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The *sikerei* of Siberut, intellectual property, and reserves for traditional knowledge



Mentawai *sikerei* and local conservation activist, Siberut, Mentawai Islands, Sumatera Barat, Indonesia, February 1989 photograph by Gordon Brent INGRAM

synopsis

Have any authentic postcolonial frameworks emerged, so far, for the conservation of rainforest and genetic resources and for the protection of associated traditional communities? Not really. Is there now a basis for intellectual property and biodiversity prospecting that is not neocolonial? Yes, but it must be based on negotiating frameworks where there is relatively autonomous territory and traditional knowledge is linked to conservation-oriented land management. Is establishment of isolated zones of traditional people contributing to types of extractive reserves of information that mine cultures with only weak possibilities of these territories supporting new strategies for cultural survival? Sometimes and hence the purpose of this essay. Should and can knowledge of the properties of plants be "owned" by local, traditional groups rather than by national governments? This has already been the case for a long time but this still has not been recognized by most state frameworks. Is there a practical basis for traditional groups claiming forms of royalties and patents over the genes of traditionally utilized species that are either wild and managed or partially or fully domesticated? This is one of the most important developments in land management in the developing world in this decade. What are the possible international instruments for bringing income generated through biotechnology, from genes derived from wild populations, back to those same communities and to locally oriented programmes of conservation and social development? What will motivate traditional healers and land managers to want to participate in any new postcolonial frameworks that link conservation of traditional knowledge and natural habitat with reassertion of local control over traditional lands and biological resources? These questions are explored for the traditional communities and healers, the *sikerei*, of the island of Siberut in the Mentawai archipelago of west Sumatra, Indonesia. The conservation efforts for the rainforest and coral reefs on Siberut, as well as for the survival of traditional Mentawai communities and cultural ecology, are assessed as are prospects of the *sikerei* harnessing the limited opportunities provided by the Convention on Biological Diversity.

Introduction:

Bioprospecting as part of indigenous re-appropriation of lands & resources

I am writing this essay to explore some new possibilities for conservation of biological diversityⁱ and the rainforest and island ecosystems that sustain them in the "margins"ⁱⁱⁱ of the Pacific Rim. I intend to highlight some of the linkages between the work of the traditional healers, the *sikerei*, of Siberut and the 1992 *Convention on Biological Diversity* (UNEP 1992) and to embed this discussion in an emphatically postcolonial narrative. Such a discussion must be inherently critical of the apparatuses of the (neocolonial) State. I intend to critique the contemporary notions of "traditional knowledge" and "extraction" from the perspective of what little I know about the *sikerei*. I use these speculations to argue for more critical and site-specific approaches to support indigenous communities in taking control of their biological resources and knowledge bases.

I have been to Siberut and have written on its conservation status.ⁱⁱⁱ But I know little about the *sikerei*. What I know is related to my concerns for the conservation of the island's natural ecosystems and biological resources. The *sikerei* have viewed me as another tourist researcher. At times, they have been very kind and I have learned a few things. In my conservation research, I have been something of a global "consumer" from another part of the Pacific Rim^{iv} with my own investments in the maintenance and enjoyment of certain biological resources and related biosphere processes. I like tropical rainforest. My work around Siberut has been an environmental planner and not as an ethnographer. I do not speak any Mentawai dialects and communicate through *bahasa Indonesia* the language of trade and tour guides.

My central arguments are that the natural ecosystems and traditional cultures of Siberut have more value, in both local and global terms, as "information reserves" rather than as areas of "extraction"^v of raw forest materials. The central contradiction that I explore is that there is still not an intellectual property framework for exchanging information that contributes to local control and management of respective environments and resources.^{vi} There has been some ethnobiological "prospecting" and now there is cultural tourism. The reduction of the production of the traditional Mentawai to a few natural products, such as rattan the gathering of which for outside markets has gone on for decades, will not solve the problem. The *Convention on Biological Diversity*, alone, will not keep these local cultures from being further marginalized and "disempowered" in the global market place. Fortunately, there are some new ideas for the exchange of traditional information and genetic resources and I have been particularly influenced by Joe Vogel's 1994 book *Genes For Sale*.

