The Southeast Asia Sustainable Forest Management Network

The objective of the Southeast Asia Sustainable Forest Management Network is to study degraded natural forests where community management may be a viable strategy in establishing access controls and thereby stabilizing forest use. The Network is comprised of a small, select coalition of Asian colleagues, many of whom have collaborated together for years, both with each other and with Network facilitators. The solidarity of the Network members is based on a common commitment and well-defined focus on exploring alternative management strategies for Asia's disturbed natural forest lands. The Network's strategy has been to move away from conventional, academic research toward more applied, interdisciplinary studies which have both practical and policy relevance. Through case diagnostic studies, the work attempts to capture the voices and needs of forest communities and to communicate their indigenous knowledge and perspectives on the human-forest relationship. To that end, the national teams in Thailand, Indonesia, and the Philippines are developing long-term working relationships with community members to learn more about their forest management issues, resource-use systems, and problem-solving strategies. The emphasis of the Network's research includes the ecology of natural regeneration, the economics of non-timber forest product systems, and the community organizations and institutional arrangements which support participatory management. The lessons stemming from the research aim to inform field implementation procedures, reorient training, and guide policy reform.

For more information about the Network and its publications, please contact Dr. Mark Poffenberger and Betsy McGean at the address below.

Center for Southeast Asia Studies
University of California
2223 Fulton, #617
Berkeley, California 94720
Tel: 510-642-3609
FAX: 510-643-7062

THIS WORK WAS SUPPORTED BY TWO GRANTS FROM THE UNIVERSITY OF CALIFORNIA, BERKELEY, THROUG.' FUNDS PROVIDED BY THE ROCKEFELLER FOUNDATION AND THE BIODIVERSITY SUPPORT PROGRAM, A USAID-FUNDED JOINT VENTURE OF WORLD WILDLIFE FUND, THE NATURE CONSERVANCY, AND WORLD RESOURCES INSTITUTE. THE CONTENTS HEREIN DO NOT NECESSARILY REPRESENT THE VIEWS OF THE DONORS.

Front cover photo: A young Dayak tribal returns from a one-month hunt deep in the rainforests surrounding Diak Lay village.

Back cover photo: Village elder from Ben Hes believes logging companies could negotiate an agreement to transfer management responsibilities of the secondary forest to local community groups.

COMMUNITIES AND FOREST MANAGEMENT IN EAST KALIMANTAN: PATHWAY TO ENVIRONMENTAL STABILITY

Southeast Asia
Sustainable Forest Management Network

Country Team Coordinators:
Oekan Abdoellah, Padjadjaran University (UNPAD)
Abu Bakar Lahjie, Mulawarman University (UNMAL)
and
Sopari S. Wangsadidjaja, Indonesian Ministry of Forestry (DEPHUT)

Herri Hadikusumah, UNPAD
Johan Iskandar, UNPAD
Bambang Sukmananto, DEPHUT

Edited by

Mark Poffenberger
and
Betsy McGean

Research Network Report
Number 3 • August 1993

Center for Southeast Asia Studies
International and Area Studies
University of California, Berkeley

II

CONTENTS

List of Figures iv

Preface v

Executive Summary vii

BACKGROUND 1

National Overview 1

Forest Use in East Kalimantan 2

Project Strategy 3

DATARBAN'S CHANGING LANDSCAPE: *IMPERATA* AND OUT-MIGRATION 8

History of the Region 8

Farming Systems of Buginese, Javanese, and Banjarese Migrants 14

Dayak Settlers: Swidden and Forest 16

Non-Timber Forest Products in Datarban 33

Future Scenarios for Datarban 37

THE FOREST STEWARDS OF DIAK LAY 40

Conservation Agriculture 42

Protecting Forest Resources to Enhance Productivity and Regeneration 49

Primary Forest Reserves (*Keletong*) and Non-Timber Forest Products 50

Changing Paradigms of Forest Management 54

SUMMARY 57

Postscript 61

Notes 63

References 65

LIST OF FIGURES

1. Logging Concessions in East Kalimantan, 1970s 4

2. Samarinda and the Lower Kutai Area, East Kalimantan 6

3. Traditional Dayak Territory with Logging Concessions and Residual Tribal Lands 7

4. Time Line of Important Events in Senoni Area 13

5. Changing Population and Land Cover in Datarban: 1950–90 15

6. Benuaq Dayak Phases of Forest Regeneration 20

7. Transects of Regenerating Forest Phases 22

8. Dayak Phases of Forest Regeneration: Relationships to Light Intensity and Vegetative Composition 27

9. Land Use Patterns in Datarban 29

Map: Official Forest Coverage of Indonesia 30–31

10. Population Migration and Forest Product Flows in Datarban 34

11. Combined Household Income and Subsistence Goods by Ethnic Group and Source in Datarban: 1991–92 37

12. Historical Transects of Diak Lay: 1870–1990 41

13. Transect of Land Use Systems in Diak Lay, East Kalimantan 45

PREFACE

This report provides a preliminary discussion of selected research findings from the Indonesian members of the Southeast Asia Sustainable Forest Management Network. The two study teams have recently concluded the first round of data collection and plan to return to the field in June 1993. Consequently, the information discussed here and the recommendations provided should be viewed as tentative, requiring further confirmation in the field. Future research reports will provide more detailed ecological and economic information concerning conditions and changes in the study areas. The research teams in Indonesia greatly appreciate the support they have received from the Rockefeller and Ford Foundations. The teams would also like to acknowledge the encouragement and cooperation given by the Indonesian Ministry of Forestry in Jakarta and the provincial forestry offices in East Kalimantan. The P.T. ITCI and P.T. Mugi timber companies have also cooperated with the studies, contributing their ideas and perspectives to the teams' understanding. Finally, the authors would like to extend their thanks to the villagers of Diak Lay, Ben Hes, and Datarban for sharing their knowledge and experience with us. Particular gratitude is due to Pak Biteq, Pak Abdullah, Pak Bourhan Mas, Pak Abraham, and Pak Daniel.

The Southeast Asia Sustainable Forest Management Network Secretariat, based at the Center for Southeast Asia Studies at the University of California, Berkeley, would also like to acknowledge its cast of supporters and contributors. We are most grateful to John O'Toole at the Rockefeller Foundation for his continued interest in the subject of community forest management and his commitment to support Network activities over the past two years. We would like to specifically thank Molly Kux and Toby Pierce of USAID for their intellectual guidance to the Network, as well as Janis Alcorn, Stephen Kelleher, and Richard Richina of the USAID-supported World Wildlife Fund's Biodiversity Support Program, for providing ideas and financial assistance for the production and publication of this study. At the University of California, Berkeley, we owe thanks for the excellent work of cartographer Jane Sturzinger, artist Anne Higgins, editors Bojana Ristich and Stephen

Pitcher, and the competent administrators in the grants office. The facilitators of the Network are indebted to Robert Reed, Eric Crystal, and Cynthia Josayma at the Center for Southeast Asia Studies for their consistent cooperation and overall institutional support. Finally, the Secretariat would like to extend its heartfelt thanks to all the member scientists of the Southeast Asia Network, whom we greatly value as friends and colleagues, for their hospitality during our field visits and for their commitment to this important research.

EXECUTIVE SUMMARY

Forest management policy has been a topic of heated discussion in Indonesia in recent decades. With nearly three-quarters of the country's land area officially under forest cover, national planners have viewed forest utilization as a vehicle to stimulate economic growth and as a land pool to absorb Java's growing population. Migrants seek forest land for farming. Businessmen see profit-generating opportunities. Nongovernment organizations perceive the richness of the cultural and biological diversity and hope to preserve it. Indigenous peoples view the forest as their ancestral home, the foundation of their traditions and their continuity.

The East Kalimantan case studies presented here do not attempt to justify any of the views described above. Rather, the researchers report changes in the environment and society occurring in the provincial study sites in recent years through human forest interactions. The study finds that forest utilization practices by concessionaires, developers, migrants, and local populations have led to a rapid process of forest degradation, especially in high pressure areas nearer roads and urban centers. The researchers raise the question, "How can Indonesia best manage its millions of hectares of degraded forest lands?" They conclude that while some of this area can be developed for settlements, agriculture, and fast-growing timber plantations, a sizable majority might best be left to regenerate naturally under the protection of local communities.

The Dayak communities in Datarban and Diak Lay both showed a deep knowledge of forest ecology and regenerative processes based on centuries of experience with long rotation agriculture. Traditional wisdom combined with more recent scientific experimentation indicates rapid regrowth can be achieved if cutting and burning are controlled. The productivity of valuable timber and non-timber forest products can be greatly increased through enrichment planting and other manipulations of the natural environment. The Dayaks, as well as the Kutai and migrant groups, are concerned about the future of their communities and the natural resources upon which they depend. The researchers conclude by urging planners, academics, and community

development specialists to empower forest people with the legal custodial authority to heal disturbed forest ecosystems and make them once again ecologically rich and economically productive.

BACKGROUND

National Overview

Indonesia possesses 60 percent of all forested lands in Southeast Asia and an even greater proportion of the remaining primary rainforest.[1] Forests are of immense importance to the country, with nearly 75 percent of the land area under official forest cover. This distinguishes Indonesia as the third largest tropical forested area in the world (after Brazil and Zaire) (see centerfold map, pp. 30–31). Rich biological diversity characterizes Indonesia's forest ecosystems, including over 10,000 species of trees, 1,500 types of birds, and 500 varieties of mammals.[2] Forests also support millions of indigenous tribal peoples who have historically resided in the interior reaches of the outer islands, as well as a growing number of migrants from densely populated Java. At the same time, logging of valuable tropical hardwoods has contributed significantly to the generation of foreign exchange, providing strategic impetus to the acceleration of the Indonesian national economy, especially during the 1970s and 1980s.

Due to the multi-purpose importance of the forests, considerable attention has been given to the formulation of forest use policies in Indonesia. Nonetheless, the outcome of these policies has not always been consistent with the intention of national planners. Currently, 34 percent of the nation's forest area has been reserved for both protection forests (21 percent) and national parks (13 percent). Another 21 percent of the forested area is allocated for conversion to agriculture, settlements, and industrial purposes.[3] The remaining 45 percent of the forest area, or approximately 64 million hectares, is designated production forest and is currently leased to approximately 500 concessions which each average 100,000 hectares in size, with some lessees holding over 1 million hectares.

Officially, 144 million hectares is entrusted to the Ministry of Forestry. Aerial photos from 1981–82 indicate that only 76 percent of this land is actually forested. This still represents 60 percent of the country's surface area, although it continues to be depleted. Current estimates suggest that deforestation has been progressing in Indonesia at a rate of 700,000–1,200,000 hectares annually.[4] In the early 1970s, the UN Food

and Agriculture Office (FAO) estimated that forest clearing denuded 300,000 hectares per year, indicating that forest utilization has been accelerating substantially over the past two decades. Recent studies have attempted to break down annual deforestation rates by cause, citing smallholder conversion (500,000 ha.), development projects (250,000 ha.), and logging and forest fires (180,000 ha.)[5] Estimates from the World Bank cite a rate of 250,000 hectares lost each year to overlogging or poor logging practices and 750,000 hectares lost to fires, development projects, and agricultural conversion.[6] However, the accuracy of these statistical estimates is questionable. While providing indications regarding the scale of the problem, statistics do little toward illuminating the processes and outcomes of various forest-use practices. The findings reported in this study demonstrate that the rapid changes in Indonesia's forest ecosystems are often a result of a progressive series of human activities and natural events. The case studies presented also show that these activities affect forests in different ways, each with implications for forest regeneration and survival. The events and agents that are currently reducing Indonesia's forest cover are often poorly understood. While the rapid deforestation of the past two decades has been frequently attributed to local people practicing "slash and burn" farming, a growing body of experience indicates that Dayak rotational swidden agriculture has been one component of a time-tested, integrated resource-use system that was highly sustainable, especially compared to current timber utilization practices and commercial plantations. These case studies attempt to document the processes of forest disturbance and the ecological changes that result. The research also highlights the stages and processes of natural forest regeneration after certain types of disturbances, suggesting potential strategies for rehabilitating and managing these degraded ecosystems in the future.

Forest Use in East Kalimantan

Due to an active timber utilization industry, the sequential ecological effects of a series of natural fires, and growing migrant pressures, it is estimated that one-half of Indonesia's deforestation during the 1980s occurred in Kalimantan. The province of East Kalimantan is currently the center of the commercial timber industry, supplying nearly 25 percent of the nation's commercial needs, or approximately 6.5 million logs per year.[7] The timber is produced by over one hundred concessionaires currently operating in the province. Over 50 percent of the

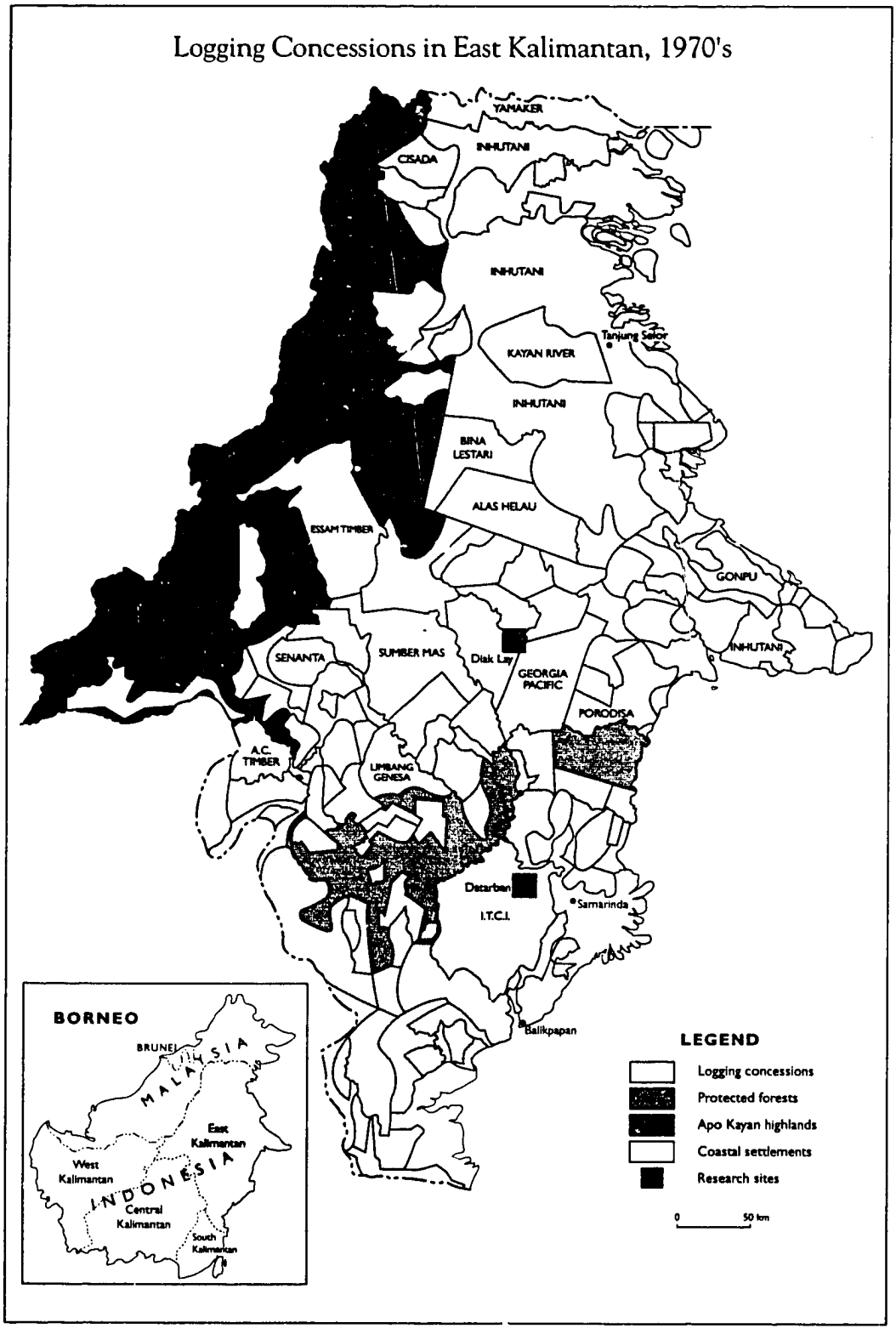
province (9.8 million ha.) was leased to concessionaires in the early 1970s (see Figure 1).[8] In the preparation of the type of forest use map presented in Figure 1, very little information is generally available to document existing community settlements and their ancestral (*adat*) land rights. It is estimated that nationwide only 20 percent of the agricultural land has been titled, while the mapping of community rights to forested areas for hunting, gathering, and rotational agriculture has not yet been initiated. As a result, the forest-use planning agreement (TGHK) process has often been unable to accurately demarcate community boundaries, and traditional rights are not incorporated in these provincial land-use plans. Migrant community needs and claims over land are typically unrepresented, except in government-sponsored transmigration sites. This situation has often generated conflicts between larger commercial users or state-sponsored development projects and local communities, as illustrated in the following case studies.

After twenty years of forest utilization in East Kalimantan, most of the leased-out area has already experienced an initial round of selective felling. In those areas where concessionaires adhered to regulations which limit them to only a few of the largest diameter trees in each hectare, forest ecosystems have suffered less damage. Nonetheless, depending on the extraction practices utilized, up to 40 percent of the standing stock may be damaged during timber operations.[9] Many concessionaires have had inadequate capital to carry out logging operations according to guidelines. Instead, they have subcontracted to small operators who fail to follow the regulations. Other contractors, who have the resources to harvest less destructively, have no incentives to follow regulations. In some cases, the Ministry of Forestry has begun to withdraw logging rights (Hak Pengusaha Hutan—HPH) from concessionaires who have violated agency felling and extraction procedures. Furthermore, concessionaires have difficulties protecting their thirty-year lease areas from subsequent illegal cutting, which often takes place once a road is built for the initial felling.

Project Strategy

The purpose of the research in East Kalimantan is to examine patterns of forest disturbance, community forest use and protection, and natural regeneration. Two contrasting research sites were selected. The first represents migrant communities within a few hours of the Samarinda-Balikpapan highway. The site is surrounded by a number of development projects and a large logging operation.

