RESEARCH ARTICLE

A Review of the Efficacy of the Protected Area System of East Kalimantan Province, Indonesia

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ABSTRACT: In 1982 the Indonesian government adopted policy for establishing a national network of protected areas to conserve the nation's biodiversity. The design of the reserve network was based on scientific principles of representation and proposed a major ecosystem reserve, supplemented by smaller reserves, in each biogeographic unit of the country. We review the protected area system for East Kalimantan Province and show that key reserves either have not been established or are degraded. As a result, the present network exhibits major gaps in representation of key biodiversity attributes. We identified the potential for establishing a new major ecosystem reserve, covering more than 440,000 ha in the Sebuku-Sembakung region, which would fill important gaps in representation. Although this proposal has the support of central government and the international donor community, it might not receive the provincial endorsement that is required for designation. We conclude that for East Kalimantan, turning systematic reserve planning into practice has failed because key assumptions of reserve planning principles are invalid in the contemporary sociopolitical landscapes of Indonesia. In our view, strategies for in situ conservation of biodiversity in the protected areas of East Kalimantan need a complete reevaluation.

Revisión de la Eficiencia del Sistema de Áreas Protegidas de la Provincia de Kalimantan Este, Indonesia

RESUMEN: En 1982 el gobierno de Indonesia adoptó una política de establecimiento de una red nacional de áreas protegidas para conservar la biodiversidad e la nación. El diseño de esta red de reservas se basó en los principios científicos de representación y propuso una reserva mayor de ecosistema, suplementada por reservas menores, en cada unidad biogeográfica del país. Revisamos el sistema de áreas protegidas de la provincia de Kalimantan Este, mostramos que las reservas claves no fueron establecidas o están degradadas. Como resultado, la red presente exhibe deficiencias mayores en la representación en los atributos claves de biodiversidad. Hemos identificado el potencial de establecer una nueva reserva de ecosistema, de 440.000 ha, en las regiones de Sebuku y Sembakung, que podría salvar importantes fallas en la representación. Aunque este propuesta tiene el apoyo del gobierno central y la comunidad donante internacional, no recibe la garantía provincial que se requiere para la designación. Para Kalimantan Este, concluimos que falló en ponerse en práctica el sistema de planeo de reservas porque las asumpciones claves de los principios de planeamiento son inválidos en la situación sociopolítica contemporánea de Indonesia. Para nosotros, las estrategias de conservación in situ de biodiversidad en las áreas protegidas de Kalimantan Este necesitan una completa reevaluación.

Index terms: biodiversity conservation, East Kalimantan, gap analysis, national parks, protected area system

INTRODUCTION

A central concern of the post–World War II conservation movement has been establishment of a worldwide network of protected areas that represent within their boundaries the variety of ecosystems, habitats, and species living on Earth. This goal provides a policy solution for aesthetic, ethical, prudential, and economic arguments for nature conservation (see Ehrlich and Ehrlich 1992). It was expressed in the 1980 World Conservation Strategy (IUCN/UNEP/WWF 1980), was reaffirmed in the 1992 Convention on Biological Diversity (UNEP 1992), and is a key principle of systematic conservation planning (see Noss and Copperider 1994, Margules and Pressey 2000, Jepson and Whittaker 2002).

Indonesia was the first tropical country to adopt the representation goal in national policy. Land use planning was a key objective of Indonesia's third national five-year (1979–1983) development plan (known as Repelita III), and the government set a target of protecting 10% of the national land area in national parks and nature reserves. With FAO/UNDP assistance, a national conservation plan (hereafter, NCP) was prepared (MacKinnon and Artha 1982) as part of a wider national park development project from 1974 to 1982 (Blower 1978, Sumardja 1985). For the first time, protected area system design principles were devised that, when applied at the national scale, provided a biogeographic framework for achieving global "representation" as devised by IUCN (see

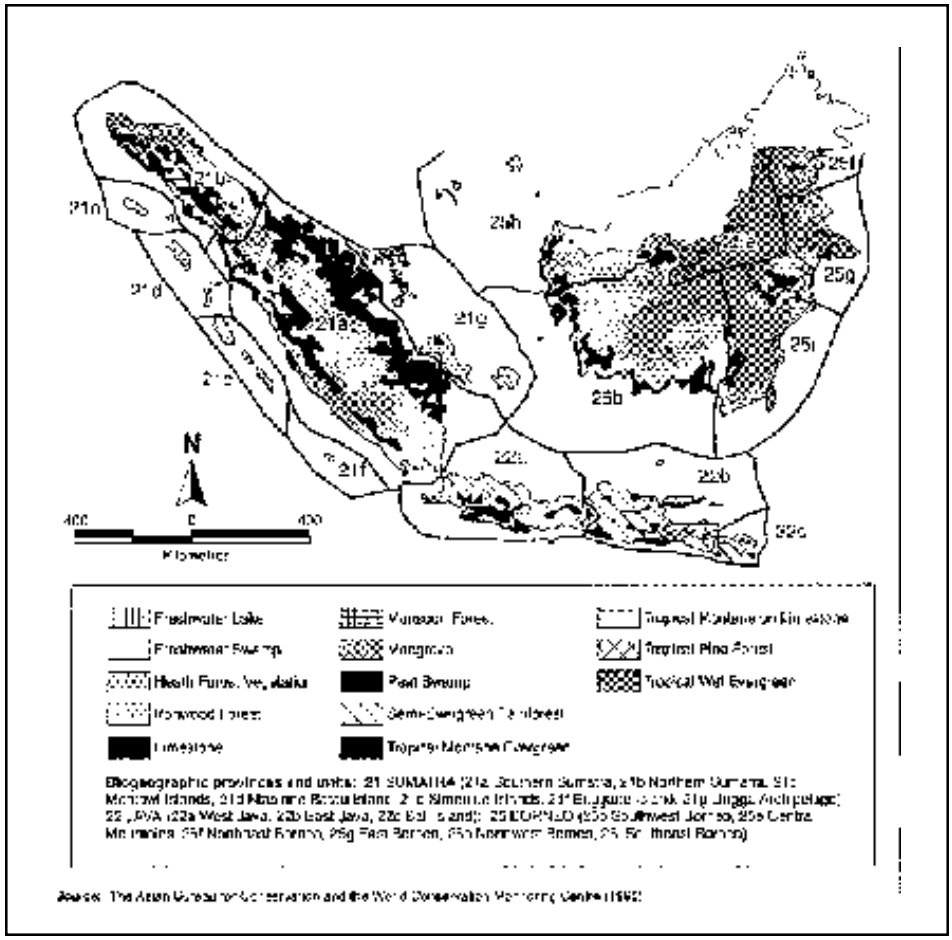

Figure 1. Biogeographic regions and original habitat types of Sumatra, Kalimantan, and Borneo, Indonesia.

Dasmann 1972). The NCP proposed the establishment of a major ecosystem reserve in each biogeographic region (Figure 1), to include continuous habitat types and, if possible, the richest examples of those habitats, augmented with smaller reserves to protect special or unique habitat types and regional variations. These principles were later applied to the Indo-Malayan and Afro-tropical realms (MacKinnon and MacKinnon 1986a, 1986b; MacKinnon 1997) and are a forerunner of modern "systematic principles of reserve design" (Pressey et al. 1993). In Indonesia a "minimum set" of 80 major ecosystem reserves was selected to meet representation goals. Designation and management of these reserves is the backbone of the Indonesian Biodiversity Action Plan (BAPPENAS 1993).

The political and environmental context of Indonesia has undergone profound changes since preparation of the NCP. The area of natural forest in Indonesia declined by 17% between 1985 and 1997. Population in frontier provinces, such as East and Central Kalimantan, has doubled from 6 people km^{-2} to 12 people km^{-2} in the same period (figures reported in D. A. Holmes, unpubl. document.). Indonesia was hit particularly badly by the unprecedented regional economic crisis starting in mid-1997 (World Bank 1998), and following the fall of the autocratic Suharto New Order regime (1967–1998), the government legislated for a rapid and far-reaching program of decentralization and greater local autonomy (see Down to Earth 2000).