The progression of this discussion begins with conceiving of postcolonial transactions where the labour of maintaining cultural relationships and knowledge bases, *in situ*, is fully recognized within the frameworks of data transmission. The environments of Siberut are outlined as well as some of the plant genetic resources of local and global significance. The land use planning frameworks imposed since the beginning of the European colonial period will be outlined as well as the subsequent intrusions of logging and tourism. The current demands^{vii} for genetic resources and information are considered. The contradictory roles of both the *Convention on Biological Diversity* and the State, in this case the Republic of Indonesia (RI) and the province of Sumatera Barat, in conservation are

explored. I end this discussion looking at ways that the *sikerei* might want to participate in these information transfer and begin to mediate competing global forces.

Traditional knowledge, plant genetic resources, and habitat conservation: Dreaming a postcolonial narrative

In order to construct a vision of postcolonial exchange of intellectual property, and a range of related products and services, I think that it is necessary to deconstruct some of the "myths" that maintain, if not regulate, the current neocolonial relationships. These stories are imposed indirectly on the *sikerei* and function to justify disparities between the marginalized and the metropolitans. Local communities may be more aware of these biases and hidden agendas than outsiders. The following are a progression of three facets of neocolonial mining of traditional knowledge and the associated biological resources.

One of the most successful yet blatantly exploitative uses of traditional knowledge, in recent years, was Wade Davis' 1987 popular book, *The Serpent and the Rainbow*. It penetrated some of the veils around "zombiism" and the related use of the properties of the plant, *Datura stramonium*, in the Bizango cult of Haiti. This well-promoted book was later made into an even more exploitative film of the same name with a more scholarly account in another book (Davis 1988). The relationships for the use of traditional information encoded in his narrative, in his myth, were profoundly colonial and, at the least, counter to support for local control of traditional information.

Plant exploration and collecting as mythic transactions

- The explorer comes to investigate the "problem" with little motivation for personal gain.
- The locals are found to be adapting traditional knowledge and are not coincidentally found to be corrupt.
- The explorer takes information from the corrupt locals, inadvertently attacking, weakening, and even endangering them. This is acceptable because the locals are "bad."
- The explorer, the (typically male) colonial adventurer, escapes the chaos and corruption of the marginalized and finds some kind of moral upper hand through "love" of the European or somewhat Europeanized woman. A cultural reproductive unit is formed. The initial appropriation is completed.
- The prosperity of the colonist / entrepreneur is due to their "goodness" and hard work, from **their** transformation of the knowledge, rather than on the original theft.

The dynamics of this myth are structured around those of the European(ized) and the "other" and between the educated and the not-so-noble shaman. Yet the confrontation of cultures is oddly obscured. While this myth justifies virtual theft of traditional knowledge and the removal of selective details from context, this myth also allows for a continued indulgence in the objectification and fetishization of the "primitive" at a time of intensifying critiques of the positioning of most ethnography. In the case of the use of this particular retrogressive myth sequence, the effectiveness of subsequent efforts to support traditional communities are limited if not actually negated.^{viii}

The initial myth for justification of the theft of knowledge has been augmented in recent decades. The transactions in the upriver sequences of Francis Ford Coppola's film, *Apocalypse Now*, though not directly involving traditional knowledge, provide additional justification for adventures in the jungle and elaborations on the fantasy of the white raj. There are two underlying messages. The first suggests that once the barriers of "difference" are broached the "modern" adventurer or plant explorer will be confronted with such unspeakable inhumanities in the "Native" (who has the plant resources) that any form of viable local autonomy is impossible. Secondly, any forms of local autonomy, based on local perspectives, and that are selective in their use of modern and Western technologies and approaches will be doomed to corruption. This suggests that "Natives" cannot adapt without being corrupted to the point where they no longer have the right to possess their own cultures. The function of this myth is to further justify the appropriation of knowledge from people who are deemed no longer worthy of possessing it.