Figure 1

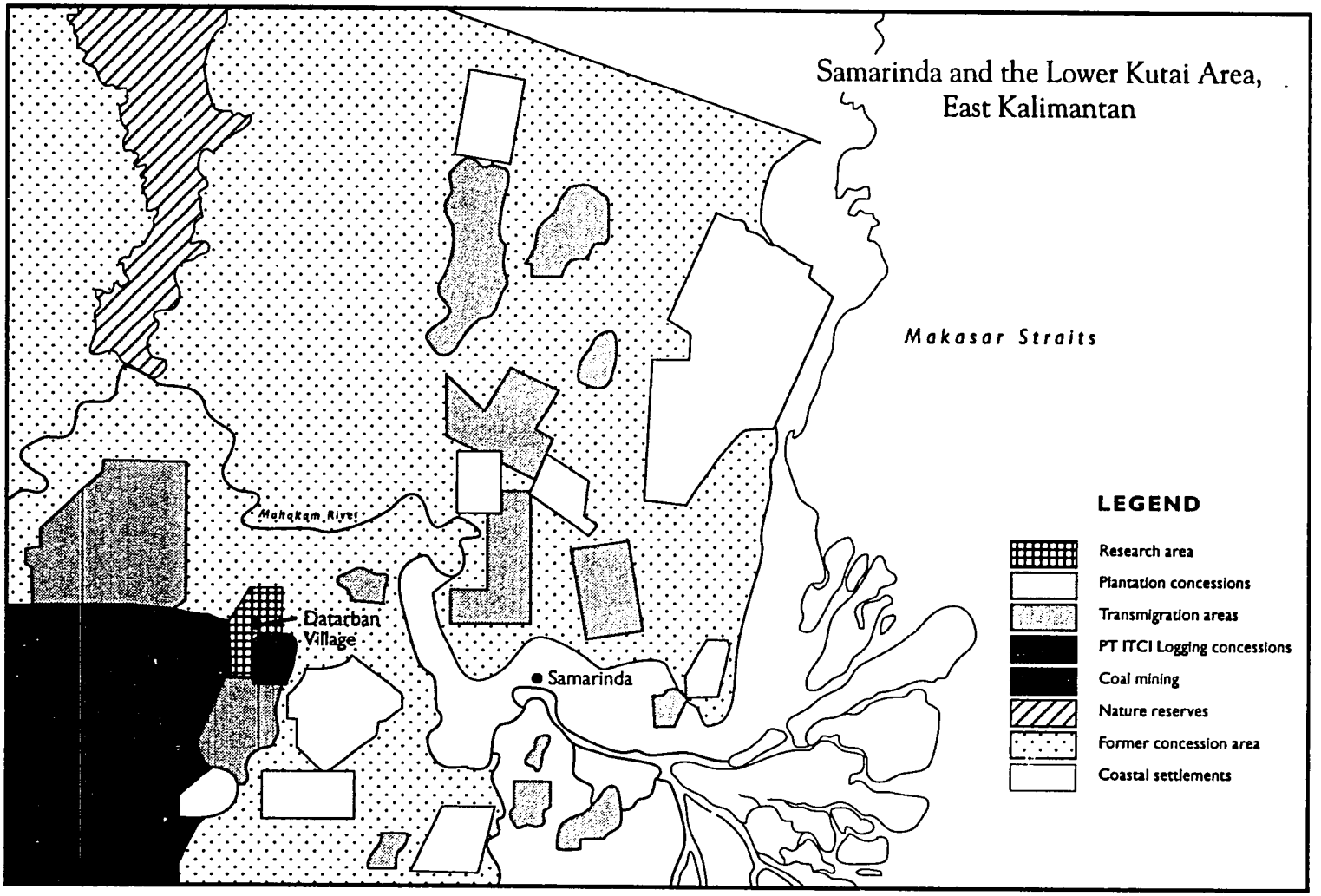


Source: Kalimantan Timur, 1:750:000 (Hamburg: TAD, 1981).

The first site was chosen to investigate land-use changes in highly pressured forest areas. The village of Datarban is situated adjacent to the P.T. ITCI logging concession. Datarban and the ITCI concession are located northwest of Balikpapan and the provincial capital of Samarinda in a zone with growing population pressures and expanding market access. The entire Lower Kutai area, in which Datarban lies and which encompasses the Mahakam River delta, was leased to concessionaires in the early 1970s. The area has undergone extensive felling. In the 1980s, many of the logged-over concession lands were reclassified for use as estate crop plantations, transmigration sites, and coal mines (see Figure 2). Families residing in Datarban sense that they are increasingly squeezed between these competing, often conflicting land-use activities.

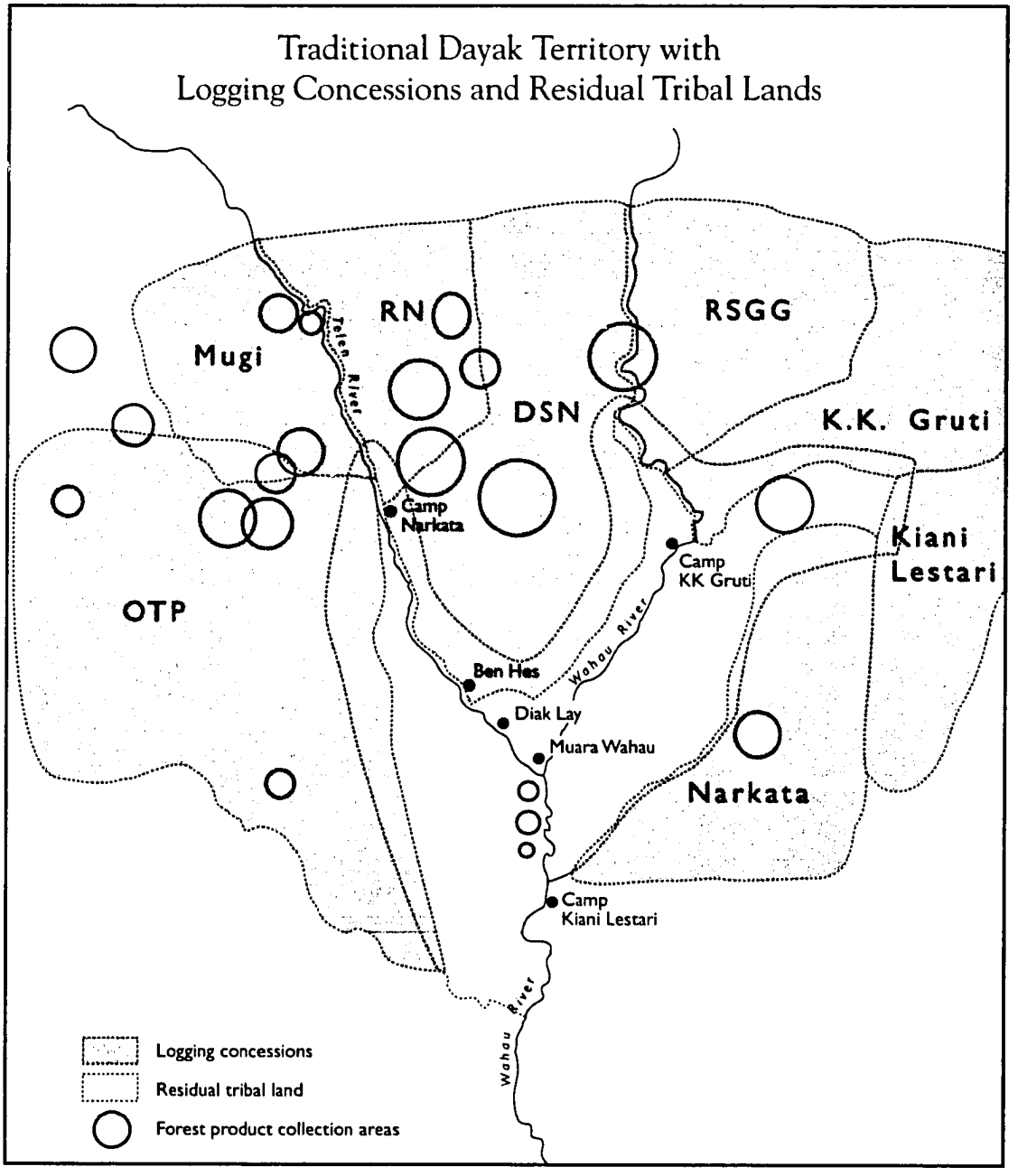
The second research site is the traditional community of Diak Lay, located to the north of Samarinda, approximately four hundred kilometers up the Mahakam River. Communities of Wehea Dayaks settled in the area over the past several hundred years. The lives of these communities had changed little until the last twenty years, when eight logging concessions initiated operations around their traditional lands (see Figure 3). Georgia Pacific entered the area in 1970 and was followed by seven other concessionaires. Since negotiations have never been held among the Indonesian government, the concessionaires, and the local communities, conflicts over resource rights continue to be a major problem. This case attempts to examine how traditional forest use systems differ from commercial timber operations and, given the often competing needs and rights of local communities and concessionaires, how forest resources might be better managed in the future.

Figure 2



Source: Lahjie (1992): 49.

Figure 3

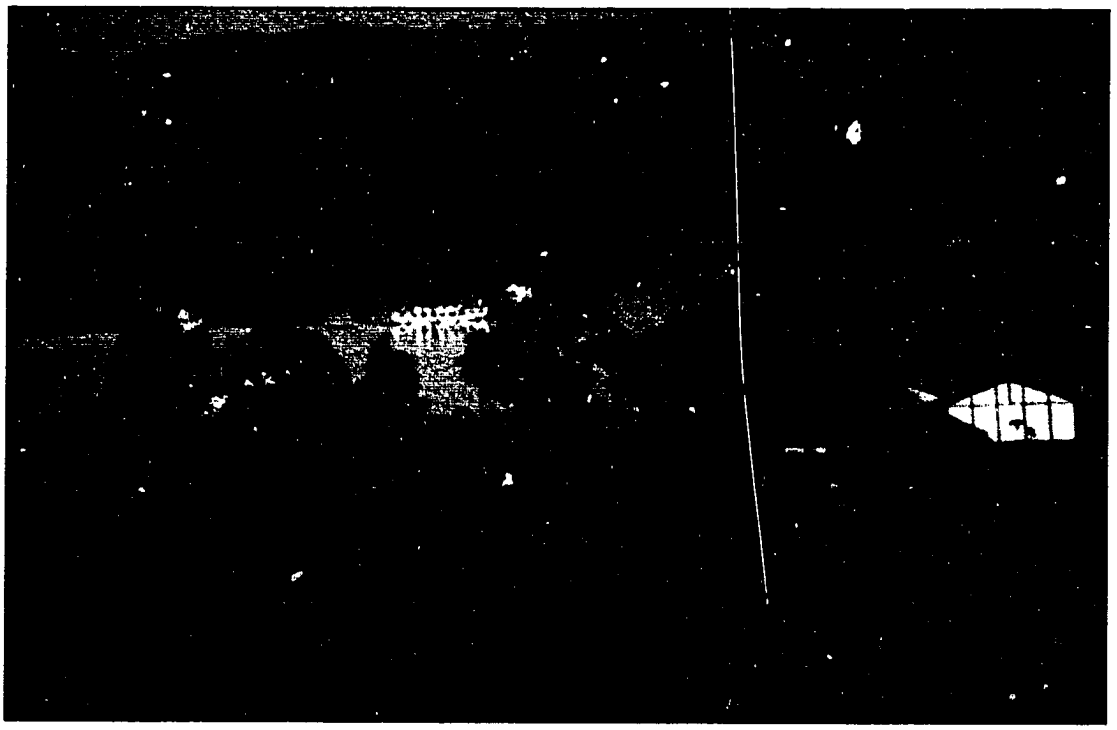


DATARBAN'S CHANGING LANDSCAPE: *IMPERATA* AND OUT-MIGRATION

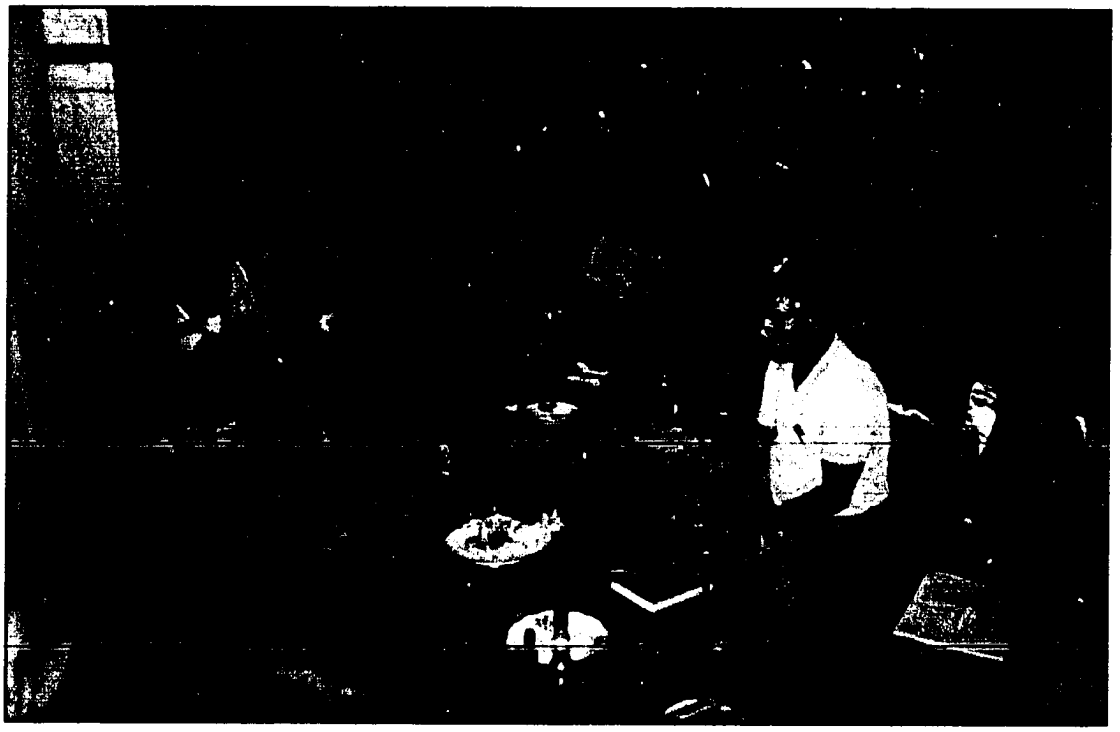
Datarban is located approximately forty kilometers west of Samarinda. Ten to twenty kilometers to the north and east of the village, the muddy brown Mahakam River snakes through the once dense primary forests that covered the region. In the 1980s, this landscape was rapidly transformed as forests were cleared for logging, mining, plantation crops, and small farm holdings. A series of forest fires further reduced large areas of the forest ecosystem into scrub. Between 1982 and 1992, the expanding village of Datarban that had comprised eighty-two households at the beginning of the decade declined to thirty-two families. The community's stream has been contaminated by acid tailings from coal mining operations. Large commercial enterprises and government programs have claimed so much land that a sufficient area is no longer available for long-term rotational swidden agriculture. The low-fertility, overworked soils are increasingly invaded by *alang alang* grass (*Imperata cylindrica*), an indicator of declining fertility. This process of resource degradation appears common in areas of East Kalimantan where roads are being built and commercial development, combined with migrant pressures, is growing. Initial research indicates that these land-use systems are not only unsustainable, but also are leading to the rapid impoverishment of the area's natural and community resources, undermining biodiversity, human support potential, and economic benefit flows. This case examines the forces and patterns driving this process in an effort to derive alternative management systems that better respond to the social, economic, and environmental needs of local communities and the nation.

History of the Region

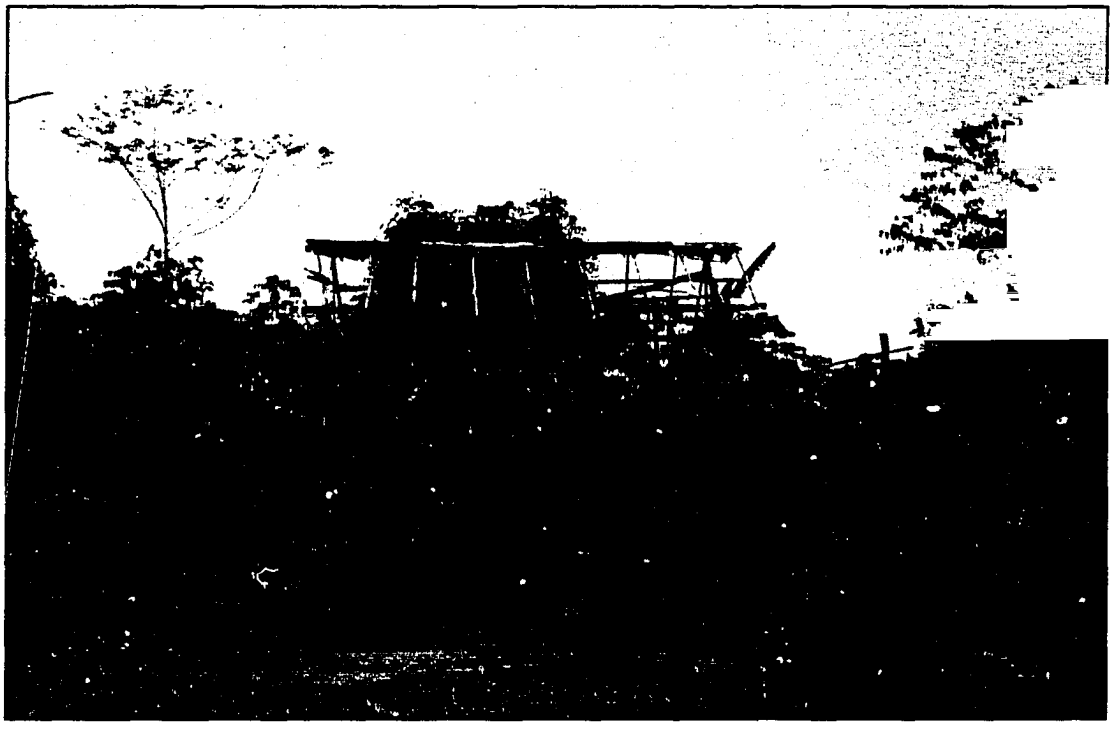
Prior to the 1950s, most of the land east of the Mahakam River and the ancient Kutai capital of Tenggarong was covered with primary forest. A coastal, Malay-speaking group that settled in the Mahakam River delta hundreds of years ago, the Kutai people hunted and collected non-timber forest products, including rattan, *gahru*, birds' nests, honey, and resins to the west and south of the river for centuries. Local



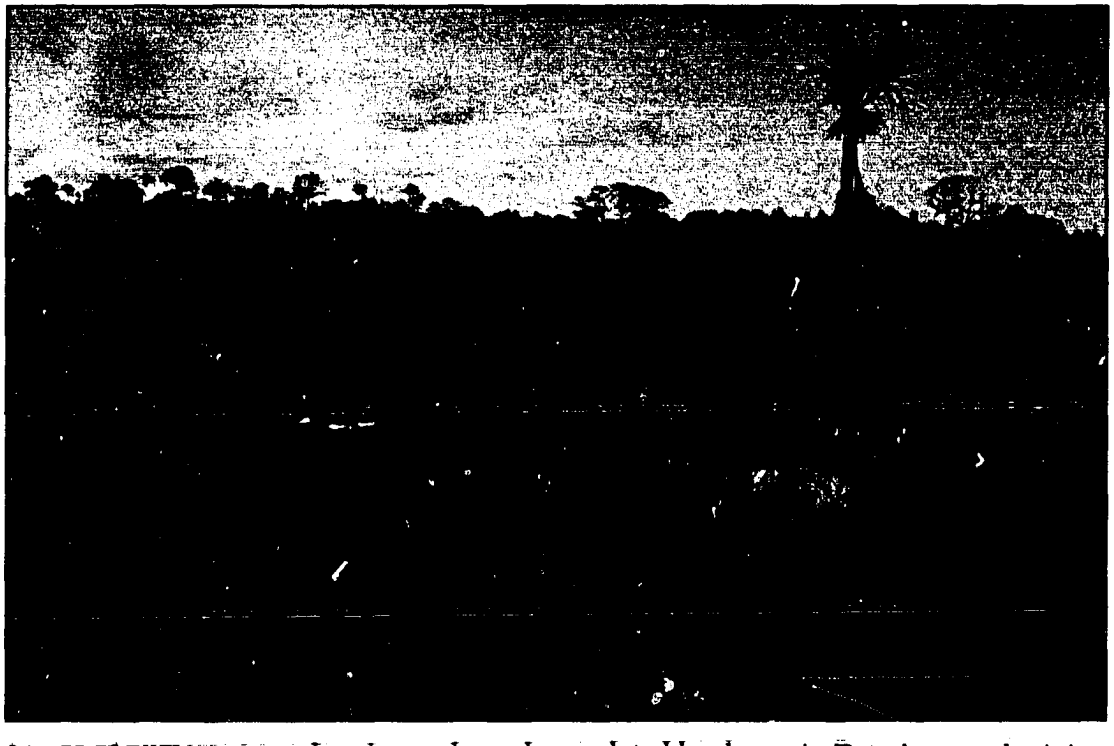
Sited along the lower Mahakam River, Tenggarong was the ancestral home of Kutai kings, whose descendants migrated to Datarban—a population flow pattern which is now reversing.