In 2000, work began on a revision of the Indonesian Biodiversity Action Plan. Our paper is relevant to this review and results from a rapid biodiversity assessment of East Kalimantan Province, which we conducted between July and August 1998, with the purpose of developing a program of conservation investments in the region. Our work is a case study designed to elucidate two questions critical to biodiversity conservation planning in Indonesia as well as in the wider region: (1) Is the goal of representing biogeographic and habitat variability in a national protected area network being realized in practice? (2) Is the major ecosystem reserve approach a viable strategy for conserving a representative range of key biodiversity attributes in contemporary Indonesia?

Our paper presents the findings of our analysis of the current status of the East Kalimantan reserve network, and includes a proposal for a new major ecosystem reserve located in the Sebuku-Sembakung region on the border of East Kalimantan with Sabah, Malaysia. This reserve proposal (Momberg et al. 1998) is currently being advocated by conservation and development agencies, but in the current political climate it is unlikely that the governor of East Kalimantan will support the proposal. Sebuku-Sembakung is therefore poised as a test case on whether new major ecosystem reserves can still be established in decentralized Indonesia.

Profile of East Kalimantan

East Kalimantan covers an area of 197,485 km^2 and is one of four provinces that comprise Indonesian Borneo (Figure 2). The island of Borneo covers an area of 746,305 km^2 and is the biggest landmass in the everwet forest biome of the Sunda Shelf. These forests are exceedingly species-rich (Whitmore 1984, Myers et al. 2000). The Bornean flora is as rich as that of the whole African continent (MacKinnon and Sumardja 1996), and the forests are inhabited by large mammal species such as orang-utan (*Pongo pygmaeus* L.), proboscis monkey (*Nasalis larvatus* van Wurmb), clouded leopard (*Pardofelis nebulosa* Griffith), and banteng (*Bos javanicus* d'Alton), and bird groups such as pheasants (5 species), hornbills (8 species), and woodpeckers (18 species). Kalimantan supports the largest remaining expanse of rainforest in the Indo-Malayan Realm, but biodiversi-

Table 1. Physiographic types and forest cover, Kalimantan Province, Indonesia.

Physiographic Types	Gross Area (ha)	Assumed Forest Cover in 1900	Area w/ Forest Cover in 1985	Approx. Area w/ Forest Cover 1997	Estimated Reduction in Forest Area Since 1985
Alluvial forest	9,790,500	8,500,000	6,494,800	4,994,800	1,500,000 (23%)
Sandy terrace	3,229,000	3,000,000	2,611,400	1,611,400	1,000,000 (38%)
Lowland plain	18,796,300	17,500,000	11,111,900	4,707,800	6,404,100 (58%)
Hill & mountain	21,270,900	21,000,000	19,602,600	19,550,006	52,594 (<1%)

Source: Reproduced with permission from D.A. Holmes (unpubl. document)

ty-rich lowland plains, sandy terraces, and alluvial forests have experienced a 23%–58% reduction in area since 1985 (Table 1) (D. A. Holmes, unpubl. document).

The province experienced two massive forest fire events in 1982–83 and 1997–98; these were associated with droughts caused by the El Niño Southern Oscillation (ENSO). The fires were not "natural" disasters. Although El Niño created conditions for the conflagrations, the fires were ignited by plantation companies and others who were clearing land (Barber and Schweithelm 2000). In 1982–83, 3.5 million ha of land and forest suffered fire damage; the loss of standing timber and growing stock was estimated at US$5 billion (Lennertz and Panzer 1983). In 1997–98, fire affected 5.2 million ha or about 25% of the entire province. Overall, fire affected 2.3 million ha of natural forest concession areas, 0.4 million ha of protected areas, 0.9 million ha of forest plantations, and 0.7 million ha of industrial timber crop plantations (Hoffmann et al. 1999).

East Kalimantan is rich in timber, oil, gas, and coal, which contribute more than 25% of Indonesia's export revenues (MacKinnon and Sumardja 1996). More recently, the province has become a focus of oil palm (*Elaeis guineensis* Jacq.) and industrial timber plantation development. The population in 1995 was estimated as 2.3 million, and since 1980 annual growth rates have been steady at 4.4% (government statistics reported in D. A. Holmes, unpubl. document).

METHODS

Our approach had three components: (1) investigation of the status of the NCP in the context of the wider forest zoning process; (2) assessment of the number and final size of NCP-proposed reserves actually designated; and (3) assessment of the degree of "intactness" of these reserves. We hoped to gain a rapid overview of the extent to which the conceptual foundation of the NCP, namely representation of the suite of key biodiversity attributes in reserves, has been achieved. The first component was addressed through a combination of literature review and expert consultation to supplement and check our own understandings gained through several years of work in this field.

To assess the extent to which proposed reserve configurations have been adopted in land use planning policy, we overlaid the protected area boundaries proposed in the NCP with designated and proposed reserve boundaries appearing in two key land use plans produced subsequently. These are the 1984 Consensus Forest Land Use Plan (Tata Guna Hutan Kesepakatan known as TGHK; see "Results and Discussion" for further explanation) and the 1998 provincial spatial plan. To check the

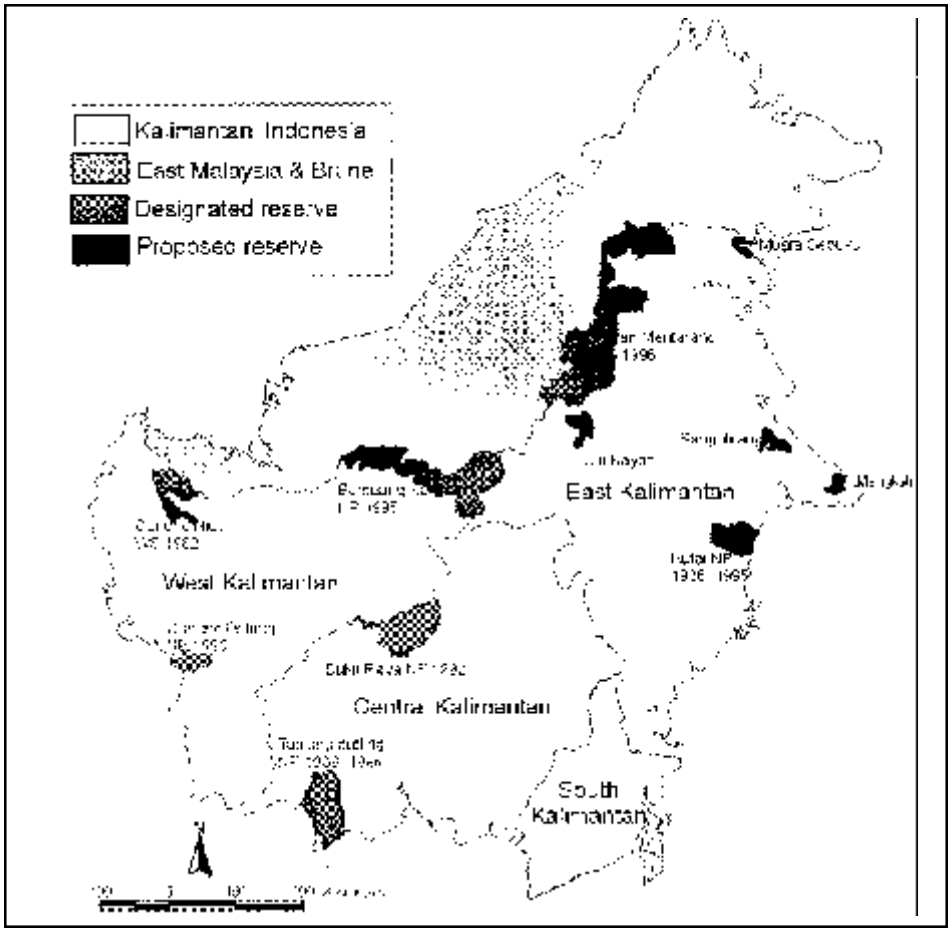

Figure 2. Designated and proposed national priority reserves in Kalimantan, Indonesia.

actual status of land in each proposed and designated reserve area, we overlaid maps of forest concessions, land allocated for industrial timber plantations, estate crops (mainly oil palm), commercial crops (fruit and vegetables), and trans-migration settlements. Maps were collected from the provincial planning department (Bappeda) and forestry office (Kanwil Kehutanan) and Integrated Forest Fire Management Project (hereafter, IFFM) in Samarinda, and the Department of Forest Inventory and Mapping (INTAG) in Jakarta. Hard-copy maps were digitized and overlay analysis was conducted using ArcInfo and MapInfo GIS.