A third set of myths that justify the taking of traditional knowledge, without full negotiation of exchange, is Carlos Castaneda's 1970 *The Teachings of Don Juan* and the many subsequent books in that series. While being totally discredited as ethnography or "truth," the success of the books suggests that they functioned to give a large group of people what they wanted. In order to escape the sins of (continuing) (neo)colonialism, the appropriation of traditional knowledge of plants is personalized. The narrator holds the personal right to transfer information, and profit handsomely from it, because he has been "chosen" by the traditional healer / shaman / witch. There is a *de facto* transfer of information and prerogatives akin to the buying of aristocratic titles by the nineteenth century bourgeoisie. The theft in these types of transactions are more insidious and involve a transition to a postmodernism of false cultural specificity. In other words, without considerable knowledge of a specific community it would be difficult to identify the neocolonialism; the nature of the polite theft of information. This third type of transaction is also difficult to identify in that in their efforts for survival and success, traditional healers may well choose to share their information, on their own terms and without any *naivete*, if only for the money.

Whatever we conceive and negotiate as postcolonial transactions around traditional knowledge and respective environments will be in the shadows of these dismal dreams. Conceiving new forms of information exchanges, new forms of safeguards for localized cultures, will require the inversion and reconstruction of these sequences.

Obfuscation of site as characteristic of neocolonial transactions

A central characteristic of neocolonial transfer of information from traditional cultural frameworks is the obscuring of the totality of environment and site. The major problem with the commodification of traditional knowledge is that there is too much of it and few potential consumers have the patience to want to "use" it. The site-specificity, in times of dwindling territories, is essentially suppressed. There are reductions of complex sequences of information embedded in complex cognitive maps to manageable "thought bytes" of "raw" material. This also aids the obscuring of the sources of the information and the myth of its transformation by the explorer. The advantage of scientific reductionism, in this context, is that it strips down the information to a form that can be used for direct

manipulation and commodification. Too much information, especially that which would counter the objectives of resource exploitation, would get in the way. Much of this excess information is about territory and community - particularly useful for the survival of respective cultures.

Traditional narratives, such as those involving knowledge of the properties of wild plants, are nearly always tied to concerns for land^{ix} and communal autonomy. Lineages relate to sites. Myths describe complex and cumulative situations and alliances. Narratives are often spatial and environmental. Plants can be related to the health of individuals, more collective experiences, natural cycles - and now to coping with intrusions, social change, and environmental degradation. In reducing complex communal experience to manageable "traditional knowledge," a key divergence in transcription and interpretation emerges. Where the transmission of the information is focused on improving the prospects for survival and autonomy of traditional cultures, the narrative will contribute to the construction of new local cognitive maps regardless of how 'pure' or 'pre-contact' is the content. The 'informant' will be relaying the information on their own terms, ones that are grounded in their own survival and prosperity, and which therefore have spatial and environmental dimensions, rather than being forced to reduce and convolute content to the demands of the ethnographer / scientist / interrogator. Too often in such neocolonial transactions, the bits and pieces - the fragments of knowledge that are received and recorded, are recombined in ways that can actually jeopardize the position of the communities of informants.

Extractive reserves for the extraction of natural forest products on a sustainable basis are still largely theoretical spaces. Such zones can be defined in various disparate ways. In the case of primary forest, some of the canopy can be maintained. For indigenous groups, badly needed cash can be made through adapting their subsistence patterns and technologies. For displaced peasants, livelihood can be obtained from maintenance of aspects of natural ecosystems in contrast to through destruction of regional environments. The questions of cultural and site-specificity in the management of extractive reserves suggests a direct link to the traditional information that usually overlaps such mythic territories - if any of that knowledge base is still in existence.

The extraction of information versus the extraction of raw material

With extractive reserves, there has been something of a false dichotomy between the transfer of raw materials and the transmission of information. But there is a continuum with a number of intersecting processes related to intrusion of outside institutions and subsequent loss of traditional culture, assimilation, and the shift from subsistence to waged livelihoods. The extractive reserves of Amazonia have largely involved displaced indigenous or mixed peasant populations organized into cooperatives or unions of workers. The knowledge base in maintaining, locating, and procuring the natural forest products is relatively modest and of a recent nature. The "use" of extractive reserves as part of strategies to slow the conversion of primary forest is part of a "last ditch" effort to counter the intensive intrusion of globalized capital. But it remains to be seen whether extractive reserves can become bastions for ecosystem and locally based management of land and natural resources and for a broader range of natural products with value-added components.

