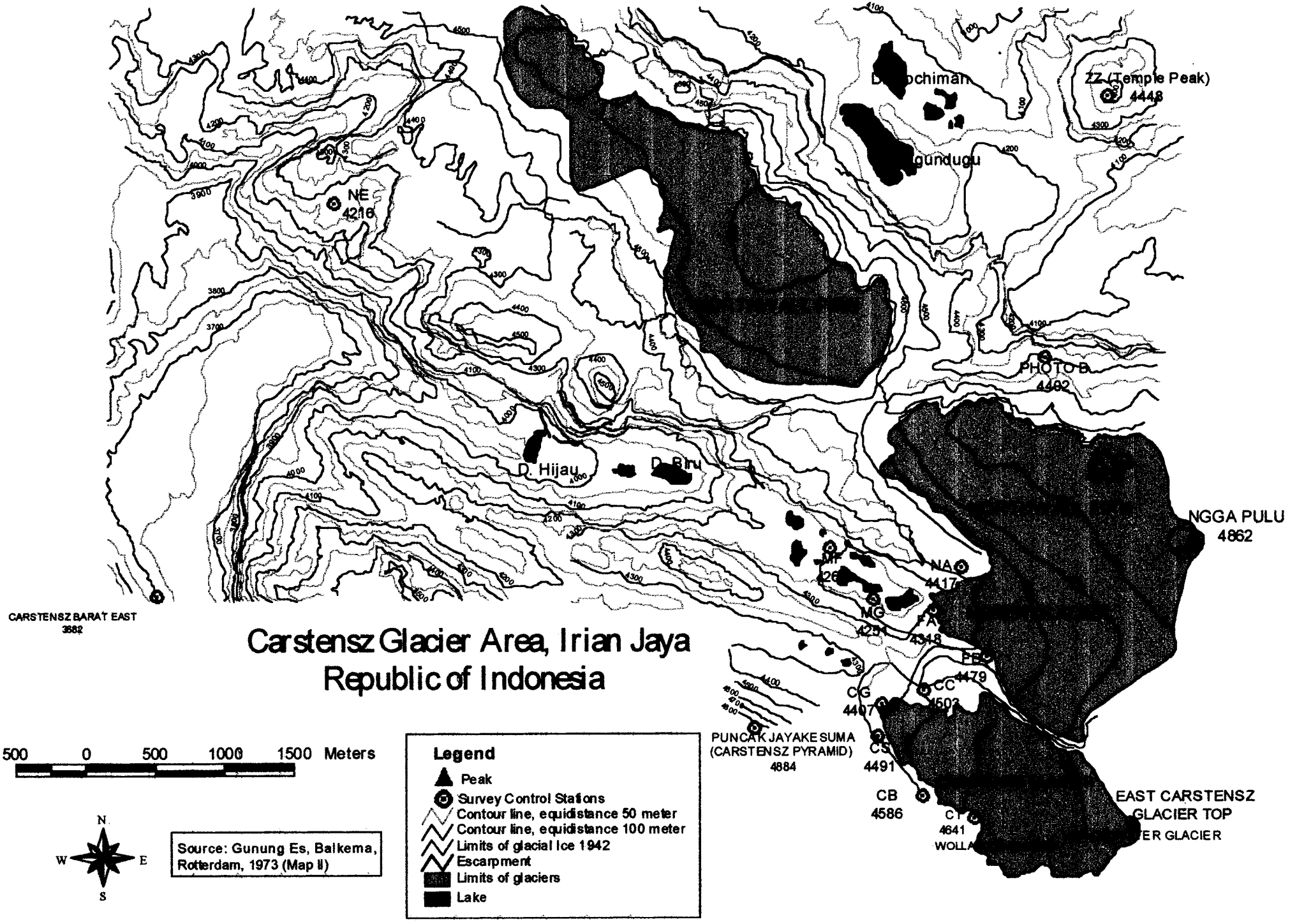
c) Examples of significant geomorphic or physiographic features

The Central Range cuts from West to East through Lorentz NP along the northern park boundary. The area is divided into several distinct physiographic divisions. From North to South they are northern ridge, East Baliem valley, outwash slopes, limestone plateau (e.g. Kemabu plateau), and Southern escarpment.

Alpine glaciation is responsible for the dissection of the Limestone Plateau and glacial valleys run from the southern escarpment to the 'necklace' of terminal moraines which mark the break of the slope at the northern edge. The entire Central Range within Lorentz NP but especially the Mt. Jaya area with the Kemabu plateau as well as the area of Mt. Trikora provide the most complete spectrum of glacial-geomorphic features in New Guinea. Glaciation and glacial retreat have created erosional and depositional glacial landforms such as U-shaped valleys, ground moraines, series of end moraines and outwash fans.

The limestone plateau, which is part of the Irian Limestone Formation and about 1000 m thick for much of its length (sometimes up to 1500 m), represents a remarkable karst landscape geomorphic features such as shark rillenkarren, pinnacle karst, sink holes and dolinas.

Two factors, the outstanding thickness of the limestone formation and high precipitation either now or in the past, makes the Irian Limestone Formation one of the most interesting cave areas in the world. Most caves are still undiscovered and the area might contain caves of extraordinary depth, length and karst features. The East Baliem River becomes one of the largest underground rivers in the world when it disappears in the Wanuga sinkhole resurging north of the ridge at Yanurik.


ZZ (Temple Peak)
4448
NE
4216
PHOTO B
4492
D. Hijau
D. Biru
NGGA PULU
4862
CARSTENSZ BARAT EAST
3682
NA
4417
MG
4251
4318
4479
CC
4503
CG
4407
PUNCAK JAYAKE SUMA
(CARSTENSZ PYRAMID)
4884
4491
CB
4586
4641
EAST CARSTENSZ
GLACIER TOP
Carstensz Glacier Area, Irian Jaya
Republic of Indonesia
500 0 500 1000 1500 Meters
N
W
E
S
Source: Gunung Es, Balkema, Rotterdam, 1973 (Map II)
Legend
Peak
Survey Control Stations
Contour line, equidistance 50 meter
Contour line, equidistance 100 meter
Limits of glacial Ice 1942
Escarpment
Limits of glaciers
Lake

2. Criterion II: "Outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals."

The very rich and diverse biota of Lorentz NP ranges over a vast continuum of habitats from sea level upwards to the highest mountains of Southeast Asia. However most of the wildlife species have very restricted ranges that may be confined to a small part of this gradient. Other species, particularly among the birds, are more opportunistic and may be found in a wide range of habitats at many elevations. Many of the honeyeaters (Meliphagidae) span ranges of 1000, 1500 or even more than 2000 m, taking advantage of flowering trees for nectar or insects. Or along with some pigeons and birds of paradise, they visit seasonally fruiting trees for nectar or insects at lower elevation when the habitats of the mountains are less productive. It is therefore, of primary importance to cover the entire altitudinal spectrum. Of equal importance is the variation in habitat types within a very narrow altitude span. Lorentz NP provides the most complete altitudinal spectrum and richness of habitat types of New Guinea.
The Sudirman range in the northern part of Lorentz NP effectively stops genetic flow and isolates many hill and lowland species on either side of the range. It thus defines two of the major lowland biogeographic units, the northern plains and foothills and the southern lowlands. The range itself within Lorentz is a formidable barrier to genetic flow along its length. Less mobile montane elements have little genetic flow along the backbone of the cordillera so that many populations develop new characteristics and visible morphological changes from west to east (e.g. endemism in the subalpine and alpine flora of Mt. Trikora and Mt. Jaya).
A large marine area has been included in the park as an integral part of the coastal swamplands that provide the nutrients for an abundant marine life.

3. Criterion III: "Superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance"

a) The area around Puncak Jaya and the Carstensz glaciers.

Every year an increasing number of visitors, both national and foreign, come to this area to climb what is regarded as one of the top seven mountains in the world, Carstensz Pyramid, which at 4884 meters, is the highest mountain in South-East Asia. The Carstenz Range is also partly covered by one of the three tropical glaciers remaining in the world.

Plate 23: *Glacier Puncak Jaya*. Photo courtesy: Tim Flannery

Lake Habbema

The lake lies in alpine grasslands surrounded by alpine swamps, with an outstanding panorama of rugged mountains beyond.

4. Criterion IV: "Containing the most important and significant natural habitats for in situ conservation of biological diversity, including those habitats that contain threatened species of universal value from the point of view of science or conservation"

a) Flora

Detailed vegetation studies of major ecosystems (e.g. lowland forests, fresh-water swamps, and mangroves) within Lorentz National Park is still lacking. Montane, subalpine, and alpine flora has been studied in great detail at Mt. Trikora and less intensive at Mt. Jaya showing high endemism that can be expected for other high mountains within the reserve. The Lorentz reserve is one of Indonesia's centers of plant diversity (IUCN 1990).

Mt. Trikora (Mt. Wilhelmina) - Danau Habbema

Several endemics are listed but the flora is very poorly known from most of the area. The area holds significant limestone and ultramaphic floras. The vegetation consists of montane, subalpine forests and alpine vegetation. The area has been proposed for listing as a Center of Biodiversity for High Priority Conservation (CI workshop Biak 1997).

Subalpine vegetation

Subalpine rainforest.

This forest is dominated by *Xanthomyrthus* and *Decaspermum, Vaccinum dominans* and *Schefflera altigena.*

Subalpine grasslands

Gleichenia vulcanica bog is common.

Subalpine shortgrass bog

Carpha alpina fen and *Carex* open fen

Alpine vegetation

Aquatic *Isoetes* community on the banks of Lake Habbema

Endemic species on Mt. Trikora

I Pteridophytes	
Cyathea everta	D. Habbema at 1400-2800 m in *Lithocarpus* forest
C. pseudomuelleri	At 3200 m on Mt. Trikora
C. tomentotissima	Along stream at 3225 m around D. Habbema
C. magma	
C.aeneifolia	
Domin var. *melanacantha.*	In cloud forest near lake Habbema
Pleisoneuron belense	On limestone near the Bele river
Pneumatopteris egenolfoides	D. Habbema
Spaerostephanus albossetosus	D. Habbema

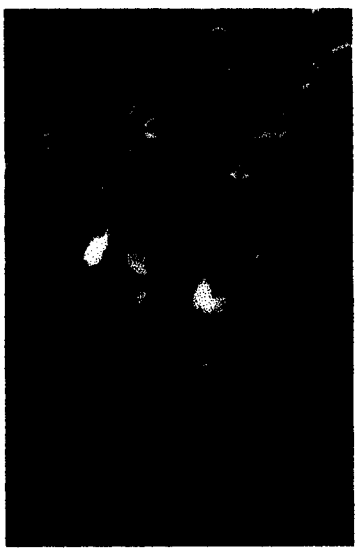


Plate 25: *Rhododendron versteegii (Habbema).* Photo courtesy: Robert Hewitt

II Monocotyledons

Eriocaulon tubiflorum	
Poa parva	In sub alpine short grassland and heath. 3780 - 4100 m W. Trikora Pass.
Poa wilhelminae	Moist places near waterfall on limestone at 3850 m.

III Endemic Dicotyledons

Aporosa parvula	In lower mountain forest from 1805 - 2100 m in Baliem Valley
Cotula wilhelminensis	In mossy bogs in alpine grasslands at 3800 m.
Euphrasia spatulifolia	On wet sandy slopes and old grassy screes in alpine grasslands on Mt. Trikora.
Gnaphalium heleios	In bogs in alpine grasslands at 3800 m.
Hydnophytum archboldianum	On trees in upper montane forests near D. Habbema or on forest margins. 3225 m.
Myrmecodia brassii	In subalpine thickets and alpine grasslands near D. Habbema. 3225 m.
Parahebe polyphylla	In alpine grasslands along stream at 3400 - 3700 m on Mt. Trikora.
P. Rigida	In alpine grasslands often in moss cushions at 3400 m on Mt. Trikora.
Potentilla habbemana	In open boggy flats, singly or grouped. D. Habbema at 3225 m.
P. indivisa	In tussock grasslands at 3100 m.
P. mangenii	In dry low vegetation at 4100 m.
P. simulans	In grasslands on peaty soil at 3225 - 4350 m. Mt. Trikora.
Keysseria extensa	In alpine grasslands at 4100 m.
K. pinguiculiformis	Forma *pinguiliformis.* In damp spots in alpine grasslands at 3800 m on Mt. Trikora.
K. pinguiculiformis	Forma *nana.* In alpine bog turf at 3950 - 4100 m. on Mt. Trikora.
Rhododendron oreites	
R. inundatum	
R. rhodochorum	
R. subarenulatum	
R. disterignoides	
R. psammogens	
R. helodes	
R. brassii	
R. subuliferum	
R. rubrobracteatum	
R. flavouride	
R. pachystigma	
R. haematpthalum	
R. versteegii	

Plate 26: *Rhododendron saxifragoides. Lake Habbema valley. Smallest Rhododendron in the world.* Photo courtesy: Robert Hewitt

Schefflera altigena	In subalpine shrubbery often with emergent *Papuacedrus papuanus* at 3200 - 3560 m both near D. Habbema and Mt. Trikora
Tetramalopium corallioides	Edge of earth screes in alpine grasslands at 3950 m.
T. tenue	Wet grassy slopes at 3650 m.
T. lanatum	D. Habbema and Mt. Trikora in wet patches in alpine grasslands and in drier areas in subalpine shrubbery from 3225 - 3400 m.
T. bicolor	On open landslides in montane forest - 2810 m.
Trachymene flabellifolia	In mossy glades in alpine grassland, Habbema at 3225 m.

Puncak Jaya (Mt. Carstensz)

Several endemic species are listed but the flora is very poorly known for most of the Carstensz area. The area has significant limestone and ultramorphic floras. The vegetation is characterized as montane and subalpine forests. The grasslands of Mt. Jaya are less disturbed than those of Mt.Trikora and support a greater diversity of species. Poa nivicola and P. lamii dominate some of the grasslands. These communities are absent from Mt. Trikora. Like the Mt. Trikora/Habbema area the Puncak Jaya area has highest priority for Biodiversity Conservation.

Endemic species on Mt. Jaya

I	**Endemic Pteridophytes**
Cyathea klossi	
C. papuana	At 700 - 1100 m.
Grammitis papuensis	
II	**Endemic Monocotyledons**
Danthonia irianensis	On drier areas, often under rock overhangs at 3510 m.
III	**Endemic Dicotyledons**
Coprasma wollastonii	Unknown 2530 - 3350 m, Utakwa R. to Mt Jaya.
Cyrtandra eriophylla	Undergrowth of upper montane forest in Bandarong Valley 3140 - 4000 m.
Euphrasia culminicola	In open alpine grasslands on sandstone at 3200 - 3800 in Bandarong valley.
E. scutellarioides	In alpine grasslands 3200 - 4500 on Mt. Jaya and Bandarong Valley.
Gentiana wollastonii	In alpine grasslands 3400 in Bandarong Valley.
Keysseria gibbsiae	Forma *minuta*. In small hard tussocks in open hummock bogs and *Carpha alpina* fen at 3450 m at Kemabu Plateau.
Olearia exilis	Var. *excilis*. In subalpine shrubberies in Bandarong valley 3140 - 4000 m.
Papaucalia carstenszensis	On edge of subalpine shrubbery at 3830 m on Mt. Jaya.
Parahebe vanderwateri	In open moraine and cracks in limestone 3660 - 4350 m on Mt.Jaya and Bandarong Valley.
Potentilla brasii	Var. *simplex*. On poor soils at 3350 - 4000 m on Mt. Jaya.
P. irianensis	In alpine grasslands and stony places at 3850 - 4600 m.
Rhododendron hameliifolium	
R. cyrtophyllum	
R. carstensense	
R. oreadum	
R. ultimum	
R. coelorum	
R. roseiflorum	At 2100 - 2700 m.
Schefflera monticola	Var. *monticola*. On forest margins of Bandarong Valley at 2070 - 3200 m.
S. monticola	Var. *lanceolata*. On forest margins at Bandarong Valley at 2530 - 3200 m.
Tetramalopium carstenszense	In open, glaciated, valley floor at 3910 m.
T. distichum	In open alpine grasslands on Carstensz and Bandarong Valley 3140 - 4000 m.
Timonius carstensensis	1940 - 3325 m in Bandarong Valley.
Trigonitus minuta	On open moraines and in alpine grasslands from 3140 - 4400 m.

b) Fauna

A 1994 Indo-Australian joint survey has revealed that, as expected by earlier researchers, the Lorentz general area is a region of very high biodiversity. Yet because of its inaccessibility, the fauna has remained very poorly known.

The Lorentz area has been rated by leading mammologists as being the most important region for mammal diversity in the Australo-Pacific region.

To illustrate the uniqueness of the Lorentz NP in terms of mammal diversity the following listing shows the 1994 (Flannery) and 1997 (Kitchener) survey's most interesting findings:

- Of the 42 species recorded during the survey, 10 - almost 25 per cent - were new records for Irian Jaya, while two were completely new species.

Plate 27: *Mountain cuscus (Phalanger carmelitae).* Photo courtesy : Tim Flannery

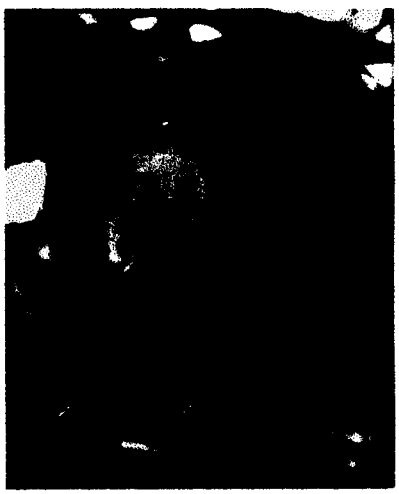


Plate 28: *Dendrolagus scottae. Tenkile tree kangaroo.* Photo courtesy: Tim Flannery

- The highlight of the mentioned survey was the discovery of a hitherto unknown species of tree-kangeroo (*D. mbaiso*). A large black and white animal, occurring at high elevation on the southern slopes of the Maokop and on some northwestern ranges. It has declined in numbers and distribution in the last 30 years, and is now rare in some areas. While the animal is now restricted to the rugged upper slopes of the Central Cordilla elsewhere, in the extreme north west of the park (Pagopa area) the animal is still relatively common and occurs in extensive tracts of the country to the north of the cordillera also. This is probably a direct consequence of the fact that the Moni people will not kill the animal since they regard it as sacred.

- A second species of *Dendrolagus* (*D. dorianus*) was also collected just west of the new western boundary of the park. This is the first record for this species from the Irian Jaya Central cordillera.

Plate 31: *Specled dasyura, endemic glacier rat.* Source: WWF-Lorentz

Plate 30: *Pseudochirops cupreus.*
Photo courtesy: Tim Flannery

- Another important discovery was that of a new species of rodent (genus *Stenomys*) at high elevation in the Meren and Kwiyawagi areas. The rat inhabits subalpine heath.
- Two species of giant rat - *Mallomys aroaensis* and *M. istapantap* - were collected close to the western boundary, and both species were new records for Irian Jaya.
- Among the bats was the small blossom feeder *Syconycteris hobbit*. This bat was only first recorded in Irian Jaya in early 1994. A specimen of *Hipposideros* cf. *Corynophyllus*, a rare horseshoe-bat, had never been recorded before from Irian Jaya. The rare Unstriped Tube-nosed Bat (*Paranyctimene raptor*) was found locally common around the New Town area (just west of the park), although it had not previously been recorded from Irian Jaya. In the Kwiyawagi area (northern slope of the Maokop Range, at 2900 m) two extremely important discoveries regarding bats were made. The first involved *Pipistrellus collinus*, a small, rare insect-eating bat, which had not been recorded previously from Irian Jaya and which apparently, possesses a harem-like structure. The second important bat discovery was that of *Tadarida kuboriensis*, a species never previously recorded from Irian Jaya known only from three occurrences in Papua New Guinea.

Fig. 4: List of mammal species collected during the 1994 Indo-Australian expedition inside Lorentz and its bufferzones:

MARSUPIALIA		
Dactylopsila palpator	Long-fingered Triok	
Dasyurus albopunctatus	New Guinea Quoll	
Dendrolagus dorianus notatus	Doria's Tree-kangeroo	1st record Maokop
Dendrolagus mbaiso	**New species**	**1st record ever**
Dorcopsulus vanheurni	Small Dorcopsis	2nd record Irian
Microperorcyctes longicauda	Striped Bandicoot	
Neophascogale lorentzii	Speckled Dasyure	
Peroryctes raffrayana	Raffray's Bandicoot	
Petaurus breviceps	Sugar Glider	
Phalanger carmelitae	Mountain cuscus	2nd record Irian
P. intercastellanus	Soutern Common Cuscus	
P. sericeus	Silky Cuscus	3rd record Irian
Pseudochirops corinnae	Plush-coated Ringtail	
P. cupreus	Coppery Ringtail	
P. caroli	Weyland Ringtail	3rd record ever
P. mayeri	Pygmy Ringtail	
MURIDAE		
Anisomys imitator	Un-even toothed Rat	
Mallomys aroaensis	Eastern Woolly Rat	1st record Irian
M. istapantap	Subalpine Woolly Rat	1st record Irian
M. rothschildi	Black Woolly Rat	
M. gunung	Alpine Woolly Rat	3rd record ever
Melomys lorentzii	Lorentz Melomys	
M. rubex	Mountain Melomys	
Rattus leucopus	Cape York Rat	
R. rattus	Black Rat	Introduced
R. steinii	Small Spiny Rat	
Stenomys niobe	Moss Forest Rat	
S. richardsoni	Glacier Rat	Maokop endemic
S. omlychodes	Adrianus rat	
Stenomys sp. nov.	**New species**	**1st record ever**
MEGACHIROPTERA		
Dobsonia magma	Bare-backed Fruit-bat	
Nyctimene albiventer	Common Tube-nosed Bat	
N. certans	Round-eared Tube-nosed Bat	
Paranyctimene raptor	Unstriped Tube-nosed Bat	1st record Irian
Rousettus amplexicaudatus	Rousette Bat	
Syconycteris australis	Common Blossom-bat	
S. hobbit	Moss Forest Blossom-bat	2nd record Irian
MICROCHIROPTERA		
Hipposideros corynophyllus	Telefomin Horseshoe Bat	1st record Irian
Miniopterus macrocneme	Small Melanesian Bent-wing Bat	2nd record Irian
M. schreibersii	Common Bent-wing Bat	1st record Irian
Pipistrellus collinus	Mountain Pipistrelle	1st record Irian
Tadarida kuboriensis	New Guinea Mastiff-bat	1st record Irian

Additional 13 species have been collected in the lowlands during a survey conducted in 1997 by PT. Hatfindo (Kitchener et al. 1997) in Freeport's COW along the Western Park boundary.