We devised a simple six -point scale (Table 2) as a broad estimate of intactness of a reserve's "natural character." To place reserves on this scale, we overlaid two other data sets: (1) a map of 1998 fire hotspots generated by the IFFM project, and (2) an atlas of protected areas commissioned by the provincial nature conservation office (Kantor Sumber Daya Alam) in 1996, which mapped all cleared land within reserves on the basis of interpretation of satellite imagery. Mapping was complemented by flight surveys of the Kutai, Sangkulirang, and Mahakam Lake regions on 2 July 1998 and the Sebuku-Sembakung region on 22 July1998.

The protocol for flight surveys was as follows. A circular route was planned to fly over areas thought to hold intact forest habitats or where fire damage, logging, or other conflicts were suspected. Observations were geo-positioned using the aircraft's GPS and an extra hand-held GPS as back up. One observer recorded landscape/habitat type on each side of the aircraft at five-minute intervals or when there was a marked landscape change. Distinct landscape elements, such as settlements and logging roads, were also noted. A second observer videotaped the route using a Sony Handycam. The third observer directed the pilot and took still photographs.

The first flight survey covered the Mahakam wetland system, Kutai, and Sangkulirang on 2 July 1998, leaving the provincial capital Samarinda (117°07' E 0°25' S) at 9.09 hrs returning 14.04 h. We flew due west to Lake Jempang (116°15' E 0°25'S) at the south of the Mahakam wetland system, then transected on a north-east course crossing the wetland system and the Muara Kaman Reserve (116°40' E 0°05' S). We then took a northerly course to the Sankulirang Massif (117°30' E 2°00' N), passing the western section of the Kutai Reserve. After circling the Sankulirang Massif, we flew a third transect on a southerly course passing over the eastern section of the Kutai Reserve. The second flight on 22 July covered the Sebuku-Sembakung region (see Figure 4) leaving Nunukan (117°40' E 4°05' N) at 8.15 h and returning to Tarakan (117°33' E 3°15' N) at 11.40 h. We flew a transect from Nunakan to the Sesayap River (approximately 117°02' E 3°33' N), passing over the extensive swamps at the mouth of the Sebuku River. We then followed the Sesayap River valley to Malinau (116°37' E 3° 34' N), where we refuelled. A second transect took a northward course to the Malaysian border (116°43' E 4°15' N), passing over forest recently cleared for transmigration settlements and oil-palm plantations. At the Agison River we turned east and followed a course 2–5 km to the south of the Malaysian border, in order to assess the extent of cross-border logging from Malaysia and an area of ultra-lowland forest immediately east of the Apan River.

Rapid ground assessments were made of the Mahakam Lake region, the lower Sebuku-Sembakung area, and the Sangkulirang peninsula. Assessments aimed to sample the range of landscape types present and generate an overview of human use and land use change. Our approach had three elements. First, we traveled as widely as possible within the time available on a roughly circular route using available transport. Second, we stopped in each landscape unit (level 3 landscapes based on the hierarchy in Forman and Godron 1986) and completed a landscape characterization form. This summarized descriptive data on landscape elements present (level 4 landscape units), landscape pattern and physiognomy, temporal stability, ethnic groups and livelihood activities, biodiversity values, ecological flows and linkages, threats and impacts, and landscape history. Temporal stability was scored on a simple logarithmic scale according to our estimate on whether the unit would appear the same in less than 5 years (1), 5 to 10 years (2), decades, (3) generations (approximately 30 years) (4), and centuries (5). Third, we stayed in villages and logging camps to conduct informal interviews with farmers, traders, hunters, and loggers to construct a socioeconomic profile of the area and collate anecdotal information on wildlife and development proposals.

The rapid ground assessment of the Mahakam Lake region (7–12 July 1998) was by powered canoe. We started from the town of Kota Bangun (116°30'E 0°31'S) on the Mahakam River, crossed Lake Semayang, and traveled up the Kahalah Riv-

Table 2. A simple six-point scale used to estimate "intactness" of reserves in the East Kalimantan protected area network, Indonesia.

Status	Definition
Intact	The reserve is still in a "primary" condition, and ecosystem function and faunal assemblages of conservation importance are still intact.
Mostly intact	Impacts localized and/or widespread but low impact and/or reversible.
Partly degraded	An area of the reserve has been converted or severely degraded but most of the reserve is still in primary condition.
Degraded	Moderate and widespread habitat modification and/or populations of key fauna significantly reduced.
Severely degraded	Habitats significantly modified and/or assemblages of key fauna and flora decimated.
Lost	Habitat loss, species degradation and/or alteration of the ecological systems is such that area no longer has potential as a biodiversity reserve. These areas may retain hydrological or other values.

er (116°28' E 0°13' S) to the interior village of Teluk Binti (116°12' E 0°02' S). We retraced our route and traveled across Lakes Semayang and Melintang to the village of Muara Enggelam (116°19' E 0°15' S) on the Enggelem River. We returned to the Mahakam River at the town of Muramuntai (116°20' E 0°23' S) via the Bermabai River.

The ground assessment of the Sangkulirang Peninsula (14–20 July 1998) was by car, motorcycle, and foot. We traveled from Tanjungredeb on the Berau River (117°00' E 2°09' N) via the Kayani Kertas pulp mill (117°50' E 2°00' N) to Beranti village (117°58' E 1°48' N). From there we treked west into the limestone hills and also visited the small delta at Talebar (118°06' E 1°46' N).

The ground assessment of the Sebuku-Sembakung region (23–27 July 1998) was by launch, truck, and foot. We started from Nunukan and traveled along the Sebuku River to Tambalang (117°00' E 0°10' N). We explored the Apan River valley by canoe and foot. We returned down river to Pembellangan (117°02' E 0°05' N) and then traveled by truck to Atap (117°03' E 0°08' S) on the Sembakung. From Atap we traveled by launch to Tanahmerah (117°41' E 0°15' S) on Mandul Island, and then on to Tarakan.

Methods for assessing representation and persistence of target attributes within sets of areas (generally termed gap analysis) can take a formalized approach that maps quantifiable surrogates of biodiversity such as distributions of species (e.g., Araujo 1999) or a holistic approach that scores the presence of qualitative conservation attributes. We chose the latter because it is rapid and reflects the fundamental purpose of reserves, namely the expression of values within society concerning the relationship between humans and nature (See Jepson and Canney 2001).

We constructed a list of biodiversity attributes occurring in East Kalimantan and embodied in the NCP. These we broadly defined as biogeographic and ecosystem variation, primary landscapes (preferably with intact environmental gradients), and species with an international conservation profile. As surrogates for biogeographic and ecosystem diversity, we used representation of zonal bio-unit and major habitat-type divisions (MacKinnon 1997), and azonal hotspots, namely Endemic Bird Areas (Stattersfield et al. 1998) and Centres of Plant Diversity (Davis et al.1994). We used presence in an IUCN action plan to denote species of international conservation concern. These included birds (Collar et al. 1994), primates (Eudey 1987), cats (Nowell and Jackson 1996), wild cattle (S. Hedges, unpubl. document), and orchids (Hagsater and Dumont 1996).