In areas with more autonomous traditional societies and relatively intact knowledge bases, reserves for the "extraction" or rather transmission of traditional information are more appropriate than for the removal of natural products. The prices paid for natural products can be relatively low forcing gatherers to work long hours at the expense of traditional social responsibilities and local culture expression. The knowledge base for traditionally used plants, for example, can decline simply from the overwork of gathering with less opportunities for learning and exchange. The transmission of this information can also be diminished with the decline of traditional institutions because the working for wages takes on the central position in people's lives. I argue that the value of the dwindling traditional information on wild species with genetic resources is increasing rapidly, in globalizing (Caldwell 1991) networks, while the prospects of adequate income for gathering forest products for export, with the fluctuating world markets, is, at best, precarious. This has particularly been the case for the remaining traditional communities of Siberut, in recent decades, with the gathering of rattan. My argument, here, parallels the one for the shift to post-industrial, service-based economies. The emphasis in market growth and accumulation of new wealth, in the global market place, has shifted to services and information from raw resources. In this context, any emphasis on export of raw resources, no matter how "sustainable" is the production and with all of the notion's contradictions (Redclift 1987), runs the risk of contributing to loss of key information and subsequent underdevelopment. Of course, if the indigenous communities of an area have already been obliterated or scattered and there are a lot of hungry, displaced peasants, such a raw resource export base is a reasonable last line of defense against loss of whatever remains of local primary rainforest. In situations like the more remote parts of Siberut, transmission of traditional knowledge is still potentially more lucrative for local institutions than a few individuals working for seasonal wages.

Reserves for traditional information and culture could begin to seem like the territories of native peoples in Huxley's novel from between the world wars, *Brave New World*. Where I live, in British Columbia, we have "Indian reserves," "mineral reserves," and "ecological reserves" - all with colonial and neocolonial apparatuses still very much in place and all tending to obliterate both the histories of the broader regional contexts and the specificity of particular indigenous histories over places. An "extractive" reserve for information could involve the export of forest material but it would be primarily germplasm for subsequent production of products to be established on disturbed lands, *ex situ*. There could be what Vogel (1994) has conceived as "genesteading" where money from biotechnology enterprises is channelled back to local conservation and, in particular, to the germplasm procurers / ecosystem managers / forest guardians. There might well be infrequent export of nonreproducible products but more in ways that enhance the position of local institutions.

What differentiates reserves for information from those for raw material export is an economic structure dominated by the exchange, compilation, review, revision, and external transmission. The valuation, of knowledge about the local environment, biophysical, social, and cultural, is a reflection of the linkages between the traditional narrative of those resources within the community and current efforts for adaptation and autonomy. This has more similarities to genetic resources preserves as postindustrial "gardens" of *in situ*

conservation of genetic resources (Ingram 1987) - though ones managed by local communities. Such genetic reserves now have key roles for expansion of biotechnology with similar functions to those of the great botanical gardens such as Kew (Brockway 1979) in the establishment of the colonial plantations.

An extractive reserve for traditional knowledge and genetic resources should be first based on customary patterns of livelihood and accumulation of wealth. Locally management museums and various research programmes would become pillars for the apparatuses for exchange. The work of such nongovernmental organizations could involving both locals and outsiders and would focus more on documentation, compilation, and control of the information than on export of raw material. Such indigenous resource and protected areas could continue to be what Annie Zetco York (et al. 1993) referred to as "universities" for respective locally based cultures. Subsequent knowledge bases could be oriented, first and foremost, to satisfying a range of local needs and in solving problems rather than on being just natural resources repackaged for use elsewhere. Such territories would provide the basis for obtaining incomes from royalties, patents, and related products. In the subsequent sections of this paper, I explore the prospects of Siberut, or at least parts of the island, becoming a reserve for traditional knowledge.