Village headman and other concerned residents of Datarban discuss with Network researchers their economic dependencies on the remaining forests and ideas for community forest protection and management.



Responding to growing land-use pressures and resource degradation, two-thirds of the population of Datarban has migrated out of the area over recent years.



As one of numerous overlapping and poorly regulated land uses in Datarban, coal mining has caused both forest degradation and contamination of the local water resource.

Kutai communities were largely located along the river, where they practiced a rotational system of swamp rice cultivation and maintained tree gardens (*kebun*). By the 1950s, growing population pressures spurred Kutai farmers to move into the interior forest and open swidden (*ladang*) fields 10–20 kilometers from the river.

The process of land conversion was next accelerated at the outset of the manual logging boom, when a system called *banjir kap* was initiated by provincial entrepreneurs. Due to the growing international market for tropical hardwood timber, local operators began organizing Kutai and Dayak chainsaw workers to log trees 1-2 kilometers from the Mahakam's banks. Since no roads or heavy equipment were available, channels were dug to float the logs down to the river or to tributaries large enough to carry them. Water buffalo were often used to haul the logs to the channels. The *banjir kap* extraction system was brief and intense, practiced widely from only 1968 to 1971. In late 1971, the central government placed a ban on manual logging due both to objections from Japanese buyers over hand-cut logs and a desire to shift concession allocations from the provinces to Jakarta.[10]

In the early 1970s, the Indonesian government began leasing larger tracts of forest land to highly capitalized national or multinational timber operations. One of the first major timber companies to establish itself in the Samarinda-Balikpapan area was Weyerhauser in 1969. Later acquired by an Indonesian consortium and renamed P.T. ITCI, the 600,000-hectare concession is considered by the Ministry of Forestry to be one of the best managed in Indonesia. This is because the company has generally followed the logging guidelines issued by the government.

In 1974 Weyerhauser set up a base camp at Senoni in the Datarban study area and began building a network of truck roads through which timber could be removed. Simultaneously, in 1974 the government built a road connecting Samarinda to Tenggarong, linking the river cities with the interior forest areas. Weyerhauser selectively felled the Senoni area between 1978 and 1984, leaving behind a fairly extensive network of compacted dirt roads. Following these conduits to the interior, families of Benuaq Dayaks from Kecamatan Damai began settling in Datarban in 1983, joining the Kutai families that had arrived some years earlier. The Dayaks reportedly left Damai, 140 kilometers to the west up the Mahakam, to gain better access to markets where they could sell vegetables, fruits, and forest products. The need for cash was stimulated by a desire to educate their children, who had to

travel downriver to Tenggarong or Samarinda to attend school above the primary level.

Pak Abraham, a Dayak elder and traditional chief (*ketua suku*) of the community in Datarban, explained that he had come to the Tenggarong area in 1978 to identify suitable land for families from Damai. He had originally opened swidden plots in Timbau near the river, but in 1982, he was evicted by a large cocoa and rubber plantation (Hasfarm) that was being established on a 15,000-hectare tract by a local entrepreneur. After moving to Datarban, Pak Abraham began opening swidden fields, hunting and gathering forest products on P.T. ITCI's logged-over concession lands. Further competition for land occurred in 1982 with the establishment of several government-sponsored transmigration sites for Javanese families and with the allocation of 47,000 hectares of forest land to a coal mining company in 1986. Thus far, while the strip mining company has exploited only 3,000 hectares, the detrimental impacts on the land and water resources are fully evident.

Forest fires have also played an important role in shaping the landscape of Senoni. In addition to the devastating East Kalimantan fire of 1982–83, fires erupted again in 1990 and 1991. Frequently they burn through the rainy season in subterranean coal seams, breaking the ground surface as the dry season progresses. Fires are also initiated when swidden fields are burned after clearing, some escaping from the plots into neighboring forests. The ecological damage caused by forest fires is often extensive in areas which have been logged due to additional dry slash on the forest floor which fuels a hotter, more destructive fire.[11] In such cases, the mortality rate among larger canopy trees is high.

In addition to fire, the sequence of logging followed by government and private-sector conversion of secondary forest for settlements, plantations, and mining has radically altered the landscape around Datarban and greatly reduced its forest cover. In the process, the transformation has undermined the tenure security of small farmers and frustrated their attempts to practice sustainable, long-term rotational agriculture, especially those Dayak households who used such farming systems in Damai. A timeline of major events in Senoni indicates that in only twenty years, a surge of human-induced activities has overtaxed the land, leaving behind an environment which can no longer support small communities at even modest subsistence levels of production (see Figure 4). The decline in population in Datarban and the growing abundance of scrub wasteland and *Imperata* grass are indicative of the negative changes. While the disappearance of primary forest

Figure 4

TIME LINE OF IMPORTANT EVENTS IN SENONI AREA

1950	First Kutai settlers open land in Datarban
1968–70	*Banjir kap* logging operations
1969	Weyerhauser granted timber concession
1974	Government builds road connecting Samarinda and Tenggarong
1976–84	Weyerhauser fells timber in Senoni area and builds access roads
1978	Benuaq Dayaks move from Damai to Tenggarong area
1982	Major East Kalimantan forest fire
	Transmigration projects established
	Hasfarm cocoa and rubber estate initiated
1983	Dislocated Benuaq Dayaks join Kutai and begin settling in Datarban
1986	Coal mining initiated
1987	Accelerated expansion of *Imperata cylindrica* grasses and scrublands
1989–	Out-migration and settlement abandonment: forty families leave Datarban to move back to Mahakam River
1990–91	Forest fires

is dramatic, the resurgence of secondary forest is encouraging and represents an important economic resource to local communities which requires careful management (see Figure 5).

Farming Systems of Buginese, Javanese, and Banjarese Migrants

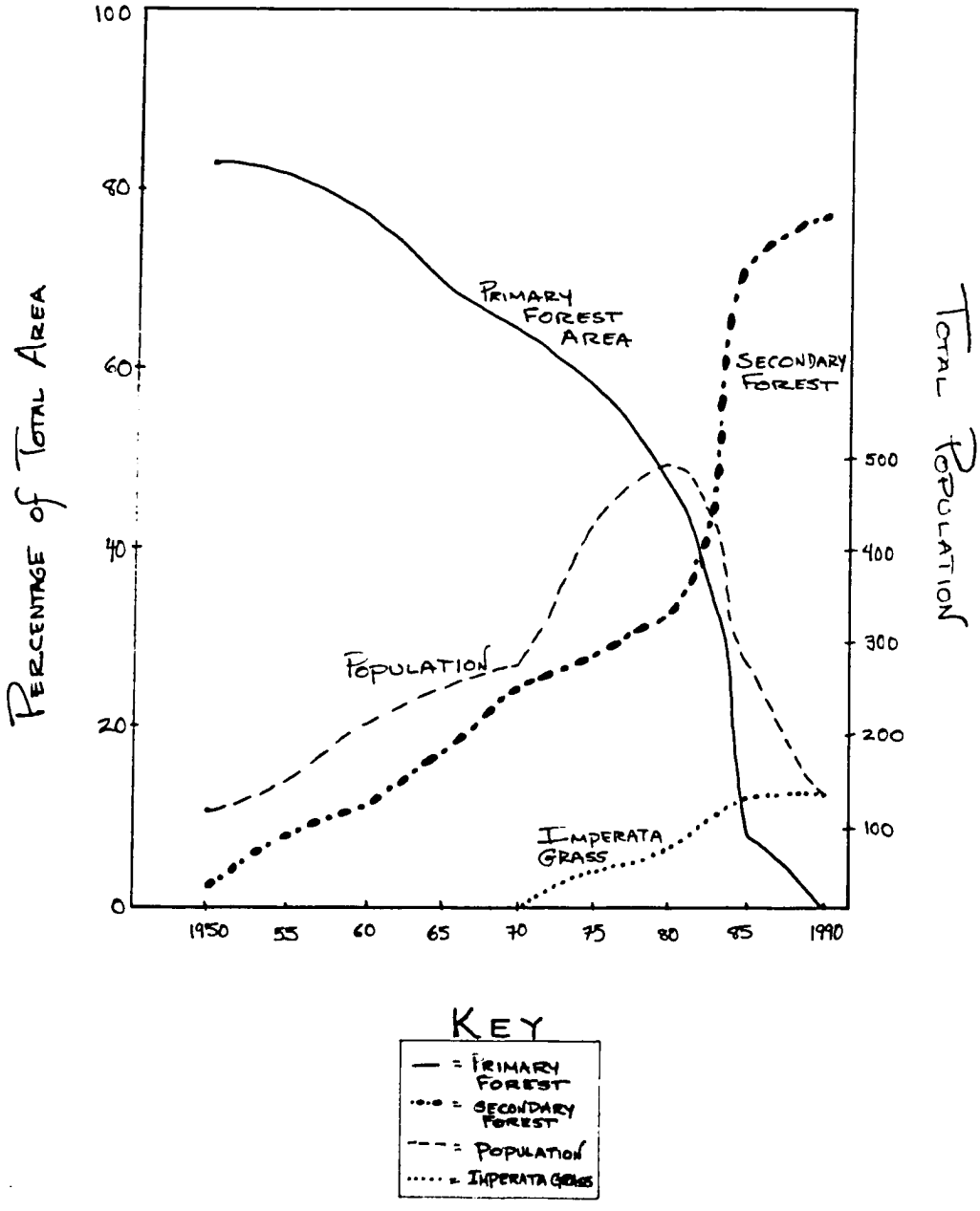
Over the past two decades, many Buginese, Javanese, and Banjarese migrants have been drawn to this frontier region to claim land and experiment with commercial crops. The experiences of Buginese farmers who establish pepper plantations along the Balikpapan-Samarinda highway is well documented.[12] Research has found that these farmers emphasize quick profitability over sustainability. Erosion rates are reportedly high in pepper-growing areas, with annual soil losses ranging from 52 to 139 tons per hectare. Pepper farmers abandon their fields once productivity falls below a certain profit level and move on to clear new forest lands.[13]

Under many migrant farming systems, the nutrient-poor peat soils of the region cannot sustain high levels of productivity. Without adequate fallow periods for the recovery of soil fertility and ground cover, nutrient depletion and soil erosion often follow. When the plots are finally left to fallow after extended periods of cultivation, they frequently lack the root stock, seed material, or fertility to promote rapid secondary forest succession. Instead, hardy, invasive plants like *Imperata cylindrica* dominate, slowing the process of natural regeneration. Frequently, migrants will abandon the area after 3–5 years. The research team estimates that 10–20 percent of the land in Datarban has been colonized by *Imperata*. This "disclimax" successional state essentially eliminates land from the swidden rotation cycle and places further pressure on remaining lands, threatening them with a similar unproductive fate.

In contrast to the commercially oriented Buginese pepper farmers, who practice monoculture and rely on chemical fertilizer and pesticides until the soil fertility declines, Javanese migrants clear the forest to cultivate rainfed rice, often establishing additional perennial mixed fruit gardens. Unlike many migrant farmers, such as the Buginese, who often have a short-term perspective on land use and extraction, indigenous communities such as the Dayak typically practice more sustainable forms of farming. They employ resource-use systems that minimize soil disturbance and facilitate regeneration under a long-term, rotational cycle. The practices of the Benuaq Dayaks who have settled in Datarban offer important lessons about the renewability of forest

Figure 5

CHANGING POPULATION AND LAND COVER IN DATARBAN: 1950–90



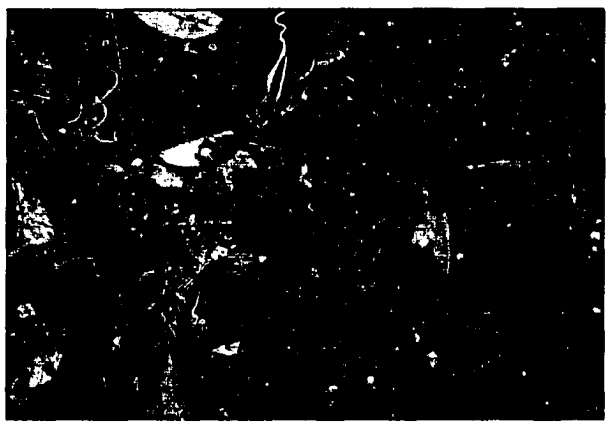
resources and the crucial nexus between forest farming and forest conservation.

Dayak Settlers: Swidden and Forest

Informed by extensive ethnobotanical knowledge, Dayaks possess centuries of farming experience within tropical rainforests. Dayak resource-use systems are exceptionally sophisticated in terms of the information and analytic procedures they employ in making management decisions. They are also democratic and consensual in the processes to decide resource allocation and use regulations. The persistence of Kalimantan's indigenous resource-use practices and their apparent compatibility with the region's dominant rainforest ecosystems indicate that, at least in the past, these swiddening, hunting, and gathering activities were both sustainable and productive, comfortably supporting communities with lively social and economic systems while causing minimal environmental problems.[14]

In Datarban, however, the Damai Dayaks faced an environment exploited by an increasing number of user groups with different objectives. When Pak Abraham and his fellow Benuaq Dayaks moved to Datarban in 1983, most of the land had been selectively logged but was still covered in closed canopy secondary forest. Dayak settlers planned to use the same long-term rotational swidden farming techniques which they had practiced for centuries in Damai. Pak Abraham explains that, depending on site conditions, sustainable forest farming practices require a fallow period of 8–15 years after a single harvest of dry rice. While the timber concession had selectively felled 1–2 large *meranti* (*Shorea spp.*) trees per hectare, most of the area still had dense, regenerating secondary forest. The Dayaks felt that because some of the giant trees had already been removed, it would be easier to clear the forest for their *ladangs*.

Pak Abraham and his clan members draw upon a number of time-tested indicators to assess the ecological suitability of sites for opening new *ladangs*. One indicator of adequate soil fertility and moisture levels involves stabbing the blade of the Dayak machete (*parang*) to a depth of 30 centimeters. Soil deposits on the blade indicate whether conditions are favorable for cultivating a *ladang*. Another suitability test requires cutting a 1.5-meter length from the stem of the wild ginger (*Hedycium coronarium*) and burying it under the humus of the forest floor. If the stem produces shoots within 3–5 days, the moisture and nutrient mi-



From top: Slashed and burned swidden rice plot has potential to regenerate if land is fallowed after cultivation and protected against further disturbances; natural regeneration of dipterocarp seedlings in the forest understory; a swidden rice field years ago, this young, secondary forest in Datarban has reached phase 3 of the Dayak-classified phases of succession.

Clockwise from upper left: Serving as forest guide and key informant to Network researchers, this young Dayak man has developed extensive knowledge about local forest flora and fauna, including species uses, regeneration patterns, and sustainability indicators; Datarban village headman Pak Daniel collects and harvests rattan, a valuable, renewable, non-timber forest product; processing of commercial ironwood shingles from the local *kayu ulin* tree is a cottage industry in Datarban.

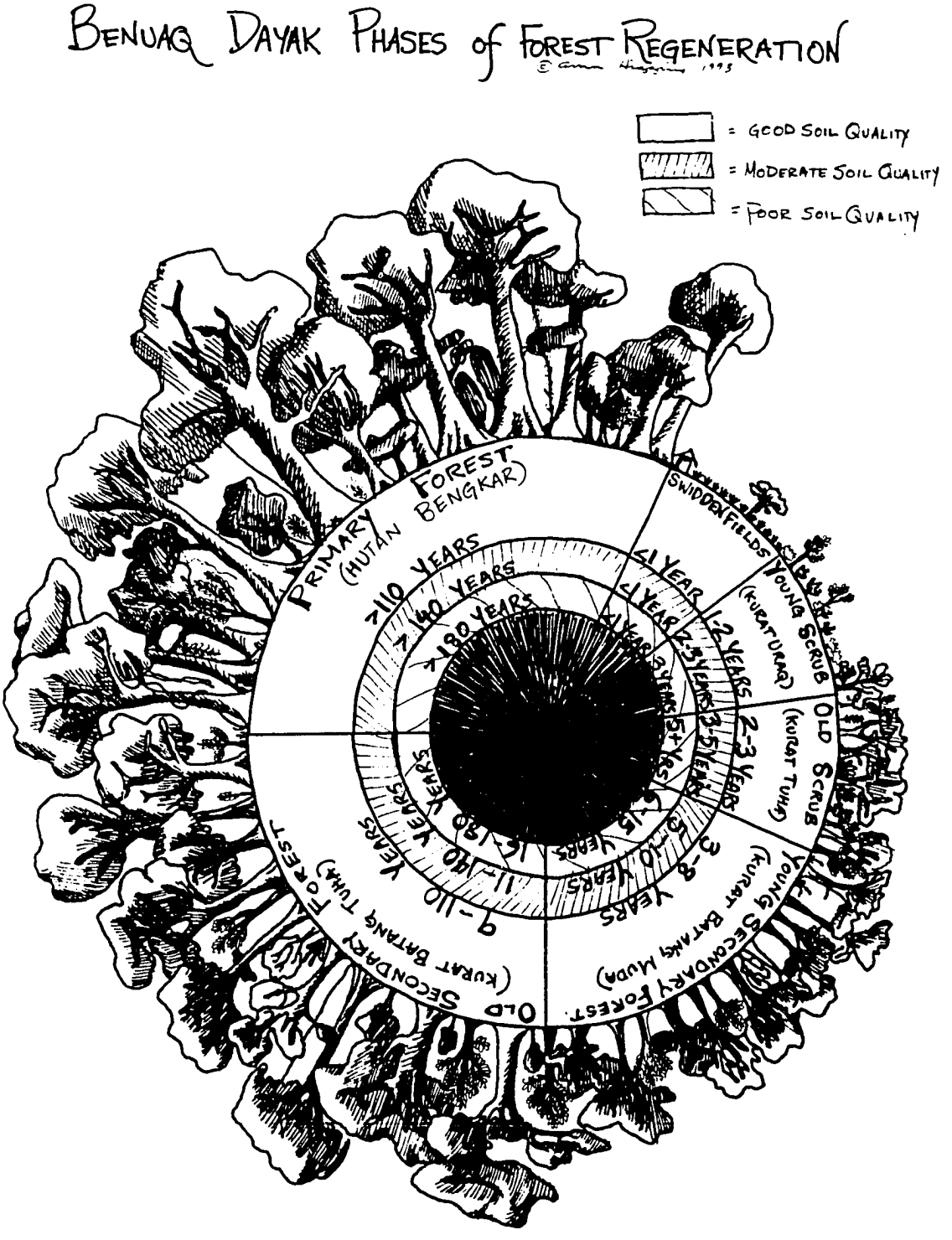
croclimate is conducive to cultivation. Soils with a dark color are also reported to indicate the presence of higher levels of humus and organic material.

Areas with tall, large-diameter trees, especially from the *Dipterocarpaceae* family, signify a long history of leaf litter fall with deep topsoil accumulation and the presence of important trace minerals. Particularly desirable indicator trees include *Dryobalanops aromatica* (*kapur*), *Shorea spp.* (*meranti*), and *Eusideroxylon zwageri* (*kayu ulin*). A forest floor dominated by herbs and wild ginger plants from the *Marantuceae, Musaceae, Arecaceae, Myrtaceae,* and *Zingiberaceae* families also suggests high levels of fertility.