Based on a review of the above action plans and classifications, previously described analysis, a regional ecology text (MacKinnon 1997), findings of the IFFM project, and opinion of relevant experts, we scored the original presence of each attribute in a reserve at the time it was designated or proposed, and then indicated whether the attribute was still present.

RESULTS AND DISCUSSION

The NCP and Subsequent Land Use Planning Initiatives

In 1984, the Ministry of Forestry (MoF) prepared a Consensus Forest Land Use Plan (hereafter TGHK), which represented an official classification of all forestland (namely land with or without tree cover under the jurisdiction of MoF) into functional categories with legally defined restrictions on use. The MoF representative office (Kanwil Kehutanan) prepared drafts of the TGHK in each province. Although the NCP was adopted as departmental policy by the Directorate-General of Forest Protection and Nature Conservation, it was not adopted as formal policy of the Ministry of Forestry or the Ministry of National Development Planning. Consequently the extent to which NCP reserve proposals (location and configuration) were incorporated in the TGHK depended on a combination of the presence of an existing reserve, support in the provincial forestry office for the NCP vision, power of forest exploitation interests, area of available forest, and advocacy by conservationists. Because an Indonesian-language version of the NCP was never distributed, the scientific principles justifying reserve distribution and configuration were never widely understood. Consequently, the primary concern of provincial forestry departments was simply to meet targets on the area of forestland reserved.

Land use planning was further rationalized under the fourth national five-year development plan (1984-89), largely through work of the Regional Physical Planning Programme for Transmigration Project (hereafter RePPProT) and subsequently, during the mid-1990s, the Second Land Resources Evaluation Project (known as LREP II). RePPProT produced a consensus TGHK for the nation and each province (several versions of TGHK maps being in existence) that became the standard base map used in government-donor-NGO forestry discourse. RePPProT (1990) also built consensus for the concept that 80 of the major ecosystem reserves form a "minimum set" critical to meeting representation goals. These are identified as priority reserves in the Indonesian Biodiversity Action Plan. Fourteen of these priority reserves are in Kalimantan, and seven are located in East Kalimantan Province. Elsewhere in Kalimantan all these reserves have been established, but in East Kalimantan only two (Kayan Mentarang and Kutai) have been designated. Proposed reserves located in the Ulu Kayan, Sembakung, Sebuku areas, and the Sangkulirang Peninsula have not yet been established (Figure 2).

The 1992 Spatial Use Management Act No. 24 required provinces and districts to prepare spatial plans (known as Rencana Tata Ruang Wilayah Propinsi/Kabupaten). To support this process, MoF was required to prepare new forest zoning maps (known as Peta Paduserasi) that integrated MoF maps with the development plans of other line ministries and provincial and district planning agencies.

Differences between present reserve boundaries proposed in the 1982 NCP and those in the 1985 TGHK and the 1997 Peta Paduserasi are shown in Figure 3. The overall forest area now given over to nature conservation is only 34% of that

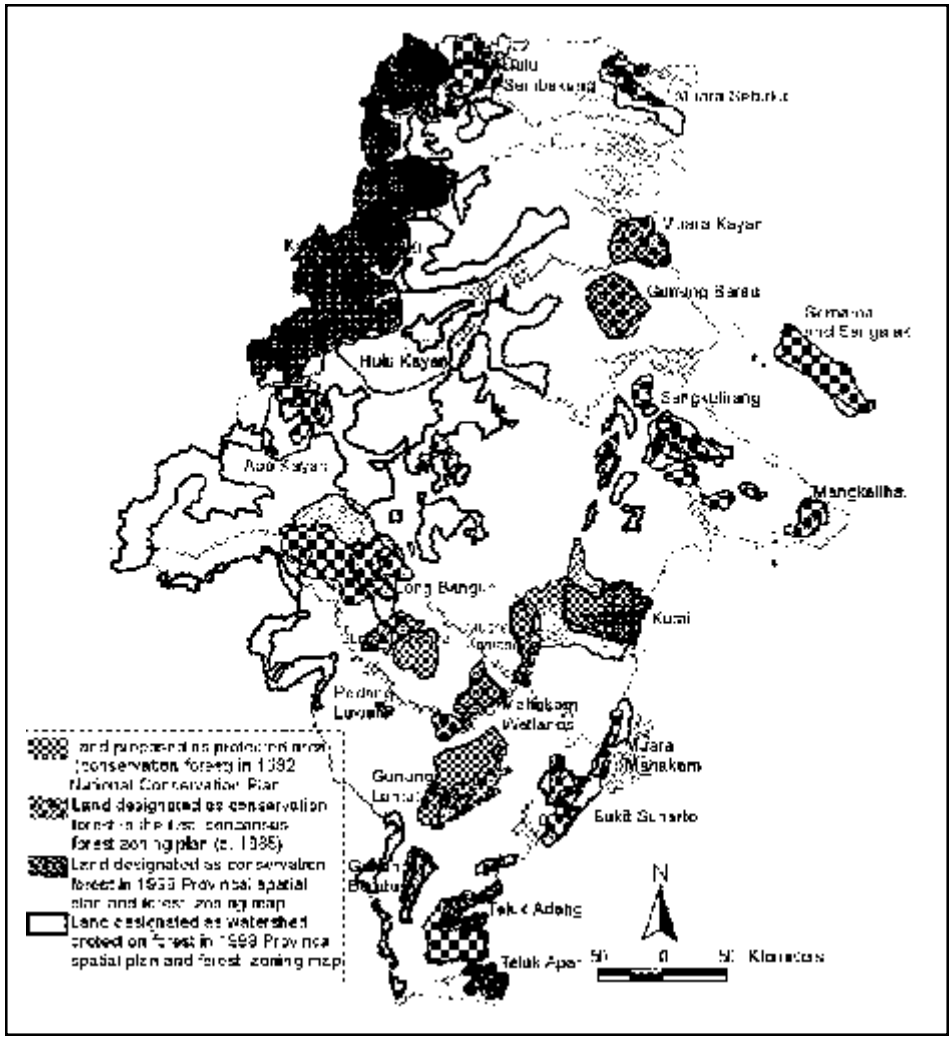

Figure 3. Reserve boundaries proposed in the 1982 National Conservation Plan, maintained in the 1985 forest zoning and revised land use plan, and in the 1997 provincial spatial plan.

proposed in 1982 (5,062,000 ha reduced to 1,735,379 ha). NCP proposals to protect large blocks of lowland forest habitats in three reserves (Long Bangun, Sungai Bermabi, and a reserve combining the present Kutai National Park, Muara Kaman reserves, and intervening land) are not marked on the Peta Paduserasi. As a result the provincial spatial plan only shows existing reserves and ignores earlier proposals for new reserves. Areas within some proposed reserves are, however, designated as watershed protection forest.

Intactness of the East Kalimantan Reserve Network

Based on our assessment (Table 3), just 9 out of the 23 reserve areas originally proposed remain "intact" (i.e., their conservation values and ecosystem functions persist) and 3 of these have been partially degraded. The intact reserves are in hill and montane areas, except the proposed Sebuku Reserve, which encompasses coastal swamp forests, and the Sangkulirang Reserve, which encompasses inaccessible limestone massifs. Of the seven minimum set reserves, only the Kayan Mentarang National Park is still intact. However, this reserve is under threat from road-building proposals, calls to excise traditional lands from the park (D. Wellington, Yayasan WWF Indonesia Kayan Mentarang National Park Development Project, Samarinda, pers. com.), and proposals to establish enclaves of oil palm plantations within the park. (S. Hedges, Wildlife Conservation Society, Bogor, pers. com.).