The environment of the Mentawai Islands and Siberut

The Mentawai Islands lie off the Indian Ocean coast of Sumatra^x and the archipelago comprises the southern portion of a larger string of islands along the west coast. The total landmass of the Mentawais is roughly 7,000 square kilometres. Siberut is the largest and most northerly of the four major Mentawai Islands^{xi} and is 85 to 135 kilometres from Sumatra. Siberut has an area of 4,480 square kilometres mainly in rainforest. The biota of Siberut can be characterized by an extraordinary combination of both isolation and species richness - a particularly rare combination for island ecosystems. In order to understand the nature of the requirements for cultural and site specificity of the strategies for reserves for traditional information necessary for Siberut, it is necessary to consider some of the major biophysical and landscape processes. The archipelago was formed with the rising of volcanoes on Sumatra with the subsequent formation of a deep underwater trench extending to depths of 1500 meters. The islands are no longer part of the southeast Asian continental shelf.^{xii} There are only two geomorphological types in the Mentawais: strongly dissected hilly areas and alluvial lowlands (Verstappen 1973).

Siberut is of recent origin. There are some pre-Miocene conglomerates, with schists and quartz, and some uplifted limestone cliffs from the Miocene. But most of the island is made up of young sedimentary shales, silts and marls from the Pliocene, Pleistocene and recent epochs (page 163, van Bemmelen 1949). The island's low-lying hills are all about the same height with the highest being 384 meters. The high rainfall and unstable parent material has lead to high erodibility and dissection. Drainage patterns are extremely complex. Slope failures and mass wasting are common in steeper areas. The west coast of the island is straight with sandy beaches. The east coast has tectonic subsidence with coral reefs, bays, islets, capes, mangroves, and in some areas extensive deposits of alluvium. The coral reefs are comparatively undeveloped because of the high levels of suspended sediment. As for soils, Siberut has mainly *red-yellow podsols*, labelled *organic luvisols* in the FAO

system (FAO 1979).^{xiii}

The climate of the Mentawais is remarkable in its mildness of temperature variation, both daily and seasonally, and the extreme levels of precipitation. The climate of the Mentawai Islands "is virtually aseasonal" (House 1983) with two slightly wetter seasons in April-May and September-January. The area is the centre of diversity and speciation for a number of tropical rainforest genera. Because of the climatic influences from the Indian Ocean, the islands continued to receive relatively high levels of precipitation in the drying phases of the Pleistocene when many areas in the region could only support drier, more seasonal forest (Meijer 1982). The forests of Siberut were little effected by the Pleistocene crises which desiccated much of the tropics. The following ecosystem types have been documented on the island (WWF Indonesia 1980).

- **Primary dipterocarp forest** dominated by *Dipterocarpus* spp. and *Shorea* spp. is confined to the hills. The canopy is relatively open with few climbers and epiphytes. The ground level is sparse. There are some palms but the fan and fishtail palms, which are common in Malaysian dipterocarp forests, are absent. There are few big, canopy-reaching rattans and many low, stemless rattans. On the hill ridges, the most common dipterocarps are Myristicaceae, Euphorbiaceae and Sapotaceae. Between the ridges, these groups occur in roughly equal portions.
- **Primary mixed forest** includes numerous families of trees but none are dominant except where topographic or geological features create specialized habitats. The most common families are Myristicaceae, Euphorbiaceae, Dilleniaceae and Dipterocarpeae. Legumes are rare in contrast to Sumatra. The most common emergents are *Shorea* spp., *Dipterocarpus* spp., *Dialium* spp., *Pentace* spp. and *Durio* spp. There are many woody climbers. Ground vegetation is dense and there are fewer emergents than in dipterocarp forest.
- **Freshwater swamp forest** has a specialized and limited tree flora dominated by *Terminalia phellocarpa*. The ground flora contains feather palms, rattans, pandans, aroids and everwet soil studded with pneumatophoric roots. The most extensive areas of this forest type are on the east coast of the island and much of the remaining tracts are not in pristine condition.
- **Mangrove forest** is only on the shore of the east coast where the sea is shallow. The mangroves are often adjacent to areas with coral reefs. A cross-section of the Siberut mangroves begins with a low fringe with stilt roots, *Rhizophora* spp., which is succeeded by taller trees with buttresses and pneumatophore roots, *Bruguiera* spp., where the substrate is exposed at low time. The estuaries of large rivers are fringed with *Nypa fruticans* which can extend up to 2 kilometres inland.
- **Barringtonia forest** is on the west coast along the sand beach fringe. There is a narrow terrace with stands of *Casuarina equisetifolia* which are usually interspersed with tree-shrub associations such as: *Barringtonia* spp. and *Hibiscus* spp. On headlands with rocks, there are usually large trees such as *Eugenia grandis* and *Calophyllum inophylloide*.
- There are some **cultural landscapes** on Siberut involving on-going gathering and