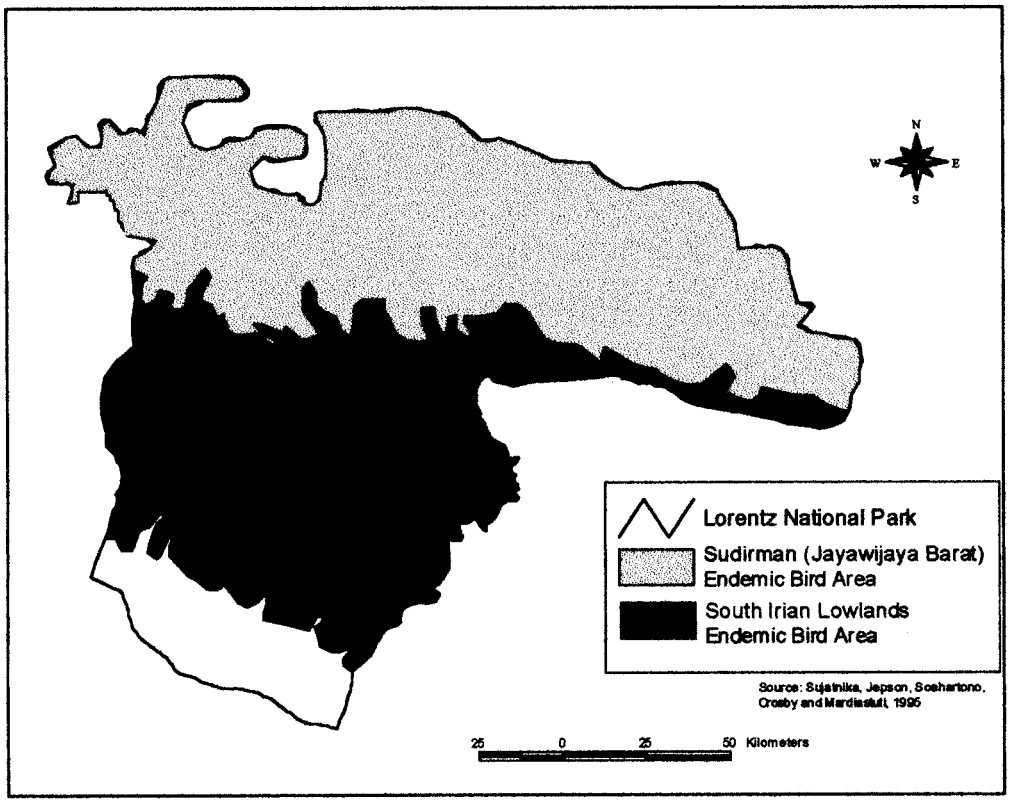
Fig. 5: Additional mammal species collected by D. Kitchener in 1996:

GENUS	SPECIES
Chiroptera	*Dobsonia minor*
	Nyctimene sp. cf. keasti
	Macroglossus minimus
	Hipposideros diadema
	Rhinolophus euryotis
	Pipistrellus angulatus
Rodentia	*Uromys caudimaculatus*
	Hydromys chrysogaster
	Rattus praetor
	Melomys sp. cf. calidior
	Melomys rufescens
Marsupialia	*Echymipera kalubu*
	Peroryctes raffrayana
	Pseudochirops corinnae

Additional species that have been collected earlier by the Carstensz Expedition and identified by Hope (1976) include the Long-baked Echidna (*Zaglossus bruijnii*), Rummler's Mouse (*Coccymys rummleri*), the Water Rat (*Hydromys habbema*), and the Long-tailed Pygmy-possum (*Cercatus caudatus*).
Szalay et al. (1996) recorded Thomas's Melomys (*Mellomys mollis*) in the Hidden valley, and the Brown Dorcopsis wallaby (*Dorcopsis muelleri*) from lowland forest close to Timika. He added to the potential list of lowland species within the Lorenz Park by listing regional names familiar to the Kamorro people: Gray Phalanger (*Phalanger gymnotis*), Common Spotted Cuscus (*Spilocuscus maculatus*), and Striped Possum (*Dactylopsila trivergata*).

A total of 64 mammal species have been identified so far for Lorentz National Park and adjacent buffer zones. No faunal surveys have been conducted in the in the central and eastern part of the Park. It is estimated that as many as 90 to 100 mammals species might occur in the Park.

Lorentz National Park covers two Endemic Bird Areas (EBA) with a total of 45 restricted range birds and 9 endemic bird species confined to the Sudirman range and the South-Papuan lowlands EBA.



Map 10: *Endemic Bird Areas within Lorentz National Park*

- Lorentz National Park covers two 'Endemic Bird Areas'. The EBA of the Central Papuan Range consists of two distinguished areas sub-divided by the Baliem valley, the Sudirman Range and the Jayawijaya Range. An extensive part of the Sudirman Range is located within the Lorentz Park having most restricted range birds of the entire EBA with 40 species of which six are endemic to this range. Two of the restricted-range species are classified as very vulnerable. Archbold's BowerBird, *Archboldia papuensis* is considered rare and patchily distributed and thus vulnerable to forest destruction. It was recorded by WWF in 1996 below the Lake Habbema area, its habitat threatened by road construction, illegal logging, and forest fires. MacGregor's Bird-of-paradise is classified as vulnerable owing to its small remnant and fragmented population (*Collar et al.* 1994, Shannaz *et al.* 1995). The Lorentz NP also covers a large part of the South Papuan lowlands EBA, an area very little studied with so far a total of 8 restricted range birds and 3 species endemic to South Papuan lowlands EBA recorded.
- Of the birds collected in the Tembagapura area (just west of the western park boundary), the most interesting species are the Blue-capped Ifrita (*Ifrita kowaldi*) and the Mountain Firetail (*Oreostruthus fuliginosus*). From the species collected in the Barren Valley (below the Meren glacier) one species of honeyeaters (*Eurostopodus archboldi*) has a range restricted just to the

Snow Mountains area. Both Glossy and Mountain Swiftlets (*Collocallia esculenta* and *C. hirundinacea*) were found nesting in several caves in the Kwiyawagi area. The very rare bird of paradise MacGregor's Bird of Paradise (*Macgregoria pulchra*) was collected in the subalpine shrub of the Prins Willem V range and was also observed in the Trikora area (WWF Lorentz 1996). This magnificent Bird of Paradise only occurs on the highest mountains of the Snow and Star Mountains and those of southeast PNG.

- During a 31 day survey in Januray- February 1997 conducted by PT Freeport Indonesia in its contract of work area 274 bird species were identified along 22 short transects in eight major habitats following the Lorentz National Park boundary from sea level to 4,000 m a.s.l. Globally threatened species recorded during this survey include: Southern Crowned Pigeon (*Goura scheepmakeri*) and Pesquet's parrot (*Psittrichas fulgidus*), found in the lowlands, and Salvadori's Teal (*Anas waigiuensis*), Snow Mountain Robin (*Petroica archboldi*) and Mc Gregor's Bird-of Paradise (*Macgregoria pulchra*) in the mountains. Additional 50 bird species were observed during other surveys in the same area.

c) Integrity of the system

Due to it's geographical location, wide range in habitats, combined with the relative inaccessibility of large tracts of the reserve, the area has already proven to score extremely high in terms of the range of habitats, bio-diversity and endemism (see annexes 3 & 5). It sheer size alone makes the Lorentz National park a unique reserve in the whole of Southeast Asia.

So far due to its remoteness, size and low population density currently immediate threats are very limited. Lorenz National Park continues maintaining a high degree of biological integrity.

All the mentioned facts on the outstanding examples of earth's history, biological and scenic characteristics, and biological integrity of the Lorentz National Park are indicative for the universal values of the area. International recognition of these values is of major importance to support the Indonesian Government in its effort to protect the integrity of this heritage.

APPENDIX A **GAZETTEMENT NOTICES**

1. Decree No. 44, 1978, Minister for Agriculture, declaring Lorentz as a Strict Nature Reserve covering an area of 2,150,000 hectares (*SK Menteri Pertanian No. 44, Tahun 1978 mengenai Penunjukan Kawasan Lorentz sebagai Cagar Alam seluas 2,150,000 hectares*);

2. Decree No. 154, 1997, Minister for Forestry, about changing the function and declaring the Lorentz Nature Reserve plus the Trikora Mountain Protection Forest with 373.125 hectare, and coastal waters with 224,975 hectares to a National Park with the name Lorentz National Park covering an area of 2,505,600 hectares. (*Perubahan fungsi dan penunjukan Cagar Alam Lorentz, Hutan Lindung Gunung Trikora seluas 373.125 Hektar, dan Perairan seluas 224.975 Hektar sebagai Taman Nasional seluas 2.505.600 Hektar dengan Nama Taman Nasional Lorentz*).

APPENDIX B RELEVANT NATIONAL LEGISLATION

1. Act No. 5, 1990 on the Conservation of Living Resources and Ecosystems (*U.U. No. 5, 1990 tentang Konservasi Sumber Daya Alam Hayati dan Ekosistemnya*);

2. Presidential Decree No. 26, 1989 on the Ratification of the Convention Concerning the Protection of the World Cultural and Natural Heritage (*Keputusan President No. 26, Tahun 1989 tentang Pengesahan Convention Concerning the Protection of the World Cultural and Natural Heritage*);

3. Act No. 24, 1992 on Spatial Planing. (*U.U. No. 24 Tahun, 1992 tentang Penataan Ruang*)

APPENDIX C LANDSYSTEMS AND SPECIES OF PARTICULAR CONSERVATION SIGNIFIGANCE IN LORENTZ NP

A) AMPHIBIANS AND REPTILES OF THE LORENTZ NATIONAL PARK REGION

Preliminary species list

(Based on a paper by G.A. Boulenger -1914, updated by A. Allison of the Bishop Museum in Hawaii including the results of the 1997 survey in the Freeport contract of work area)

Note: It is likely that the park has ca 150 species of reptiles and amphibians [pers. comm. Dr. A. Allison] so this list includes just little over half the species likely to occur in the area.

Genus, Species

** Order: Suborder: Family Amphibia: Anura: **Hylidae** [TREEFROGS]
Litoria chloronota
Litoria eucnemis
Litoria genimaculata
Litoria infrafrenata
Litoria pygmaea
Litoria thesaurensis
Litoria wollastoni
Nyctimystes granti
Nyctimystes montana

** Order: Suborder: Family Amphibia: Anura: **Microhlyidae**
Cophixalus crucifer
Oreophryne kampeni
Sphenophryne cornuta
Sphenophryne klossi
Sphenophryne macrorhyncha
Xenobatrachus sp.

** Order: Suborder: Family Amphibia: Anura: **Ranidae** ["TRUE"FROGS]
Platymantis papuensis
Rana arfaki
Rana daemeli
Rana grisea
Rana grunniens
Rana novaeguineae

** Order: Suborder: Family Reptilia: Chelonia: **Carettochelidae**
Carettochelys insculpta [FLY RIVER TURTLE] (popolar trade species)

** Order: Suborder: Family Reptilia: Chelonia: **Chelidae** [SIDE NECKED TURTLES]
Elseya novaeguineae (popular trade species)
Emydura subglobosa (popular trade species)

Chelodina reimanni is expected to occur in the reserve as well. *C. reimanni* is endemic to the general area.

** Order: Suborder: Family Reptilia: Chelonia: **Trionychidae** [SOFT SHELL TURTLES]
Pelochelys bibroni

** Order: Suborder: Family Reptilia: Lacertilia: **Agamidae** [AGAMID LIZARDS]
Hypsilurus auritus
Hypsilurus binotatus
Hypsilurus dilophus
Hypsilurus godeffroyi
Hypsilurus modestus
Hypsilurus nigrigularis

** Order: Suborder: Family Reptilia: Lacertilia: **Gekkonidae** [GECKOS]
Cyrtodactylus marmoratus
Cyrtodactylus mimikanus
Gehyra interstitialis
Gekko vittatus

** Order: Suborder: Family Reptilia: Lacertilia: **Scincidae** [SKINKS]
Carlia fusca
Emoia aenea
Emoia bogerti
Emoia caeruleocauda
Emoia irianensis
Emoia jamur
Emoia klossi
Emoia kordoana
Emoia longicauda
Emoia physicina
Emoia tropidolepis
Emoia veracunda
Eugongylus rufescens
Lamprolepis smaragdina
Lipinia longiceps
Lobulia sp. nov. *"alpina"*
Lygisaurus novaeguineae
Papuascincus stanleyanus
Prasinohaema semoni
Sphenomorphus jobiensis
Sphenomorphus longicaudatum
Sphenomorphus melanopogon
Sphenomorphus mimikanus
Sphenomorphus muelleri
Sphenomorphus neuhausii
Sphenomorphus nigriventris
Sphenomorphus nototaenius
Sphenomorphus oligolepis
Sphenomorphus stickeli
Sphenomorphus undulatus
Sphenomorphus wollastoni
Tiliqua scincoides gigas (popular trade species)
Tribolonotus novaeguineae (popular trade species)

** Order: Suborder: Family Reptilia: Lacertilia: **Varanidae**
Varanus indicus (popular trade species)
Varanus pantopes (popular trade species)
Varanus prasinus (popular trade species)
Varanus salvadorii (popular trade species)

** Order: Suborder: Family Reptilia: Serpentes: **Acrochordidae** [FILE SNAKES]
Acrochordus arafurae (popular trade species)

** Order: Suborder: Family Reptilia: Serpentes: **Boidae** [SMALL BOAS]
Candoia asper (popular trade species)
Candoia carinata

** Order: Suborder: Family Reptilia: Serpentes: **Colubridae** ["TRUE SNAKES"]
Boiga irregularis
Dendrelaphis calligastra
Dendrelaphis lineolatus
Dendrelaphis lorentzii
Fordonia leucobalia
Stegonotus cucullatus
Stegonotus modestus
Stegonotus plumbeus
Tropidonophis doriae
Tropidonophis mairii
Tropidonophis picturatus

** Order: Suborder: Family Reptilia: Serpentes: **Elapidae** ["COBRA" FAMILY]
Acanthophis antarcticus
Aspidomorphus muelleri
Micropechis ikaheka
Toxicocalamus grandis

** Order: Suborder: Family Reptilia: Serpentes: **Pythonidae**
Morelia albertisii
Morelia amethistina
Morelia viridis
Morelia boelenii

B) BUTTERFLIES OF THE LORENTZ NATIONAL PARK REGION

preliminary species list
(Main source Henk van Mastricht)

The available information on the insect bio-diversity of the area is very limited indeed. Till date we only have detailed information on one group of butterflies from the central mountain area (Henk van Mastricht), apart from that we have got some anecdotal information for butterflies from the lowland area (WWF-Irian). The given list contains the data from van Mastricht.

Occurance	**Group or sub-group**	**Sub-species**
	Chrysomelanea group	
LA		*Delias ladas levis*
LA		*D. ladas wamenaensis*
	Geraldina group	
	Sagessa sub-group	
WM		*D. geraldina ssp*
WM, EM		*D. microsticha microstiga*
WM, EM		*D. rileyi yofona*

WM		*D. hypomelas rubrostriata*
EM		*D. hypomelas lieftincki*
EM		*D. argentata argentata*
	Fascelis sub-group	
WM		*D. fascelis amungme*
EM		*D. fascelis ibelana*
	Aroae-pheres sub-group	
WM, EM		*D. yabensis*
EM		*D. balimensis*
WM, EM		*D. approximata ♀f. rectimargo*
	Eichhorni sub-group	
EM		*D. heliophora germana*
EM		*D. antara*
WM		*D. carstensziana*
EM		*D. carstensziana f. alcicornis*
WM		*D. leucobalia distincta*
EM		*D. leucobalia ericetorum*
?		*D. catisa wisseliana*
EM		*D. catisa aurostriga*
WM		*D. toxopei morosa*
EM		*D. toxopei toxopei*
	Bornemanni group	
WM		*D. nais denigrata*
EM		*D. nais holophaea*
EM		*D. zebra zebra*
WM		*D. klossi klossi*
EM		*D. klossi chrysanthemum*
	Mesoblema sub-group	
WM, EM		*D. arabuana arabuana*
EM		*D. flavistriga flavistriga*
WM		*D. callista callipulchra*
EM		*D. callista callipareia*
WM		*D. luctuosa gottsi*
EM		*D. luctuosa archboldi*
	Weiskei group	
WM		*D. hapalina ssp. Nov.?*
EM		*D. hapalina amoena*
	Weiskei sub-group	
WM, EM		*D. leucias leucias*
EM		*D.rosamontana rosamontana*
	Kummeri group	
WM		*D. ligata weylandensis*
EM		*D. ligata interpolata*

WM		*D. alepa ssp. ?*
EM		*D. alepa orthobasis*
	Nigrana group	
WM		*D. wollastoni wollastoni*
EM		*D. wollastoni bryophila*
	Mariae sub-group	
EM		*D. walshae walshea*
WM		*D. inexpectata ssp. nov.?*
WM		*D. inexpectata*
	Mira sub-group	
WM		*D. hiemalis flabella* new species (?)
EM		*D. autumnalis autumnalis*
	Niepelti group	
WM, EM		*D. meeki hypochrysis*
WM, EM		*D. meeki hypoxantha*
	Belisima group	
LA		*D. aruna irma*
	Hyparete group	
LA		*D. mysis lara*

WM = Western mountain area of the park
EM = Eastern mountain area of the park
LA = Lower areas of the park (south of the range)
? = Doubt about exact location

Anecdotal information:
In Jila (central part of the highlands) a completely white type of *Morphotaenans* sp (*Amathusidae)* can frequently be observed. Densities are relatively high. This complete white form is known only from the mountain areas of PNG, it is not known from any other location in Irian Jaya than Jila.
John Matabang [WWF-Irian] traveled from Agats to the Mimika (lowland swamp forest) area and did some collecting on the way (± 50 m above sea level). Two species of Birdwing butterflies were collected which according to the literature do not occur under the 1000 m high contour line (*Ornithoptera chimaera* sp, *O. goliath* sp).

C) Birds species known from the Lorentz area

In general it needs to be stressed that the whole Jayawijaya mountain range scores extremely high in rates of endemism. The whole central mountain range is extremely important in terms of bird conservation.

Bird observations in the Eastern highlands near Mapenduma. Data from the 1995/1996 survey from the Biological Science Club (BScC).

Species	English Name	Remarks
Aceros plicatus	Blyth's Hornbill	The only Australasian Hornbill
Accipiter meyerianus	Meyer's Goshawk	
Anthamus cinerus	Black-Faced Wood-Swallow*	
A. maximus	Great Wood-Swallow	Papuan Endemik (P), 800 - 2800 m
Androphobus viridis	Papuan Whipbird	**Endemic to Irian Jaya (E), 1400-2700 m and rare**
Cacatua galerita	Sulphur - Crested Cockato	Up to 1000 m (rarely to 1450 m)
Centropus menbeki	Greater Black Coucal	(P) up to 800 (rarely to 1250 m)
Cacomantris variolosus	Brush Cuckoo	sea level - 1300 (rarely to 1700 m)
Collocalia esculenta	Glossy Swiftlet	common in hills
Charmosyna wilhelminae	Pygmy Lorikeet	(P) 1000-2000 m
C. puchella	Little Red Lorikeet	(P) 500-1800 m
C. papou	Papuan Lorikeet	(P), 1750m - timberline (usually 2000 m)
Chaetorhynchus. Papuensis	Mountain/Pygmy Drongo	(P), 600 - 1600 m
Coracina melaena	Black Cuckoo-Shrike	(P), up to 750 (rarely to 1200 M)
C. schisticeps	Grey-headed Cuckoo-Shrike	(P), 500 - 1200 m
C. caeruleogrisea	Stout-billed Cuckoo-Shrike	(P), up to 1600 m (rarely to 2000 m)
Corvus tritis	Grey Crow	(P), up to 1400 m)
Cracticus quoyi	Black Butcherbird	up to 750 m, (rarely to 1400 m
Crateroscelis nigrorufa	Bicoloured Mouse-Warbler	(P), 1300 - 2000 m
C. murina	Rusty Mouse-Warbler	(P), up to 1700 m
Cyclopsitta diophthalma	Double-eyed Fig-parrot	up to 1600 m
Colluricincla megaryncha	Little Shrike-Thrush	up to 1450 m (rarely to 2150 m)
Cuculus saturatus	Oriental Cuckoo	up to 1500 m (one record at 4400 m)
Dicaeum pectorale	Papuan Flowerpecker	(P), up to 1500 m (rarely to 2350 m)
Ducula pinon	Pinon Imperial Pigeon	(P), up to 500 m (rarely to 750 m)
D. rufigaster	Purple-tailed Imperial Pigeon	up to 600 m (rarely to 1200)
D. zoeae	Zoe Imperial Pigeon	(P), up to 1500
Eopsaltria pulverulenta	Mangrove Robin	inhabit in coastal region (mangrove)
Eudynamys scolopacea	Common/Asian Koel	up to 1500 m
Gerygone chloronotus	Green-backed Gerygone	up to 1500 m
G. chrysogaster	Yellow-bellied Gerygone	(P), up to 800 m
G. magnirostris	Large-billed Gerygone	rarely to 1000 m
G. palpebrosa	Fairy Gerygone	up to 1450 m
G. cinerea	Grey Gerygone	(P), 1750-2700 m (rarely as low as 1000 m)
Gymnophaps albertisii	Papuan Mountain Pigeon	sea level to timberline
Grallina cyanoleuca	Magpie Lark	**posibly new record**
Halcyon megaryncha	Mountain Kingfisher	(P), 1100-2100 m
H. torotoro	Yellow-billed Kingfisher	up to 700 m (rarely to 1200)
Haliastur indus	Brahminy Kite	up to 1000 m (rarely to 2000 m)
Lorius lory	Western Black-capped Lory	(P), up to 1200 m (rarely up to 1750)
Lalage leucomela	Varied Triller	up to 1500 m
Lophorina superba	Superb Bird of Paradise	(P), 1150 - 2300 m
Macropygia amboinensis	Brown Cuckoo-dove	up to 1800 m (rarely to 2300 m)
M. nigrirostris	Black-billed Cuckoo-dove	up to 2600 m
Meliphaga montana	Forest White-eared Meliphaga	(P), 500-1150
M. aruensis	Puff-backed Meliphaga	(P) up to 1200
M. orientalis	Mountain Meliphaga	(P), 800-1750 m, common above 1300m
Mino dumontii	Yellow-faced Myna	up to 750 (rarely to 1500 m)
Microeca flavigaster	Lemon-bellied Flycatcher	up to 1400 m
M. flavovirescens	Olive Flycatcher	(P), up to 1000 m (rarely to 1500 m
M. papuana	Canary Flycatcher	(P), 1750-3500 m
Monachella muelleriana	Torrent Flycatcher	up to 1800 m
Monarcha frater	Black-winged Monarch	400-1600 m
Microdynamis parva	Dwarf Koel	(P)< up to 1450 m
Myzomela sclateri	Scarlet-throated Honeyeater	(P), above 1000 m, **new record for NG mainland**
M. adolphinae	Mountain Red-headed H.	(P), 800-2000 m
M. eques	Red-throated Honeyeater	up to 500 m (rarely 1000 m)
M. cruentata	Red Honeyeater	600-1500 m
M. rosenbergii	Red-collared Myzomela	(P), 1500-4000 m
Melipotes ater	Spangled Honeyeater	**(P). restricted to Mts Huon Peninsula 1300-3300m, new record in Lorentz**
M. fumigatus	Common Smoky Honeyeater	(P), 1000-4200 m
Motacilla cinerea	Grey Wagtail	600-2500 m
Melilestes megarhynchus	Long-billed Honeyeater	(P), up t 1500 m (Occasionally to 1750 m)
Machaerirhynchus nigripectus	Black-breasted Boatbill	(P), 1300-3000 m