Kutai was designated in 1936 as a wildlife sanctuary covering 306,000 ha. In 1969, 100,000 ha were excised from Kutai for logging and oil exploration. In 1971, the logged-over area was reinstated but a further 106,000 ha were excised for logging (Meijer 1981). The current reserve area is 198,629 ha (Table 3). Kutai was declared a national park in 1982, but it continues to be seriously degraded by fire, agricultural encroachment, wildlife poaching, and illegal logging. In 1996 timber worth US$157 million was illegally extracted from the park (Wells et al. 1999). In 1997–98, fire damaged 92% of the park; the burn intensity was medium to severe on 153,000 ha (Hoffmann et al. 1999). In 2000, the Kutai District government allocated 15,000 ha within the coastal zone of the park for settlement, leading to aggressive encroachment by Bugis and other settlers. The district now proposes that the zone along the settlement road be excised and the park be divided into two. Current opinion is that it is too late to save Kutai National Park (see *www.tn-kutai.or.id*). By our criteria (Table 2), we classify this reserve as "lost."

Logging concessions cover three of the other five proposed minimum set reserves, affecting the "primary" character of habitats. In much of the Sebuku and Sembakung region, logging has been relatively light because the army-owned concession has the dual role of timber extraction and security along the Malaysian border. However, a recent analysis of Landsat TM data made by Yayasan WWF Indonesia and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) showed massive logging from Malaysia across the international border (A. Hoffmann, Integrated Forest Fire Management Project, Samarinda, pers. com.). The Sangkulirang and Mangkalihat areas are included in the minimum set by virtue of the karst flora and fauna assemblages of their limestone massifs. The proposed Sankulirang and Mangkalihat reserves were partially burned in the 1982–83 fires (Lennertz and Panzer 1983) and again in 1997–98, but large parts of the northern and central parts of Sankulirang remain

Table 3. Overview assessment of the intactness of the East Kalimantan reserve network proposed in the 1982 National Conservation Plan. See Table 2 for "intactness" definitions.

Reserve Name	Status	Area (ha)	Date	Conservation Purpose	Intactness	Impacts
Reserves in National "Minimum Set"						
Kutai	NP	198,629	1936	Lowland forest ecosystem, large mammal populations	**Lost**	Fires, encroachment, illegal logging, hunting.
Kayan Mentarang	NP	1,360,500	1992	Mountain forest ecosystems, traditional Dyak cultural landscapes	Intact	Hunting & non-timber forest product collection, road development, fires
Muara Sebuku	*P*	*110,000*	—	Lowland & coastal swamp ecosystems	Mostly intact	Two logging concessions (one covering mangrove). Northern part excised for Nunakan road corridor
Ulu Sembakung	*P*	*500,000*	—	Hill forest & karst ecosystems	Mostly Intact	Low intensity logging
Sankurilang	*P*	*200,000*	—	Karst ecosystems	Partly degraded	Fire, conversion of lowland forests to plantations, proposed quarrying
Mangkalihat	*P*		—	Karst ecosystems	**Severely degraded**	As above
Ulu Kayan	*P*	*800,000*	—	Lowland forest ecosystems	Mostly intact	Four logging concessions cover the area
Important Supplementary Reserves						
Muara Kaman	NR	62,500	1976	Freshwater-, peat swap gallery forest habitats	**Lost**	Fires, illegal logging, encroachment
Pulau Semama	WS(M)	220	?	Turtles, coral reefs	**Degraded**	Illegal turtle catching, reef bombing
Pulau Sangalaki	WS(M)	240	?	Turtles, coral reefs	**Degraded**	Illegal turtle catching, reef bombing
Teluk Adang	NR	59,057	?	Mangroves & delta ecosystem	**Severely degraded**	Mostly converted to shrimp ponds, marine resource over exploitation
Teluk Ampar	NR	69,788	1993	Mangroves & delta ecosystem	**Severely degraded**	As above
Bukit Suharto	RF	61,850	1988	Lowland forest ecosystems	**Lost**	Fires (burning coal seams), illegal logging & hunting, reforestation
Gng. Beratus/Sesulu	*PF/P*	*130,000*	—	Montane & hill forest ecosystems	Mostly intact	Logging concession cover land not designated as Protection Forest
Pantai Samarinda	*PF/P*	*95,000*	—	Costal swamp & mangrove ecosystems	**Lost**	Conversion to shrimp ponds, two logging concessions, illegal logging, industrial development and sedimentation.
Gng. Lumut/Agathis	*PF/P*	*30,000*	—	Moss and sub-montane forest	Partly degraded habitats	25% (the lowland areas) allocated for conversions to industrial timber plantation and logging concessions.
Muara Kayan	*P*	*80,000*	—	Coastal swamp & mangrove ecosystems	**Lost**	Mostly converted to shrimp ponds
Apo Kayan	*P*	*100,000*	—	Montane forest ecosystems	Mostly intact	Hunting & Non Timber Forest Product collection, three logging concessions cover the area
Long Bangun along	*P*	*350,000*	—	Hill & lowland forest ecosystems	Mostly intact	Eight logging concession cover the area. Industrial timber plantations the Mahakam river corridor.
Sungai Berambi	*P*	*110,000*	—	Lowland & heath forest habitats	**Degraded**	50% allocated for industrial timber plantations, remainder under three logging concessions.
Mahakam wetlands	*P*	*200,000*	—	Wetland system	**Severely degraded**	Fires, exotic weeds, over-utilisation.
Gunung Berau timber	*P*	*100,000*	—	Hill & lowland forest ecosystems	**Severely degraded**	Four logging concessions cover the area, 15% converted to industrial plantation
Pulau Maratua	*P*	*?*	—	Turtles, coral reefs	**Degraded**	Illegal turtle catching, reef bombing
Reserves for protection of localized species, habitats or for research & recreation						
Padang Luwai	NR	5000	1982	Orchids	**Severely degraded**	Orchid collection, fires
Pulau Birah-briahan	*P*	*100*	—	Turtles	*Degraded*	Over-exploitation

Key: Reserve status, NP=National Park, WS=Wildlife Sanctuary, NR= Nature Reserves, RF= Recreation Forest, PF=Protection Forest, (M) = marine. "P" denotes proposed reserve (highlighted by italics). 'Lost' means the loss of potential to maintain or establish a biodiversity conservation reserve because of habitat loss, species degradation and alteration of the ecological systems: the are may retained hydrological or other values. Severely degraded means we anticipated that there is little potential to create a reserve.

intact and the karst ecosystem is yet in good condition. The area's intrinsic value as a landscape of outstanding natural beauty, however, is compromised by conversion of the natural forest around the foot of the massifs to industrial timber plantations dominated by *Acacia mangium* (Willd.). We class Sankulirang as "partly degraded" and Mangkalihat as "severely degraded."

Sixteen important supplementary reserves were proposed in the NCP, of which six have been designated. In our assessment, four of these six supplementary reserves are now lost. In the case of the two lowland forest reserves, Muarah Kaman and Bukit Suharto, the causes are fire, major encroachment, and rampant illegal logging (G. Fredriksson, Balikpapan Orangutan Survival Foundation, Balikpapan, pers.com.). In the case of the two coastal reserves, Teluk Adang and Teluk Ampar, the mangrove and nipa palm forests have been largely destroyed by illegal conversion of mangrove habitats to shrimp ponds (Ade Rachman, Kantor Sumber Daya Alam, pers. com.). The three offshore island reserves have all been degraded as a result of reef bombing and over-harvesting of turtles (eggs and adults) and fish.

Interviews with men in villages in the Sebuku Estuary and Sangkulirang Peninsula revealed two types of aggressive resource exploitation along Kalimantan's east coast, namely armed fisherman from the Philippines exploiting marine resources around the Derawan Islands (reef bombing and harvesting of turtles), and groups of 100 or more Buginese clearing mangrove without permits. In both cases, communities and authorities feared these groups and felt powerless to take action. In short, the proposed reserves that are still mostly intact are those located in remote forested landscapes of the interior hill and montane regions, namely Apo Kayan, Long Bangun and Mount Beratus and Sesulu.