clearing. The areas of intensive horticulture are dominated by banana and taro and can be considered another category of vegetation. These areas are primarily on the edges of freshwater swamps.

- There are three major habitat types in **shallow marine areas**: mangroves, coral reefs and sea-grass beds. There are coral reefs off the east, south and southwest coasts of Siberut as well as the off-shore islands. The reefs off the central part of the east coast may be the most extensive and diverse complex in the Mentawai archipelago (Mitchell 1982).

Si berut, "the mouse" in a local Mentawai dialect (Loeb 1935), is remarkable in the absence of large Sumatran predators, including the larger predators, and in its level of animal and plant endemism. The WWF-Indonesia (1980) report on the island suggests that some forest types are "unique." Perhaps 15% of the island's plants are endemic. There are more than 27 species of native mammals on Siberut. Of the non-flying mammal species, roughly 80% are either endemic species or subspecies. The Mentawais have the highest levels of primate endemism on Earth (WWF - Indonesia, page 39).

The cultural ecology of the Siberut Mentawai

Mentawai societies are peculiar in the cultural isolation which extended into the Twentieth Century. This, "enabled the people to retain many cultural practices once common throughout archaic Indonesia" (Mitchell and Tilson 1986). There was a New Stone Age level of development and an economy based on sago, taro, fishing, pig-raising, and the hunting of primates. Until the last century, there were no food grains, metal, woven cloth, pottery, craft specialists, villages, chiefs, betel nut, tobacco or alcohol. There was a great deal of linguistic variation on Siberut and language units could often be correlated with watersheds.^{xiv}

The nature of the restraints on land management as part of social organization was remarkable (Schefold 1972). The basic unit of Mentawai society is the *uma* (Schefold 1980): an exogamous, patrilineal (Wallace 1951) and patrilocal clan (Loeb 1928). There is very little organization above the level of the village, *laggi*, though in recent years there has been some linking with clans from other watersheds. Decisions were often made by consensus (McNeely 1979) and ownership within the *uma* remains largely communal.

The Mentawai people have been noted for their system of rituals and taboos which "kept people and forest resources in an equilibrium" (Mitchell and Tilson). The traditional religion of the Mentawai was centered on a belief in "internal harmony in the environment" (Mitchell and Tilson). Hunting, gathering and agriculture require various observances and ceremonies for the maintenance of the balance. Taboos and codified knowledge of local ecosystems and populations contributed to relatively sustainable patterns of natural resource use. There were familial religious observances, *lia*, and essential rituals, *punen*, for a number of activities which could disturb the environment, such as tree cutting and primate hunting, as well as other related taboos, *kerei*. Ceremonies which involve making peace between *uma* are called *paabat*. Extended religious festivals, involving entire clans, *puliaijat* (Borri 1986), were the focus of seasonal cultural expression. Ceremonies were highly

elaborate and involved the sacrifice of domestic animals, the use of offerings of such items as flowers (Brent 1979) and other plant material on *ker*a poles, and invocations in order to strike harmony with various species and forces (Loeb 1929).

"the Mentawai's supernatural world was a reflected image of their own social conditions and relationships. Souls, spirits and ancestors have equal rights among themselves just as the living people in their settlements: they communicate with each other and could exert mutual influence. Just as a man could convince his fellows only by means of discussion, he could only achieve success in the realm of the supernatural by means of invocation and mediation." (Schefold 1973)

In such a relatively classless society, there were few religious positions: the *rimata*, the leader of ceremonies, and the "seer" or shaman, the *sikerei*. Much of the local knowledge of plant names, properties, and locales are known by the *sikerei*.