Malurus cyanochepalus	Emperor Fairy-Wren	(P), up to 1000 m
Melanocharis longicauda	Mid-mountain Berrypecker	(P), 700-1900 m, Also known as Lemon-breasted Berrypacker
M. nigra	Black Berrypecker	(P), up to 1450 m
Melidectes belfordi	Belford's Honeyeater	(P), 1600-3200 m
Oedistoma iliolophus	Dwarf Honeyeater/Longbill	(P), 100-1700 m
O. pygmaeum	Pygmy Honeyeater/Longbill	(P), up to 700 m (rarely to 1300 m)
Oreocharis arfaki	Tit/Painted Berrypecker	(P), 1750-3000 m (Occasionally 1450 m)
Paradisaea raggiana	Raggiana Bird of Paradise	(P), up to 2000 m (lowland to Lower montane Forest)
Philemon brassi	Brass's Friarbird	(E), up to 50 M. **New altitude record**
P. buceroides	Helmeted Friarbird	up to 1000 m (rarely to 1500 m)
Pitohui dichrous	Hooded Pitohui	(P), 600-1700 m
P. kirhocephalus	Variable Pitohui	(P), up to 1500 m
Ptilinopus ornatus	Ornate Fruit-Dove	(P), up to 2400 m
P. magnificus	Wompoo Fruit-Dove	up to 1450 m
P. iozonus	Orange-bellied Fruit-Dove	(P), up to 800 m
P. solomonensis	Yellow-bibbed Fruit-Dove	Lowland species (no altitude data)
Pseudeos fuscata	Dusky Lory	(P), up to 1500 m (rarely to 1800 m)
Psittrichas fulgidus	Vulturine/Pesquet's Parrot	(P), 1000 m (patchily distributed, rarely to 2000 m)
Ptilorrhoa caerulescens	Blue Jewel-Babbler	(P), up to 800 m
Ptiloprora perstriata	Grey-streaked Honeyeater	(P), above 1700 m
Pycnopygius ixoides	Plain Honeyeater	(P), up to 1150 m (rarely to 1400)
Pachychepala sp	Whistler	
P. schlegelii	Regent Whistler	(P), 1750-3650 m
P. pectoralis	Common Golden Whistler	Hill to Mountain Forest
Peltops montanus	Mountain Peltops	(P), 550-3000 m
Pachycare flavogrisea	Dwarf/Golden-faced Whistler	(P), 400-1750 m
Peneothello bimaculatus	White-rumped Robin	(P), 350-970 m
P. cyanus	Blue-grey Robin	(P), 1550-2400 m
Ptilinopus rivoli	White-breasted Fruit-dove	200-3000 m
Parotia carolea	Carola's Parotia	(P), 1200-1800 m. (also called Six-wired Bird of Paradise)
Paradigalla brevicauda	Short-tailed Paradigalla	(P), 1600-2580 m
Phylloscopus trivirgatus	Island/Mountain Leaf-warbler	1400-2400 m
Reinwardtoena reinwardtii	Great Cuckoo-dove	
Rallina sp	Forest rail	
Rhipidura atra	Black Fantail	(P), 1000-2400 m
R. albolimbata	Friendly Fantail	(P), above 1750 m
Saxicola caprata	Pied Chat	up to 2850
Sericornis nouhuysi	Large/Noisy Scrub-wren	(P), 2100-2500 m (rarely 1200-3750 m)
S. perspicillatus	Buff-faced Scrub-wren	(P), 1700-2600 m
S. papuensis	Papuan Scrub-wren	(P), 2100-3500 m
S. virgatus	Perplexing Scrub-wren	(P), 600-1500 m (also called Streaked Scrub-Wren)
T. fulvigula	Olive Straightbill	(P), 1400-2200 m
Toxorhamphus poliopterus	Slaty-chinned Longbill	(P), 400-2450 m
Trugon terrestris	Thick-billed Ground-pigeon	up to 600 m
Zosterop atrifrons	Black-fronted White-eye	400-1450 m
Z. fuscicapillus	Western Mountain White-eye	(P), 1200-2100 m. (also called Dark-capped White-eye)
Z. griseotinctus	Lousiades/Island White eye	**Island Bird**

D) Information on bird species diversity in the Lorentz area from the Asian Wetland/Birdlife International data base. [mainly records from the lowlands]

All species recorded for CAGAR ALAM LORENTZ (IRJ14) in ALL habitats (based on the original reserve boundaries).

No.	Species name	English name	Local name	RDB+Cites+Prot.
1.	Actitis hypoleucos *	Common Sandpiper	Trinil pantai [laut]	
2.	Anas gibberifrons	Sunda Teal	Itik benjut [benjol]	
3.	Anas superciliosa	Pacific Black Duck	Itik gunung	
4.	Anas waigiuensis *	Salvadori's Teal	Itik noso [Salvadori]	
5.	Anhinga novaehollandiae	Australian Darter	Pecuk-ular Australia	
6.	Anseranas semipalmata	Magpie Goose	Angsa boiga	
7.	Ardea sumatrana	Great-billed Heron	Cangak laut	

8.	Arenaria interpres	Ruddy Turnstone	Trinil karang [Pembalik Batu]	
9.	Aythya australis	Australian Pochard	Itik mata-putih	
10.	Butorides striatus	Striated Heron	Kokokan laut	
11.	Casmerodius albus *	Great Egret	Kuntul besar	Prot.
12.	Ceyx lepidus	Variable Dwarf Kingfisher	Udang-merah kerdil	Prot.
13.	Charadrius dubius	Little Ringed Plover	Cerek kalung-hitam	
14.	(Circus spilothorax)			
15.	Collocalia esculenta	Glossy Swiftlet	Walet sapi	
16.	Coracina novaehollandiae	Black-faced Cuckoo-shrike	Kepudang-sungu besar	
17.	Crateroscelis robusta	Mountain Mouse-warbler	Tepus-tikus seka	
18.	Dendrocygna arcuata	Wandering Whistling-duck	Belibis kembang	
19.	Dendrocygna guttata	Spotted Whistling-duck	Belibis tutul	
20.	Egretta garzetta	Little Egret	Kuntul kecil	Prot.
21.	Egretta intermedia	Intermediate Egret	Kuntul perak	Prot.
22.	Egretta novaehollandiae	White-faced Heron	Kuntul Australia	Prot.
23.	Egretta sacra	Reef Egret	Kuntul karang	Prot.
24.	Esacus magnirostris *	Beach Thick-knee	Wili-wili besar	Prot.
25.	Gallicolumba rufigula	Cinnamon Ground-dove	Delimukan pomo	
26.	Gallinago hardwickii	Latham's Snipe	Berkik Jepang	
27.	Gallinago megala	Swinhoe's Snipe	Berkik tirok [rawa]	
28.	Gymnocrex plumbeiventris	Bare-eyed Rail		
29.	Halcyon sancta	Sacred Kingfisher	Cekakak suci	Prot.
30.	Haliaeetus leucogaster	White-bellied Sea-eagle	Elang-laut siput [perut putih]	AppII
Prot.				
31.	Haliastur indus	Brahminy Kite	Elang bondol	AppII
Prot.				
32.	Hirundo tahitica	Pacific Swallow	Layang-layang batu	
33.	Irediparra gallinacea	Comb-crested Jacana	Burung-sepatu [pindo(?); jengger]	
34.	Ixobrychus flavicollis *	Black Bittern	Bambangan hitam	
35.	Limosa lapponica	Bar-tailed Godwit	Biru-laut ekor-blorok	
36.	Megacrex inepta	New Guinea Flightless Rail		
37.	Melanocharis longicauda	Lemon-breasted Berrypecker	Burung-buah [dada-kuning]	
38.	Melanocharis versteri *	Fan-tailed Berrypecker	Burung-buah utupi	
39.	Melidora macrorrhina *	Hook-billed Kingfisher	Raja-udang sugaba	Prot.
40.	Melilestes megarhynchus	Long-billed Honeyeater	Isap-madu [ero]	Prot.
41.	Melionyx nouhuysi *	Short-bearded Honeyeater	Isap-madu [jenggot-pendek]	Prot.
42.	Melipotes fumigatus	Common Smoky Honeyeater	Melipotes obeti [orai]	Prot.
43.	Monachella muelleriana	Torrent Flycatcher	Sikatan nintere	
44.	Myzomela eques	Red-throated Myzomela	Myzomela [leher-merah]	Prot.
45.	Nettapus pulchellus	Green Pygmy Goose	Angsa-kerdil hijau	
46.	Numenius madagascariensis	Far Eastern Curlew	Gajahan timur	Prot.
47.	Oreocharis arfaki	Tit Berrypecker	Burung-buah Arfak [megino]	
48.	Phalacrocorax carbo	Great Cormorant	Pecuk-padi besar	
49.	Phalacrocorax melanoleucos	Little Pied Cormorant	Pecuk-padi belang	
50.	Phalacrocorax sulcirostris	Little Black Cormorant	Pecuk-padi hitam	
51.	Pluvialis fulva	Pacific Golden Plover	Cerek kernyut [kliit]	
52.	Porphyrio porphyrio	Purple Swamphen	Mandar besar [pelung]	
53.	Porzana tabuensis	Spotless Crake	Tikusan ololinta [polos]	
54.	Rallina tricolor	Red-necked Crake	Tikusan tukar	
55.	Rhipidura threnothorax	Sooty Thicket-fantail	Kipasan-semak bayan [tusada]	
56.	Scolopax saturata	Horsfield's Woodcock	Berkik-gunung tekken	
57.	Stiltia isabella	Australian Pratincole	Terik Asia [padang]	
58.	Tachybaptus novaehollandiae *	Black-throated Little Grebe	Titihan Australia	
59.	Tadorna radjah	White-headed Shelduck	Umukia raja [Tadorna raja]	
60.	Threskiornis molucca	Australian Ibis	Ibis sawela [Australia]	Prot.
61.	Turdus poliocephalus	Island Thrush	Anis gunung	
62.	Xanthotis chrysotis	Tawny-breasted Honeyeater	Isap-madu [dada-coklat]	Prot.
63.	Zonerodius heliosylus	Forest Bittern	Bambangan rimba	

E) FISH

Lake Habbema is of extreme importance for several endemic fish species. Throughout Irian the lakes are foci of fresh water endemism, the lakes in the central range of the Lorentz area being no exception. Little information is available on the aquatic diversity of the Central Range's southern foothills.

Fish Species (Lorentz river, just east of the reserve. Data from Allen & Boeseman, 1982)

1	Arius carinatus	Comb-spinned catfish	
2	Arius latirostris	Broad-snouted catfish	
3	Arius macrohynchus	Sharp-nosed catfish	
4	Clupeoides venulosus	West Irian River Sprat	
5	Cochlefelis danielsi	Daniel's Catfish	
6	Crateracephalus nouhuysi	Mountain Hardyhead	
7	Cynoglossus heterolepsis	Freshwater Tongue Sole	Ikan lidah
8	Ooiichthys novaguineae	Spoon-snouted Catfish	
9	Glossamia trifasciata	Three-barred Mouth Almighty	
10	Hephaestus roemeri	Roemer's Grunter	
11	Melanotaenia ogilbyi	Ogilby's Rainbowfish	
12	Medystoma dayi	Day's Catfish	Ikan dukang
13	Oloplotosus mariae	Maria's Tandan	

14	Parambassis gulliveri	Giant Glass Perchlet	
15	Pingalla lorentzi	Lorentz Grunter	
16	Plotosus papuensis	Papuan Tandan	
17	Porochilus obbesi	Obbes' Tandan	
18	Tetranesodon conorhynchus	Lorentz's Catfish	
19	Zenarchopterus novaguineae	Fly River Garfish	Julung-julung

F) Mammals of the Lorentz area

The main source of data for mammals in the Lorentz area stems from Flannery's work . The species list is already presented in chapter 5. This data set is restricted to the mid elevation and high mountain areas of the central mountain range. From Flannery's data , it has become clear that again the central mountain range is of extreme importance for the conservation of biodiversity. Several species have only been recorded from the Lorentz area so far. The most striking new record is that of a new species of tree kangaroo; the Dingiso (*Dendrolagus* sp). While familiar to Moni, Amungkal, Dani and Nduga speakers of the western Maokop, this striking tree kangaroo has remained unknown to outsiders until very recently. The first evidence in the form of a piece of furred skin turned up in the Kwiyawagi area in 1991, photographs were taken in the same year in the Tembagapura area (just west of the Park). In June 1994 the first specimens were taken for taxonomical purposes. It is a large (8.5-9.0 Kg) black and white, largely terrestrial tree kangaroo. In the eastern part of the mountain range it is restricted to the rugged, rocky south-wards-facing upper slopes of the Maokop (above the 3000 m line). In the west, where it is still protected from hunting by traditional taboos, it inhabits gentler slopes as well as the northern area of the Cordillera.
Apart from housing the largest rat in the world (*Hyomys goliath*), the Lorentz area also houses the rat living at the highest altitudes of all rat species, the Glacier Rat (*Stenomys richardsoni*). This species has been recorded from only three areas, all atop the Central Cordillera in Irian Jaya (3225-4500 meters). Specimens have been collected from around Lake Habema and Mount Wilhelmina, and from the Mount Jaya (Carstenz Range), the highest mountain in New Guinea. In these areas, it occurs in tussock grassland and bare tundra-like habitat that is largely rock or gravel widely interspersed with mats of herbs and grass tufts. It has even been found in areas that have been uncovered by glacial retreat for as little as 35 years. It is found to be common in the Meren Valley, Mount Carstensz, where it occupied alpine shrub alongside the Moss-forest Rat (*Stenomys omlichodes*).

G) Phytoplankton and Zooplankton of Selected Glacial Lakes

Lakes (elevation m/max. depth m)

1) L. Discovery (3747/16.2) 2) L. Senewe (3974/13.7) 3) L. Larson (3990/22.8) 4) L. Rochiman (4140/10.1) 5) L. Dugundugu (4150/8.8) 6) L. Ketel (4014/2.7) 7) Pond 13 (4200) 7) Pond 15 (4200) 8) L.Coprosma (4209/10.1) 9) Shoal L. (4213/6.7) 10) Route-Foot l. (4230) 11) Lower Muddy L. (4231/4.6) 12) Harrer L. (4232/6.4) 13) Pond 16 (4240) 14) L. Mapala L. (4360).

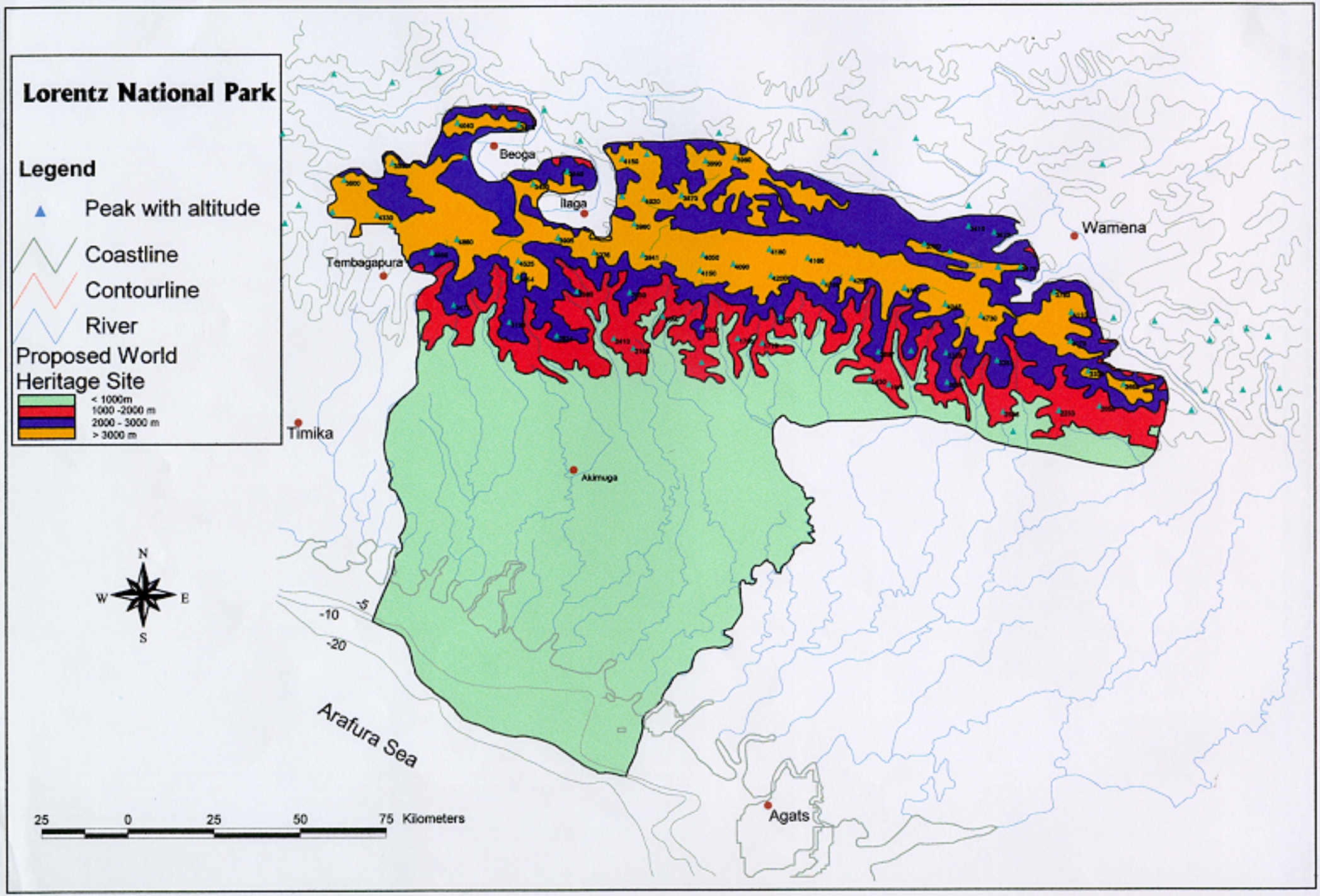
PHYTOPLANKTON /LAKES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CYANOPHYTA															
Stigonematalis															
Stigonema							?							+	
Croococcales															
Anabaena								+							
Merismopedia				+											
Nostocales															
Aphanocapsa							+								
Lyngbya														+	
Nostoc						+	+		+					+	
Oscillatoria						+	+	+						+	
Sytonema							+							+	
PYRROPHYTA															
Peridialis															
Gymnodinium		+				+		+	+				+		+
Dinococcales															
Ceratium		+		++			+		+		+	+			
EUGLENOPHYTA															
Euglenales															
Trachelomonas				+											
T. volvoeina													+		
Chrysophyta															
Crysophyceae															
Dinobryon				+											
Xantophyceae															
Triboneura													+		
Bacillariophyceae															
Acanthes						+									
Amphora	+										+		+		
Caloneis													+		
Cymbella	+			+		+		+		+	+		+	+	+
Denticulata										+					
Epithemia	+							+						+	
Eunotia	++							+		+			+		
Gomphonema														+	
Navicula				+	+	+							+		
Nitzschia	+														
Pinnularia	+					+	+						+		
Stauroneis													+		
Synedra													+		
CHLOROPHYTA															
Chlorococcales															
Actinastrum															+
Botryococcus braunii				+	+						+	+			
Dactyloccus				?											
Elakatothrix				+											
Pediastrum				+											
Scenedesmus					+	+									
S. bijuga				+											

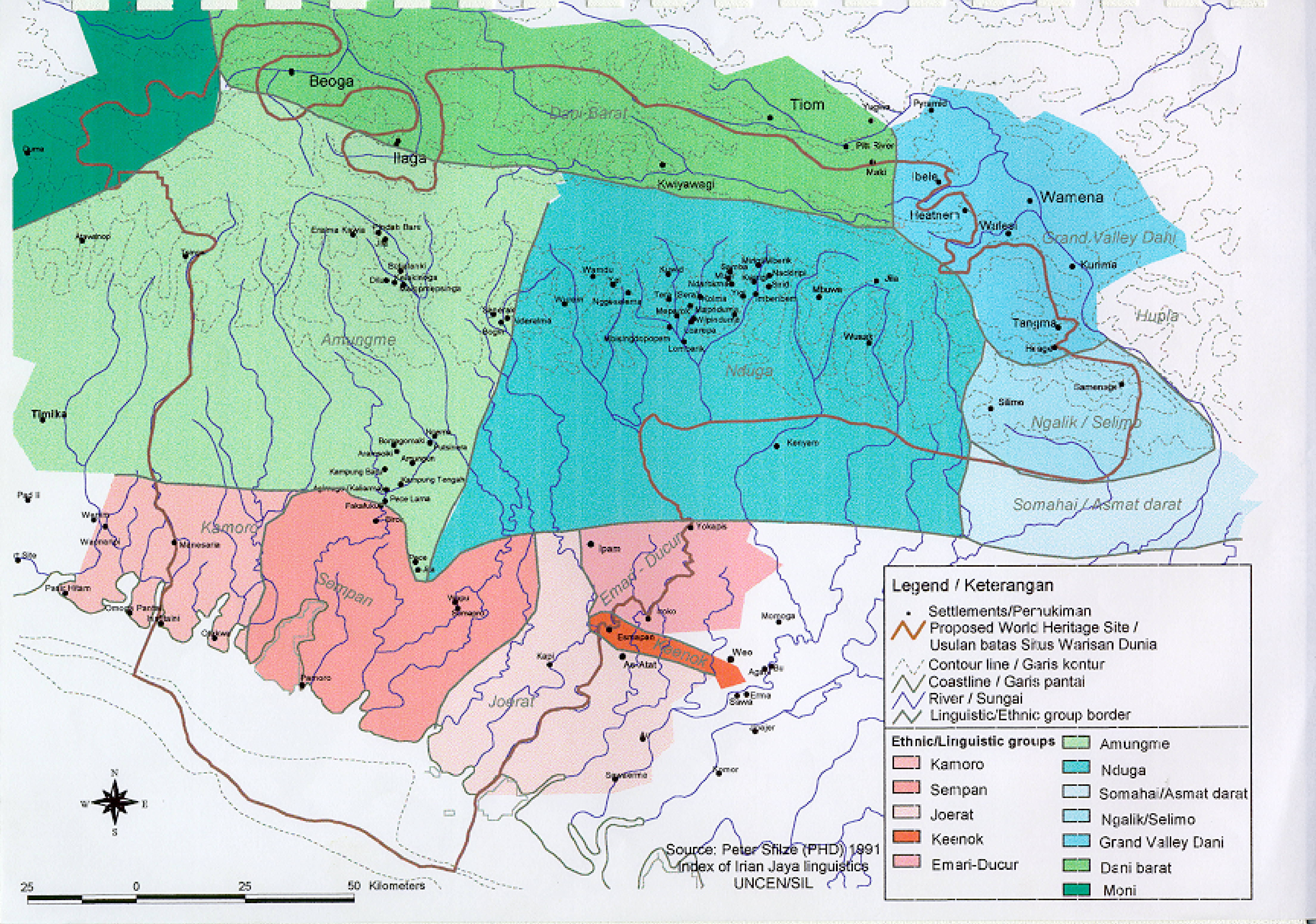
Tetrasporales							+				+				
(Continued)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Coelastrum							+				+				
Volvacales															
Gloeocytis							+								
Zygnematales															
Mougeotia									+						
Pandorina							+								
Sirogyra															
Staurastratum					+										
Dedogoniales					+										
Cosmarium				+		+							+	+	
Oedogonium							+						+		
ZOOPLANKTON															
PROTOZOA															
Difflugia	+												+		
Nematode								+							
ROTIFERA															
Asplanchma		+													
Brachionus						?							+		
CLADOCERA															
Bosmina	++	+	+	+	++							+			
Daphnia	++	++	+	+	++										
Harpacticoid		+													
COPEPODA															
Acanthocyclops				+											
A. viridis			++		+										
Calanoid													+		
Cyclopoid	+	+	+			+	+				+				
C. nauplii						++					++				
INSECTA															
Chironomid larvae	+			+	+								+		
Collembola (Springtails)															
Midge larvae							+				+				
Mosquito larve	+			+		+	+				+		+		
Mites		+											+		