In summary, natural habitats and protected areas in East Kalimantan are severely threatened. These threats derive from at least four interrelated factors, each of which alone is responsible for massive damage: (1) ENSO-related droughts and fire events, to which much of this province is especially prone; (2) government and commercially driven land conversion programs in these last extensive lowland forests in Indonesia outside Irian Jaya; (3) activities of in-migrants, who tend to take over what natural resources the commercial interests leave; and (4) illegal and semi-legal business activities of corrupt government officials, which is pervasive at every level, even down to village heads (Jepson et al. 2001). Creation of a "paper park" (legal designation but with no management) usually provides protection against legal land conversion, but our analysis shows that in lowland and coastal areas the other three factors are leading to severe degradation or loss of key biodiversity attributes in reserves within time-scales of ten to twenty years.

Management of East Kalimantan Reserves

On-site reserve management has been limited and mostly confined to three sites: Kutai, Kayan Mentarang, and Bukit Suharto. Only Kutai National Park has its own reserve management unit (known as UPT) and approved park management plan (Wirawan 1985). In Financial Year 1996–97, the UPT employed 58 staff and had an operational budget of US $303,282. These figures compare with the national average (based on 12 operational UPTs) of 104 staff and US $540,250 budget, which is considered relatively high by international standards (data reported in MacAndrews and Saunders 1999). All other reserves are managed under the small provincial office of natural resource management (known as Balai KSDA) based in Samarinda.

A technical assistance project under the auspices of UNESCO and UNDP supported management of Kutai National Park between 1995 and 1998 (*www.un.or.id./undp/proginfo*). This project, which had a total budget of US $837,600, conducted various activities, including encroachment monitoring, socioeconomic surveys, boundary rationalization, staff training, and the incorporation of a "Friends of Kutai Secretariat." The latter brought together eight companies (gas, mining, and forestry) with operations bordering the park, which pledged funds and support for park management. Although this action provided an important precedent, the monetary amounts pledged are modest, and some of the "Friends" commercial interests continue to negatively impact the park (Wells et al. 1999). For example, illegal loggers use roads constructed by industrial timber companies to transport timber cut in the park (R. Blouch, UNESCO/UNDP "Friends of Kutai" Support Project, Samarinda, pers. com.).

The Kayan Mentarang National Park has been the focus of Yayasan WWF Indonesia activities in the province during the last 15 years. To date, activities have focused on building the foundations of knowledge, trust, and understanding for participatory park management employing the integrated conservation and development project model. These have included interdisciplinary biological and anthropological research, development of a GIS, community resource use mapping, local stakeholder and policy workshops, and awareness and education activities. A park management and zonation plan that reflects ancestral rights is close to completion (Wells et al. 1999; D. Wellington, Yayasan WWF Indonesia Kayan Mentarang National Park Development Project, Samarinda, pers. com.). An important achievement of the project was successful promotion of an alternative low-impact road route to link villages within the park and the district town of Malinau (Momberg 1998).

The Bukit Suharto "Reserve" is classed as recreation forest and therefore comes under the management of the provincial forestry department, which lacks the capacity, training, and will to carry out any enforcement or management activities. As a result forest degradation continues unabated.

Assessment of Gaps in the Existing Reserve Network and of the Potential to Establish a Representative Reserve Network in East Kalimantan

The results of our simplified gap analysis (Table 4) show that the East Kalimantan network of designated reserves provided good representation of key conservation attributes when it was intact. The only major gaps were centers of plant and gas-

Table 4. Simplified gap analysis of East Kalimantan protected area network, Indonesia.

			Hotspots & Biounits						Habitat Formations										Species of International Conservation Concern																		
Protected Area	**Area (ha)**	**Intact altitudinal gradient**	**Endemic Bird Area**	**Centre Plant Diversity**	**North Borneo**	**Central Mountains of Borneo**	**East Borneo**	**South-east Borneo**	**Montane & hill forest**	**Lowland dipeterocarp forest**	**Limestone forest**	**Heath forest**	**Peat swamp forest**	**Fresh-water swamp forest**	**Brackish-water swamp forest**	**Mangroves**	**Lake ecosystems**	**Beach formations**	**Coral reefs**	**Asian Elephant *Elephas maximus***	**Sumatran Rhino *Dicerorhinus sumatrensis***	**Banteng *Bos javanicus***	**Proboscis Monkey *Nasalis larvatus***	**Orang-utan *Pongo pygmaeus***	**Clouded Leopard *Neofelis nebulosa***	**Flat-headed cat *Prionailrus planiceps***	**River Dolphin**	**Storm's Stork *Ciconia stormi***	**White-shouldered Ibis *Pseudibis davisoni***	**Pheasants Galliformes**	**Straw-headed Bulbul *Pycnonotus zelanicus***	**Green\Hawksbill Turtle**	**Esturaine Crocodile *Crocodylus porosus***	**Orchids**
Existing reserves																																				
Kutai	198,629						☆☆			☆☆						☆						☆	☆☆	☆☆	☆☆			☆			☆☆					
Kayan Mentarang	1,360,500		☆☆	☆☆		☆☆				☆		☆									?	☆☆	☆		☆☆	☆				☆☆	☆☆				
Muara Kaman	62,500						☆☆						☆☆	☆☆													?	☆								
Pulau Semama	220						☆											☆	☆													☆				
Pulau Sangalaki	280						☆			☆								☆	☆☆													☆☆				
Teluk Adang	c80,000							☆							☆	☆☆								☆☆									☆			
Teluk Ampar	46,900							☆							☆	☆☆								☆												
Padang Luwai	5,000							☆																												☆☆
Bukit Suharto	61,850							☆☆		☆															☆											
Gaps in representation		⬇					⬇	⬇		⬇			⬇	⬇		⬇				⬇					⬇				⬇		⬇					⬇
Recommended additional reserves																																				
Sebuku\Sembakung		☆☆	☆	☆		☆☆	☆☆			☆☆	☆		☆	☆	☆☆	☆☆				☆☆	?	☆	☆☆	☆	☆	☆☆		?			☆		☆☆		
Sankulirang Complex				☆☆						☆	☆☆											?		☆						☆☆					?
Recommended special management area																																				
Mahakam lakes							☆☆					☆	☆☆	☆☆			☆☆						☆				☆☆						☆☆		

Key: ☆☆ significant areas of habitat or population numbers; ☆ = attribute present in reserve in small areas or populations number; gray shading signifies biodiversity value destroyed or seriously degraded; ⬇ signifies important gaps in representation, which the recommended additional reserves will help to fill.

Table 5. Area of ecological zones within the boundaries of the proposed Sebuku-Sembakung National Park calculated from the GIS overlays shown in Figure 4.

	Area (ha)
Sebuku Hulu	
Forested hills with limestone outcrops	120,700
Lowland forest	92,889
Sub total	213, 589
Muara Sebuku-Sembakung	
Lowland forest	26,642
Riverine corridors	36,043
Swamp forest	80,000
Tidal forest	74,187
Shallow water (marine)	19,901
Subtotal	235,000
Total area proposed	**448,589**

tropod biodiversity associated with karst ecosystems, and an intact coast-to-mountain habitat gradient.

Damage to these actual or proposed reserves in the last 20 years has seriously reduced representation. The loss of Kutai National Park, a key sanctuary for the conservation of lowland large mammals and birds, has created a major gap in representation in the East Kalimantan and wider Bornean reserve network. Destruction of Muara Kaman, and degradation of Teluk Ampar, mean that swamp and mangrove forest ecosystems are now seriously under-represented. Moreover, Tanjung Puting National Park and Gunung Palung, the other major Bornean reserves covering these habitats, are suffering from serious degradation (EIA/Telapak 1999).

On the positive side, our analysis shows that, at least in theory, it is still possible to meet the representation goal of the NCP. At a minimum, this would require the establishment of three new reserves based on proposals in the NCP: (1) a major ecosystem reserve linking the earlier proposed reserve of Muara Sebuku and Ulu Sembakung (in effect a replacement for Kutai and Muara Kaman); (2) a reserve protecting the Sankulirang karst ecosystems; and (3) creation of a special management area to restore the conservation values of the Mahakam wetland system.