Other considerations in plot selection include proximity to the community, a river or water source, and a road. The community generally reviews information regarding candidate sites for new fields before making a consensual decision. Household members and elders discuss the advantages and disadvantages of each proposed site, including ecological suitability, potential productivity, logistical convenience, and potential conflicts among families and other groups. In Datarban recently this system has broken down as many Dayak families have left the area and there are no longer enough people to organize labor-sharing for clearing fields. Once a *ladang* site has been selected, it is usually cleared by a group of men from the village using *parangs*. Large trees are typically left behind, especially valuable *kapur, putih* (honey tree), and *meranti* species. Slash is gathered into piles and burned to minimize soil damage. Stumps are left to eliminate the need for labor to extract them and to facilitate coppice regeneration. Dayak farmers utilize the swidden plot for only a single crop of rainfed rice, followed by a mixed crop of corn, chilis, and cucumbers. After one rainy and one dry season crop cycle, the plot is left to fallow, although sometimes bananas or a few other fruit trees may be planted to mark ownership.

The time required for a forest to regenerate depends on soil fertility and microclimatic conditions in the area, as well as the effects and extent of disturbances experienced earlier during the cropping period and the recovery. The successive phases of regeneration from swidden field to primary forest, as defined by Benuaq Dayaks of Datarban, may take from one to two hundred years (see Figure 6). Regrowth is influenced by such factors as soil conditions, moisture levels, rainfall, temperature, slope, and aspect. Where soils are poor due to leaching, erosion, compaction, or other problems, each phase of regeneration

Figure 6



requires a longer period. Benuaq people divide forest regeneration into five phases: young scrub, old scrub, young secondary forest, old secondary forest, and primary forest. The appearance of dense young scrub growth (*kurat uraq*) usually occurs during the first 1–3 years after field abandonment, depending primarily on soil quality. Light-demanding grasses, perennial shrubs, herbs, and pioneering tree species dominate during this phase, generally reaching heights of 3–4 meters, while canopy closure is usually under 20 percent. Second-phase old scrub conditions (*kurat tuha*) occur 2–5 years after fields are fallowed. Emergent sapling trees average 5 centimeters in diameter at breast height. Lianas, dense shrubs, and herb undergrowth are common, attaining heights of 5–6 meters.

In the third phase of regeneration, young secondary forest (*kurat batang muda*) succeeds into medium-size pioneering tree saplings of 10–15 centimeters in diameter. This process normally occurs 3–10 years after fallowing, but where soil conditions are poor—due to fires, exceptional erosion, or otherwise depauperate nutrient status—the third phase may not be reached for 15 years. As the upper canopy closes to over 50 percent cover, reducing the light below, the grass and herb layers thin out.

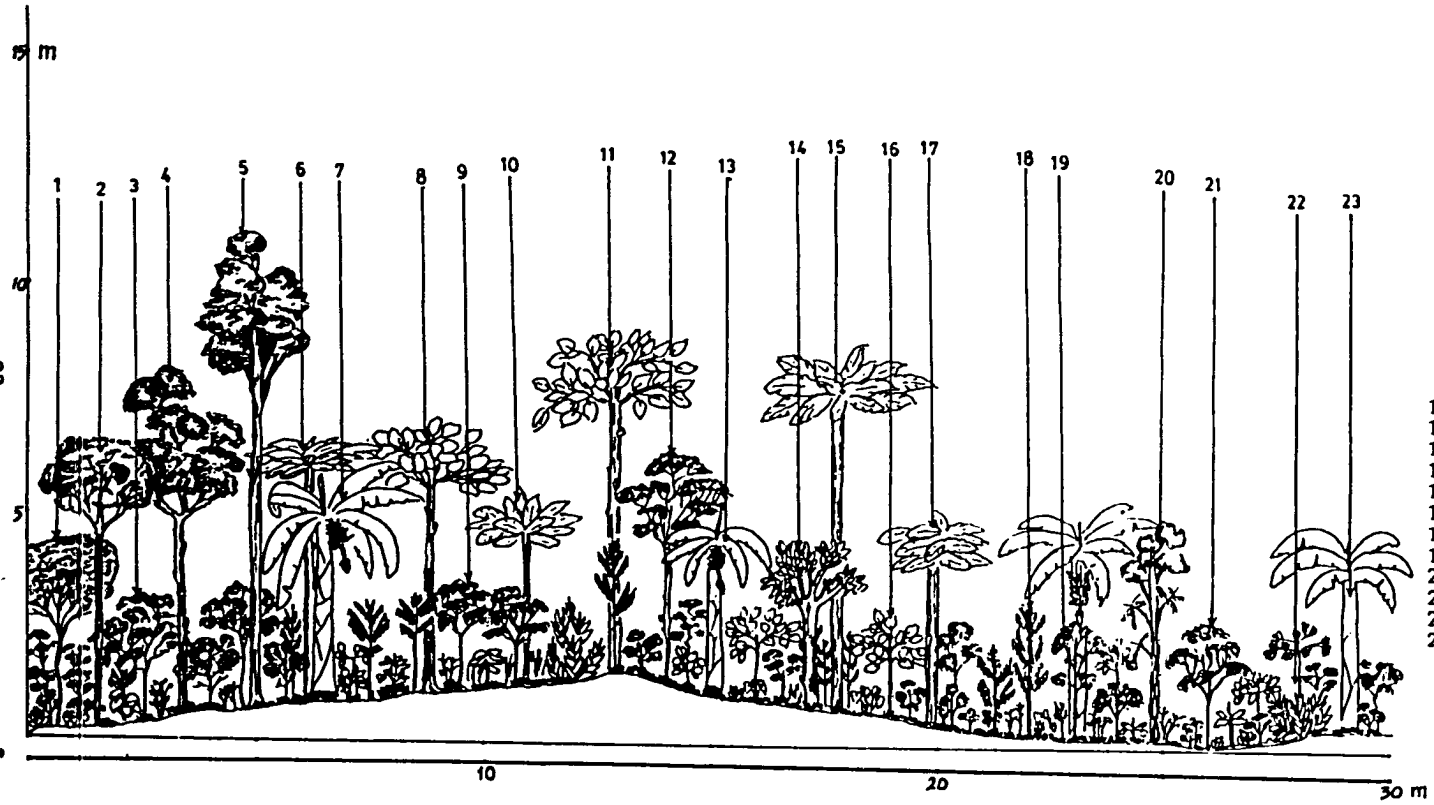
The fourth successional phase, old secondary forest (*kurat batang tuha*), is characterized by significant canopy closure (over 80 percent) and a higher proportion of larger trees over 10 centimeters in diameter. Under good to moderate soil conditions, abandoned swidden plots will begin to regenerate old secondary growth after 9–15 years and will continue to be classified as such for one hundred years or more until the forest may once again be considered primary (*hutan bengkar*) (see Figures 7 and 8). Dayaks consider the old swidden plot to have reached the fourth stage when the more valuable hardwood species (*meranti, kayu ulin, putih,* and *kapur*) begin displacing the fast-growing pioneering species. The Benuaq Dayaks prefer to wait until the swidden plots reach this fourth successional phase before they open them again. In Damai, Pak Abraham reports that Dayaks prefer to return to previous swidden sites in regenerated secondary forest rather than opening primary forest for their *ladangs*.

The above classification system reflects the Benuaq Dayak understanding of forest succession and how the ecosystem can still be utilized and manipulated sustainably to maximize agricultural and forest products. As forest succession proceeds, the forest is perceived to gain broader species diversity, higher levels of forest litter, greater canopy

Figure 7

TRANSECTS OF REGENERATING FOREST PHASES:
DOMINANT SPECIES COMPOSITION OF SAMPLE PLOTS IN DATARBAN AREA

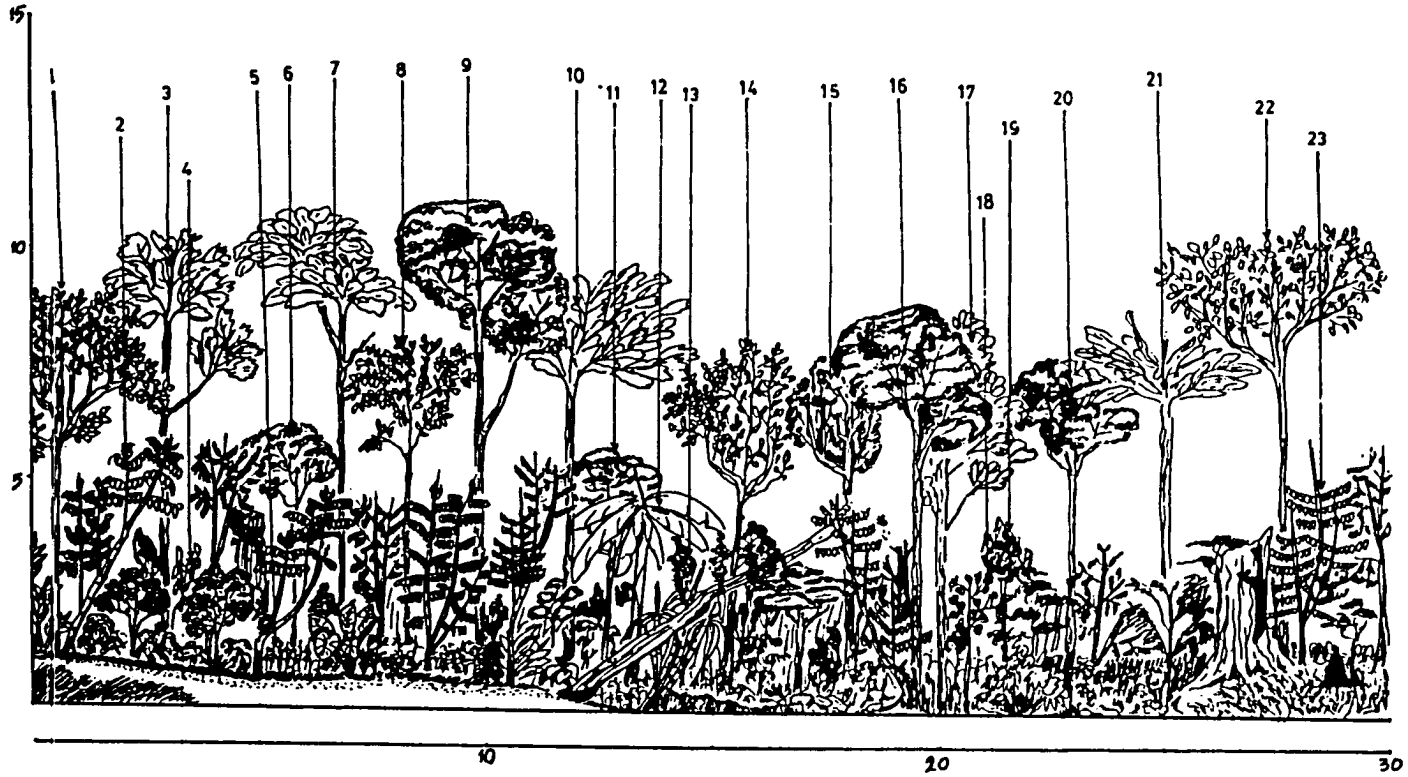
Phase 1 Regeneration: Young Scrub



1. *Vernonia arborea*
2. *Vernonia arborea*
3. *Geunsia pentandra*
4. *Hydnocarpus sp.*
5. *Hydnocarpus sp.*
6. *Dillenia excimia*
7. *Musa sp.*
8. *Macaranga gigantea*
9. *Melastoma malabathricum*
10. *Dillenia excimia*
11. *Macaranga gigantea*
12. *Melastoma malabathricum*
15. *Dillenia excimia*
16. *Ficus geocarpa*
17. *Dillenia excimia*
18. *Piper aduncum*
19. *Geunsia pentandra*
20. *Malotus afimis*
21. *Trema orientalis*
22. *Melastoma malabathricum*
23. *Musa sp.*

Figure 7 *(cont.)*

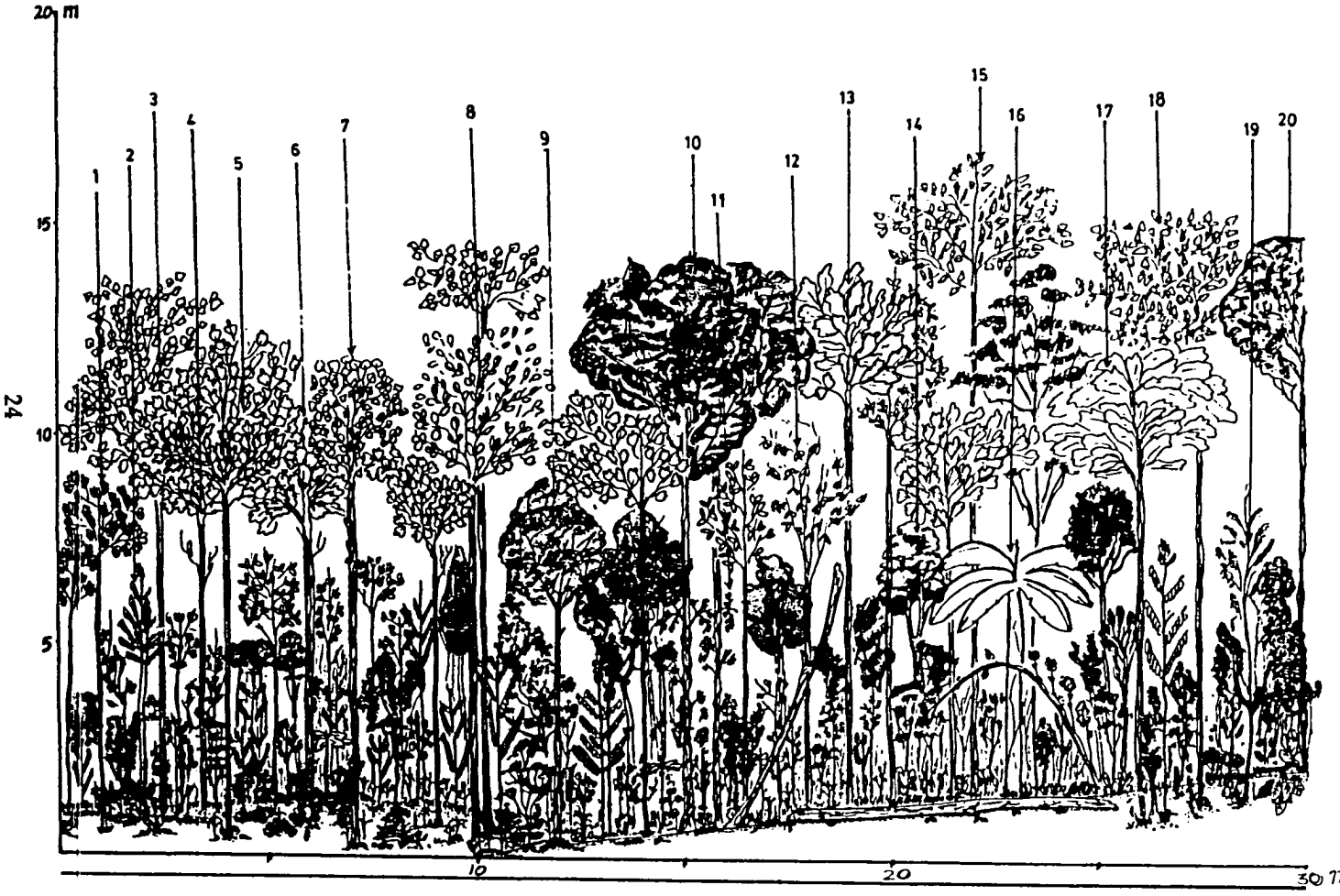
Phase 2 Regeneration: Old Scrub



1. *Pterospermum niveum*
2. *Piper aduncum*
3. *Macaranga gigantea*
4. *Geunsia pentandra*
5. *Imperata cylindrica*
6. *Eugenia sp.*
7. *Dillenia excelsa*
8. *Malotus paniculatus*
9. *Hydnocarpus sp.*
10. *Macaranga gigantea*
11. *Ficus geocarpa*
12. *Musa sp.*
13. *Sacharrum oficinarum*
14. *Ficus heteropoda*
15. *Malotus paniculatus*
16. *Hydnocarpus sp.*
17. *Hydnocarpus sp.*
18. *Sterculia macrophylla*
19. *M. hypoleuca*
20. *Malotus paniculatus*
21. *Dillenia excelsa*
22. *Malotus paniculatus*
23. *Piper aduncum*

Figure 7 *(cont.)*

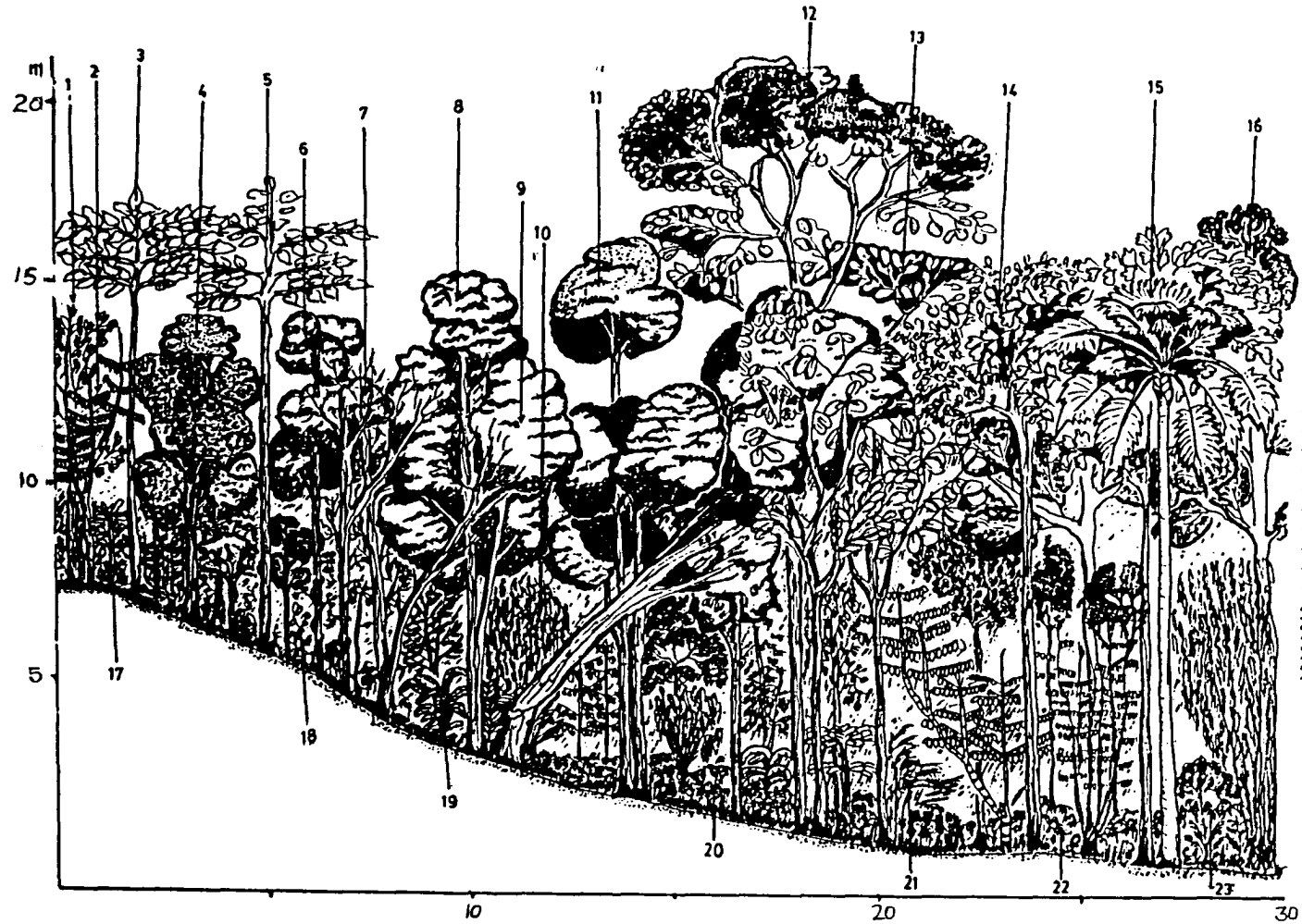
Phase 3 Regeneration: Young Secondary Forest