+ Present ++ Common (Peterson 1976)

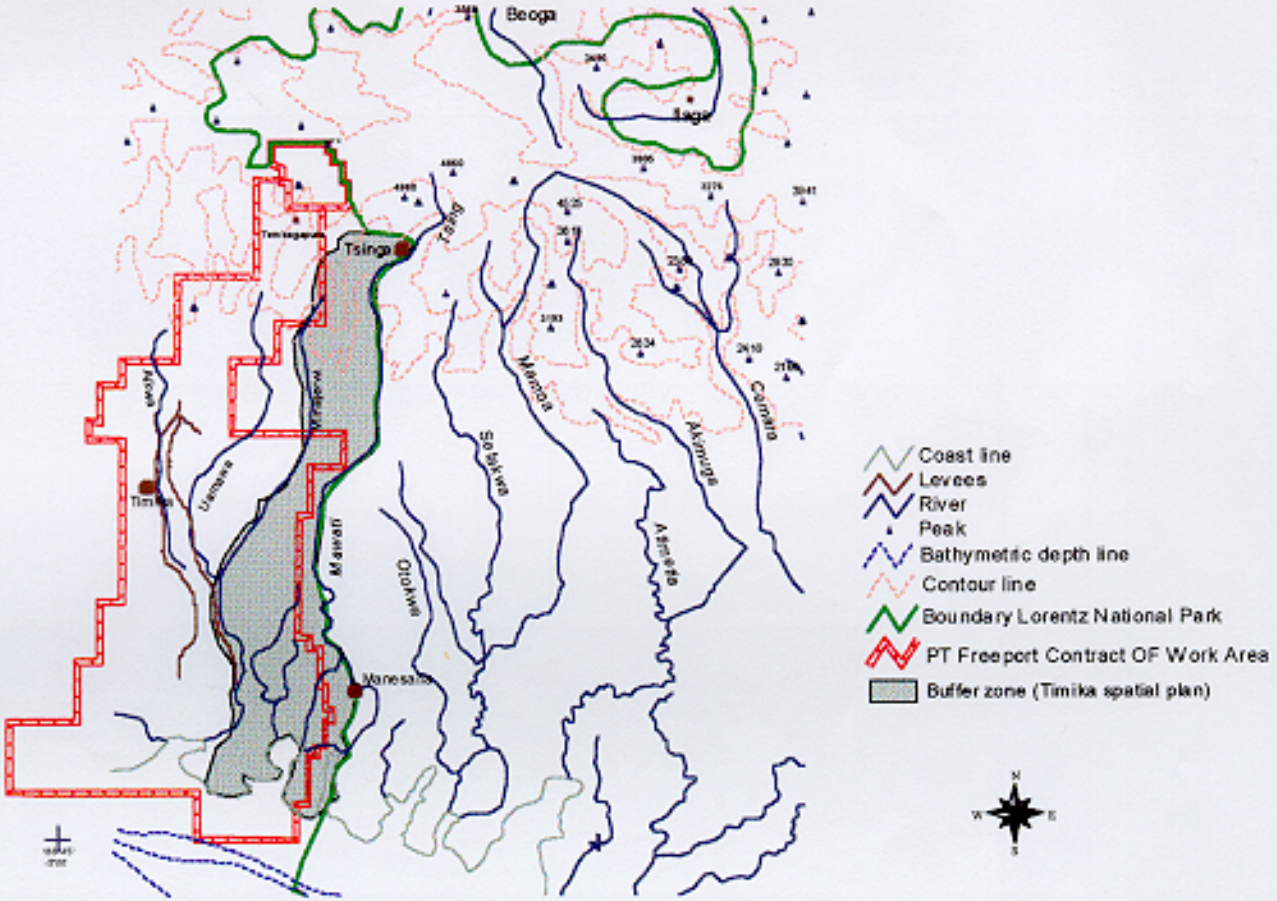
APPENDIX G PHOTOGRAPHIC AND CINEMATOGRAPHIC DOCUMENTATION OF LORENTZ NATIONAL PARK

(see attached slides)

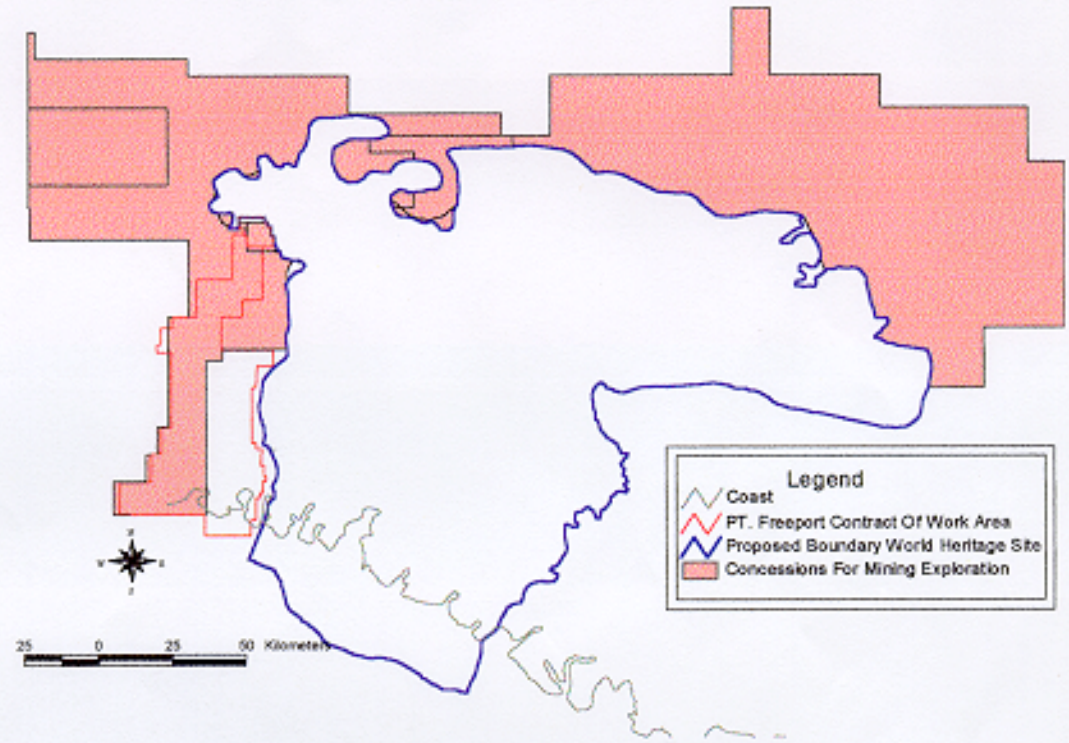

Lorentz National Park
Legend
Peak with altitude
Coastline
Contourline
River
Proposed World Heritage Site
< 1000m
1000 -2000 m
2000 - 3000 m
> 3000 m
Beoga
Ilaga
Wamena
Tembagapura
Timika
Akimuga
Agats
Arafura Sea
-5
-10
-20
N
W
E
S
25 0 25 50 75 Kilometers


Beoga
Tiom
Ilaga
Dani-Barat
Kwiyawagi
Ibele
Wamena
Heatnen
Wailesi
Grand Valley Dani
Kurima
Hupla
Tangma
Amungme
Nduga
Ngalik / Selimo
Silimo
Kenyam
Timika
Somahai / Asmat darat
Yokapis
Kamoro
Sempan
Ipam
Emari - Ducur
Keenok
Joerat
Wao
Legend / Keterangan
Settlements/Pemukiman
Proposed World Heritage Site / Usulan batas Situs Warisan Dunia
Contour line / Garis kontur
Coastline / Garis pantai
River / Sungai
Linguistic/Ethnic group border
Ethnic/Linguistic groups
Kamoro
Sempan
Joerat
Keenok
Emari-Ducur
Amungme
Nduga
Somahai/Asmat darat
Ngalik/Selimo
Grand Valley Dani
Dani barat
Moni
Source: Peter Silze (PHD) 1991
Index of Irian Jaya linguistics
UNCEN/SIL
25 0 25 50 Kilometers
N
W E
S

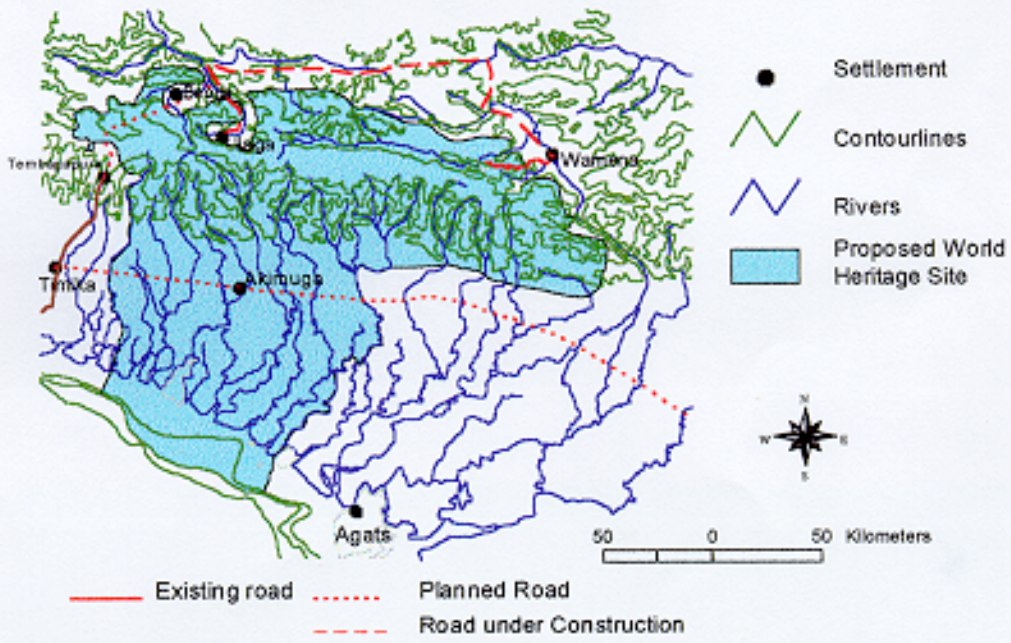
WESTERN BUFFER ZONE (TIMIKA SPATIAL PLAN)

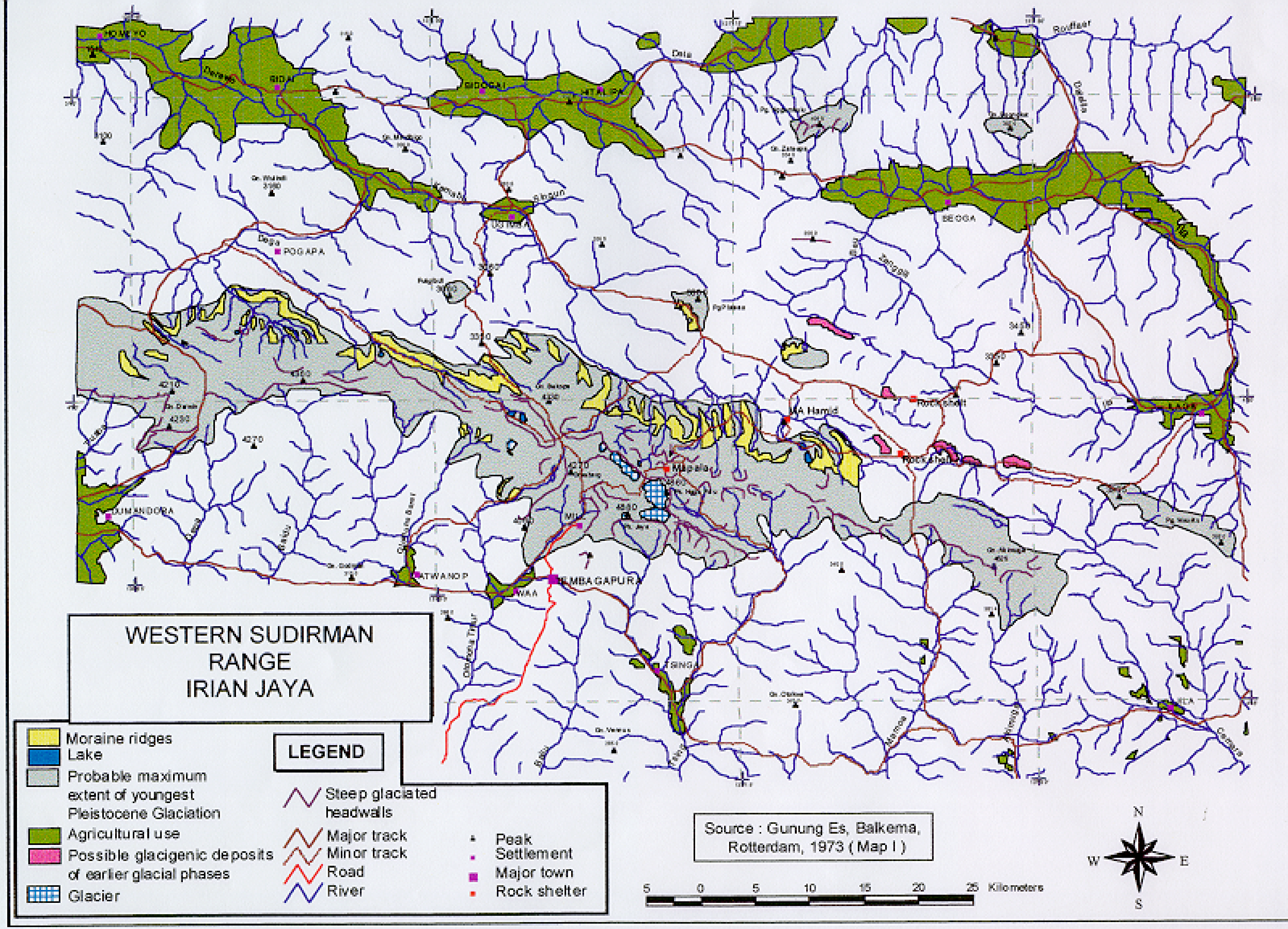


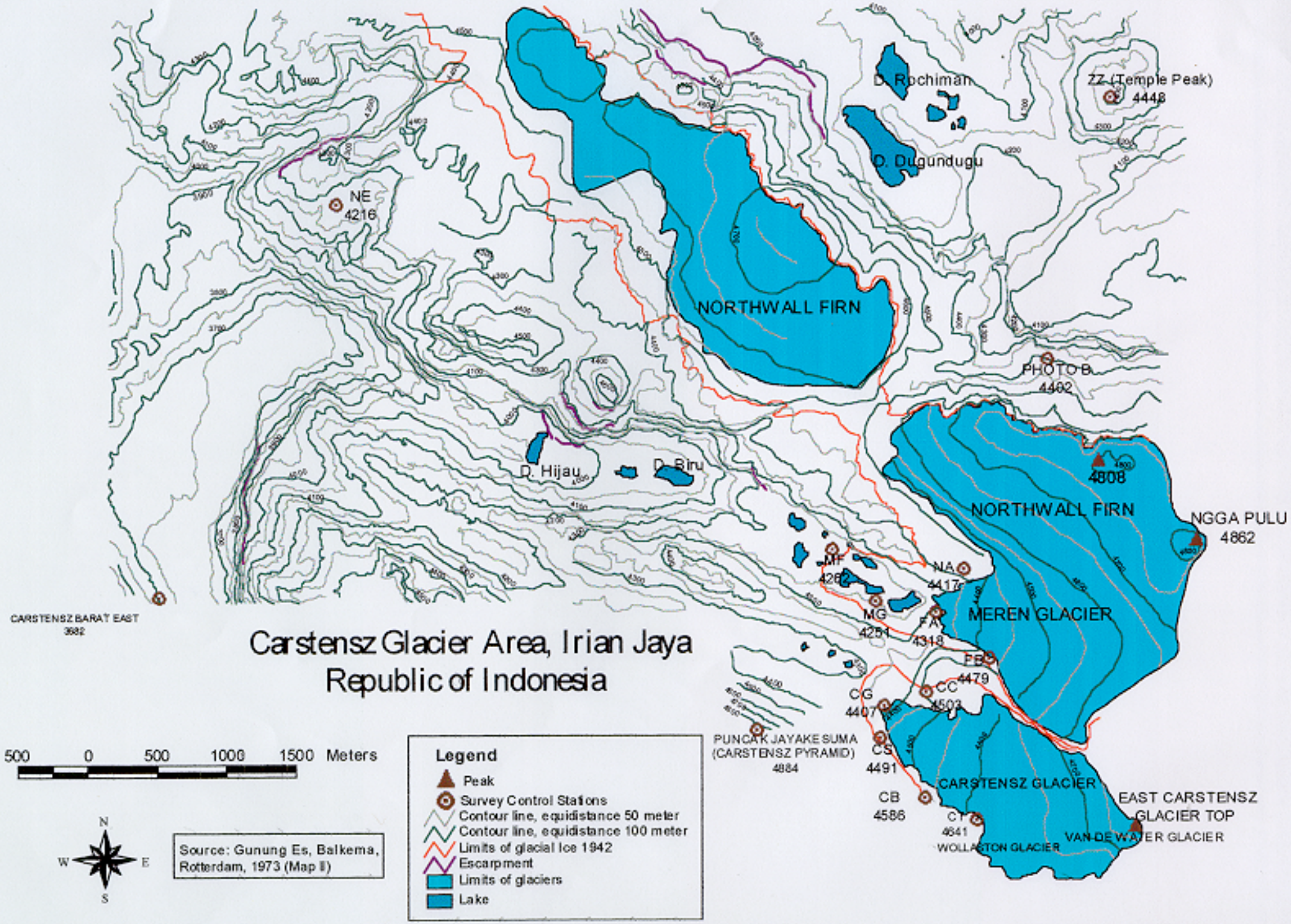
Map 5: *Mining exploration concessions*

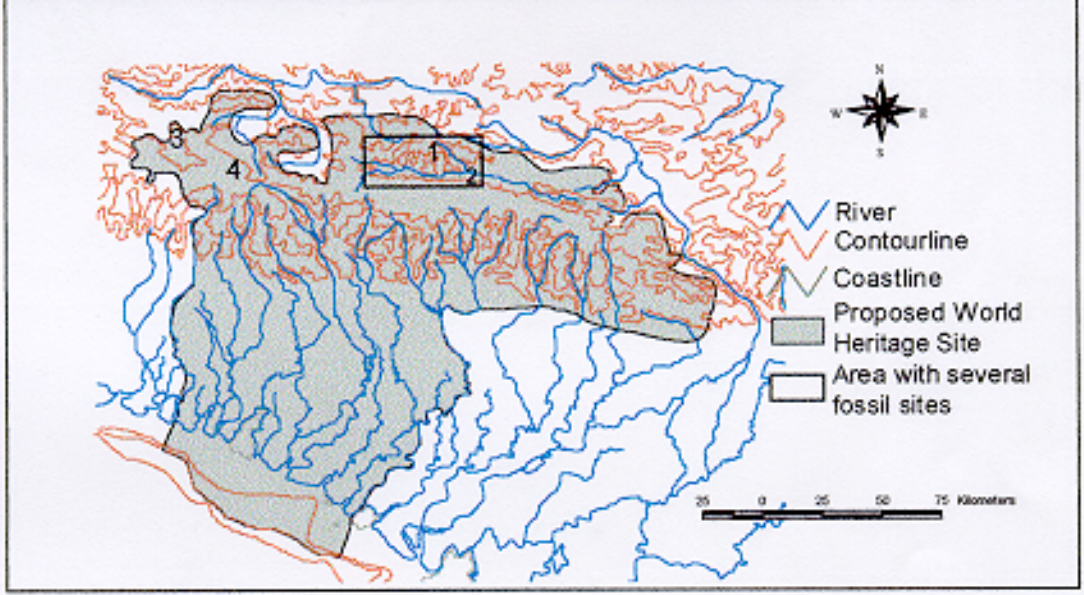


Map 6: *Road development*

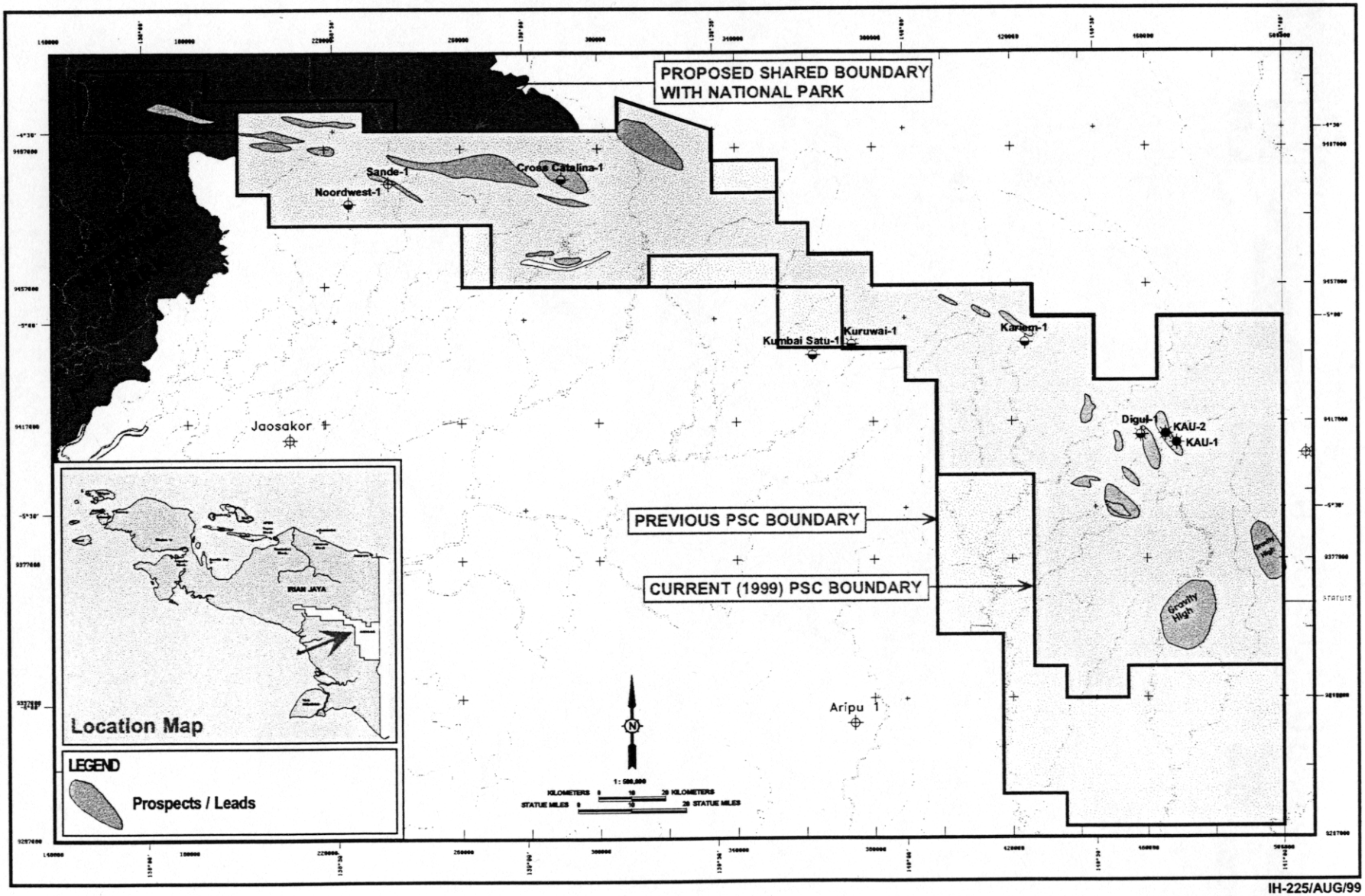



WESTERN SUDIRMAN
RANGE
IRIAN JAYA
LEGEND
Moraine ridges
Lake
Probable maximum extent of youngest Pleistocene Glaciation
Agricultural use
Possible glacigenic deposits of earlier glacial phases
Glacier
Steep glaciated headwalls
Major track
Minor track
Road
River
Peak
Settlement
Major town
Rock shelter
Source : Gunung Es, Balkema, Rotterdam, 1973 (Map I)
5 0 5 10 15 20 25 Kilometers
N
S
W
E
HOMEYO
BIDAI
BIDOGAI
HITALIPA
BEOGA
POGAPA
DUMANDORA
ATWANOIP
WAA
TEMBAGAPURA
TSINGA
MA Hamid
Rock shelt
Rock shelter
Mapala
MU
ILAGA
Dega
Dela
4210
4230
4270
4350