As a result of this assessment, Momberg et al. (1998) proposed a new national park in the Sebuku-Sembakung region of East Kalimantan (Figure 4). The proposed reserve covers an altitudinal and habitat gra-

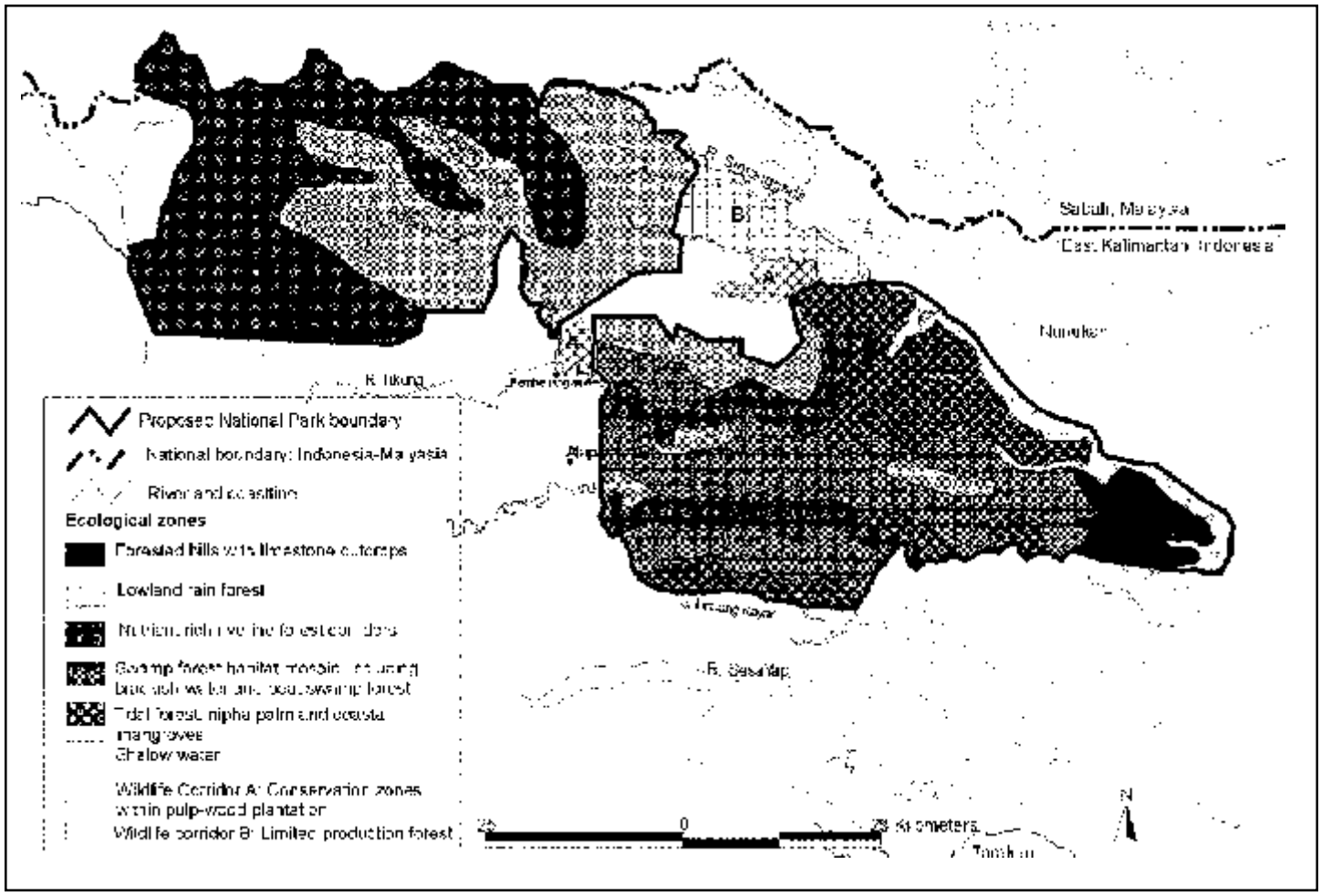

Figure 4. Revised boundary proposals for a Sebuku-Sembakung National Park (after Momberg et al. 1998).

dient from delta to interior limestone hills with a maximum altitude of 1055 m. Six broad ecological zones are represented. It is expected that together these zones contain a near-complete range of biodiversity components (e.g., genetic to landscape-scale) that characterize lowland landscapes of northeastern Borneo; are of sufficient size (Table 5) to support viable populations of large mammal species; and are immune to future species loss due to the "relaxation effect" predicated on MacArthur and Wilson's (1967) equilibrium theory of island biogeography, which postulates that species number will re-equilibrate to a lower number if habitat area is reduced (see Whittaker 1998).

The proposed reserve is divided into two units: Sebuku Hulu and Muara Sebuku-Sembakung. This division represents a compromise negotiated in 1998 with competing government and private land use interests. Planned conversion of a north-south corridor through the primary landscape could not be reversed because this is the proposed route of the trans-Kalimantan highway and because licenses for establishment of pulpwood plantations had been issued. Disruption of animal movements between the two reserve units can be minimized because plantation companies are required to leave uncut blocks as conservation forest and these could be aligned in a corridor configuration (Figure 4).

In terms of contribution to representation, the conservation importance of the reserve units and ecological zones (Figure 4) can be summarized as follows:

- The western area of the Sebuku Hulu unit comprises forested hills with limestone areas and outcrops and the Agison and Apan river systems. Limestone hills in northeastern Kalimantan are centers of global plant diversity (Davis et al. 1994), which are not currently represented in the national protected area network. Freshwater fish are one of the most threatened components of biodiversity in Asia (Kottelat and Whitten 1996). Knowledge of Kalimantan's fish fauna is limited but Southeast Asia foothill forest streams harbor a diverse fish fauna (Kottelat 1995). Consequently, the Agison and Apan rivers are expected to support important freshwater fish assemblages.
- The eastern area of the Sebuku Hulu unit is a quality example of lowland forest, including a flat lowland plain. This ecological zone compensates for the losses of this biodiversity-rich habitat type in Kutai National Park due to fire. We confirmed, by observation of tracks, that the area supports Kalimantan's only population of elephant (*Elephas maximus* L.) and a population of banteng. Dayak villagers report the presence of other threatened mammals such as clouded leopard, flat-headed cat (*Prioailurus planicpes* Vigors & Horsfield), sun bear (*Ursus malayanus* Raffles), and Bornean gibbon (*Hylobates muelleri* Martin). Rijksen and Meijaard (1999) estimate that eastern Sebuku Hulu supports a population of 150 orang-utan, and at 90,000 ha this zone is larger than the minimum viable area requirements of the species (estimated at 10,000 ha; C. van Shaik, Duke University, Durham, N.C., pers.com.). Globally threatened birds (Collar et al. 1994, O'Brien et al. 1998) that are ultra-lowland specialists such as Storm's stork (*Ciconia stormi* Blasius), Bornean peacock pheasant (*Polyplecton schleiermacheri* Brüggemann), Wallace's hawk eagle (*Spizaetus nanus* Wallace), and wrinkled hornbill (*Rhyticeros corrugatus* Temmink) are also expected to occur in eastern Sebuku Hulu.
- The eastern unit of the reserve encompasses the best remaining example of mangrove and tidal forest in East Kalimantan supporting economically important fisheries (Silvius 1989). These habitats are threatened by the massive expansion of shrimp ponds in coastal areas since 1995. Local fishermen report that estuarine crocodile (*Crocodiles porosus* Schneider) is still common in the area.
- The nutrient-rich river corridors of Sebuku and Sembakung are distinct in terms of hydrology and vegetation. Both river corridors support high densities of wildlife and the most important proboscis monkey populations in East Kalimantan. This species is in rapid decline (Erik Meijaard, Australian National University, Canberra, pers. com.). The border of this ecological zone is set at 5 km on either side the river, which is the maximum distance that proboscis troops range from riverine roosting trees (Carey Yager, Yayasan WWF Indonesia, Jakarta, pers. com.).
- Between the Sebuku and Sembakung Rivers is intact fresh and brackish water swamp forest with patches of lowland forest on low hills. Only small-scale, localized timber extraction occurs in the area. Proboscis monkeys frequent the area, and Dayak villagers report regular sightings of orang-utan on Bukit Serapun. Rijksen and Meijaard (1999) estimate a population of 165 orang-utan in the North Sembakung swamps.