1. *Melannorhoea walichii*
2. *Piper aduncum*
3. *Trema orientalis*
4. *Macaranga gigantea*
5. *Macaranga triloba*
6. *Macaranga gigantea*
7. *Trema orientalis*
8. *Sterculia macrophylla*
9. *Sindora leiocarpa*
10. *Shorea sp.*
11. *Calamus nematospadix*
12. *Shorea sp.*
13. *Macaranga gigantea*
14. *Shorea sp.*
15. *Trema orientalis*
16. *Musa sp.*
17. *Dacryodes rostrata*
18. *Sterculia macrophylla*
19. *Doemonorops fissa*
20. *Ficus heteropoda*

Figure 7 *(cont.)*

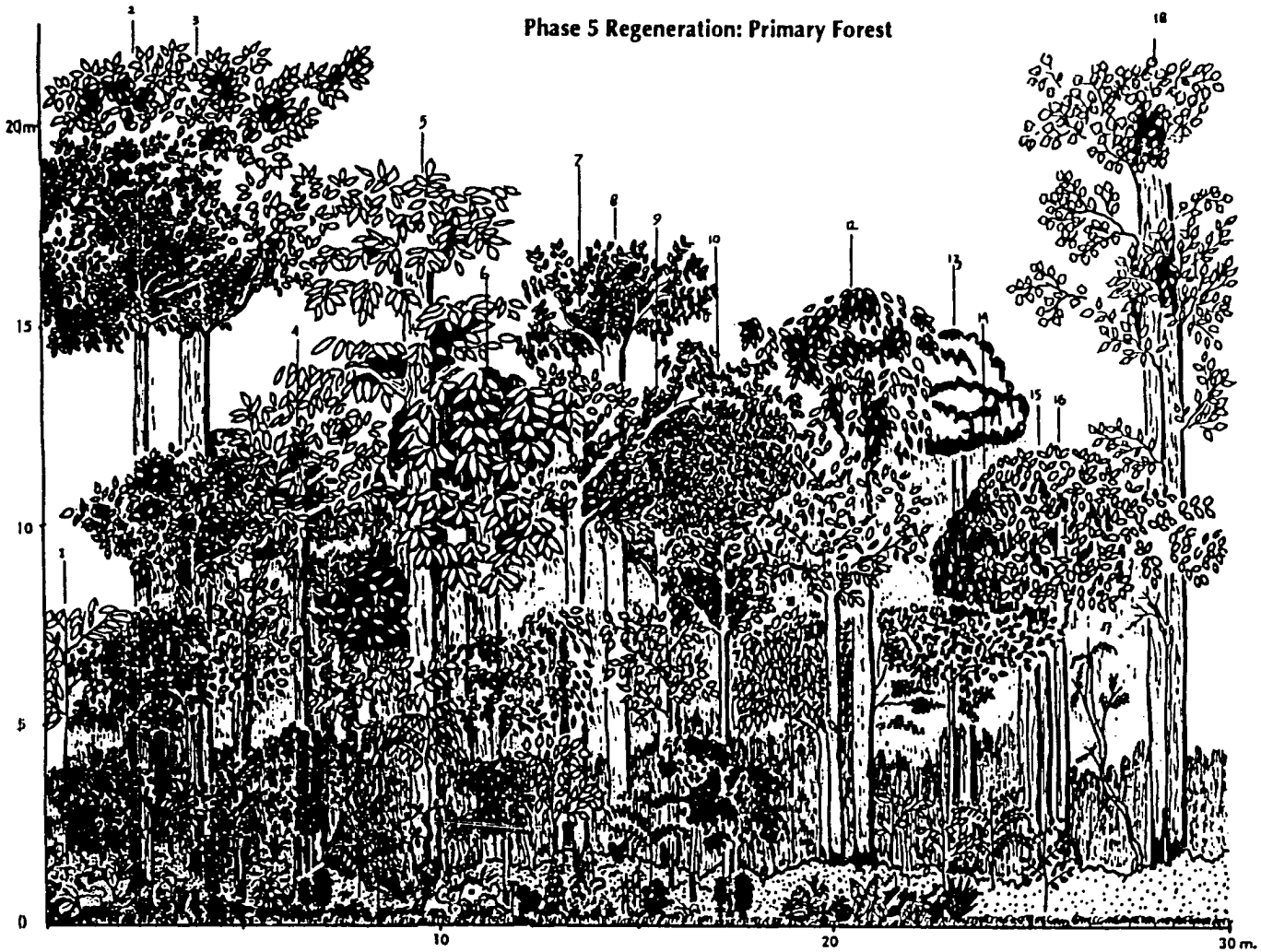
Phase 4 Regeneration: Old Secondary Forest



1. *Melannorhoea walichii*
2. *Piper aduncum*
3. *Macaranga gigantea*
4. *Hydnocarpus sp.*
5. *Macaranga gigantea*
6. *Ficus sp.*
7. *Polyalthia curtisii*
8. *Litsea sp.*
9. *Macaranga gigantea*
10. *Ficus geocarpa*
11. *Trema orientalis*
12. *Anthocephalus cadamba*
13. *Melannorhoea walicchi*
14. *Macaranga triloba*
15. *Borassodendron borneensis*
16. *Ficus heteropoda*
17. *Eugenia sp.*
18. *Geunsia pentandra*
19. *Musa sp.*
20. *Eleidoxa conferta*
21. *Hedycium sp.*
22. *Calathea sp.*
23. *Leea indica*

Figure 7 *(cont.)*

Phase 5 Regeneration: Primary Forest



1. *Mangifera sp.*
2. *Diospyros sp.*
3. *Eusi deroxylon zwageri*
4. *Scorodocarpus borneensis*
5. *Shorea bracteolata*
6. *Aquilaria malaiensis*
7. *Polyalthia curtisii*
8. *Pteleocarpus lampongus*
9. *Eugenia sp.*
10. *Sterculia sp.*
11. *Glachidion sp.*
12. *Polyalthia curtisii*
13. *Pteleocarpus lampongus*
14. *Dryobalanops lanceolata*
15. *Eugenia conglomerata*
16. *Memecylon sp.*
17. *Korthalsia robusta*
18. *Pentaxe laxiflora*

Figure 8

DAYAK PHASES OF FOREST REGENERATION: RELATIONSHIPS TO LIGHT INTENSITY AND VEGETATIVE COMPOSITION

Regeneration Phase	Dayak Classification of Regeneration	Average Light Intensity (≥1 meter above ground) (*Percent*)	Vegetative Cover (≥1 meter) (*Percent*)	Vegetative Composition (30 m. × 30 m. plots) (*Frequency in percent*)				
				Grass (Includes *Imperata*)	Seedlings (<1 meter height)	Saplings (<1.5 meter height; <5 cm. DBH)	Poles (5–10 cm. DBH)	Trees
1	Young scrub (0–3 years)	>80%	20%	3.4%	2.5%	11.7%	2.2%	0.2%
2	Old scrub (2–4 years)	70	30	2.4	5.5	15	5.9	1.2
3	Young secondary forest (3–15 years)	45	55	0.0	17.6	20.9	10.5	6.1
4	Old secondary forest (7–180 years)	20	80	0.0	21.6	20.8	17.6	20
5	Primary forest (110–180+ years)	<10	90	0.0	27	14.4	18	30.6

Source: Lahjie 1992.

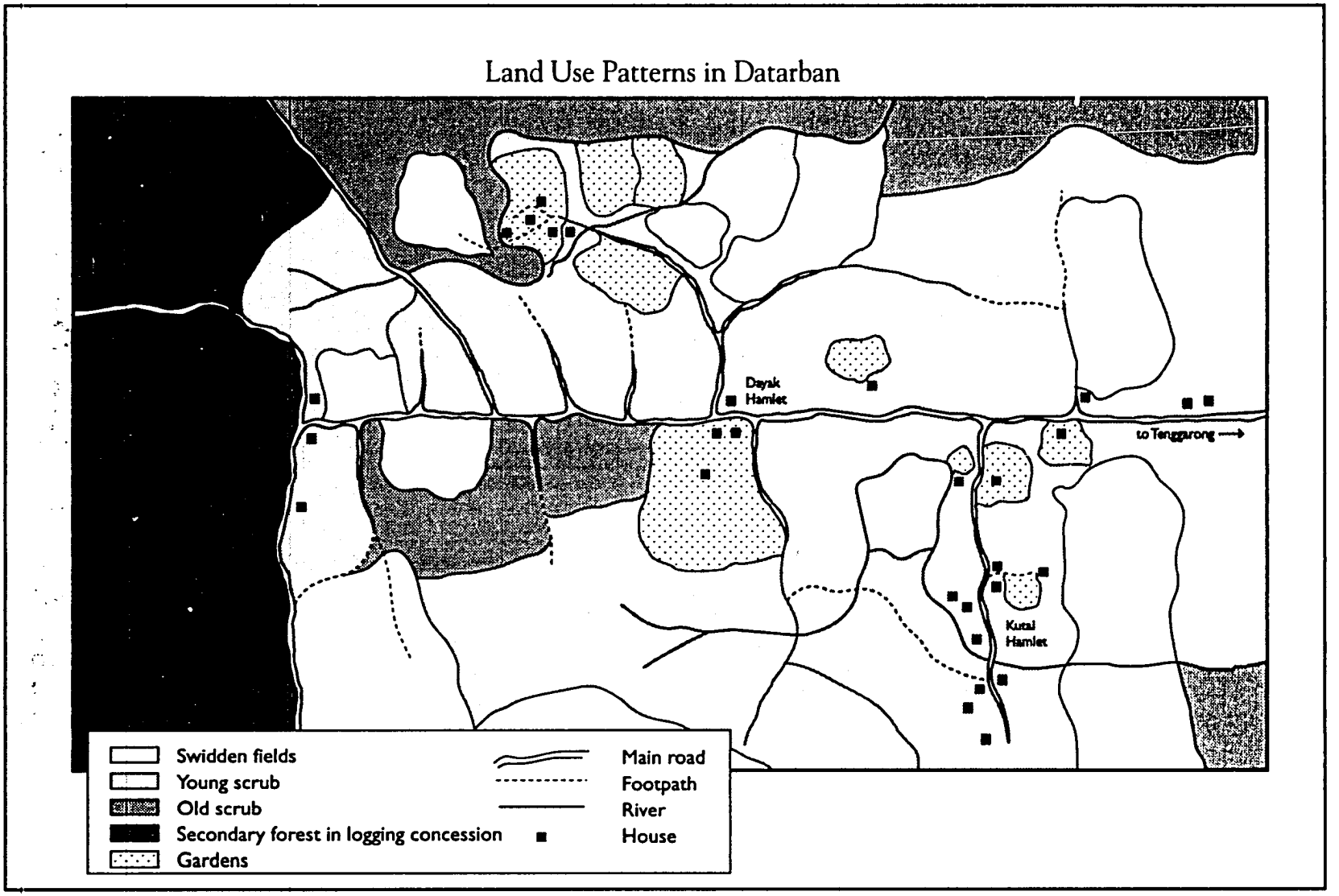
closure, increasing humidity, higher rates of nutrient cycling and decomposition, lower soil erosion rates, and generally larger flows of non-timber forest products. These positive changes, combined with recovery of soil fertility and moisture levels, make forest regeneration a highly promoted and valued process among Dayak people.

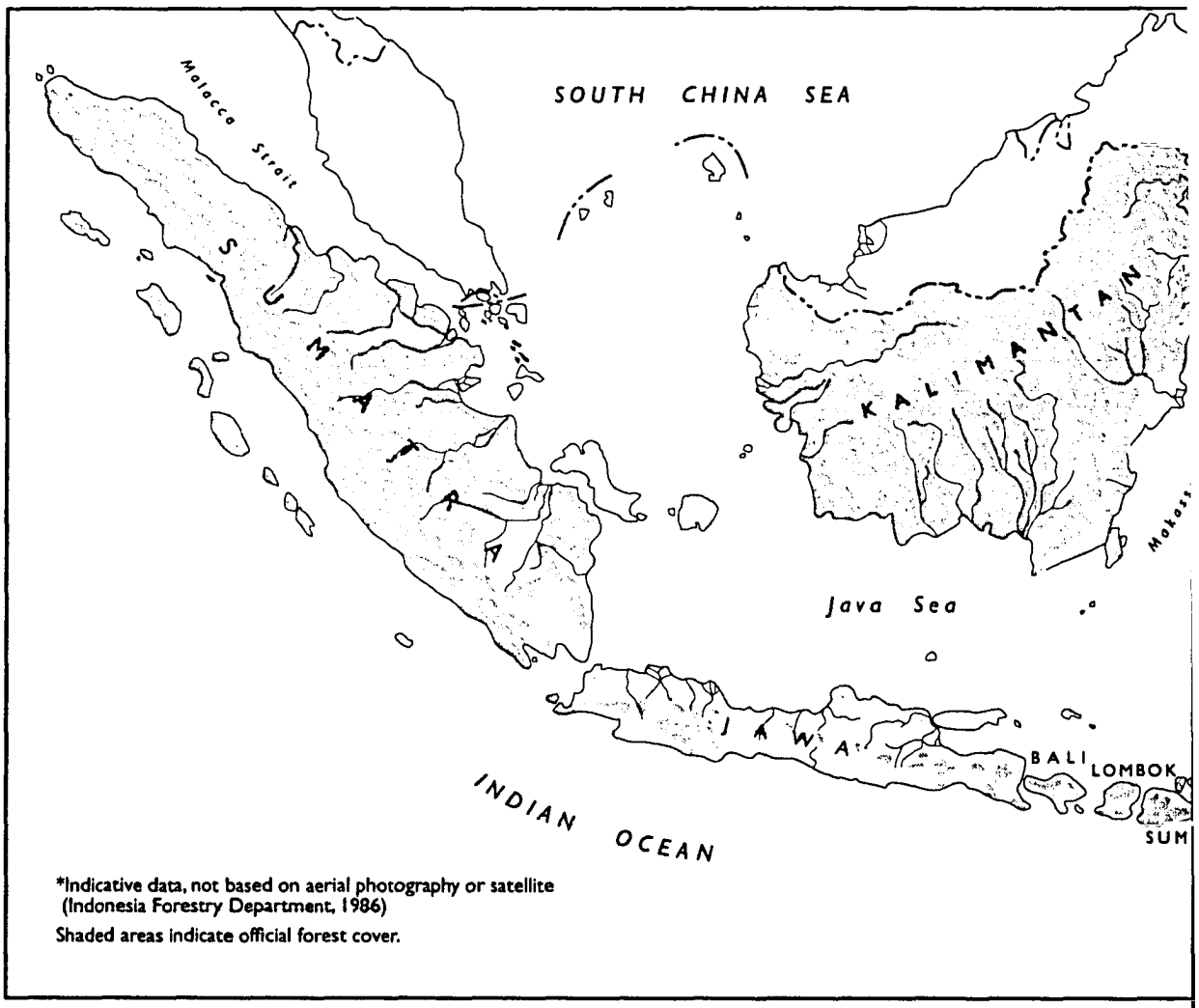
In Datarban, due to the growing land-use pressures and competition from non-Dayak migrants, the amount of secondary forest is no longer sufficient to practice long-term rotation. It is apparent that much of the land near Datarban is under young or old scrub (phases 1 and 2), while a large part of the secondary forest (phases 3 and 4) lies within the ITCI logging concession and is not officially available for use (see Figure 9). Shrinkage of the land estate for rotational swidden has forced many farmers to shorten their rotation, opening phase 2 land which has not yet regained its fertility. Land of this type is particularly susceptible to invasion by *Imperata* grass and other pioneering weeds. Frequent fires in fallowed swiddens also slow or arrest secondary forest regeneration by suppressing the development of the multi-tiered structure and encouraging weed and grass establishment.

Compromise of the traditional Dayak fallow system is evident in Pak Abraham's personal site selection. He opened his first forest field around Datarban in 1983. Between 1983 and 1988, Pak Abraham continued to open between 1.5 and 5 hectares of land for swidden plots each year. After one year of farming, he abandoned the plots to allow regeneration. In 1989, he was forced to reopen his 1983 *ladang* since no other secondary forest was available. He notes that his 1983 plot had only begun to enter phase 3 regeneration and should have been allowed to fallow longer. By contrast, Pak Abraham explains that in his home in Damai he would always wait until phase 4. Even so, he feels it might have been feasible to open the swidden during phase 3 had the recurrent fires in the area not disturbed and suppressed the regeneration process.

The introduction of the chainsaw, particularly since 1982, has accelerated the clearing of *ladangs*. Pak Abraham estimates that 15 percent of the farmers hire chainsaw labor, paying Rp. 60,000 ($30) per hectare. Generally, *ladangs* are opened in logged-over areas on the old Weyerhauser concession (now PT. ITCI). While signs are posted at the concession entrance that illegal cutting is punishable by 10–20 years imprisonment or fines of Rp. 5–10 million, no one has been accused or brought to court. P.T. ITCI has attempted to negotiate an agreement with the local government and community leaders allowing swidden farming

Figure 9





Source: World Bank (1989).

in certain areas demarcated by logging roads. It appears that the timber concession's main struggle has been against "encroachment" by the large coal companies, agricultural estates, and resettlement projects. While the central and provincial governments, as well as a number of technical line agencies, attempt to coordinate planning, conflicts of interest are common. As a consequence, the immense P.T. ITCI concession has gradually been reduced as the government has exerted pressure to release areas for other large-scale interests.

In most cases, the rights of small cultivators are ignored when new allocations of land are made. Pak Abraham experienced this when he opened his first swidden in 1978 in Timbau, approximately 15 kilometers from Datarban. Despite the fact that he had received approval to open his swidde.. from the local government officer (*rukun tetangga*—RT), when a wealthy entrepreneur named Pak Hassan was granted a 15,000 hectare estate that encompassed Pak Abraham's fields, he was forced to move. He appealed to the district government for compensation, but after several years of court inaction, he has received no decision.

Pak Abraham expresses pessimism about the sustainability of his agricultural system: "I have a coal mine on one side and a transmigration settlement on the other. We are being squeezed." In his ancestral homeland of Damai, Pak Abraham describes certain areas of forest that were specially demarcated for protection (*lati*), only to be used for hunting and the collection of non-timber forest products like honey, birds' nests, and rattan. He would like to see similar protection of forests and a management system in Datarban that ensures sustainable use, but neither the Kutai nor the Dayak residents of Datarban feel they have the authority to organize such a system. Despite his status in the Dayak community in Datarban, Pak Abraham claims he holds no political influence in local government planning or decision-making. Hence, any initiative must come from the local government. Moreover, Pak Abraham predicts that with large coal-mining initiatives, huge rubber and cocoa estates, and government-sponsored resettlement projects, the chances are poor that any local community action to control land use would be effective. However, in Damai, he and the village elders are formulating a proposal to strengthen community claims to ancestral forest lands. They hope that the provincial government will recognize their traditional (*adat*) rights. They also wish to be vested with the authority to oversee land use and ensure that uncontrolled exploitation like that in Datarban does not occur in their homeland.