D. Rochiman
ZZ (Temple Peak)
4448
D. Dugundugu
NE
4216
NORTHWALL FIRN
PHOTO B
4402
D. Hijau
D. Biru
4808
NORTHWALL FIRN
NGGA PULU
4862
CARSTENSZ BARAT EAST
3682
MF
4262
NA
4417
MG
4251
FA
4318
MEREN GLACIER
FB
4479
CC
4503
CG
4407
PUNCAK JAYAKESUMA
(CARSTENSZ PYRAMID)
4884
CS
4491
CARSTENSZ GLACIER
CB
4586
CT
4541
EAST CARSTENSZ
GLACIER TOP
VAN DE WATER GLACIER
WOLLASTON GLACIER
Carstensz Glacier Area, Irian Jaya
Republic of Indonesia
500 0 500 1000 1500 Meters
N
W
E
S
Source: Gunung Es, Balkema, Rotterdam, 1973 (Map II)
Legend
Peak
Survey Control Stations
Contour line, equidistance 50 meter
Contour line, equidistance 100 meter
Limits of glacial Ice 1942
Escarpment
Limits of glaciers
Lake


N
W
E
S
1
2
3
4
River
Contourline
Coastline
Proposed World Heritage Site
Area with several fossil sites
25
0
25
50
75 Kilometers

WARIM / LORENTZ
NATIONAL PARK OVERLAP - MAP "C"



IH-225/AUG/99

WORLD HERITAGE NOMINATION - IUCN TECHNICAL EVALUATION

LORENTZ NATIONAL PARK (INDONESIA)

1. DOCUMENTATION

i) **IUCN/WCMC Data Sheet** (10 references)

ii) **Additional Literature Consulted:** Conservation International. 1997. Irian Jaya Biodiversity Conservation Priority Setting Workshop. Map.; Davis, S.D. *et. al*. 1995. **Centres of Plant Diversity**. Vol. 7. IUCN; P.T. Freeport Indonesia 1998. **Biodiversity Surveys – Compilation Report**. 702p.; Mealey, G.A. 1996. **Grasberg**. Freeport; Deutsche Forst Consult. 1992. Preparation Report on Lorentz. Asian Development Bank.

iii) **Consultations:** 8 external reviewers, Provincial Government officials, church and military representatives, WWF, local NGO's, Freeport Mine representatives.

iv) **Field Visit:** February 1999. Jim Thorsell, Peter Hitchcock, Jeff Sayer.

2. SUMMARY OF NATURAL VALUES

Lorentz National Park (LNP) stretches for over 150km from the equatorial glaciers of New Guinea's Central Cordillera, the highest mountains in South East Asia, to the south coast bordering the Arafura Sea. It is the largest protected area in Southeast Asia (2.5 mil. ha.), extending from sea-level up to 4,884m at the summit of Puncak Jaya (also known as Mt Carstensz), the highest mountain in New Guinea and Indonesia. There are 3km² of ice in the summit region, one of only three regions in the world where glaciers are to be found in equatorial latitudes. The park which includes part of the Sudirman Range, has a large number of streams and rivers which have cut deep valleys in the mountains and foothills as they drain south to the coastal plain. Here they form extensive areas of swamps with numerous permanent and seasonal lakes. A marine component extends into the Arafura Sea to the 10m depth boundary. At the meeting point of two colliding continental plates, the area has a complex geology. In the north, moraines overlie an extremely rugged karst limestone topography; the Central Cordillera mountains are folded and metamorphosed oceanic sediments of Cretaceous (100 million years BP) and Eocene (40 million years BP) origin. Alluvial deposits cover the southern coastal plain. Extensive fossils of ice age plants and animals are found in four highland caves. Climate is humid tropical with rainfall of 5000mm/year recorded at the higher elevations.

All the main natural land systems found in Irian Jaya occur within Lorentz National Park. Some 34 vegetation types and 29 "land systems" have been identified. The coastal plain has extensive areas of wetlands, including mangroves along the coast, tidal and freshwater swamp and riparian forests, sedgelands, *Pandanus* and sago palm formations, and permanently and seasonally flooded peat swamp forests. Lowland rain forest, the richest community, occurs up to 1,000m. Lower montane rain forest, which is less rich in tree species than lowland alluvial and hill forests, occurs between 1,000m and 3,000m. An abrupt change in vegetation occurs at 3,000m. Tree ferns, bogs, grasslands and heath vegetation predominate, until at 4000m the alpine zone is reached.

Some 123 mammals have been recorded from the reserve, representing 80% of the total mammalian fauna of Irian Jaya. The swamplands are home to two species of crocodile, both of which are threatened: the estuarine crocodile (Endangered) and the New Guinea crocodile (Vulnerable). The

avifauna is likewise extremely rich, with 411 species recorded, including at least 20 species endemic to Irian Jaya. Notable species include 2 species of cassowary, 4 megapodes, 30 parrots, 20 birds-of-paradise and 6 species of bowerbirds.

LNP has been inhabited for more than 25,000 years. A total of 6,300 people from 8 indigenous groups live inside the park. Some are agriculturalists cultivating bananas, taro and sweet potatoes. Others also raise pigs with hunting providing additional protein. Subsistence use by the coastal groups is focused on sago palms and fish. The Freeport gold/copper mine is adjacent to the northwest boundary of the park.

3. COMPARISON WITH OTHER AREAS

The island of New Guinea (of which Irian Jaya makes up almost half) is home to the most physiographically and biotically diverse assemblages in the Australo-Pacific region. Some 60-90% of the flora is endemic and the island has the highest mammalian diversity in the Oceanian Realm. All the main environments of Irian Jaya are represented in LNP including 29 "land systems" and 34 vegetation types that extend from the coastal plain through lowland rain forest, montane rain forest, conifer forest, heath, grassland and the alpine zone. The range of altitudinal, life zone and temperature variation in LNP is probably the greatest of any protected area in the world (with the possible exception of Santa Marta/Tayrona in Colombia).

LNP is in the Papuan Biogeographical Province which has in it one existing natural World Heritage site – East Rennell in the Solomon Islands. East Rennell is a small raised coral atoll and has no geographic or species similarities with Lorentz which is part of a continental island and is a mountainous area with an icefield.

Indonesia has an extensive protected area system consisting of 105 IUCN Category I and II areas totalling 15 mil. ha. Irian Jaya, however, is in a different Biogeographic Realm (Oceania) from the rest of Indonesia (Indomalayan Realm). Wallace's Line (as modified by Huxley) separates the two and splits the predominantly Oriental biota of Asia and the Australasian biota to the south. As Table 1 indicates, Irian Jaya is the richest biogeographical region of Indonesia with the highest level of endemism in the country. LNP is by far the largest protected area in Indonesia and indeed of all the region, with the next closest areas only reaching half its size. For comparative scale, LNP is 25% larger than Kakadu National Park (Australia).

Table 1 - Comparative biotic richness and endemism in the biogeographical regions of Indonesia

Island	Resident Bird Spp.	% Bird Endemism	Mammal spp. Richness	% Mammal endemism	Reptile spp. richness	% Reptile endemism	Relative plant spp. richness	% Plant endemism
Sumatra	465	2	194	10	217	11	820	11
Java	362	7	133	12	173	8	630	5
Borneo	420	6	201	48	254	24	900	33
Sulawesi	289	32	114	60	117	26	520	7
Lesser Sunda	242	30	41	12	77	22	150	3
Maluku	210	33	69	17	98	18	380	6
Irian	602	52	125	58	223	35	1030	55

In Irian Jaya itself, there are 47 protected areas (not including 8 recreation parks). Several other very important sites exist (for example the Arfak Mountains and the Mamberamo-Foja National Park), but these are smaller, have less diversity, are not as varied altitudinally and do not provide the "mountains to the sea" spectrum of habitats that are found in LNP.

The geology and geomorphology of LNP is also distinctive. Its main mountain range is at the collision point on the leading edge of the Australian tectonic plate and the Pacific plate. While there is graphic evidence of the plate collision along the length of New Guinea, nowhere is it better expressed than within LNP. Although the mountains of Lorentz are located on the Australian plate, there are no mountains of age or genesis on the adjacent Australian continent which is mainly an ancient tectonically stable surface.

LNP is also one of three areas where equatorial glaciers are still found – the others being in eastern Africa and in the Andes. All these tropical glaciers are in retreat but LNP retains vestigial glaciers as well as classic evidence of past glaciation such as glacial lakes and moraines. Mount Kinabalu on Borneo illustrates evidence of past glaciation as well but glaciers are no longer found there and it lacks the cordilleran physiography of Irian Jaya which causes greater snow accumulation.

In conclusion, LNP is distinctive in the region and in the world for its biogeographically strategic position between Asia, Australia and the Pacific, its geological history at the junction of two tectonic plates, its exceptionally rich biodiversity, its large size and its steep "mountains to the sea" gradient which is unmatched anywhere on the planet.

4. INTEGRITY

One of the outstanding features of LNP is its large size (2.5 mil. ha.) making it a globally significant large tract of intact tropical forest. Only one road enters the park and that is on the north-east edge to Lake Habbema. An additional aspect of the integrity of the site is that it protects a whole sequence of river catchments from their source in the mountains to the Arafura Sea. Despite its large size, LNP still faces a number of threats and a number of management issues need to be addressed if its stewardship is to be assured. These relate to boundaries, development pressures, human residents and management constraints.

4.1. Boundaries

Protection of the Lorentz area dates back to 1919 when the colonial government gazetted a 300,000 nature reserve around the main peaks. Boundaries and legal status changed several times before the current national park was established in 1997 encompassing 2.5 mil. ha. Boundary details are still being negotiated with a small section of community land near Wamena soon to be excised.

The main boundary issue is on the western side where LNP borders the Freeport mine "Contract of Work" (COW) area. A series of straight lines which delineate the COW have no regard for the topography and, although there is no drainage from the mine into the LNP, it certainly can be seen from vantage points in the park. Although all mining activity has been excluded from the park, the limit of the Grasberg mine lease extends to within several hundred metres of the summit of Mount Jaya. It is unlikely that mining will take place any closer than it already does to the park (except underground). Freeport, however, could take full advantage of their surface rights to mine or place infrastructure right up to the boundary. The agreed western boundary buffer zone, however, should assist in minimising further conflicts.

Another boundary issue is in the southern foothills in the east where a pre-existing petroleum exploration lease extends into the park and forestry concessions have been excluded. Similarly, the human settlements in the Illaya and Beoga on the northern boundary have been excluded from LNP and result in the convoluted shape. The integrity of the marine boundary to the 10m depth mark is dependent on awareness and law enforcement.

In sum, the boundaries of LNP are a realistic compromise between existing land uses and human population distribution. There are no major features of the system lacking and, apart from minor adjustments, boundaries are ready for final proclamation.

4.2. Resident human population

The 2.5 mil. ha. of LNP's pristine forests are occasionally interrupted by small settlements of indigenous peoples several of which are serviced by missionary airstrips. These small settlements (some 50 in all) are accessible by foot-trails and their impact is limited to cultivation on steep slopes, removal of forests for subsistence uses, and fishing. Some 8 indigenous groups with a total of 6,300 people (one estimate gives 10,000) are involved. The greatest portion of the park is uninhabited though partly visited by local subsistence hunters and gatherers. Health, nutrition, security, land tenure, education, and loss of traditional customs are issues being faced by these park residents.

Given the number of indigenous people living in the park and in proximity to it, it is essential that park management work in partnership with them. The various indigenous groups have much to offer in contributing to the management of the park and the park could bring significant benefits to them in return. WWF have undertaken some excellent work with the local communities here and the Asian Development Bank (1992) has also studied what types of projects are needed to address community issues. The process of preparing the management plan for LNP has also involved representatives from the different stakeholders and this involvement needs to be encouraged and further expanded.

4.3. Development pressures

Threats to LNP come from mining activity, petroleum exploration, proposed road construction and illegal logging. Adjacent to the western boundary of the site, P.T. Freeport Indonesia (PTFI) has been producing huge volumes of copper ore and gold since it began operation in 1972. In 1997, the mine generated sales of 1.2 billion pounds of copper and 1.9 million ounces of gold making it one of the largest and most profitable mines in the world. Current reserves within the mining lease are estimated to last another 40 years. Opencast mining has created a number of social and environmental problems including displacement of the indigenous Amungme people, river pollution, oil spillages, forest clearance and construction of support services for the 14,000-strong workforce. It is important to note that all of these impacts occurred outside the current boundary of the LNP and that the mine drains to a catchment outside the park.

A part of the mining area was once inside the Lorentz reserve but in 1997 when the LNP was created the new boundary excised the portion affected. Nevertheless, the Suridman range is highly mineralised and mining exploration concessions exist all around the western and northern borders of LNP (see Map). Mining exploration concessions formerly within the LNP have been withdrawn and national park legislation does not allow new mining in parks. PTFI has stated that it supports the World Heritage site nomination and also that they do not intend to expand their activities inside the park (a formal letter confirming this has been received). It is also noteworthy that one of the four government ministers to sign the World Heritage nomination was the Minister of Mines and Energy.

Despite the progress in the re-drawing of the boundaries to exclude the mine, the current intention not to expand into the park and the considerable effort that PTFI has put into environmental restoration and research over the past 5 years, IUCN remains concerned over the influence on the park of such a dominant neighbour. In this regard, the 9 point list of actions (Table 2) given in Freeport's Biodiversity Survey Report (1998, p.575) form a strong basis for cooperation. IUCN is also aware that a Trust Fund to support the management of LNP (and to which Freeport would contribute) is now being established. The Bureau may consider it essential for the future integrity of the site to encourage both the Government of Indonesia and PTFI to implement these actions which will establish an effective management regime for the LNP and enhance the well-being of local indigenous residents.

The second threat from proposed development comes from oil exploration permits which predate the national park inside the east boundary. In this case, IUCN was informed that investors in the CONOCO oil company's proposed US$40 million investment which would have been inside LNP had been voluntarily withdrawn and that no further activity on this lease will take place. Negotiations with CONOCO to forfeit lease areas in the park have resulted in agreement. Exploration will, however, proceed outside the LNP and once again cooperation between private interests and the Government of Indonesia such as underway with PTFI should be encouraged. The Bureau may wish to point out the incompatibility of oil extraction within the LNP.

Table 2. - P.T. Freeport Mine Assistance in LNP Management

The GOI is responsible for the conservation of biodiversity in the Lorentz National Park, and PTFI will assist GOI by:

i) working with PHPA to rationalize the boundaries of the Lorentz National Park;

ii) providing logistical support for field studies in the Lorentz National Park;

iii) carrying out ecological research in ecosystems which occur in both the PTFI COW Mining and Project Area and the Lorentz National Park;

iv) working with GOI to establish biodiversity research sites and permanent monitoring plots within the Lorentz National Park which can provide ecosystem management data for ecosystems within the park, and also serve as "control" sites for biodiversity research sites and permanent monitoring plots established within the PTFI COW Mining and Project Area;

v) preparing and distributing field guides which summarize the results of PTFI biodiversity research to agencies (government, universities, NGOs) who are involved in the management of the Lorentz National Park;

vi) developing an integrated GIS and mapping system which can be adapted for use in the Lorentz National Park, as well as in the PTFI COW Mining and Project Area;

vii) carrying ethnobotanical studies for indigenous groups living in ecosystems within the PTFI COW Project Area and the Lorentz National Park, and assisting these groups to develop potential income generating activities based on the sustainable use of local plants and animals;

viii) developing the PTFI COW Mining and Project Area as a "buffer" between the Lorentz National Park and development activities to the west of the PTFI COW Mining and Project Area; and

ix) working with government agencies, including PHPA, and other private sector companies operating in the area, for bioregional/ecosystem conservation of biodiversity.

(Source: P.T. Freeport Indonesia 1998. Biodiversity Surveys in the PTFI COW Mining and Project Area, Irian Jaya, Indonesia, p.575.)

Three proposed road developments in LNP are discussed in the nomination. The new road to Lake Habbema along the northern boundary was constructed with little regard for the environment and is now in an unstable condition. During the field inspection, IUCN expressed concerns over reduction of the impacts of this road with government officials and greater care to protect the fragile highland life zone was encouraged.

A proposed road that would link the Freeport Mine site with Beoga has also been under study but is unlikely to be seriously considered for some years. Of greater concern would be a proposed road across the width of the park between Timika and Merauke (via Agimuga) (see Map 3.).

Such a road would severely disrupt the forest and catchment integrity of the park and, although unlikely to proceed (for financial and security reasons), strong cautionary warnings should be given by the Bureau.

Logging concessions border LNP on the east. These pose a threat to the park as they include long-term changes to traditional lifestyles of some inhabitants (i.e. dependency on a consumer economy and shortage of suitable trees for making canoes). Already, some of the Nakai tribe are engaged in logging activities, some of them illegal. There is currently no management presence by the Forestry Department in this region.

The final issue affecting integrity is the need for a more adequate management regime to be put in place. The LNP does not have a headquarters, a resident Director or a management plan. It does have a person nominally responsible based in Jayapura and forest department rangers based in several locations nearby but all these people have other responsibilities. A beginning has been made towards preparing a management plan by bringing together a meeting of stakeholders but work has not progressed since then. LNP has been largely supported to date by WWF-Indonesia with funds from the German and US Governments. The Government of Indonesia is intending to establish a local headquarters and staff early next year but a capital budget to support site management has not yet been estimated.

A particular requirement will be for the managers of LNP to make a concerted effort to build a partnership with the local people both within and outside the park. Close liaison through the Tribal Councils, a cooperative management approach and the establishment of staff community liaison positions are three suggested actions. A commitment to strengthening local managerial capacity is another high priority task.

The availability of resources for management of LNP is seen as the main issue facing the park in future. There are proposals to establish a special foundation to independently raise funds for the park. PTFI has indicated an interest in participating in such a project as has CONOCO. The regional offices of UNESCO and WWF are both acting to facilitate the setting up of a “Friends of Lorentz” following the model of the Friends of Kutai National Park in Kalimantan. Completion and adoption of a management plan thus becomes ever more important as a means of demonstrating the commitment of the park authorities and establishing funding priorities.

Another proposal discussed during the field inspection is the establishment of a partnership between LNP and the Wet Tropics World Heritage Area in tropical Australia. Preliminary inquiries of both agencies suggests a positive interest. Such a pairing of these two large tropical rainforest areas could be particularly beneficial to Lorentz in the short term and eventually should be mutually beneficial.

In conclusion, all the above issues will require a concentrated effort in the years ahead. Although LNP has been affected by human activity along its periphery, its size and rugged terrain have helped maintain it in a relatively pristine state to date. With various regional pressures now mounting and with social concerns with local residents in need of attention, the Government of Indonesia and its partners in LNP need to take a proactive stance. The initial management planning process now needs strong follow-up to prepare a programme of action.

5. ADDITIONAL COMMENTS

The field inspection found strong levels of support for the nomination from many sectors. In particular, it is apparent that there is a good level of support for the nomination in the indigenous communities which were consulted. Notwithstanding, it is apparent that there is still a significant level of concern about protection of their traditional rights and questions about how the Government might impact on their lives. Indigenous groups voiced the need for greater efforts by all levels of Government in building trust with the local people. This needs to be addressed by a communication programme by the park managers and others, including regular community liaison and information.

The official positions presented by Central and Provincial government agencies were highly supportive of the nomination and future management of LNP as a World Heritage area. The fact that the nomination was signed by the President and three senior ministers was taken as a strong sign of commitment from the Government of Indonesia. This provides a timely opportunity to press for this commitment to be translated into more adequate management.

The non-government environmental and community welfare organisations, including the church, indicated strong support for the nomination. The Dani Tribal Council indicated support but also showed some concern about possible restrictions on access to resources in their traditional lands. Again, they expressed the need for better relations with government agencies.

PTFI also indicated their strong support for the nomination. The company is already actively involved in sponsoring social development programmes with the local indigenous programme and shows interest in a more direct role in helping the park.

6. APPLICATION OF WORLD HERITAGE NATURAL CRITERIA

All assessments conducted on the biological priorities of protected areas in Asia/Pacific by FAO, UNEP, IUCN, ADB, Conservation International, WWF as well as the Government of Indonesia, rank LNP at the top. With its size, variety of habitats and the combination of numerous additional natural values, LNP is a clear candidate for inscription on the World Heritage List on the basis of the following three criteria:

Criterion (i): Earth's history and geological features

The geology and geomorphology of LNP provides extraordinarily graphic evidence of major elements of the earth's evolution. The main mountain range is the direct product of the collision of the leading edge of the Australian tectonic plate with the Pacific plate. Massive marine sediments, comprising mainly limestone and sandstone, have been rapidly uplifted to produce a major cordillera, albeit of very recent origin. The uplift is on-going.

Whilst the graphic evidence of the plate collision is evident along the length of the island of New Guinea, there is no doubt that Lorentz represents the most outstanding example, containing as it does the highest points on the mountains and the only remaining glaciers on the island. Furthermore, it is the only intact mountains-to-sea transect on the island which has been incorporated in a protected area.