The proposed reserve area is effectively uninhabited, but coastal Tidung and Bugis communities enter the estuaries to fish, and Dayak communities living in villages along the Tulit River (Figure 4), hunt and collect swiftlet nests (three species of *Collocalia*) within the proposed reserve. Maintenance of these traditional, low-intensity activities is compatible with conserving the biodiversity values represented in the proposed reserve.

The reserve proposal received support of then Minister of Forestry and Estate Crops, Muslimin Nasution, in August 1998 (WWF 1998); of the provincial planning agency in March 1999 (Amin 1999); and of President Abdurrahman Wahid and then Minister of Forestry and Estate Crops, Dr. Nurmachmundi Ismail AP, in January 2000. In a joint letter to the Director of the World Bank, Jakarta (in his capacity as chair of the Consultative Group on Indonesia), dated 10 January 2000, heads of seven international conservation NGOs working in Indonesia urged completion of the Indonesian protected area network and cited establishment of Sebuku-Sembakung as a conservation priority.

Implications for Future Reserve Planning in East Kalimantan

The NCP and Biodiversity Action Plan did initially lead to the creation of a represen-

tative protected area network, but this was largely because designation of the Kayan Mentarang National Park in one step added key conservation attributes that were missing from the existing protected area network (e.g., lowland and coastal habitats). Kayan Menterang, however, is the only new reserve designated in the province since the NCP; 16 of the 25 reserves proposed are not designated, and the present-day network covers just 34% of that originally proposed. As a consequence, every reserve in the East Kalimantan network has a high "irreplaceability" score (see Pressey et al. 1993) because there are no alternative reserves (designated or proposed) if any are lost. Subsequent degradation of individual reserves has caused serious gaps in representation of key biodiversity attributes within the system. Based on our analysis, the simple message for future reserve planning is that conservation attributes that occur in economically marginal hill and montane landscapes are relatively safe from degradation, whereas conservation attributes confined to lowland and coastal landscapes are under serious threat and are poorly protected.

The Sebuku-Sembakung National Park proposal and subsequent advocacy demonstrate two important points: (1) given the political will, a major ecosystem reserve could be established to restore representation; and (2) the representation principle still has high-level support within the national government and the international donor community. The Kayan Mentarang National Park is evidence that under the Suharto New Order regime, such arguments were sufficient to lead to designation of a new major ecosystem reserve. However, we are pessimistic that the same will hold true for Sebuku-Sembakung under the current government despite a stronger advocacy "package" for Sebuku-Sembakung, comprising support from the president, the provincial planning department, and the international donor community (including a three million Deutche Mark funding commitment), and (2) IMF-conditions on reform of the forestry sector and growing calls from the international donor community for stabilization of forest boundaries (see Barber and Schweithelm 2000).

Our pessimism concerning Sebuku-Sembakung is based on observations that: (1) park establishment would require the government to resolve the issue of illegal logging across the Indonesian border from Malaysia, which may be politically difficult; (2) the area proposed covers lowlands with potential for conversion to estate crops; and 3) the power of state and central government departments has declined markedly since the fall of the Suharto New Order regime. Whereas previously, provincial and district administrations would follow central government policies and directives this is no longer guaranteed (Jepson et al. 2001).

Political and administrative decentralization is a major policy initiative of the Habibie (1998-1999) and Wahid (1999–present) governments (see Down to Earth 2000), which makes major ecosystem reserves harder to designate. As part of the decentralization process in 2000, Bulungan District was divided into three new districts: Nunukan, Bulungan, and Malin. In the case of Nunukan, 320,000 ha of Kayan Metarang National Park and 420,000 ha of the proposed Sebuku-Sembakung park lie within the boundaries of the new district. This represents 60% of the district territory proposed for nature conservation, a proportion that district leaders are unlikely to sanction. This is because district administrations perceive decentralization as an opportunity to replicate Suharto's crony capitalism (see Schwarz 1999) at a smaller scale. From a district-scale perspective, a major ecosystem reserve is perceived as too big and a major impediment to the short-term political and economic benefits that can be gained by converting natural habitats to estate crop and pulp wood plantations. Such perceptions are exacerbated by the facts that districts do not yet use income-expenditure budgeting, and central government has not indicated whether districts will receive payments from the state for land in national parks and reserves.

These changes in the political context of East Kalimantan invalidate key assumptions of the NCP reserve planning principles relating to the notion that central government can plan and enforce natural resource management at the macro-scale. As a result, the major ecosystem reserve may no longer be a viable concept in East Kalimantan and elsewhere in Indonesia, except in remote mountainous regions.

The capacity and will of government and civil organizations to develop and manage a representative reserve network appears limited. Apart from Kayan Menterang, there has been little strategic and coordinated effort on the part of international and national conservation agencies to deliver representation goals in East Kalimantan. Designation of the four proposed national minimum set reserves (Sebuku, Sembakung, Sangkulirang, Mahakam Lake) was not pursued until 1998 (this study), and no effort has been made to establish important supplementary reserves identified in the NCP. Conservation investments have taken a site-based, as opposed to a network-based, approach and focused on Kutai and Kayan Mentarang. Two factors have influenced this strategy: (1) the widely held view that there is little merit in establishing additional "paper parks" when management capacity and resources for existing parks are limited, and (2) the desire of donors to integrate biodiversity conservation with community and local development and to test participatory park management models. As a result, the representation goal has been down played in practice.

Government (i.e., the Department of Forest Protection and Nature Conservation as of 2000) ability to manage and protect reserves in East Kalimantan is severely constrained by Indonesia-wide problems, including insufficient funding, workforce shortages, over-centralization (World Bank 1990), inappropriate project models, weak sanctions and penalties, a general lack of support for conservation in society, corruption and well-connected commercial resource exploitation interests (Wells et al. 1999), and the aggressive posture of migrant groups.

These factors add weight to Sayer's (1995) argument that "Indonesia is struggling to establish a protected areas system that might have been viable in the 19th century but will not be viable in the 21st century." This ob-

servation raises the following question: What are the strategic options for delivering representation in Indonesia in the twenty-first century? Sayer (1995) proposed many smaller reserves, strategically placed, to optimize representation goals. Other options include opportunistic acquisition of large blocks of degraded forestland by targeting nonviable logging concessions, and mounting a major international campaign to protect a small number of "unspoiled" lowland landscapes such as Sebuku-Sembakung. A further question is how are reserves to be protected? In the face of current threats, can conservation agencies maintain their focus on "soft" community-based management approaches or will it be necessary to introduce militaristic enforcement approaches? These are strategic questions requiring urgent consideration.

CONCLUSION

Support for the representation principle appears stronger than ever among conservation scientists and policymakers. The science and practice of the systematic design of protected area networks to meet representation goals is developing rapidly and is attracting significant investment (see Olson and Dinerstein 1998, Pressey 1999, Myers et al. 2000).

Twenty years ago, Indonesia used the best principles of conservation biology to plan a national protected area system. Our case study shows that in present-day East Kalimantan, there has been a failure to turn planning into practice, chiefly because key assumptions of Indonesia's reserve planning principles are invalid in the context of sociopolitical realities operating at the local level. Although similar assessments of reserve network efficacy have not been done for other provinces and regions of Indonesia, this general conclusion probably holds true for Sumatra and Sulawesi. Within densely populated Java, landscapes are more stable, and within Irian Jaya (Western New Guinea) threats to conservation attributes are not as immediate because the region is at an early stage of development.

On the basis of this case study, we suggest that if the conservation community is truly committed to the principle of establishing networks of reserves that are representative of biotic diversity, it will be necessary to undertake an urgent, radical, and comprehensive reassessment of protected area policy and management in East Kalimantan and other regions of Indonesia.

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