Non-Timber Forest Products in Datarban

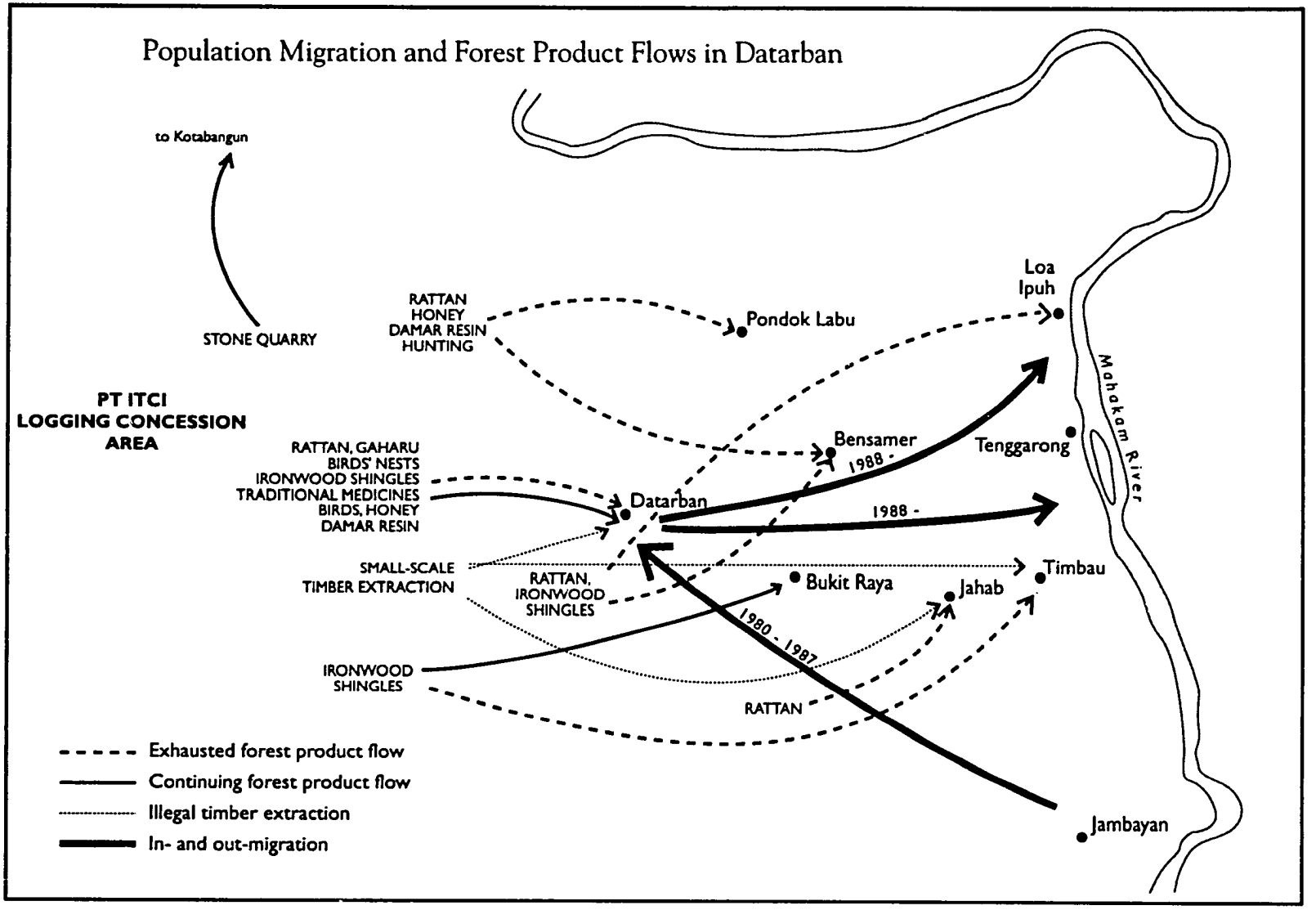
Until thirty years ago, the primary forests around Datarban were used almost exclusively for hunting and gathering of non-timber forest products. For over one thousand years, a significant Southeast Asian trading system supported the exchange of such forest products as rattan, honey, aromatic woods (*gahru*), birds' nests, gold, resins (*damar*), and ironwood for shingles (*kayu ulin*). Collection of forest products in the Datarban area was largely done by Kutai and Benuaq Dayaks living along the Mahakam River near Tenggarong. They would paddle small canoes (*ketinting*) up the Jahab River tributary, travel into the forest on foot, and carry out ironwood shingles, rattan, and other products.

Over the past few decades, as the forest was first logged for commercial timber and subsequently used for agriculture and mining, the availability of natural forest habitat and associated products declined. Many collection areas were overexploited between 1965 and 1985 and are no longer yielding products (see Figure 10). Collectors still operate, although the remaining secondary and small patches of primary forest are considerably diminished, especially in the Senoni Camp area. However, the ITCI concession has generally followed felling prohibitions on trees which have high value for local communities, including the ironwood, the *kapur*, and the honey tree. Products from these trees are still available in some areas.

Rattan has been widely exploited in the Datarban environs for generations, although the destruction of the forest environment and overharvesting have greatly reduced its stock in recent decades. Ideal for weaving strong, high-quality mats, the small diameter *wei sega* is considered the most valuable variety. Good *sega* is now scarce and currently sells for Rp. 500 per kilogram. This contrasts with lower-grade varieties such as *wei biyuang*, which brings only Rp. 50 per kilogram. *Biyuang* is still common, and a collector might be able to gather three forty-kilogram bundles per day. Although collection is difficult, the income is attractive to people with few other profitable activities.

Fine quality rattan sleeping mats, a specialty of many Dayak communities, are woven in 1.5-meter lengths which sell for Rp. 25,000 ($12.50) per 20-centimeter width. Consequently, a 1.5 by 1 meter mat to sleep one or two persons currently costs Rp. 125,000 ($62.50). Such a mat may take two months to weave. While income from mat-weaving averages only Rp. 2,500 ($1.25) per day, the activity is flexible and can be done when convenient.

Figure 10



Pak Daniel, a resident Benuaq Dayak of Datarban, has become increasingly engaged in searching for *gahru* in the remaining forest near the village. *Gahru, (Aquilaria sp.)*, a fragrant wood product, is found in trees which are infected with a fungus which causes the wood to assume desirable properties. *Gahru* is used as an ingredient in Chinese incense and in traditional Chinese and Thai medicine. In part because of its rarity, it is very valuable, costing up to Rp. 1.2 million per kilogram (and Rp. 50,000 per kilogram minimum).

Pak Daniel's search for *gahru* over the past year identified only one tree infected with the fungus. In the process of his exploration, he felled twenty trees. Once a *gahru* tree is cut, the collector must make several slashes through the trunk to expose the inner wood and determine whether *gahru* is present. Darker, almost black discoloration and a strong perfume are indications. Exploitation must be done carefully to separate the *gahru* from surrounding wood fibers. In the one tree that Pak Daniel discovered *gahru*, he removed approximately four kilograms of mixed qualities, which he sold for Rp. 1 million ($500) to a Chinese shopkeeper in Samarinda.

Many Benuaq Dayak boys and men in Datarban are still actively involved in hunting wild game. The three main hunting systems include spears (*tumbak*) and dogs to track wild boars; spring traps to catch deer, porcupine, and jungle fowl; and blow guns to kill monkeys and birds in the forest canopy. Hunters may venture into the forest for a month or more, bringing only rice, salt, and oil and surviving off forest foods. Hunting families catch up to eight wild pigs a year, each weighing 30–40 kilograms. Wild boar are typically hunted from January through March, the season when trees are fruiting and the feeding pigs are easier to locate. In addition, those who regularly set and monitor spring traps may bring in 1–2 jungle fowl a week, as well as several species of dwarf (*kancil*) or larger deer each month. While many important fauna used as local foods still remained after the initial round of cutting in the ITCI concession, subsequent forest clearing for mining, settlements, plantations, and swidden fields has further reduced forest habitat and wild animal populations, making hunting a less productive livelihood strategy. Many village families have experienced a decline in the dietary protein which they used to derive from forest animals.

Another economically important food product gathered in the forest is honey. Certain trees, such as the *kayu putih*, are specially managed to encourage bees to establish hives. Surrounding trees are often

cleared away to permit more light to fall on the tree. Branches are either cut, pruned, or encouraged to grow if they provide favorable hive-building environments. Finally, the trees are protected from cutting by strict rules, fines, and superstitions. Honey tree harvesting rights are often controlled by individual families. The honey is gathered from the hives each year. A productive tree with 25–50 hives can yield up to 300 liters of honey per harvest.

The *putih* trees are generally left by loggers due to their extremely hard and unforgiving wood. It is reported that the wood has silicates that cause chainsaw blades to spark and become dull. Dayak communities also forbid the felling of *putih* trees when *ladangs* are opened. Dayaks believe that some *putih* trees are inhabited by one-eyed ghosts (*hantu*). If these ghosts peer at the harvester while he is climbing the tree, he may lose control of his legs and fall. If this occurs, an elaborate ritual must be conducted. These beliefs ensure that care is taken in tending and harvesting honey, while also serving to ensure that use rights, stewardship, and conservation mechanisms are respected.

Ironwood shingles (*sirap*) are an important source of cash, especially for the Kutai, who typically specialize in this work. They are made from the trunk of the *kayu ulin* tree. The shingles are highly valued in local markets for their ability to resist termites and rot; villagers report that the shingles can last for several generations. Often when old houses are torn down, the ironwood shingles are carefully removed and recycled. Once an ironwood tree is identified, it is cut with a handsaw or machete. After felling, the worker makes sample cuts to determine if the wood grain is sufficiently straight for splitting into shingles. If not, the tree is left to rot. Once a tree is prepared for splitting, a man can split up to two bundles of shingles per day with his machete, receiving approximately Rp. 3,000 ($1.50) per bundle.

Dayaks also collect many varieties of edible bamboo and rattan shoots. They generally collect 300–500 grams on a trip and might make several trips a week to supplement their diet. While hunting, Dayak men will also collect wild tubers, which are cooked and eaten as a starch. However, as the forest recedes, hunting and food-gathering in Datarban's forests are declining. The forests, soils, water, flora, and fauna have become increasingly depleted, while alternative resources for local community survival have not replaced them.

In summary, forest products play a crucial role in generating cash income and subsistence materials for community residents of Datarban. A survey of household income for 1991–92, however, found that

forest dependencies vary substantially by ethnic group. Dayak families receive more of their total income in cash and kind from the forest (29 percent) than from any other source. Hunting, rattan, and *gahru* comprise most of the Dayaks' forest-based income. Kutai families average 14 percent of their household revenues from the forest, primarily from ironwood shingle manufacturing. Income from swidden agriculture is the dominant source of cash and subsistence for the Kutai (54 percent). In contrast, Banjarese, Buginese, and Javanese migrant families have little dependence on the forest for timber and non-timber forest products and rely more upon sedentary fruit garden agriculture (see Figure 11). As a group, migrants appear least affected by the disappearance of forest products and resources, except for depletion of soil fertility. All groups were dependent on fertile soils for approximately 80 percent of their incomes. The recurrence of the forest ecosystem, through regeneration, is the primary force sustaining soil fertility. As farmers of forest soils, all local residents, including the Dayak, Kutai, Buginese, Javanese, and Banjarese, have a potential long-term interest in maintaining the field-fallow-forest successional cycle.

Future Scenarios for Datarban

In the 1970s, much of Datarban was selectively logged. During the 1980s, a series of fires swept through much of the area. Migrants from South Sulawesi, South Kalimantan, and Java moved in to open logged-over forest for cultivation of commercial and subsistence crops. Migrant groups such as the Buginese often had little prior knowledge of

Figure 11

COMBINED HOUSEHOLD INCOME AND SUBSISTENCE GOODS BY ETHNIC GROUP AND SOURCE IN DATARBAN: 1991–92

(Percent)

Ethnic Group	Source				
	Swidden Field	Fruit Garden	Home Garden	Forest	Off-Farm
Dayak	26%	18%	6%	29%	21%
Kutai	54	14	1	14	17
Buginese, Javanese, and Banjarese migrants	48	30	3	1	18

agroecological methods to sustain soil fertility in the Datarban environment. Only the Dayaks appear to possess a sophisticated understanding of methods to farm the forest sustainably.

After much of the forest area had undergone a first round of logging in the 1980s, the central and provincial governments began transferring lease rights from the logging concessions to mining companies and large plantation operators, who had also arrived to clear the forest. The state, which claims control, and the corporations, which are empowered with rights over land resources, have not had sufficient field level capacity to monitor or arbitrate access, further facilitating unsustainable use practices. Competing groups have rapidly reduced the remaining secondary forest, often leaving behind scrub and *Imperata* grass lands. The declines in vegetative cover have led to soil erosion and lost fertility. Many small farmers are now migrating out of the area in search of new forest land which can be cleared for agriculture. Given the experience of the past three decades, what is the future of Datarban?

In light of past overexploitation and the sandy, nutrient-poor soils of Datarban, agricultural land use will require careful husbanding and management of soil fertility and water supply. Effective resource management must provide tenure security and incentives which encourage long fallows and maximize use of traditional knowledge regarding resource management in a fragile and sensitive environment. The continuation of uncontrolled access and poor management, either by large commercial operations or small migrant farmers, will only result in further resource degradation. This will likely stimulate continued outmigration. In certain tracts which are well managed, smallholder mixed fruit gardens, understory forest and agroforestry plantations, and long-term rotational agriculture seem to offer long-term prospects for productive use. However, the widespread incidence of illegal logging, exploitative farming practices, and unmonitored coal mining are driving the process of resource depletion.

For the future, effective access controls and carefully planned resource-use and conservation strategies need to be tailored to specific local areas. Settled communities, if organized, can provide the most stable basis for developing and implementing these plans. With their superior knowledge of the forest environment and how to use it productively and sustainably, Dayak communities can play a key role in developing protection and management systems which minimize the damage caused by periodic forest fires and enhance the ability of nature to regenerate itself.

Although the rate of forest depletion and environmental degradation has been rapid in the Datarban area, it is hoped that these trends can be reversed. Dayak elders like Pak Abraham discuss how degraded forests might be demarcated and protected, conserving hunting ranges and selected areas for forest product collection. Much of the felled and disturbed forest still harbors considerable regenerative potential if protected from further decline. The regeneration process requires consistent protection, a service which communities can provide if so empowered. However, their needs for tenure security and a share of benefits must be addressed to ensure their commitment. Recent experiences with community-managed logged-over concessions from West Kalimantan are beginning to offer examples of such new management models.[15]

THE FOREST STEWARDS OF DIAK LAY

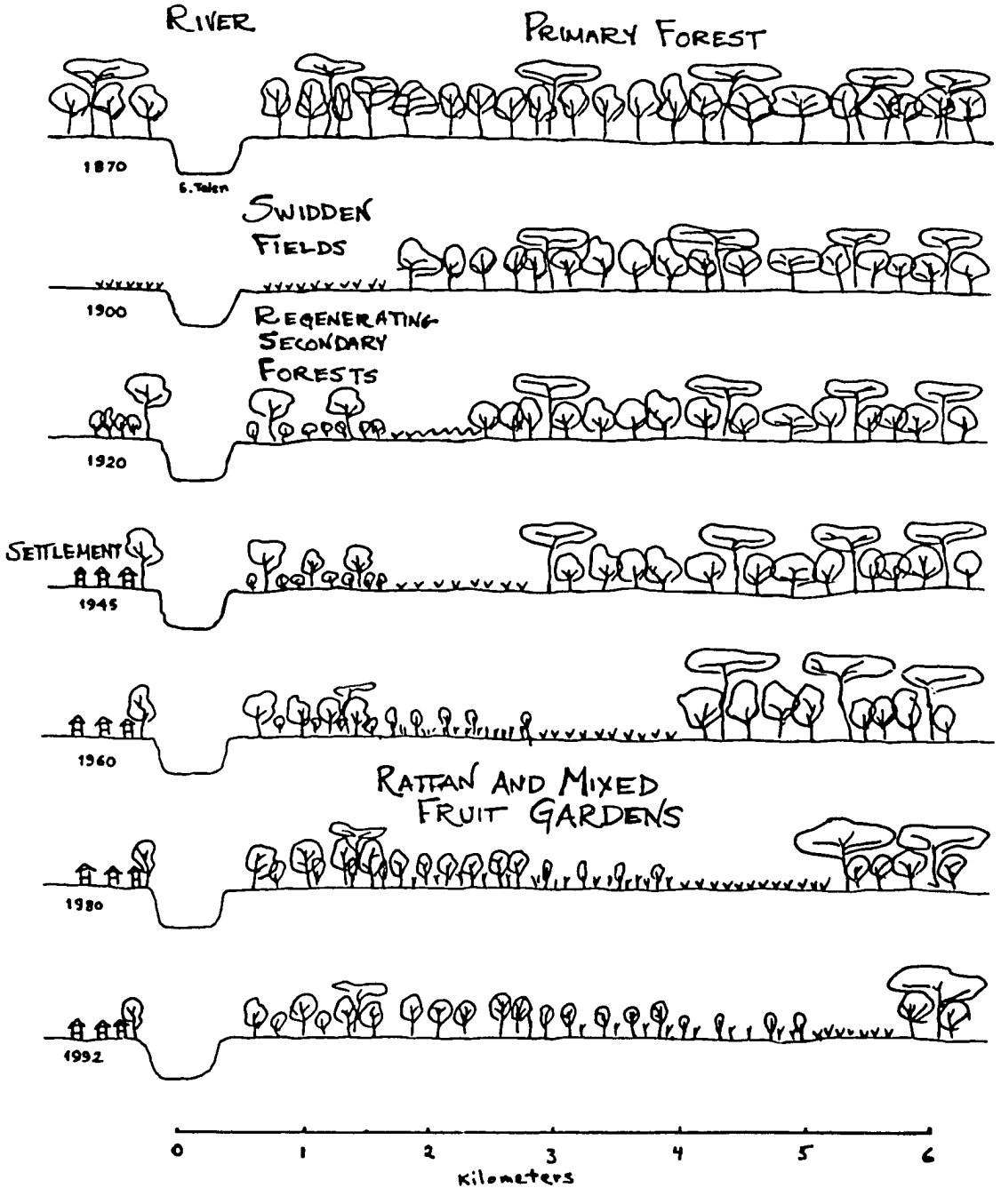
It is believed that the Wehea Dayaks descended from the mountains of the Apo Kayam into the upper reaches of the Mahakam River over the past four hundred years. The Wehea Dayaks have a sophisticated understanding of the region's forest and riverine ecosystems. As their communities have grown, they have moved progressively downstream, establishing new villages. In 1870, they sited a village approximately ten kilometers upriver from the current settlement of Diak Lay, constructing a large, traditional communal longhouse. By 1945, however, the village had become too large for the residential space, and the Council of Elders decided to relocate the families into four new communities along the Telen and Wahau Rivers. Diak Lay was one of the larger new communities, with fifty-two households. Tribal elders met to demarcate communal lands among the groups. The area allocated to Diak Lay was bounded to the north and south by streams feeding the Wahau. To the east and west, since no other communities resided in the forest area or had prior claims, the community was allowed to extend its range as necessary for hunting and the creation of new swidden fields.

Over the past 120 years, the forests of Diak Lay have undergone a series of changes and recurrent patterns (see Figure 12). Initially, both sides of the Telen River were covered in primary forest. In the early 1900s, the Wehea Dayaks began opening swidden rice fields along the east bank of the river. By the 1920s, these abandoned fields along the river had been left to fallow and regenerate as secondary forests and fruit gardens. Swidden plots for rice cultivation were opened further from the river, deeper into the forest. In 1945, the village of Diak Lay was established on the opposite bank. Over the next four decades, *ladang* fields penetrated progressively further into the primary forest, extending up to six kilometers from the village. Former *ladangs* were allowed to regenerate into thick, secondary forest.

Village leaders estimate that the traditional community lands (*adat*) of Diak Lay comprise approximately 920 square kilometers. Community lands are bounded by the Suad River on the northwest border and the Kenden River on the northeast, down to the Sebeluh River on the southeast cutting across to the west (see Figure 4). Most of the area

Figure 12

HISTORICAL TRANSECTS OF DIAK LAY: 1870–1990



recognized as *adat* land serves as territory for hunting and gathering. Lands more intensively managed for active or fallowed swidden fields, banana, rattan, or mixed fruit gardens, and boundary forests (*keledung*) comprise at most 80 square kilometers closest to the village, or less than one-tenth of the tribe's ancestral land.