LNP also graphically illustrates a remarkable response to the last glacial and the post-glacial period. The main range shows all the classic evidence of glaciation, including glacial lakes and moraines. Furthermore, Lorentz retains vestigial direct evidence of the last glacial with 4 or 5 small remnant glaciers, all retreating rapidly. None of the two other tropical glacier fields in the world exhibit the features of Lorentz. Indeed, there appears to be no better example of the combined effect of collision of tectonic plates with the secondary major sculpting by glacial (glaciation) and post-glacial events

(shoreline accretion). Analogues of this do extend across much of the southern side of the island of New Guinea but only Lorentz retains its glaciers and is in a protected area.

In response to global warming, as the glaciation of the mountains was receding, the sea level was rising. Almost the whole of the southern lowlands of Lorentz National Park post-date the last glacial as the massive amounts of debris eroded from the mountains, including the products of glaciation, contributed to rapid accretion of the southern coastline. Most of the southern lowlands are inundated during high tide, both in the estuarine and freshwater zones, attesting to their very recent origin.

LNP thus meets Criterion (i) in representing a major stage of the earth's history, in particular the mountain building associated with collision of tectonic plates, overlaid with the impact of glacial and post-glacial events, including the rise of sea level in response to global warming. Furthermore, there is an abundance of known fossil sites in the nominated area which provide a major resource recording the evolution of life on the island of New Guinea. Some of the fossils and fossil sites are of international significance, including many now extinct New Guinea endemic species, such as the *Protemnodon hopei*, a large extinct member of the kangaroo family.

Criterion (ii): Ecological processes

The geophysical processes at work in LNP (mountain building and tectonic plate collision and accretion of erosional materials in the lowlands) along with high rainfall have led to coincident development of significant on-going ecological processes. LNP's climatic gradient represents the most complete climatic gradient for the island of New Guinea, indeed for the whole of the Australian tectonic plate, from nival zones and glaciers to lowland equatorial with an equally extreme range of plants and animal species and communities. LNP is the only protected area in the world which incorporates a continuous, intact transect from snow cap to tropical marine environment, including extensive lowland wetlands. The combination of these two geophysical processes, mountain building and coastal accretion, has created climatic and salinity gradients along which ecological processes have sieved the regional biota in an outstandingly graphic way.

The rapid and expansive growth of the lowlands from the many parallel rivers flowing from the mountains, means that the altitudinal change over much of the lowlands is minimal and is mostly at or below high-tide level, even in freshwater areas. The result is that tidal influence in LNP extends well into the freshwater areas towards the base of the mountains. The biota of the lowlands have therefore been sieved into a complex array of species. These occur along a salinity gradient, from mangrove communities in the lower estuaries, giving way upstream to nipa palm and sago palm forests which in turn give way to open freshwater swamps, freshwater swamp forest and peat forests further upstream.

The mountain building process has provided temperate refuges in the tropics for ancient Gondwana species of plants during climatic warming since the last ice age. For example, LNP's *Nothofagus* beech forests are well represented, although their closest relatives are otherwise confined to the cool temperate regions of south-eastern Australia, New Zealand and the southern Andes.

The refugial effect or local genetic evolution, or both, are manifest as local endemic species or restricted range species. Although research to date has been limited, it is apparent for example, that a number of mammal species, including some newly discovered species such as the Dingiso tree kangaroo, have evolved to utilise the specialised habitats of the sub-alpine and upper montane climatic zones. The mammal fauna of the mountains is distinguished by the predominance of marsupials and monotremes indicating a Gondwanan origin, the Asian origin placentals being limited to rodents and bats.

LNP provides evidence of a highly developed endemism in both plants and animals, at least for the higher altitudes of the mountains. This is what would be expected in a region combining on-going uplift and climatic warming.

LNP thus also meets criterion (ii) as an outstanding example of on-going ecological and biological processes in the development of terrestrial, freshwater, coastal and marine systems and communities of plants and animals.

Criterion (iv): Biodiversity and threatened species

Biological research in LNP to date has been very restricted and relatively little is known about the species composition of the area. However, research undertaken by Freeport and others in specific localities has been extrapolated to some extent across altitudinal zones of the LNP and confirm that the park supports the highest biodiversity of species in the region. The greater part of the case for meeting criterion (iv) is based on detailed information available for several montane, sub-alpine and alpine areas on the main range. Here a high level of local endemism is apparent, including many newly discovered species.

Much of the rich biota of LNP is new to science and some of special interest to science. For example, the newly described tree kangaroo is of special interest given the hypothesis that it has entered on an evolutionary reversal, re-evolving from an arboreal species to a mainly ground dwelling animal. LNP contains substantial portions of two Endemic Bird Areas with a total of 45 restricted range birds and 9 endemic bird species. Two of the restricted range bird species, Archbold's bower bird, and MacGregors Bird of Paradise are considered rare and vulnerable.

LNP, however, is a not just the habitat for many rare, endemic and restricted range species. Given the large size and exceptional natural integrity, it is an especially important habitat for these species and their on-going evolution. Given the population and development pressures that are starting to build in Irian Jaya, LNP will become increasingly important for long term conservation of the species already recorded and the many that remain to be discovered.

It is clear that LNP contains "the most important and significant natural habitats for in-situ conservation of biological diversity, including those habitats that contain threatened species of universal value from the point of view of science or conservation". LNP thus meets Criterion (iv). Furthermore, given the limited knowledge on the park, it is possible to predict that further research will reinforce the fact that LNP is a globally important protected area for the conservation of a rich biodiversity, including many local endemic and rare species.

Criterion (iii): Superlative natural phenomena, scenic beauty

The case for this criterion has not been convincingly made in the nomination. Although there are many scenic features in LNP such as waterfalls and the glaciers on Puncak Jaya, these features are secondary in importance to the park's main values under criteria (i), (ii) and (iv).

Conditions of Integrity

The LNP nomination meets all related Conditions of Integrity except (v) which notes that a nominated site "should have a management plan". In as much as the planning process has commenced with a stakeholders workshop in 1997, the plan has at least been initiated. The Bureau may wish to note that the Government of Indonesia intends to give priority attention to completing the plan and to strengthening the management presence in the coming year.

7. RECOMMENDATION

At its twenty-third session, the Bureau recommended to the Committee that the Lorentz National Park be **inscribed** on the World Heritage List under natural criteria (i), (ii) and (iv). The Centre has

informed the Indonesian authorities of concern over a number of aspects dealing with management of the site as discussed above. In particular, these are:

- the priority need to continue the process of management planning for the park with full involvement of the local stakeholders;
- encouragement for the proposed establishment of a Foundation which would assist in the management of the park;

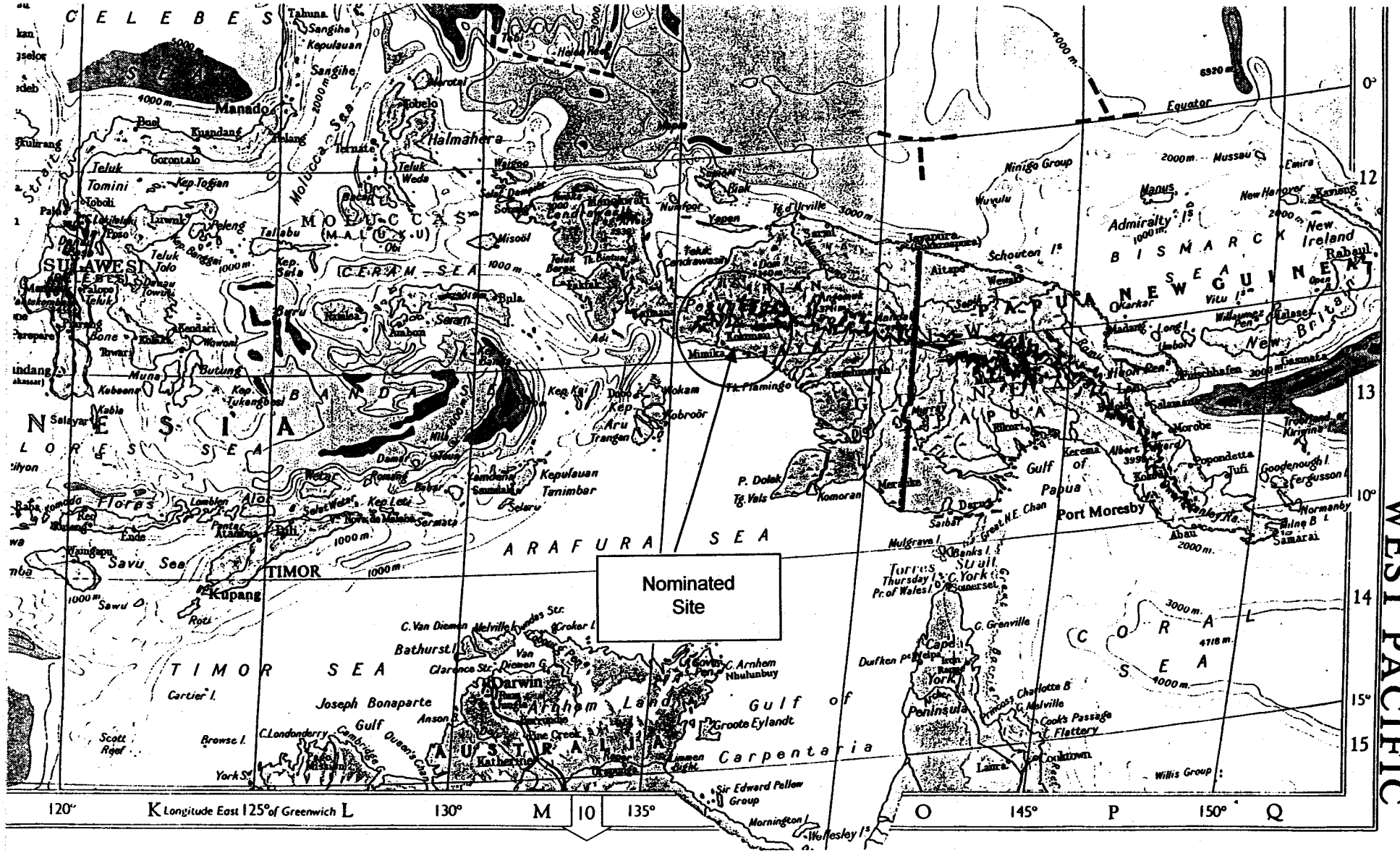
- possible twinning arrangement with the Wet Tropics World Heritage site in Australia;

- appointment of a Park Director and support staff (as planned for 2000);

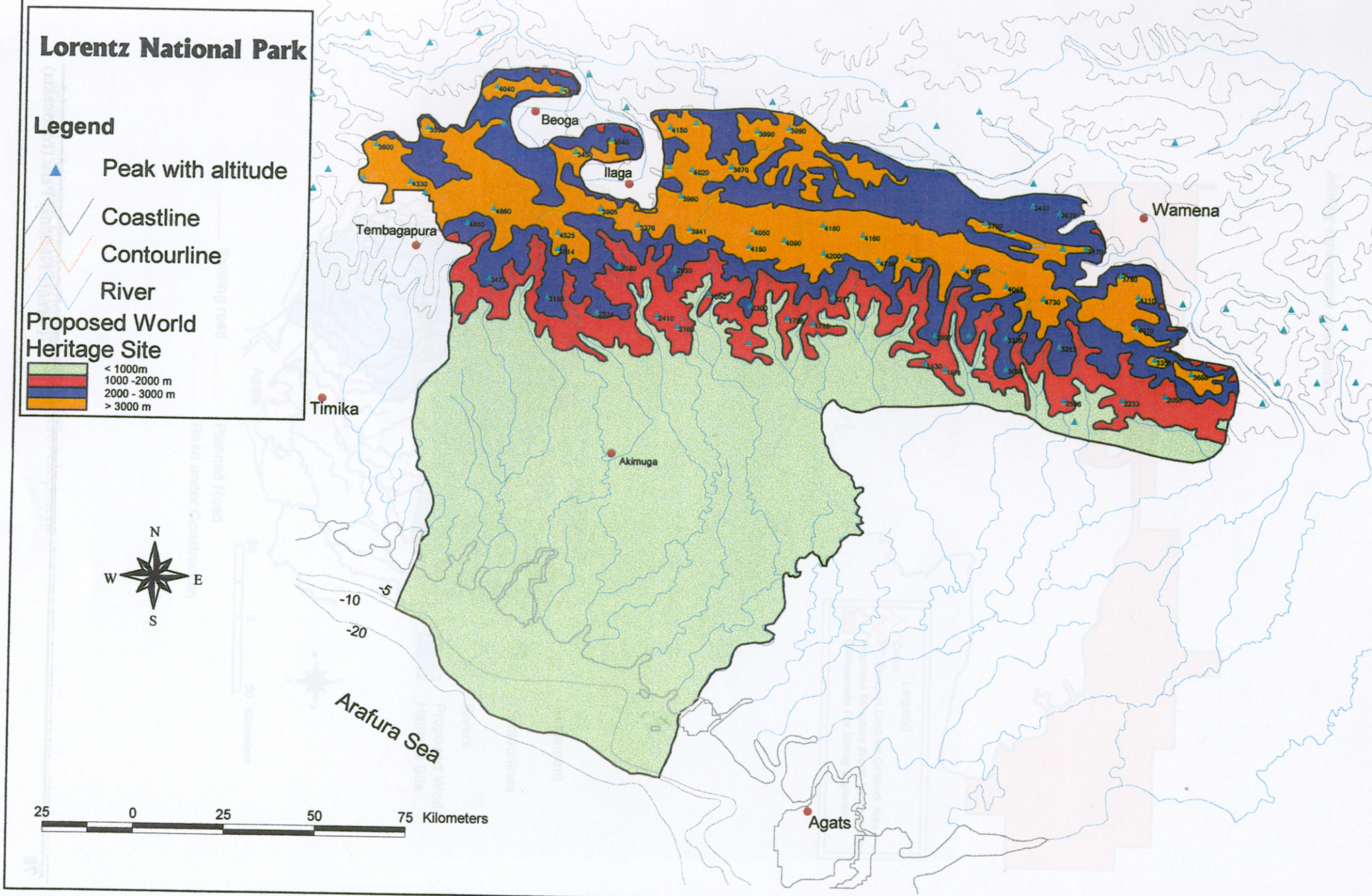
- the concern over development projects that would affect the park, for example the proposed Timika/Merauke road and any expansion of mining activity towards the park boundary so as not to conflict with LNP's nomination as a World Heritage Site.

The Indonesian authorities have subsequently responded positively to all the above concerns in a 1 October 1999 letter to the Centre.

The Committee may also wish to commend the Government of Indonesia for acting to ensure that the former existing mining and petroleum exploration leases in the park were withdrawn. Finally, the Committee may wish to recommend that a monitoring mission be undertaken to gauge progress three years after inscription.

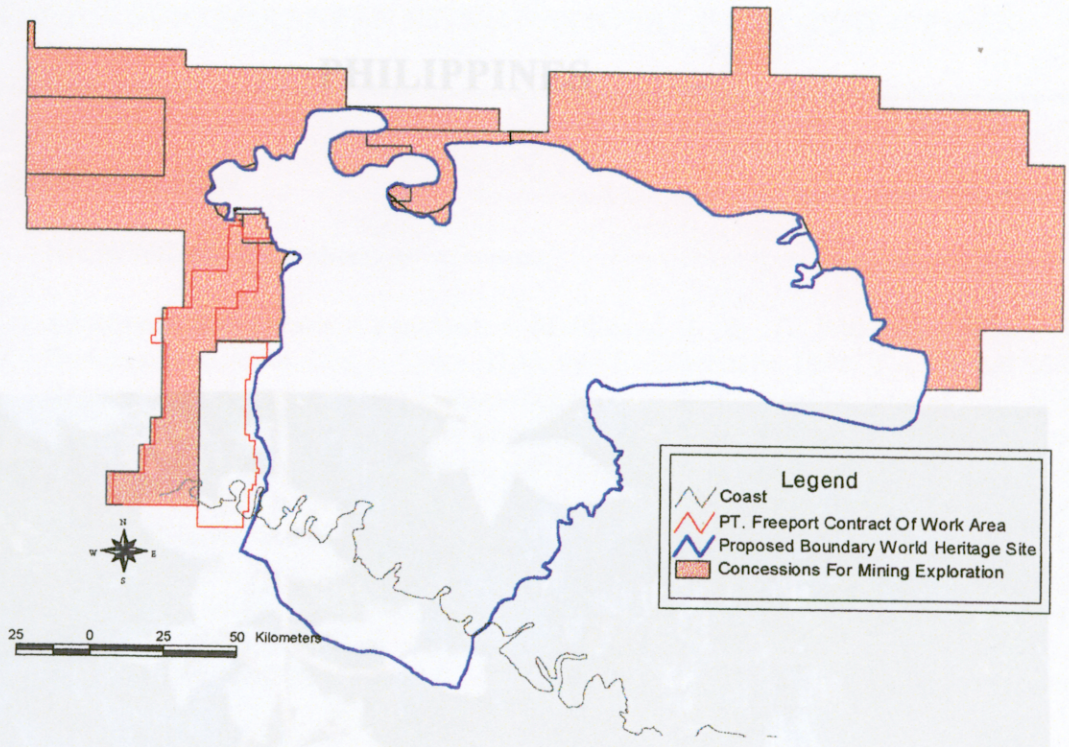


Map 1. Location of Nominated Site

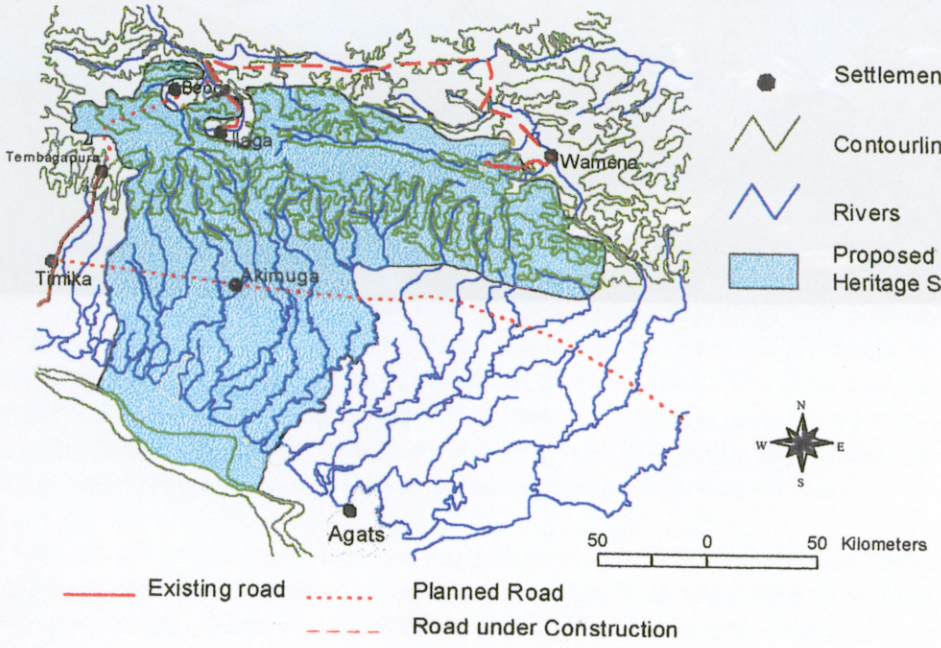


Map 2. Nominated Site

Mining exploration concessions



Road development



Map 3. Mining Exploration and Road Development

CANDIDATURE AU PATRIMOINE MONDIAL - ÉVALUATION TECHNIQUE UICN

PARC NATIONAL DE LORENTZ (INDONÉSIE)

1. DOCUMENTATION

i) **Fiches techniques UICN/WCMC** (10 références)

ii) **Littérature consultée:** Conservation International. 1997. Irian Jaya Biodiversity Conservation Priority Setting Workshop. Map.; Davis, S.D. *et. al.* 1995. **Centres of Plant Diversity**. Vol. 7. IUCN; P.T. Freeport Indonesia 1998. **Biodiversity Surveys – Compilation Report**. 702p.; Mealey, G.A. 1996. **Grasberg**. Freeport; Deutsche Forst Consult. 1992. Preparation Report on Lorentz. Asian Development Bank.

iii) **Consultations:** 8 évaluateurs indépendants, fonctionnaires du gouvernement provincial, représentants de l'Église et de l'armée, WWF, ONG locales, Représentants de la mine Freeport.

iv) **Visite du site:** février 1999, Jim Thorsell, Peter Hitchcock, Jeff Sayer.

2. RÉSUMÉ DES CARACTÉRISTIQUES NATURELLES

Le Parc national de Lorentz (PNL) s'étend sur 150 km, des glaciers équatoriaux de la Cordillère centrale de Nouvelle-Guinée, montagnes les plus élevées de l'Asie du Sud-Est, à la côte méridionale de la mer d'Arafura. C'est la plus vaste aire protégée d'Asie du Sud-Est (2,5 millions d'hectares), s'étendant du niveau de la mer jusqu'à 4,884 m d'altitude au sommet du Puncak Jaya (aussi connu sous le nom de mont Carstensz), la plus haute montagne de Nouvelle-Guinée et d'Indonésie. Avec ses 3 km^2 de glaciers au sommet, c'est l'une des trois seules régions du monde où l'on trouve des glaciers sous latitude équatoriale. Le parc, qui comprend une partie de la chaîne de Sudirman, possède un grand nombre de cours d'eau qui ont creusé de profondes vallées dans les montagnes et sur les contreforts en s'écoulant jusqu'à la plaine côtière, vers le sud, où ils forment une vaste étendue de marécages, avec de nombreux lacs permanents et saisonniers. Le parc compte un secteur marin, atteignant 10m de profondeur, dans la mer d'Arafura. À la jonction entre les deux plateaux continentaux se trouve une zone géologiquement complexe. Au nord, des moraines recouvrent une topographie extrêmement accidentée de calcaire karstique; les montagnes de la Cordillère centrale sont formées de sédiments océaniques plissés et métamorphiques du Crétacé (100 millions d'années avant notre ère) et de l'Éocène (40 millions d'années avant notre ère). Des dépôts alluviaux couvrent la plaine côtière méridionale. Quatre grottes creusées dans les plateaux recèlent de nombreux fossiles animaux et végétaux datant de la période glaciaire. Le climat est tropical humide avec des précipitations de 5,000 mm par an dans les zones les plus élevées.

Les principaux systèmes terrestres de l'Irian Jaya sont tous représentés dans le PNL, où quelque 34 types de végétation et 29 "écosystèmes terrestres" ont été décrits. La plaine côtière présente de vastes étendues de zones humides, y compris des mangroves le long de la côte, des marais cotidaux et d'eau douce et des forêts riveraines, des zones de laîches, des formations à *Pandanus* et à palmiers sago, ainsi que des forêts marécageuses sur tourbe inondées en saison. La forêt ombrophile de plaine, qui est la communauté végétale la plus

riche, s'étend jusqu'à 1000m d'altitude. Entre 1000 et 3000m, on trouve des forêts ombrophiles montagnardes de basse altitude, moins riches en essences que les forêts alluviales de plaine et les forêts de collines puis, à 3000m, la végétation change brusquement. Fougères arborescentes, végétation de tourbière, prairie et lande prédominent jusqu'à la zone alpine, à 4000m.