Conservation Agriculture

The Wehea Dayaks practice a number of agricultural, agroforestry, and forest-management systems. Land resources are broadly divided: those used for swidden fields, either active or in one of the five phases of successive regeneration; those converted to long-term use as banana, mixed fruit, or rattan gardens; and those permanently under large or smaller tracts of secondary or primary forest. The Wehea Dayak classification scheme for natural regeneration is similar to that of the Benuaq Dayaks, although some variation exists in the time periods. A transect illustrates various types of Wehea Dayak land-use systems (see Figure 13).

The selection of swidden sites, or *ladangs*, occurs during a community meeting (*petku meu*) held in May. The Benuaq Dayaks have a similar communal decision-making process in Damai, although the system has broken down in Datarban since the population began to plummet. During the meeting in Diak Lay, possible sites are proposed by the tribal headman, village headman, chief of the fields (*kepala padang*), and the fifteen tribal elders. Other community members may also propose sites. Each proposal must be supported by a description of the characteristics which qualify the site as suitable for agriculture. The primary consideration in selecting a prospective site is whether sufficient natural forest regeneration and soil fertility recovery have occurred since it was last opened for agriculture. Forest land designated *empla neumeu* is deemed ecologically premature or unready for reopening. In general, if a forest has regenerated for more than ten years, it has usually reached the stage known as *eulang neumeu*—adequately rejuvenated in terms of nutrients and water moisture to support agriculture. Prospective plots must be at least one hectare in order to support several families. Most plots have been previously used for *ladangs* and are selected in regenerating secondary forests. The site histories and past productivity are weighed and considered. Since the original primary forest was first cleared in Diak Lay in the second half of the 1940s, new *ladangs* are now opening regenerated forests for a third rotation. This fallow period is similar to that of the Kenyan Dayaks, where families usually clear swiddens from

Perched on the riverbank of the Mahakam, curious children of Diak Lay are eager to greet visitors.

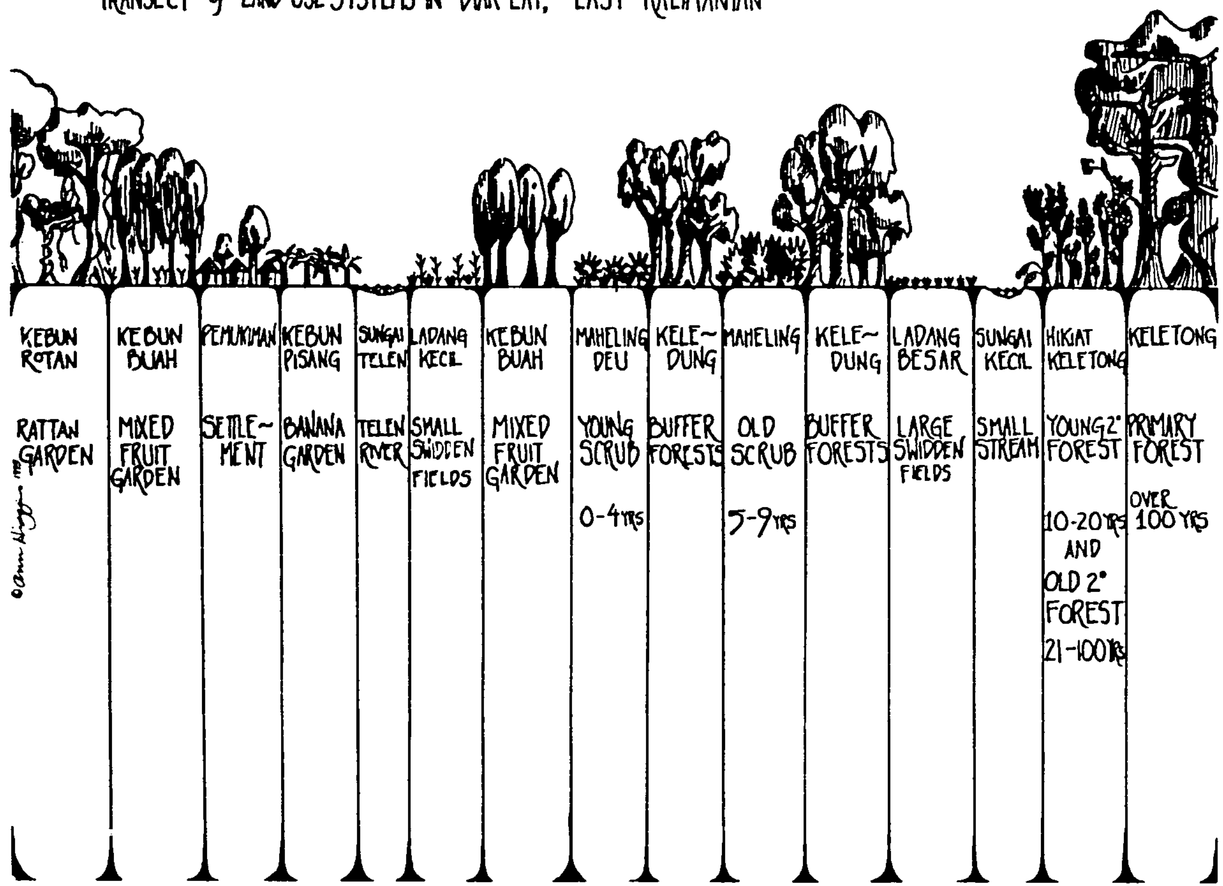
This couple in Diak Lay describes its dependencies on the rainforest for game, vegetables, fruits, gum, medicines, fuelwood, and structural building materials; the Dayaks also harbor a special respect for forest animals, many of which they collect as pets or place on display.

The Mahakam River serves as the primary conduit for barge transport of commercial logs harvested from the rainforests.

A typical scene of a Dayak riverside settlement along the Mahakam.

Figure 13

TRANSECT of LAND USE SYSTEMS IN DIAK LAY, EAST KALIMANTAN



Best Available Document

regenerating, secondary forest ranging in age from eight to twenty-five years.[16] Once a *ladang* site has been proposed during the communal meeting, the committee visits the area to determine whether the site meets all the ritual and physical requirements. If so, the *kepala padang* will attempt to divide the area equally among the community members interested in farming it.

While primary forests often give somewhat higher yields initially due to their greater soil fertility, they are generally avoided due to the additional work involved in clearing larger trees. Recently, one man proposed opening a primary forest using a chainsaw. Other members of the community were reluctant to join him because the site was too far from the village. Nonetheless, he proceeded to open the *ladang*. While his crop was bountiful, his harvest was poor due to damage by monkeys, deer, and other pests. Community members believe that because he acted alone and without the cooperation of others to help guard his crop, he suffered accordingly.

Fields are frequently opened by cooperative groups of 10 families. An adult male and female from each household travel to the *ladang* and provide one full day of labor to each member of the group of 10. Such an arrangement is usually enough to clear most of the larger trees and brush on the plot. Each *ladang* averages about one hectare. In Diak Lay for the 1991–92 cropping season, a total of 53 hectares was under *ladang* for 47 households. This land yielded approximately 41 metric tons of paddy (dry unhusked grain), or 774 kilograms per hectare—a good harvest for swidden fields.

While the Wehea Dayaks have maintained small house gardens (*kebun*) for generations, growing populations, interactions with other Indonesian ethnic groups, and a desire to generate more agricultural cash produce have stimulated the expansion of *kebun* in Diak Lay. *Kebun* are primarily dedicated to the production of fruit or rattan and are considered permanent land-use systems apart from the swidden rotation cycle. *Kebun* may be formed from old regenerating *ladangs*, secondary forests, buffer forests (*keledung*), or homegardens (*pekarangan*). Generally planted on communal lands, usufructs to *kebun* may become privatized. Once an individual has invested significant labor in planting fruit trees or rattan, the community recognizes his/her rights to that produce. In Diak Lay, the three types of *kebun* are differentiated according to primary produce, including rattan, bananas, and mixed fruit. Most *kebun* also shelter a wide variety of additional domesticated and natural forest species.

In the Diak Lay area, rattan gardens (*hetan gue*) were started in the early twentieth century in response to expanding commercial demands stimulated by Kutai rulers downstream. Certain rattan gardens in Diak Lay are nearly one hundred years old. Once an old *ladang* has been taken over for a rattan or mixed fruit garden, the investment and care is substantial enough that it rarely reverts back to *ladang*. *Sega* and *pendas* are the most valuable commercial rattan varieties, prized for their strength and pliability in weaving.

Sega rattan is usually planted in secondary forests with good canopy closure. According to Pak Biteq, in the first year rattan seedlings do best with approximately 30 percent light, planted 5–10 meters apart in clumps of 3–4 plants. Only the most suitable sites are planted, generally averaging 200 seedlings per hectare. As the plants mature, they require larger trees to climb. Certain silvicultural operations can enhance rattan productivity and help sustain maximum yields. Maturing rattan requires 40–60 percent light to achieve optimal productivity; consequently, larger trees of 50 centimeters in diameter are sometimes felled to create more openings in the canopy. The rattan groves may also be cleaned of undergrowth and climbers to lend additional spacing. The plants are ready for harvest by the time they are 6–10 years old. When fully grown, a *sega* shoot may reach 15 meters or more in length. After reaching maturity, shoots can be selectively harvested annually. The plant sprouts up to 10 new coppice shoots each year. Once a well-stocked garden is established, it may produce for generations.

When they achieve full productivity, Pak Biteq reports that rattan gardens can generate up to 5,000 kilograms of cane per hectare annually. In Diak Lay, however, most rattan gardens produce on average only 500 kilograms per hectare due to damage resulting from periodic fires which burned the area during the 1980s. After drying, this shrinks to 250 kilograms. Growers in Diak Lay received Rp. 500–1,200 ($0.25–0.60) for one kilogram of dry rattan in 1992, depending on variety and quality. These prices were somewhat lower than in 1987, before the Indonesian government banned whole rattan exports. However, after an initial drop in the late 1980s, prices have been rising again.

Approximately one-third of the rattan gardens in Diak Lay are owned by the old village headman, who has moved to Tenggarong. Still, most village families own small plots of 1–2 hectares. It is estimated that Diak Lay may have over one hundred hectares cultivated in rattan gardens. Most of the rattan supply is purchased by Pak Abdul-

lah, a Kutai agent who owns the village store and handles trade in many forest products. Occasionally, operators of river taxis purchase rattan from family producers.[17] In 1991, Pak Abdullah reports making 4 trips to Samarinda to sell 17 metric tons of rattan, produced from Diak Lay gardens or the neighboring forests.

Villagers and traders report that rattan markets and prices are uncertain. Demand for rattan is often driven by orders from furniture-makers and exporters in Samarinda and other large urban centers. Nonetheless, most families in the village might earn Rp. 150,000–300,000 ($75–150) per year from rattan.

The most serious threat to rattan gardens is fire. The publicized East Kalimantan fire of 1982 caused extensive damage to the rattan gardens of Diak Lay, and they are still recovering. Communities attempt to protect the gardens against fires. When they do break out, a gong is struck and all members join together to suppress the fires, using their *parangs* to hack away burning materials and beat out flames.

While rattan is the primary product from these groves, the gardens tend to harbor a diverse mix of native and exotic species. This research in Diak Lay has documented over ninety different species of climbers, herbs, trees, and other plants flourishing in rattan gardens, many of which are useful subsistence goods. The prospects for sustaining rattan culture in Diak Lay are promising. With natural reserves declining under increasing forest pressure, market opportunities for cultured rattan should grow. International markets also appear robust, with demand increasing. Rattan cultivation could continue to produce a reliable and expanding source of cash.

Mixed fruit gardens as a land use appear to have evolved only in the last 30 years in response to growing markets for fruit downriver. Particular species such as durian, guava, langsat, mangos, citrus, pineapples, bananas, rambutan, and kemiri nuts are cultivated for the market, while a much wider variety of fruits are grown for home consumption. Gardens are usually located near the village homesteads. Diversity inventories of mixed gardens in Diak Lay identified 150 species of plants. Banana gardens, by contrast, tend to be much less biologically diverse and are characterized by a stronger sense of private ownership and commercial orientation.

Homegardens (*pekarangan*), planted in the courtyard surrounding a house, produce goods solely for subsistence. These are planted with a variety of vegetables, ornamentals, spices, fruits, and plants for medicinal and ritual use. *Pekarangan* in Diak Lay average 200 square me-

ters and support 122 species of plants. Social interactions, rituals, construction, and many other activities occur in the *pekarangan*.

Protecting Forest Resources to Enhance Productivity and Regeneration

The Wehea Dayaks believe that natural forest protection and regeneration are among the best ways to ensure the steady availability of fertile agricultural lands. Depletion of soil fertility in fields close to the village forces communities to walk increasing distances to open new fields or even relocate their village. Both situations result in considerable expenditure of unproductive labor. Consequently, there are strong incentives to maintain the productivity of forest lands in close proximity to the village through long rotations and careful stewardship.

The Wehea Dayaks recognize that rapid regeneration can best be facilitated by selecting forest areas with sufficient soil fertility and minimizing disturbance when the *ladang* is opened and while crops are growing. The Dayaks know that the relatively low general fertility status of the tropical laterite soils in the area prohibits more than one year of productive farming. They are also attentive in their use of fire, controlling burns so that the soils are not overly hardened. Certain *ladangs* which were fallowed and regenerating but later burned by the spontaneous forest fires of the 1980s have succumbed to *Imperata* grass. When opening a *ladang*, the Dayaks of Diak Lay collect the slash and wood into small piles to isolate the burn. They leave large trees (over 100 centimeters in diameter at breast height—DBH) as mother trees to reseed fallowed *ladangs*. Tree stumps are not removed from fields, allowing their root systems to hold the soil, or, with certain species, to produce coppice shoots which regenerate rapidly once the field is abandoned. By minimizing damage to the forest ecosystem throughout its preparation and use for agriculture, forest regeneration in old *ladangs* usually results in vigorous regrowth.

The Wehea Dayaks also reserve strips of natural forest (*keledung*) between *ladangs* of households with kinship ties. Generally, *keledungs* are 20–30 meters wide and as long as the *ladang* field, with an average *keledung* to *ladang* ratio of 6:1. The Wehea Dayaks say the *keledung* serves numerous social functions by clarifying field boundaries and establishing physical barriers, reducing in-breeding within extended families. Ecologically, the *keledung* provides a source of seed for the regeneration of fallowed swiddens, as well as corridors for the movement of humans, birds, and animals. *Keledungs* play an important role in enhancing natural regeneration by moderating the microclimate, reducing the

temperature, and increasing the humidity near the *ladang*. The *keledung* can also slow the movement of pests from one *ladang* to another. Broadly classified by age of regenerating secondary forest, *keledungs* include young forests 10–40 years old (*muda*) and those 40–100 years old (*tua*). Forests over one hundred years are classified as primary forest, or *keletong*.[18]

Primary Forest Reserves (Keletong) and Non-Timber Forest Products

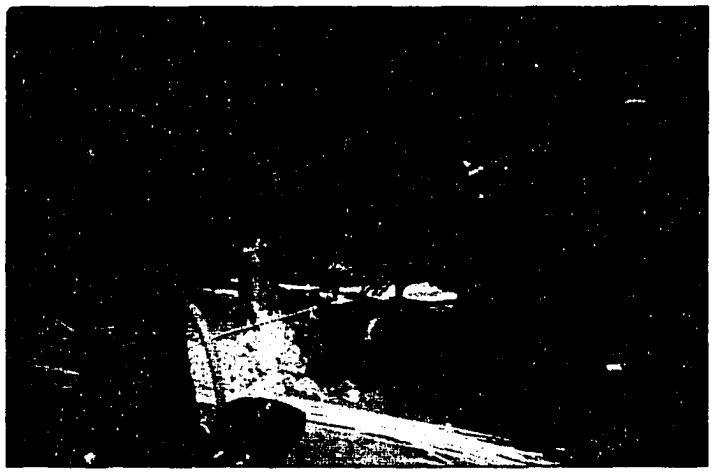
Much of the tribal land within five kilometers of Diak Lay village is covered in young, secondary forest, the majority used formerly as *ladang* and fruit and rattan gardens. Further from the river (usually more that five kilometers west), the land is dominated by primary forest (*keletong*) and mature, secondary forests. Perceived by Dayaks as communal lands, these forests are generally deemed too far away for *ladangs* and *kebun* and are used primarily for hunting and the collection of non-timber forest products. Any member of the village can freely collect forest products with the exception of birds' nests, for which harvesting rights to nesting caves are owned by individual families.

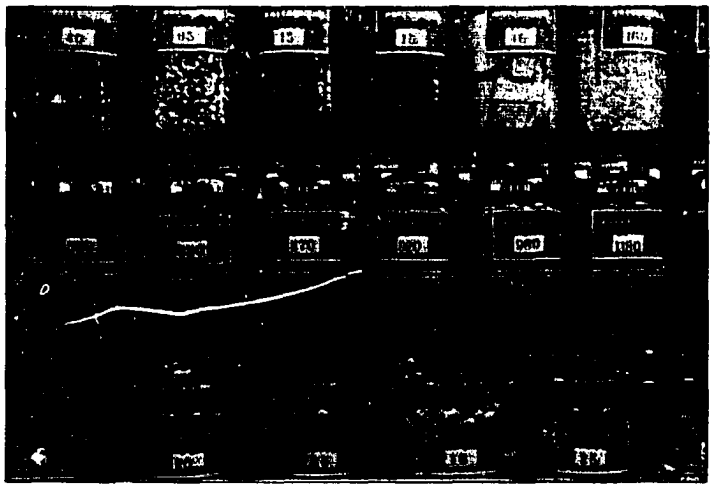
Birds' nests have been collected by Dayaks in the Kalimantan forests for centuries and sold to traders for the Chinese market. The nests, built by swifts (*Collocalia spp.*) using their saliva, are highly valued as an ingredient in Chinese soups. Controlled by seven households, there are twelve birds' nest caves in the Diak Lay area. In the neighboring village of Ben Hes, ten caves are controlled by six families. Many cave claims date back one hundred years and are passed on from generation to generation.

Owners must protect their caves or hire guards during each nesting cycle. Several male members of a family typically take turns guarding their caves, which are usually within a day's walk of the village. Due to the high value of the nests, theft attempts are common. Historically, conflicts have occurred over cave control, and the forests nearby are rumored to hold the bones of those who have struggled for this right. In the past, the caves of Diak Lay and Ben Hes were owned by the Dayak Raja of Wehea. After this system of control dissolved due to political changes during the colonial period, the more powerful local families gained claims over the caves. Still, acts of sabotage and conflict occur regularly. Occasionally, a family will lease the harvest rights of its cave to others for Rp.50,000–100,000 ($25–$50) per collection period.

A mixed homegarden with banana, rattan, cassava, and many other species is an important traditional land use practiced by the Dayaks and other local and migrant groups.

Initiated by village headman Pak Biteq, an understory plantation of rattan in the rainforest will eventually evolve into a valuable rattan garden in which he holds the harvest rights.





From top: Dayak woman weaves baskets from high quality *sega* rattan from the forest; successful young hunter returns from forest with deer and boar to share with community; differing qualities of birds' nests collected from the forests of Indonesia and China are sold in the booming medicinal markets of Hong Kong.