Quelque 123 espèces de mammifères ont été enregistrées dans la réserve, soit 80% du nombre total de mammifères de l'Irian Jaya. Les zones marécageuses abritent deux espèces menacées de crocodiles: le crocodile marin (menacé d'extinction) et le crocodile de Nouvelle-Guinée (vulnérable). L'avifaune est aussi extrêmement riche, avec 411 espèces décrites, y compris une vingtaine d'espèces endémiques de l'Irian Jaya. Parmi les plus remarquables figurent 2 espèces de casoars à casque, 4 mégapodes, 30 perroquets, 20 paradisiers et 6 jardiniers.

L'occupation humaine du Parc national de Lorentz remonte à plus de 25 000 ans. Actuellement, 6300 personnes appartenant à 8 groupes autochtones vivent à l'intérieur du parc; certaines pratiquent l'agriculture et cultivent la banane, le taro et la patate douce; d'autres élèvent des porcs, la chasse venant compléter leur ration de protéines. Les activités de subsistance des populations côtières sont axées sur le palmier sago et le poisson. La mine d'or et de cuivre de Freeport jouxte la limite nord-ouest du parc.

3. COMPARAISON AVEC D'AUTRES AIRES PROTÉGÉES

L'île de Nouvelle-Guinée (dont l'Irian Jaya couvre près de la moitié) présente les ensembles les plus divers, du point de vue physiographique et biologique, de toute la région australo-pacifique. Soixante à quatre-vingt dix pour cent des espèces de la flore sont endémiques et l'île possède la plus grande diversité de mammifères du domaine océanien. Les principaux milieux naturels de l'Irian Jaya sont tous représentés dans le PNL, y compris 29 "écosystèmes terrestres" et 34 types de végétation s'étendant de la plaine côtière à la zone alpine, en passant par la forêt ombrophile de plaine, la forêt ombrophile de montagne, la forêt de conifères, la lande et la prairie. Le gradient altitudinal, biologique et thermique du site est probablement le plus élevé de toutes les aires protégées du monde.

Le Parc national de Lorentz se situe dans la Province biogéographique papoue, à l'intérieur de laquelle se trouve le Bien naturel du patrimoine mondial de Rennell Est, aux îles Salomon. Rennell Est, petit atoll corallien surélevé, n'a aucune ressemblance géographique ou spécifique avec le PNL qui fait partie d'une île-continent et présente une zone de montagnes avec un champ de glace.

L'Indonésie possède un vaste réseau (15 millions d'hectares) d'aires protégées, dont 105 correspondent aux Catégories UICN I et II de gestion des aires protégées. Toutefois, l'Irian Jaya appartient à un domaine biogéographique (océanien) différent du reste de l'Indonésie (domaine indomalais). La ligne de Wallace (modifiée par Huxley) sépare les deux domaines et le biote à prédominance orientale de l'Asie du biote australasien au sud. Comme le montre le Tableau 1, l'Irian Jaya est la province biogéographique la plus riche d'Indonésie, avec le degré d'endémisme le plus élevé du pays. Le PNL est, de loin, l'aire protégée la plus étendue d'Indonésie et même de toute la région, suivi par des aires deux fois moins vastes. À titre comparatif, la superficie totale du Parc national de Lorentz dépasse de 25% celle de Kakadu (Australie).

Tableau 1 – Comparaison de la diversité et de l'endémisme spécifiques dans les provinces biogéographiques d'Indonésie

Île	Espèces d'oiseaux résidentes	Endémisme de l'avifaune en %	Diversité spécifique des mammifères	Endémisme des mammifères en %	Diversité spécifique des reptiles	Endémisme des reptiles en %	Diversité spécifique relative des végétaux	Endémisme des végétaux en %
Sumatra	465	2	194	10	217	11	820	11
Java	362	7	133	12	173	8	630	5
Bornéo	420	6	201	48	254	24	900	33
Célèbes	289	32	114	60	117	26	520	7
Petites Sunda	242	30	41	12	77	22	150	3
Moluques	210	33	69	17	98	18	380	6
Irian Jaya	602	52	125	58	223	35	1030	55

L'Irian Jaya possède 47 aires protégées (sans compter les 8 parcs de loisirs). Il y a aussi d'autres sites très importants (par exemple les monts Arfak et le Parc national de Mamberamo-Foja) qui sont, toutefois, moins étendus, moins diversifiés, avec un gradient altitudinal moindre et ne possèdent pas la gamme étendue d'habitats "montagne-mer" du Parc national de Lorentz.

Le PNL se distingue, en outre, par sa géologie et sa géomorphologie. Sa principale chaîne de montagnes est située à l'extrémité de la plaque tectonique australienne, au point de collision avec la plaque pacifique. Bien que la collision des plaques ait laissé des traces visibles sur toute la longueur de la Nouvelle-Guinée, c'est à l'intérieur du PNL qu'elle est le plus manifeste. Les montagnes de Lorentz sont situées sur la plaque australienne mais il n'existe aucune montagne ancienne ou de cette origine sur le continent australien adjacent qui est, principalement, une surface ancienne tectoniquement stable.

Le Parc national de Lorentz est l'une des trois régions du monde où subsistent des glaciers équatoriaux - les autres sont en Afrique de l'Est et dans les Andes. Tous ces glaciers tropicaux sont en récession mais le PNL a conservé des glaciers reliques ainsi que des traces classiques de la glaciation ancienne, telles que des lacs glaciaires et des moraines. Le mont Kinabalu, à Bornéo, possède lui aussi des vestiges de la période glaciaire, mais n'a plus de glacier et ne présente pas la physiographie de la Cordillère de l'Irian Jaya qui favorise une accumulation de neige plus importante.

En conclusion, le site désigné se distingue à l'échelle régionale et mondiale par sa position biogéographique stratégique entre l'Asie, l'Australie et le Pacifique, son histoire géologique à la jonction entre deux plaques tectoniques, sa diversité biologique exceptionnelle, son étendue et son gradient "mer-montagne", unique au monde.

4. INTÉGRITÉ

Étant donné sa superficie exceptionnelle (2,5 millions d'hectares), on peut dire que le PNL représente un peuplement forestier tropical intact d'importance mondiale. Une seule route pénètre dans le parc, à sa limite nord-est marquée par le lac Habbema. Le fait que le PNL protège tout un réseau hydrographique, entre la source des rivières dans la montagne et la mer d'Arafura, est un facteur supplémentaire d'intégrité du site. Néanmoins, malgré son étendue, le PNL est exposé à diverses menaces et ne pourra faire l'objet d'une gestion avisée que lorsque les problèmes auront été résolus en ce qui concerne les limites, les pressions du développement, les résidents et les obstacles administratifs.

4.1. Limites

La protection du site de Lorentz remonte à 1919, lorsque le gouvernement colonial créa une réserve naturelle de 300,000ha autour des principaux sommets. Les limites et le statut juridique ont changé plusieurs fois avant l'établissement du parc national actuel (1997) qui couvre 2,5 millions d'hectares. Les limites précises du parc sont toujours en négociation, et une petite portion de terres communautaires proche de Wamena devrait bientôt être retranchée.

C'est surtout à l'ouest du site que se posent des problèmes de limites, à l'endroit où le parc national jouxte la zone de concession de la mine de Freeport. Cette zone a été délimitée par une série de lignes droites, au mépris de la topographie et, bien qu'il n'y ait pas de drainage de la mine au parc, on aperçoit néanmoins celle-ci depuis certains points de vue dans le parc. Toutes les activités minières sont interdites dans le parc mais la limite de la mine de Grasberg remonte jusqu'à quelques centaines de mètres du sommet du mont Jaya. Il est peu probable que les activités minières s'approchent davantage du parc (à l'exception des activités souterraines). Toutefois, Freeport pourrait profiter de ses droits territoriaux pour pousser ses activités ou son infrastructure jusqu'aux limites du parc. La zone tampon convenue, à la limite occidentale du parc, devrait contribuer à atténuer les conflits futurs.

Un autre problème de limites se pose dans les contreforts méridionaux, à l'est, où une concession pétrolière antérieure à la création du parc pénètre à l'intérieur des limites et où des concessions forestières ont été exclues du parc. De même, les établissements humains d'Illaya et de Beoga, aux limites septentrionales, ont été exclus du parc, ce qui explique le tracé sinueux à cet endroit. L'intégrité de la limite marine fixàe à 10 mètres de profondeur dépend de la sensibilisation et de l'application de la loi.

En résumé, les limites du PNL sont un compromis réaliste entre les utilisations existantes des sols et la répartition de la population humaine. Aucune caractéristique importante ne manque à ce système et, à part quelques ajustements mineurs, les limites actuelles sont compatibles avec l'inscription du Parc national de Lorentz sur la Liste du patrimoine mondial.

4.2. Population résidente

Les 2,5 millions d'hectares de forêt primaire du Parc national de Lorentz sont ponctuellement interrompus par la présence de petites communautés autochtones, dont plusieurs sont desservies par les pistes d'atterrissage des missions. Ces petites agglomérations (une cinquantaine en tout) sont accessibles par des sentiers pédestres, et leur impact se limite à des cultures sur les pentes abruptes, des coupes et une pêche de subsistance. Environ huit groupes autochtones, soit 6300 personnes au total (10 000 selon une estimation) sont concernés. L'essentiel du parc est inhabité mais des chasseurs-cueilleurs traditionnels fréquentent certains endroits. La santé, la nutrition, la sécurité, le régime foncier, l'éducation et la dégradation des coutumes traditionnelles font partie des problèmes que connaissent les résidents du parc.

Vu le nombre de groupes autochtones vivant à l'intérieur et autour du parc, il est essentiel qu'ils soient associés à la gestion. Ces groupes autochtones ont beaucoup à offrir en la matière et pourraient aussi retirer des avantages certains d'une telle coopération. Le WWF a entrepris un excellent travail avec ces communautés locales, et la Banque asiatique de développement (1992) a également étudié les types de projets susceptibles de répondre à leurs besoins. La préparation du plan de gestion s'est également faite en concertation avec les représentants des différentes parties prenantes et une telle participation mérite d'être non seulement encouragée mais élargie.

4.3. Pressions du développement

Les menaces qui pèsent sur le site sont inhérentes aux activités minières, à l'exploitation pétrolière, au projet de construction routier et à l'exploitation forestière illégale. Depuis le début de ses opérations, en 1972, P.T. Freeport Indonesia (PTFI), situé à la limite occidentale du site, a extrait de grandes quantités de minerais de cuivre et d'or. En 1997, cette mine a vendu environ 550 000 tonnes de cuivre et 1,9 million d'onces d'or, ce qui en fait l'une des mines les plus importantes et les plus rentables du monde. On estime que les réserves actuelles de la concession minière devraient encore durer une quarantaine d'années. Un site minier à ciel ouvert est à l'origine de divers problèmes sociaux et écologiques, notamment le déplacement d'un groupe autochtone, les Amungme, la pollution des cours d'eau, le déversement d'hydrocarbures, le déboisement et la construction d'infrastructures pour les 14 000 employés de la mine. Il importe de noter que tous ces impacts se sont fait sentir à l'extérieur des limites actuelles du PNL et que les eaux de la mine sont drainées vers un bassin versant hors du parc.

Une partie de la zone minière se trouvait autrefois à l'intérieur de la réserve de Lorentz, mais en 1997, lors de la création du le Parc national de Lorentz, cette portion fut retranchée du nouveau site. Néanmoins, la chaîne de Sudirman est fortement minéralisée et des concessions minières subsistent tout autour des limites occidentales et septentrionales du PNL (voir carte). Les concessions minières qui existaient autrefois à l'intérieur du site ont été annulées et la législation relative aux parcs nationaux interdit toute nouvelle exploitation minière dans les parcs. PTFI a exprimé son soutien à la candidature du site et son intention de ne pas étendre ses activités à l'intérieur du parc (une lettre officielle de confirmation nous est parvenue). On notera en outre que l'une des quatre personnes à avoir signé le document de la proposition est le ministre des Mines et de l'Énergie.

Malgré les progrès que représente le nouveau tracé du site, qui exclut les mines, l'intention de renoncer à étendre les activités minières dans le parc et l'effort considérable déployé ces cinq dernières années par le PTFI en matière de restauration écologique et de recherche, l'UICN demeure préoccupée par l'influence qu'un voisin aussi puissant peut exercer sur le parc. À cet égard, la liste de mesures en 9 points (Tableau 2) figurant dans le rapport d'évaluation de la diversité biologique de Freeport (1998, page 575) constitue une excellente base de coopération. L'UICN sait qu'un Fonds d'affectation spéciale est en voie d'établissement pour soutenir la gestion du site désigné (Fonds auquel Freeport contribuerait). Le Bureau pourrait considérer comme essentiel, pour l'intégrité future du site, d'encourager le Gouvernement indonésien et PTFI à mettre en œuvre ces mesures, qui contribueront à améliorer la gestion du Parc national de Lorentz ainsi que la qualité de vie des résidents autochtones.

Tableau 2. Appui de la mine de P.T. Freeport Indonesia (PTFI) à la gestion du Parc national de Lorentz

Le Gouvernement indonésien est responsable de la conservation de la diversité biologique à l'intérieur du Parc national de Lorentz, et PTFI l'appuiera:
i) en collaborant avec PHPA à la rationalisation des limites du Parc national de Lorentz;
ii) en fournissant un appui logistique aux études de terrain menées dans le Parc national de Lorentz;

iii) en procédant à des recherches écologiques sur les écosystèmes se trouvant à la fois dans la zone de concession et de projet de PTFI et dans le Parc national Lorentz

iv) en collaborant avec le Gouvernement indonésien à l'établissement de sites de recherche sur la diversité biologique et de parcelles de surveillance continue à l'intérieur du Parc national de Lorentz, qui fourniront des données sur la gestion des écosystèmes du parc tout en servant de centres de "contrôle" pour les sites de recherche sur la diversité biologique et les parcelles de surveillance continue établis dans la zone de concession et de projet;

v) en préparant des guides de terrains résumant les résultats des recherches sur la diversité biologique menées par PTFI et en les distribuant aux organismes concernés par la gestion du Parc national de Lorentz (gouvernement, universités et ONG);

vi) en mettant au point un système intégré de GIS et de cartographie utilisable dans le Parc national de Lorentz et dans la zone de concession et de projet de PTFI;

vii) en menant des études ethnobotaniques sur les groupes autochtones vivant dans les écosystèmes de la zone de concession et de projet de PTFI et du Parc national de Lorentz, et en aidant ces groupes à concevoir des activités rémunératrices axées sur l'utilisation durable de la faune et de la flore locales;

viii) en aménageant la zone de concession et de projet de PTFI comme une zone "tampon" entre le Parc national de Lorentz et les activités de développement menées à l'ouest de la zone de concession et de projet de PTFI;

ix) en collaborant avec des organismes gouvernementaux, y compris PHPA, et d'autres entreprises privées actives dans la région, à la conservation de la diversité biologique régionale/écosystémique.

(Source: P.T. Freeport Indonesia 1998. Biodiversity Surveys in the PTFI COW Mining and Project Area, Irian Jaya, Indonesia, p.575.)

Les concessions d'exploitation pétrolière antérieures à la création du parc national, à l'intérieur de la limite orientale, constituent une deuxième menace. À cet égard, l'UICN a été informée que des investisseurs de la compagnie pétrolière CONOCO auraient proposé un investissement de 40 millions de dollars à l'intérieur du parc national, mais que ce projet avait été volontairement abandonné et qu'aucune autre activité ne serait menée sur cette concession. Les négociations engagées avec la CONOCO pour l'amener à renoncer à ses concessions à l'intérieur du parc ont abouti à un accord. Toutefois, l'exploitation se poursuivra à l'extérieur du parc national et, une fois de plus, une coopération entre le secteur privé et le Gouvernement indonésien devrait être encouragée, à l'instar de celle qui existe avec PTFI. Le Bureau pourrait souhaiter relever l'incompatibilité de l'exploitation pétrolière à l'intérieur du Parc national Lorentz.

Trois projets de construction routière à l'intérieur du Parc national de Lorentz sont évoqués dans le texte de la proposition. La nouvelle route menant au lac Habbema, à la limite septentrionale du site, a été construite au mépris de l'environnement et se trouve aujourd'hui dans un état précaire. Durant la visite du site, l'UICN a exprimé à des fonctionnaires gouvernementaux son souci de parvenir à une réduction des impacts de cette route et à une meilleure protection du biome fragile des zones d'altitude.

Un projet routier qui relierait le site de la mine de Freeport à Beoga a également été étudié mais il est peu probable qu'il soit sérieusement envisagé avant plusieurs années. Un projet

routier traversant le parc sur toute sa largeur, entre Timika et Mapurajaya (voir carte 3) est une source de préoccupation nettement plus grave.

En effet, cette route perturberait gravement l'intégrité de la forêt du bassin versant du parc et, bien qu'elle ait peu de chances de voir le jour (pour des raisons financières et de sécurité), il conviendrait que le Bureau émette une sérieuse mise en garde à ce sujet.

Les concessions forestières bordant le Parc national de Lorentz à l'est font peser une menace sur le parc car elles entraînent des changements à long terme dans le mode de vie traditionnel de certains résidents (par exemple dépendance vis-à-vis d'une économie de consommation et pénurie d'arbres pour la construction des canoës). Certains membres de la tribu Nakai participent déjà à des activités de coupe, parfois illégales. Pour le moment, le département forestier n'assure aucune présence administrative dans cette région.

La dernière question liée à l'intégrité est la nécessité de mettre en place un régime de gestion plus adéquat. Le Parc national de Lorentz ne dispose ni d'un siège, ni d'un directeur résident, ni d'un plan de gestion. Il existe une personne nominalement responsable, basée à Jayapura et des gardes du département forestier sont basés en plusieurs endroits à proximité du parc mais tous ces gens ont d'autres responsabilités à assumer. Un premier pas a été accompli vers la préparation d'un plan de gestion sous la forme d'une réunion des parties prenantes, mais rien n'a été fait depuis. Le Parc national de Lorentz est largement soutenu par le WWF-Indonésie, grâce à des fonds des Gouvernements allemand et américain. Le Gouvernement indonésien a l'intention d'établir un siège local et de recruter du personnel au début de l'année prochaine pour améliorer la gestion du site, mais le budget d'investissement n'a pas encore été estimé.

Il importe tout particulièrement que les administrateurs du Parc national de Lorentz déploient des efforts concertés pour instaurer un partenariat avec la population locale, tant à l'intérieur qu'à l'extérieur du parc. Trois mesures ont été proposées, à savoir, une coordination étroite passant par les conseils tribaux, une approche concertée en matière de gestion et la création de postes de chargés de liaison avec les communautés. L'engagement à renforcer les capacités de gestion locales est une autre tâche hautement prioritaire.

Le principal obstacle que ce parc devra surmonter à l'avenir est celui de la disponibilité de ressources pour la gestion. Il a été proposé d'établir une fondation spéciale, indépendante, qui serait chargée de recueillir des fonds pour le parc. PTFI s'est déclaré intéressé par ce projet, de même que CONOCO. Les délégations régionales de l'UNESCO et du WWF essaient de faciliter l'établissement d'une association des "Amis de Lorentz" sur le modèle des "Amis du Parc national de Kutai" au Kalimantan. L'achèvement et l'adoption d'un plan de gestion sont plus importants que jamais pour démontrer l'engagement des autorités du parc et établir des priorités de financement.

Une autre proposition discutée durant la visite du site est l'établissement d'un partenariat entre le Parc national de Lorentz et le Bien du Patrimoine mondial des Tropiques humides du Queensland, en Australie tropicale. Des enquêtes préliminaires des deux organismes révèlent un intérêt positif. À court terme, le jumelage de ces deux zones de forêt ombrophile tropicale pourrait se révéler particulièrement bénéfique à Lorentz, et, finalement, aux deux régions.

En conclusion, tous les points susmentionnés exigeront des efforts concentrés durant les années à venir. Bien que le Parc national de Lorentz ait été affecté par des activités minières dans sa périphérie, son étendue et son relief accidenté l'ont aidé à conserver un état relativement vierge. Face aux pressions régionales diverses qui ne cessent d'augmenter et aux préoccupations sociales des résidents

locaux insuffisamment prises en compte, le Gouvernement indonésien et ses partenaires du Parc national de Lorentz se doivent d'adopter une attitude proactive. La procédure initiale du plan de gestion doit faire l'objet d'un suivi rigoureux et déboucher sur la préparation d'un programme d'action.

5. AUTRES COMMENTAIRES

La mission sur le terrain a révélé que de nombreux secteurs soutiennent fermement cette désignation, notamment les communautés autochtones consultées. Il apparaît néanmoins que des préoccupations considérables subsistent quant à la protection de leurs droits traditionnels et à la manière dont le gouvernement pourrait influencer leur mode de vie. Les groupes autochtones ont exprimé leur souhait de voir tous les paliers de gouvernement redoubler d'efforts en signant des chartes avec la population locale. Cette question doit être résolue par les administrateurs du parc, entre autres, au moyen d'un programme de communication comportant, notamment, un volet de coordination et d'information communautaires régulières.

Les positions officielles exprimées par les organismes des gouvernements central et provincial sont nettement favorables à la désignation et à la gestion future du Parc national de Lorentz en tant que bien du patrimoine mondial. Le fait que le texte de la proposition ait été signée par le Président et par trois ministres principaux est considéré comme une marque d'engagement sérieux de la part du Gouvernement de l'Indonésie.

Les organisations environnementales et les organismes communautaires d'aide sociale, y compris l'Église, ont exprimé leur soutien à la proposition. Le Conseil tribal de Dani a donné son appui tout en se déclarant quelque peu préoccupé par d'éventuelles restrictions d'accès aux ressources de ses terres ancestrales. Une fois de plus, la nécessité d'établir de meilleures relations avec les organismes gouvernementaux a été exprimée.

PTFI a également manifesté son appui à la proposition. Cette entreprise participe déjà activement au financement de programmes d'action sociale, dans le cadre du programme autochtone local, et a l'intention de soutenir le parc de façon plus directe encore.

6. CHAMP D'APPLICATION DES CRITÈRES NATURELS DU PATRIMOINE MONDIAL

Toutes les évaluations menées sur les priorités biologiques des aires protégées dans la région Asie/Pacifique par la FAO, le PNUE, l'UICN, LA BAsD, Conservation International, le WWF ainsi que le Gouvernement indonésien, placent le Parc national de Lorentz en tête de liste. De par son étendue, la variété de ses habitats et la combinaison de nombreux éléments naturels supplémentaires, ce site mérite clairement d'être inscrit sur la Liste du patrimoine mondial, au titre des trois critères suivants:

Critère (i): histoire de la terre et processus géologiques

La géologie et la géomorphologie du Parc national de Lorentz témoignent de façon extraordinairement spectaculaire des grands stades de l'évolution de la planète. La principale chaîne de montagnes est le produit direct de la collision entre la plaque tectonique australienne et la plaque pacifique. Le soulèvement rapide de sédiments marins énormes, constitués principalement de grès et de calcaire, a donné naissance à une importante cordillère, malgré son origine très récente, et ce processus se poursuit.

Si la collision des plaques a laissé des traces manifestes sur toute la longueur de l'île de Nouvelle-Guinée, il ne fait aucun doute que Lorentz en est l'illustration la plus exceptionnelle, du fait que le parc possède les plus hauts sommets et les seuls vestiges glaciaires de l'île. Qui

plus est, il s'agit-là du seul gradient "montagne-mer" intact de l'île qui fasse partie d'une aire protégée.

Le Parc national de Lorentz illustre aussi concrètement une réaction exceptionnelle à la dernière période glaciaire et postglaciaire. La principale chaîne possède toutes les traces classiques de la glaciation, y compris des lacs glaciaires et des moraines. En outre, Lorentz contient un vestige direct de la dernière glaciation, avec quatre ou cinq glaciers, tous en récession rapide. Aucun des autres champs de glace tropicaux du monde ne présente les caractéristiques de Lorentz. En fait, il semble qu'il n'existe aucun meilleur exemple des effets conjugués de la collision des plaques tectoniques et de la sculpture secondaire importante due aux phénomènes glaciaires (glaciation) et postglaciaires (accrétion du rivage). On trouve des caractéristiques analogues dans la plus grande partie de la zone méridionale de l'île de Nouvelle-Guinée mais seul le PNL a conservé ses glaciers et est une aire protégée.

À mesure que les glaces se retiraient, en réaction au réchauffement mondial, le niveau de la mer s'élevait. La majeure partie des plaines méridionales du Parc national de Lorentz se sont formées après la dernière glaciation, les immenses quantités de détritus géologiques produits par l'érosion des montagnes, y compris par la glaciation, ayant contribué à l'accrétion rapide du littoral méridional. La plus grande partie des plaines du sud sont inondées à marée haute, dans les zones aussi bien estuariennes que d'eau douce, ce qui atteste de leur origine très récente.

Le Parc national de Lorentz satisfait donc au critère (i) puisqu'il constitue un exemple d'un stade important de l'histoire de la Terre, notamment la formation de montagnes associée à la collision des plaques tectoniques, à laquelle s'est ajouté l'impact de phénomènes glaciaires et postglaciaires, y compris l'élévation du niveau de la mer en réaction au réchauffement mondial. Il possède en outre de nombreux sites fossiles qui constituent un élément important témoignant de l'évolution de la vie sur l'île de Nouvelle-Guinée. Certains fossiles et sites fossilifères revêtent une importance internationale, et recèlent de nombreuses espèces endémiques aujourd'hui éteintes en Nouvelle-Guinée, comme *Protemnodon hopei*, membre important de la famille des kangourous.

Critère (ii): processus écologiques

Les processus géophysiques à l'œuvre dans le Parc national de Lorentz (orogenèse, collision des plaques tectoniques et accrétion de matériel d'érosion dans les plaines), conjugués à un niveau de précipitations élevé ont favorisé le développement concomitant de processus écologiques significatifs, toujours en cours. Le gradient climatique du Parc national de Lorentz est le plus complet de l'île de Nouvelle-Guinée et même, de toute la plaque tectonique australienne, des zones nivales et glaciaires au climat équatorial de plaine, avec une gamme tout aussi extrême d'espèces et de communautés animales et végétales. Le site désigné est la seule aire protégée du monde qui contienne un gradient intact continu, allant d'une calotte neigeuse à un milieu marin tropical, en passant par de vastes zones humides de plaine. La conjugaison de ces deux processus géophysiques - orogenèse et accrétion littorale - a créé des gradients climatiques et de salinité, ainsi que des processus écologiques qui ont façonné le biote régional de façon spectaculaire.

L'expansion rapide des plaines, sous l'action des nombreux cours d'eau parallèles qui descendent des montagnes, explique que le changement altitudinal soit minime dans la majeure partie des plaines qui se situent, généralement, à la laisse de haute mer, voire au-

dessous, même dans les zones d'eau douce. Il en résulte que l'influence de la marée à l'intérieur du PNL se fait sentir à l'intérieur des zones d'eau douce jusqu'au pied des montagnes. Ainsi, la faune et la flore des plaines ont évolué vers une gamme complexe d'espèces, suivant un gradient de salinité, en partant des communautés de mangroves des estuaires, pour passer aux forêts de palmiers nipa et sago puis, en amont, aux marais d'eau douce ouverts, aux forêts marécageuses d'eau douce et aux forêts sur tourbe.

Durant le réchauffement climatique enregistré depuis la dernière période glaciaire, le processus d'orogenèse a créé des refuges tempérés pour les anciennes espèces végétales du Gondwana dans les tropiques. Par exemple, les forêts de hêtres *Nothofagus* du PNL sont bien représentées, même si les espèces apparentées les plus proches sont généralement confinées aux régions tempérées fraîches du sud-est de l'Australie et de la Nouvelle-Zélande, et des Andes méridionales.

L'effet "refuge" ou l'évolution génétique locale, voire les deux, se manifestent sous la forme d'espèces endémiques locales ou d'espèces à l'aire de répartition restreinte. Bien que les recherches menées à ce jour soient limitées, il apparaît par exemple que plusieurs espèces de mammifères, y compris quelques espèces découvertes récemment comme le kangourou arboricole Dingiso, ont évolué pour pouvoir utiliser les habitats spécialisés des zones climatiques subalpines et de haute montagne. Les mammifères des montagnes se distinguent par une prédominance des marsupiaux et des monotrèmes attestant leur origine gondwanienne, les placentaires d'origine asiatique se limitant aux rongeurs et aux Chiroptères.

Le site désigné présente des exemple d'endémisme extrêmement développés, au niveau tant des plantes que des animaux, du moins pour ce qui est des montagnes les plus élevées, phénomène normal pour une région présentant des processus de soulèvement et de réchauffement climatique en cours.

Le Parc national de Lorentz satisfait également au critère (ii), en tant qu'exemple éminemment représentatif de phénomènes écologiques et biologiques en cours dans le développement de systèmes terrestres, d'eau douce, côtiers et marins et de communautés végétales et animales.

Critère (iv): diversité biologique et espèces menacées

Les recherches biologiques menées à ce jour dans le PNL sont limitées et la composition spécifique de la région est relativement mal connue. Toutefois, des recherches menées, entre autres, par Freeport dans des localités particulières ont, dans une certaine mesure, été extrapolées aux zones altitudinales du Parc national de Lorentz et confirment que celui-ci possède la diversité spécifique la plus élevée de la région. Dans le texte de la proposition, le critère (iv) est principalement étayé par des données détaillées disponibles sur plusieurs régions montagnardes, subalpines et alpines de la chaîne principale. On y relève un niveau élevé d'endémisme local, y compris de nombreuses espèces découvertes récemment.

Une bonne partie du riche biote du Parc national de Lorentz est nouveau pour la science et certaines espèces présentent un intérêt particulier. Par exemple, le kangourou arboricole décrit récemment est particulièrement intéressant si l'hypothèse se confirme selon laquelle il serait en train de connaître un processus d'évolution inverse, à savoir qu'espèce devenue arboricole, il évoluerait pour redevenir une espèce vivant principalement au sol. Le PNL contient des portions substantielles de deux Zones d'endémisme de l'avifaune, avec au total 45 espèces d'oiseaux à l'aire de répartition limitée et 9 espèces d'oiseaux endémiques. Deux espèces

d'oiseaux à l'aire de répartition limitée, le jardinier d'Archbold et le paradisier de MacGregor sont considérés comme rares et vulnérables.

Toutefois, le site désigné n'est pas simplement l'habitat de nombreuses espèces rares, endémiques et à l'aire de répartition restreinte. Étant donné son étendue et son intégrité naturelle exceptionnelle, c'est aussi un habitat d'une importance exceptionnelle pour ces espèces et leur évolution en cours. Vu les pressions démographiques et de développement qui commencent à se faire sentir en Irian Jaya, le Parc national de Lorentz est voué à jouer un rôle de plus en plus important pour la conservation à long terme des espèces déjà décrites et des nombreuses espèces qui restent encore à découvrir.

Le site désigné contient clairement "les habitats naturels les plus représentatifs et les plus importants pour la conservation *in situ* de la diversité biologique, y compris des habitats où survivent des espèces de plantes et d'animaux menacées ayant une valeur exceptionnelle du point de vue de la science et de la conservation". Le Parc national de Lorentz satisfait donc au critère (iv). En outre, étant donné la connaissance limitée que l'on a de ce site, on peut prévoir que les recherches à venir renforceront le fait que le Parc national de Lorentz est une aire protégée d'importance mondiale pour la conservation d'une riche diversité biologique, y compris de nombreuses espèces endémiques et rares.

Critère (iii): phénomènes naturels exceptionnels, beauté naturelle exceptionnelle

Ce critère n'a pas été étayé de façon convaincante dans le texte de la proposition. Bien que le site contienne de nombreuses particularités de beauté exceptionnelle, par exemple des chutes et les glaciers de Puncak Jaya, ces caractéristiques ont une importance secondaire par rapport à celles qui satisfont aux critères (i), (ii) et (iv).

Conditions d'intégrité

La proposition du Parc national de Lorentz satisfait à toutes les conditions d'intégrité associées, à l'exception du point (v) qui établit que le site désigné "doit avoir un plan de gestion". Dans la mesure où le processus de planification a débuté, avec une réunion des parties prenantes organisée en 1997, on peut dire que le plan a enfin été lancé. Le Bureau souhaitera peut-être noter que le Gouvernement indonésien prévoit d'accorder une attention prioritaire à l'achèvement du plan de gestion et au renforcement de sa présence administrative dans le courant des années à venir.

7. RECOMMANDATION

À sa vingt-troisième session ordinaire, le Bureau a recommandé que le Comité **inscrive** le Parc national de Lorentz sur la Liste du patrimoine mondial au titre des critères naturels (i), (ii) et (iv). Le Centre a informé les autorités indonésiennes d'un certain nombre de points préoccupants concernant la gestion du site, en particulier il conviendrait:

- de continuer à privilégier la poursuite du processus de gestion du parc, avec la participation active des parties prenantes locales;

- d'encourager la création du Fonds proposé, qui contribuerait à la gestion du parc;

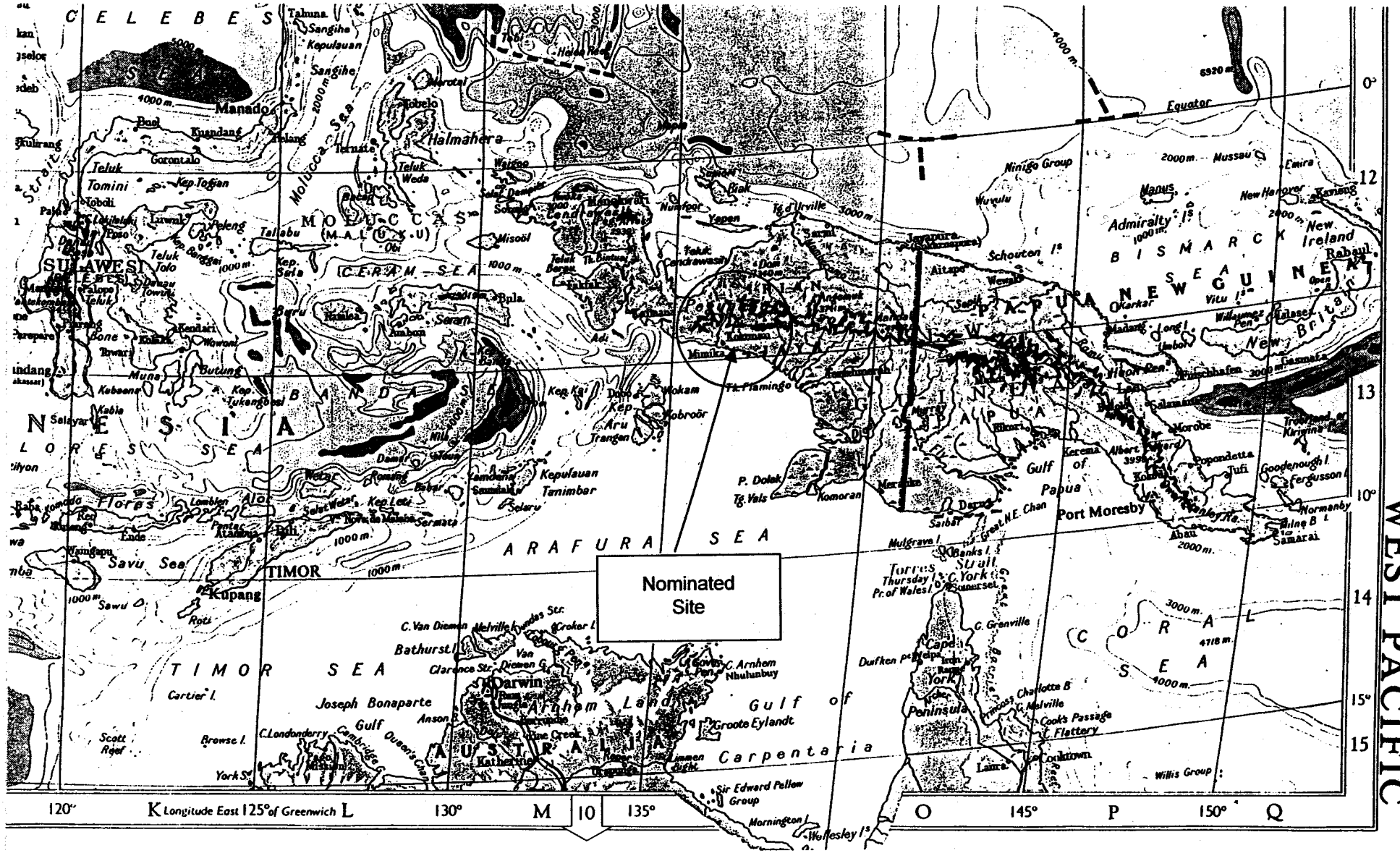
- de réfléchir à un accord éventuel de jumelage avec le Bien du patrimoine mondial des Tropiques humides du Queensland en Australie;

- de nommer un directeur de parc et du personnel d'appui (comme cela a été prévu pour l'an 2000);

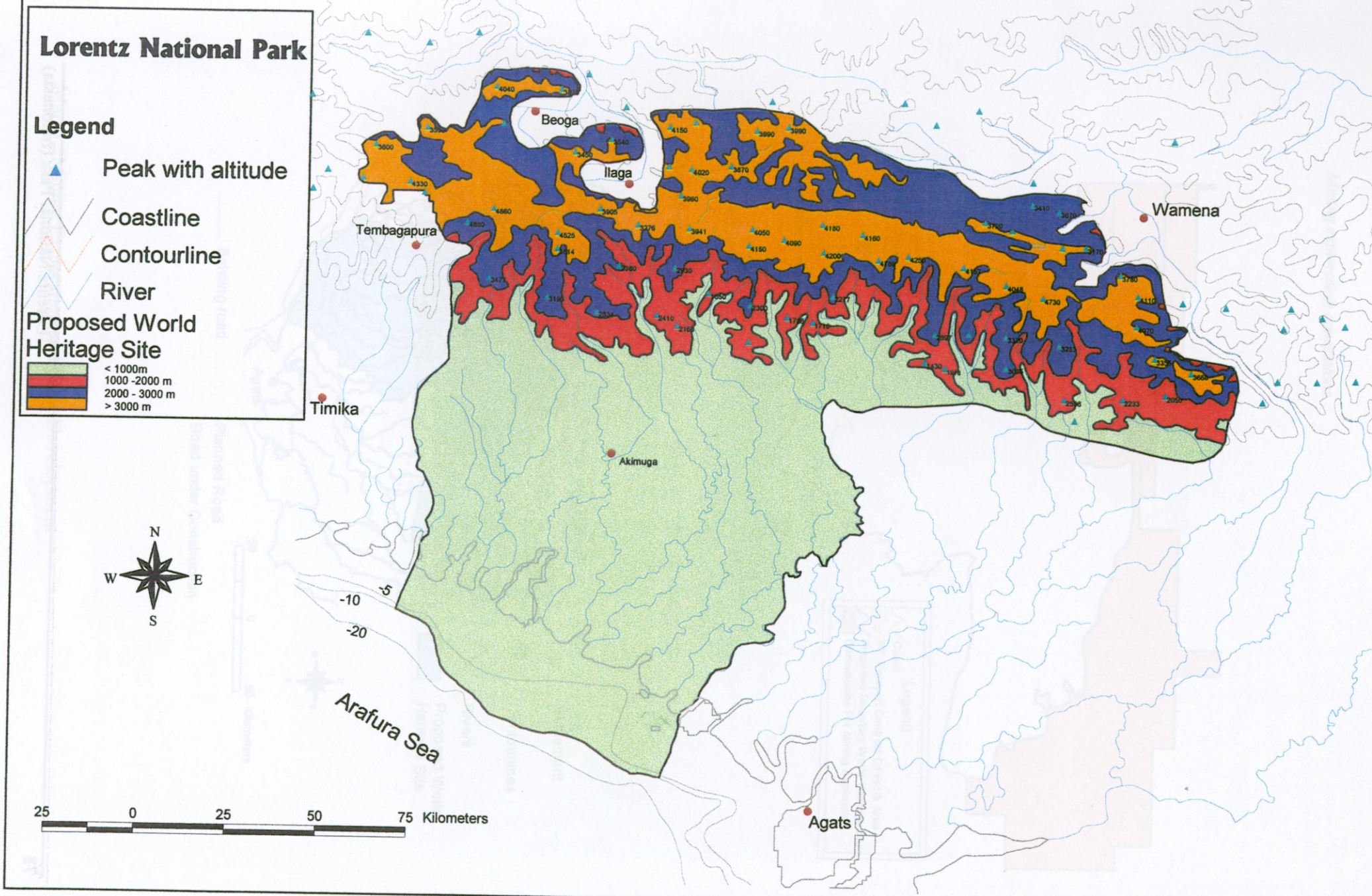
- de réfléchir sérieusement aux projets de développement qui risquent d'affecter le parc, notamment le projet routier Timika/Mapurajaya et l'extension des activités minières en direction des limites du parc, afin que ces projets n'entrent pas en conflit avec l'inscription du Parc national de Lorentz en tant que bien du patrimoine mondial.

Dans une lettre au Centre, datée du 1er octobre, les autorités indonésiennes ont répondu positivement à toutes les préoccupations mentionnées ci-dessus.

Le Comité souhaitera peut-être féliciter le Gouvernement indonésien d'avoir réussi à faire en sorte que les concessions minières et pétrolières existant à l'intérieur du parc soient retirées. Enfin, le Comité souhaitera peut-être recommander qu'une mission ait lieu pour évaluer les progrès enregistrés trois ans après l'inscription du site.

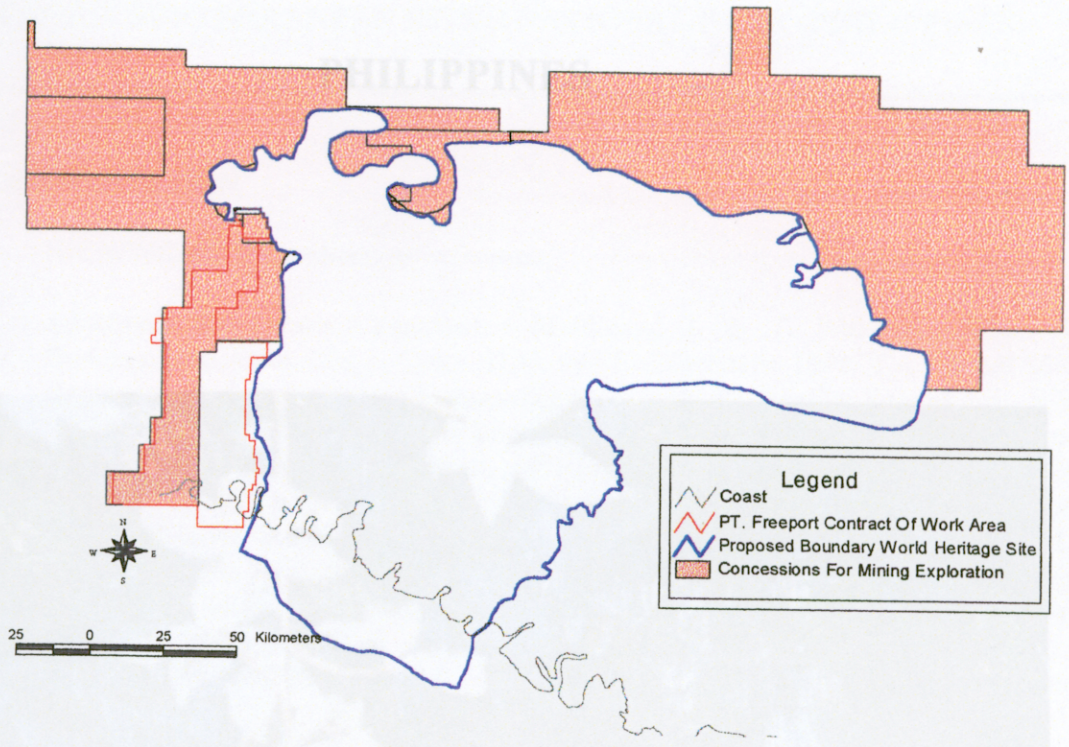


Map 1. Location of Nominated Site

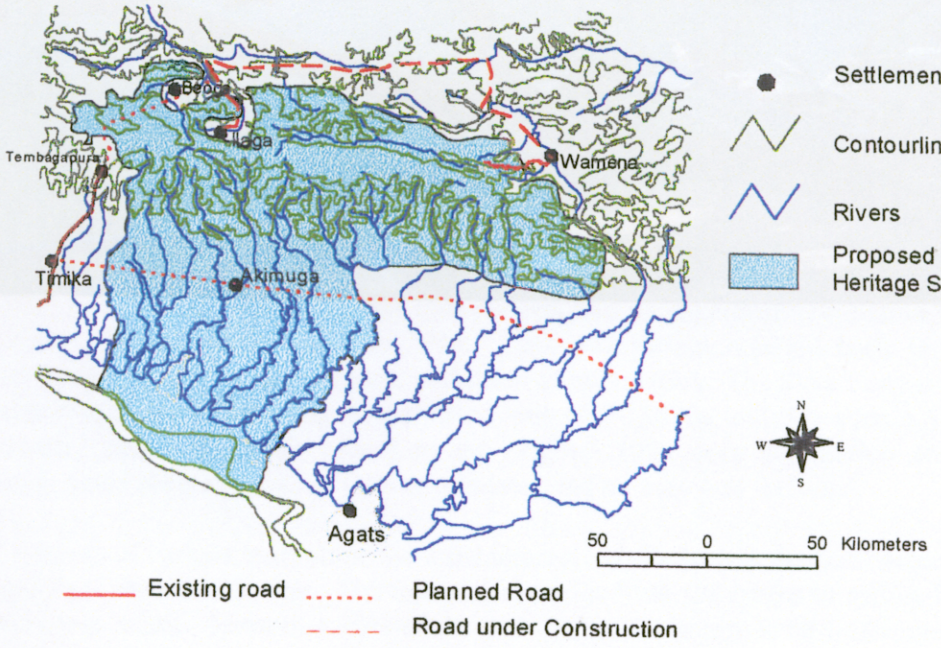


Map 2. Nominated Site

Mining exploration concessions



Road development



Map 3. Mining Exploration and Road Development