The swifts require approximately 42 days to build their nests, after which the collection activity begins. Normally, 8 nest harvests take place each year, and one cave may yield 15–100 nests. The maximum harvest occurs during the peak nesting season between January and April, while the lowest yields occur from May to July. Each nest may be worth Rp. 5,000–15,000 ($2.50–$5), depending on its quality. The clearer and whiter the nest, the higher its value. The nests are collected immediately after the eggs are laid. If left longer, the quality will deteriorate as the nests darken. However, the removal of the nests before the eggs are allowed to hatch may influence the population of the swifts. Traditionally nest harvests were more regulated and allowed only every 75 days.

Pak Abdullah, the agent handling birds' nest sales from Diak Lay and Ben Hes, reports that most collectors gather 90–100 nests per harvest, grossing an average of Rp. 600,000 ($300). Collectors' costs for food and other supplies to camp near the cave for 42 days average Rp. 75,000 ($37.50) per person, often advanced by the agent. This leaves each collector with a net profit of Rp.125,000, or approximately Rp.3,000 per day ($1.50)—one-third the wage available from timber companies.

Pak Abdullah sells the nests to Pak Idwar, another Kutai, at the subdistrict headquarters of Muara Wahau. Pak Idwar has purchased the rights to handle nest transactions for 89 caves in the area, paying Rp. 106 million ($52,000) for this concession. In turn, he sells the nests to a Chinese Indonesian, Pak Iyeng, who purchased monopoly rights to become the *pahtar* (exclusive buyer) to all nest trading in East Kalimantan Province for 1992 at the annual auction in Tenggarong. The *pahtar* in Kalimantan can earn a 300 percent profit over and above the collectors' income. However, in Hong Kong medicinal markets, high quality Indonesian birds' nests sell for over $3,000 per kilogram, in contrast to the $500–$750 the collectors may receive. Since this new system has been recently installed, it is premature to assess how it will affect birds' nest markets and collectors' prices.

Gahru is also collected in the Diak Lay area, gathered primarily by Banjarese, Javanese, and Kutai who have moved into the Muara Wahau region. Intensive *gahru* collection began only in 1990. Pak Dahlan, a Kutai involved in *gahru* collection in South and Central Kalimantan feels that the supply will have been largely tapped out in the Muara Wahau area in another two or three years. There are eleven small "bosses" or middlemen who finance approximately one hundred collectors each. Only an estimated 10 percent of the collectors are local

Dayaks. Generally the local population is unable to compete with more experienced collectors who migrate to the area from other parts of Kalimantan.

In the Diak Lay area, Pak Dahlan reports that an experienced collector can find *gahru* on average in one of every seven trees he fells. Usually it occurs in larger trees. In September 1992 Pak Dahlan and four other Kutai men collected 10 kilograms of *gahru* and received Rp. 2 million ($1,000). The boss, who purchased a collector's permit from the Ministry of Forests, the local government, and the police, gave the collectors a cash advance of Rp. 100,000 for field supplies. The trees are cut with axes, as it is too far to carry chainsaws and fuel. The collectors' net profit of Rp. 300,000 ($150) per person translated to about Rp. 10,000 per day—approximately what loggers or agricultural laborers might receive—for their labor. However, the search for *gahru* is more closely related to prospecting in terms of the risks involved. Many collectors remain in the forest for weeks without discovering any of the substance.

Changing Paradigms of Forest Management

The entry of timber operations initiated radical changes in land-use patterns in Diak Lay. Due to sedimentation from erosion caused by eight timber concessions around the village, the Telen River has turned a muddy brown. On the river's west side, the OTP Company has encroached several kilometers onto the traditional lands claimed by the Wehea Dayaks. Pak Bourhan Mas, the tribal leader of Ben Hes, reports that OTP logged right up to the river's edge between 1979 and 1984. Its felling and extraction operations caused severe erosion, clogging the Mbung River. Pak Bourhan feels that OTP seriously infringed on the concession boundaries, overcutting the forest and inflicting considerable ecological damage during the extraction process. As a result of the subsequent soil erosion and compaction, very little natural forest regeneration has occurred. Pak Bourhan explains that instead of progression through the sequences of secondary succession after *ladangs* are fallowed, much of the logged-over forest has turned to *Imperata* grass and scrub, with scant evidence of high-value *meranti* saplings or other indicators of renewed fertility. Apparently, OTP made no 'tempts to reforest the area, nor to carry out any environmental rehabilitation or community development program.

Pak Bourhan recalls that when OTP and other concessionaires first arrived in the early 1970s, the villagers were hoping they would create new employment and local markets for their fruit and vegetables. In-

stead, few individuals have found steady work in the concessions, which tend to intensively cut and move quickly on to new areas. Pak Bourhan feels that the environmental costs of timber operations have been heavy and unfairly borne by the local, forest-dependent communities. The slow recovery of felled areas eliminates them from production for a period of time during which they are not even considered for potential *ladang* fields. At the same time, the availability of rattan, gum, and other important economic non-timber forest products has declined sharply in logged-over areas. Revealing the unequal power relationship and lack of communication among resident user groups, OTP did not consult the Wehea Dayak leaders in Ben Hes or Diak Lay before beginning timber operations on Dayak communal lands. The villages were first visited by representatives of the timber company only when they came to recruit additional laborers for the felling.

In contrast, Pak Bourhan expressed greater satisfaction with P.T. Mugi, the timber concession to the north which has made an effort to comply with the government's 1989 requirement that concessionaires conduct community development programs (Bina Desa). Mugi has sent two young extension workers with college degrees to assist the community with agricultural development and educational projects. In Diak Lay, the extension workers are helping expand the school through the sixth grade and assisting in the construction of a road from Diak Lay to the subdistrict headquarters at Muara Wahau. The community had identified both activities as priorities.

The Diak Lay villagers are less enthusiastic about the concessionaire's Bina Desa program in the agriculture sector. The extension workers have wanted to help the farmers move from rotational to sedentary agriculture, but their demonstration plots for soybean cultivation failed after a pest infestation. Furthermore, a company pesticide demonstration accidently killed household chickens in Diak Lay. The experience of outsiders with the nuances of ecological productivity in the area are limited, and it is uncertain whether the fragile soils of Diak Lay can sustain annual cropping. Instead, the Dayaks' time-tested, long-term fallow and rotational swidden strategies may provide the best option for sustainable farming and forest regeneration.

The Mugi extension workers have encouraged the villagers to work together with the local government to clarify their land boundaries. Community leaders have been reluctant, fearing that their lands may be further restricted due to the government's perceived sympathies with the concessionaires. Pak Biteq, the headman in Diak Lay,

explains that villagers are concerned that the concessionaires are taking over too much land. As Diak Lay's population grows, the community may not have adequate land to meet its needs for new *ladangs*. Pak Biteq feels that the concessionaires should take responsibility for replanting the logged forests with a comparable mixture of valuable species which they have extracted, including rattan damaged during the process. He feels that the temporary logging roads left behind should be improved before the companies move on to facilitate development of the local transportation infrastructure. Along the same lines, Pak Biteq believes that former logging camps could be adapted so that Dayak communities could use them as bases for nursery and reforestation activities. Once the concessionaires have completed their operations, he feels they should be required to repair their roads and camps and return the land to the authority of indigenous local communities, thus allowing the Dayaks to protect, manage, and utilize the area.

Pak Biteq recommends that management decisions regarding logged-over forest lands be based on consensual decisions emphasizing access controls, natural regeneration, and enrichment planting to meet the long-term needs of future generations. Such land-use decisions should be discussed and determined during open community meetings. In Diak Lay, he feels that individual households could be assigned use and protection responsibilities for specific tracts of forest, in similar fashion to their current allocation of rights and responsibilities over *ladangs*. However, the forest land should never be privately owned, nor should outsiders be allowed to enter or operate in these areas without the permission of the community. While usufruct rights can be sold and traded, Pak Biteq feels strongly that the land should remain inalienable, under the control of the community in perpetuity.

SUMMARY

Forest management policy in Indonesia is approaching a crossroads. Over the past twenty years, the timber industry has generated important foreign exchange for the government, helping to offset a $50 billion external debt. By the end of the 1980s, forestry products were valued at $3 billion annually, primarily from timber.[19] In addition, the nation's vast forest lands have provided a reservoir of arable land that can absorb the country's growing population. Consequently, Indonesian planners often react defensively when criticized for their forest utilization policies. At the same time, there is a growing realization among policy-makers that many current practices are unsustainable. As demonstrated in the two East Kalimantan case studies, forests located near urban areas and road networks, as well as those in isolated sites far upriver, are vulnerable to increasing pressures. In the area around Datarban, the primary forests have largely been transformed to secondary forests, scrub, and *Imperata* grass over the past thirty years. Despite the four hundred kilometer distance upriver and relative isolation of Diak Lay, timber operations are having a similar impact there.

Unless better management controls are introduced in both Datarban and Diak Lay, competition for resources will continue to stimulate uncontrolled extraction practices which result in resource degradation. The absence of long-term tenure stability in Datarban has undermined attempts of the community to develop a stable infrastructure or encourage resource-use patterns that can endure. Instead, the degradation of the once rich forest ecosystem and the pollution of watercourses has caused out-migration. While the Kutai and Dayak residents have attempted to develop informal agreements governing local land use, without any authority from the government—and in the face of well-financed government development programs and commercial operations—they have been unable to control access or protect their resources.

The Indonesian government is well aware that many timber concessionaires violate felling and extraction regulations. In response, it has revoked approximately one hundred concession licenses. Furthermore, government programs are underway to encourage migrants to utilize more sustainable farming methods. Current forest management

policies seek to replant up to 50 million acres of deforested land. However, as former Environment Minister Emil Salim notes, given practical funding levels, this goal will require sixty-five years to achieve.[20] Present policies do not yet reflect the great potential of Indonesia's degraded forests to regenerate naturally. If protected by communities from further disturbance, much of the nation's rainforest could recover its biological and economic productivity. In both Datarban and Diak Lay, it is apparent that Dayak communities have both ecological knowledge based on generations of experience and strong motivations to manage the environment sustainably. In both villages, non-timber forest products are important in generating both cash and subsistence goods. If these products are to be harvested sustainably, community forest management groups will need to be assured that they have exclusive rights to such benefits. The desire to secure their homelands, which are increasingly threatened by outside interests, provides indigenous people of East Kalimantan with powerful incentives to protect forest resources from further degradation.

In addition, foreign tourists are increasingly interested in exploring Indonesia's natural heritage and observing its remarkable diversity of flora and fauna. While the timber industry has been generating $3 billion annually, tourism profits have recently reached $4 billion per year and are growing rapidly. While timber harvesting and uncontrolled migrant farming may generate a declining stream of income for a few years before seriously undermining the local ecological and economic functions of a rainforest, ecotourism, non-timber forest product harvesting, and long-term rotational farming and gardening provide options for sustainable growth industries that will help ensure the environment is preserved into the future. Processed rattan products from Southeast Asia alone are currently valued at nearly $3 billion annually, and a wide range of medicinal, food, fiber, and construction products are beginning to find new markets.[21]

East Kalimantan currently has millions of hectares of disturbed forest land. The majority of the territory in the province has experienced timber exploitation, forest fires, and clearing for agriculture. Many of these activities have decreased vegetative cover, spurred soil erosion, and driven a process of degeneration resulting in a continuing loss of productivity. If the province is to escape a scenario whereby much of its land is reduced to unusable waste, it will need to immediately establish better management systems based on effective access controls. While a small proportion of the affected area may be converted for settlements,

industry, and plantations, vast regions may be best utilized by allowing the remaining forest to regenerate. Given the limited field staff in the Ministry of Forestry, communities provide a major social and institutional resource for stabilizing forest use. These studies show that Dayak communities in particular possess a store of ethnobotanical wisdom regarding the forest ecosystem which can be applied to the problems of rehabilitating degraded environments. Furthermore, communities like those in Datarban, Diak Lay, and Ben Hes fear for the future of their environment and are already motivated to cooperate and take action.

However, communities will need the support of both local and national governments to gain the authority to protect and manage natural forests. The government must formulate policies which support community user groups and develop operational guidelines and tenure mechanisms to create partnerships with local people. As one senior Indonesian official notes, "Whatever the tenurial arrangement to be implemented, the objectives remain the same, to improve the prosperity of the communities while ensuring forest sustainability."[22]

While the formulation of local use agreements and microplans with communities will require new capacities on the part of local government, growing environmental concerns among villagers are resulting in grass-roots initiatives to solve local resource problems. Certain communities, such as the Dayak of Damai and Diak Lay, are already discussing the creation of management proposals, and are ready to invest their time in developing and enforcing rules and regulations to prevent resource misuse. Governments will discover willing partners in many areas if they can identify ways to respond effectively to community needs by supporting local initiatives. To do this, they will need to listen closely to voices and lessons emerging from the field.

Intentionaly Left BLANK

POSTSCRIPT

The concerns of Wehea Dayak tribal elders in Diak Lay and Ben Hes reflect a desire to organize and coordinate access controls to their ancestral homelands and thereby establish a process of sustainable resource development. The initiatives of the Benuaq Dayaks in Datarban indicate that local communities are often motivated to stabilize land use and protect forest resources to ensure their long-term productivity. At least some of the migrant communities of East Kalimantan also have a vested interest in protecting the ecological integrity of their new homes. The communities and research teams have established the potential for naturally regenerating forest ecosystems which have been disturbed by timber exploitation, fires, and unsuitable agricultural practices. This report summarizes the teams' findings from the first phase of diagnostic research. Over the next two years, the Indonesian research teams hope to assist these communities, the provincial government, and the Ministry of Forestry in exploring how collaborative management systems for their forests might be operationalized. The teams would like to exchange their learning with other action research programs with similar objectives, both in Kalimantan and in other parts of the world. For further information regarding the Indonesian research program, please write to:

Dr. Oekan Abdoellah
Institute of Ecology
Jl. Sekoloa
Universitas Padjadjaran
Bandung, JABAR 40132
INDONESIA

Dr. Abubakar M. Lahjie
Faculty of Forestry
Universitas Mulawarman
Kampus Gunung Kelua
Samarinda, KALTIM
INDONESIA

Ir. Sopari S. Wangsadidjaja, Chief
Program and Planning Division
Directorate General for Forest Utilization
Gedung Manggala Wana Bakti
Lantai V/Blok I
Jakarta Pusat 10270
INDONESIA

Intentionaly Left BLANK

NOTES

1. World Bank, *Indonesia Forest, Land and Water: Issues in Sustainable Development* (Washington, D.C.: Asia Regional Office, 1989); Report No. 7822-IND.

2. "Forestry: A Saw Point for Ecology," *Far Eastern Economic Review*," 19 April 1990, p. 60.

3. Indonesia Department of Forestry, "Project for the Development of Forestry Data and Information Systems, 1986–87."

4. "Forestry: A Saw Point for Ecology," p. 60.

5. Atlanta/INPROMA, *Wood Raw Material Supply;* vol. 3 of the Wood Processing Industry Sector Study (Hamburg/Jakarta, 1987).

6. World Bank, *Indonesia Forest, Land and Water*, p. 3.

7. *Ibid.*, p. 7.

8. *Ibid.*, p. 41.

9. *Ibid.*, p. 10.

10. . Nancy Lee Peluso "The Political Ecology of Extraction and Extractive Reserves in East Kalimantan, Indonesia," *Development and Change*, 1992.

11. Collaborative research by forest ecologist Mark Leighton and remote-sensing analyst Jean-Paul Malingreau has identified logged over areas as subject to much hotter burns due to the abundance of slash on the forest floor; as a result, there is a much higher death rate among affected canopy trees.

12. Andrew P. Vayda and Ahmad Sahur, "Forest Clearing and Pepper Farming by Bugis Migrants in East Kalimantan: Antecedents and Impact," *Indonesia*, no. 39 (April 1985).

13. *Ibid.*, pp. 105-10.

14. Cynthia Mackie, T.C. Jessup, A.P. Vayda, and Kuswata Kartawinata, "Shifting Cultivation and Patch Dynamics in an Upland Forest in East Kalimantan, Indonesia," *Impact of Man's Activities on Tropical Upland Forest Ecosystems;* Man and Biosphere Project, 1986; Michael Dove, "Swidden Systems and Their Potential Role in Agricultural Development: A Case Study for Kalimantan," *Prisma* 21 (1986): 81–100.

15. Departemen Kehutanan, "Social Forestry: Tengkawang Development Project, Kalimantan Barat"; unpublished project report, 1991.

16. Mackie et al., p. 465.

17. See Nancy Lee Peluso, "Networking in the Commons: A Tragedy for Rattan," *Indonesia* 35 (April): 95-108.

18. Recent archeological studies of the Mayans of Guatemala indicate that they practiced highly sustainable and productive farming in the rainforests for hundreds of years by using strategies similar to those of the Dayaks of Diak Lay. A primary characteristic of Mayan agriculture appears to have been the use of small, polyculture plots with long rotations and wide tree corridors between the fields. Since these traditional systems have been abandoned, modern farmers practicing monoculture on large fields have experienced a rapid loss in topsoil and fertility. Report presented on CNN *Future Watch*, 13 March, 1993.

19. Steven Erlanger, "Indonesia Takes Steps to Protect Rain Forests," *New York Times*, 26 September 1989, p. C4.

20. *Ibid.*

21. Jenne H. de Beer and Melanie J. Mcdermott, *The Economic Value of Non-Timber Forest Products in Southeast Asia* (Amsterdam: Netherlands Committee for IUCN, 1989), p. 7.

22. Sopari S. Wangsadidjaja and Agus Djoko Ismanto, "Research Needs for Enhancing Peoples' Participation in Indonesian Production Forest Management" (Honolulu: East West Center Writers' Workshop, 1991).

REFERENCES

Atlanta/INPROMA. 1987. "Wood Raw Material Supply." Vol. 3 of the Wood Processing Industry Sector Study. Hamburg/Jakarta.

Beer, Jenne H. de, and Melanie J. Mcdermott. 1989. *The Economic Value of Non-Timber Forest Products in Southeast Asia.* Amsterdam: Netherlands Committee for IUCN.

Departemen Kehutanan. 1991. "Social Forestry: Tengkawang Development Project, Kalimantan Barat." Unpublished project report.

Dove, Michael. 1986. "Swidden Systems and Their Potential Role in Agricultural Development: A Case Study for Kalimantan." *Prisma* 21: 81–100.

Erlanger, Steven. 1989. "Indonesia Takes Steps to Protect Rain Forests." *New York Times,* 26 September.

"Forestry: A Saw Point for Ecology." 1990. *Far Eastern Economic Review,* 19 April.

Lahjie, Abubakar M. 1992. *Laporan Perkembangan: Diagnostic Study of Community Forest Management Options in East Kalimantan.* Samarinda: Mulawarman University.

Mackie, Cynthia; T. C. Jessup; A. P. Vayda; and Kuswata Kartawinata. 1986. "Shifting Cultivation and Patch Dynamics in an Upland Forest in East Kalimantan, Indonesia." *Impact of Man's Activities on Tropical Upland Forest Ecosystems.* Washington, D.C.: Man andBiosphere Project.

Peluso, Nancy Lee. 1992. "The Political Ecology of Extraction and Extractive Reserves in East Kalimantan, Indonesia." *Development and Change.*

————. N.d. "The Ironwood Problem: (Mis) Management and Development of an Extractive Rainforest Product."

Vadya, Andrew P., and Ahmad Sahur. 1985. "Forest Clearing and Pepper Farming by Bugis Migrants in East Kalimantan: Antecedents and Impact." *Indonesia,* no. 39 (April).

Wangsadidjaja, Sopari S., and Agus Djoko Ismanto. 1991. "Research Needs for Enhancing People's Participation in Indonesian Production Forest Management." Honolulu: East West Center Writers' Workshop.

World Bank. 1989. *Indonesia Forest, Land and Water: Issues in Sustainable Development.* Washington, D.C.: Asia Regional Office. Report No. 7822-IND.