The Dutch military had a minor influence on Mentawai life in the Nineteenth Century. Even the missionaries rarely have ventured beyond the coastal villages of Siberut. Since 1920, the policy of the missions and the government has been to concentrate the Mentawai into villages and to breakdown the *uma* into houses limited to nuclear families. A large portion of the resettled Mentawai do not observe the traditional religion and the indigenous socioreligious structures in these villages has been "largely nonfunctional" (Nooy-Palm 1972) for decades. However, Schefold (1973) documented traditional villages in the south central areas around the village of Sakuddei where resource exploitation and conservation patterns, as well as the associated religious system, continued to be relatively intact (Lindsay 1992).

The missionaries have encouraged a change in land use patterns from one based on subsistence to one based on the production of surplus and cash. There has been a corresponding shift away from the traditional constraints on use of biological resources. The production of rice rather than sago, has required considerably more work which has allowed for less time available for traditional religious observances. The breakdown of the traditional observances required for environmental interaction, in combination with the ecological disruption associated with commercial logging and expanded agriculture have caused the loss of some components of the self-regulation of local communities. For example, taboos on the hunting of the two larger primates of the island, the gibbon and the pigtailed langur, relaxed by 1970 through missionary influences.

Wild plant species utilized by the traditional Mentawai and of significance as potential extractive species or genetic resources

The following species are examples of some of the biological resources which are key to the Mentawai and of growing significance to the global economy. The many species of medicinal value are not mentioned here.^{xv} The only raw materials that has been exported on a regular basis have been rattan. There are various kinds of genetic resources. There are those in the more immediate parts of the gene pools of the major crops and for the wild species of Siberut these are nearly all tropical trees. There are species that can contribute genes to crop gene pools through various laboratory interventions. They are species that may be introduced into cultivation possibly in the distant future. There are species and ecosystems that while not ever providing germplasm may be resources for the study of adaptive complexes and environmental responses. There are genotypes of traditionally

utilized species that have been domesticated, semi-domesticated, or at least managed.

The following are some of the key food species of the traditional Mentawai: the "cabbage" of *ari ribbuk*^{xvi}, *Oncosperma horridum* and *O. tigillarum*; the fruits of *bebeget*, *Calamus manan*, the sago palm, *sagaike*, *Metroxylon sagu*^{xvii} and *M. rumphii*; one or more species of wild citrus called *muntei*; two species of durian, *Durio graveolens* and *roriat*, *D. zibethinus*; jackfruit, *pegu*; four species of mango: *paggu*, *beiloy*, *lemu* and *Iabungan*; and a number of banana species, *suggunei*, *Musa sumatrana* plus another species, *Musa* sp.

As for technology, two plant species, *Derris elliptica* and *Antiaris toxicaria*, are used for making poison arrows. The *sinuba* tree is used for poisoning in fishing. A number of rattans are used: *pelege*, *Calamus javensis*; *bebeget*, *C. manan*; *labi*, *Daemonorops angustifolia*; and *sasa*, *Daemonorops* sp. There are a number of other palms which are important in traditional Mentawai technology: *nappou*, *Nenga pumila*, *Pinanga densiflora*, and *P. coronata*; *saplap*, *Pholidocarpus* sp. aff. *macronatus* and *nipa*, *Nypa fruticans*. There are a number of dipterocarp species used in construction: *jining*; *atarat* for the largest canoes; and *katuka*. One palm, a *Oncospermos* species is relied upon heavily for house construction. Large specimens of *Shorea* spp. trees, probably some of which are listed above by their local names, are used for canoe-making. The following plants are important in various ceremonies (Loeb 1929): species key to the *katsaila*, loral bouquet such as *pola*, *Arenga obtusifolia*; *sikopuk*; one or more species of wild citrus called *muntei*; and *kinuu*, curry berry, *Piper juvenile*. The large structural trees, such as all of the Dipterocarpaceae species (Ashton 1982) are valuable for traditional Mentawai villagers as well as are targets for logging: *Dipterocarpus retusus*; *koka*, *D. warburgii*; *D. hasseltii*; *Vatica lutea*; *V. papuana*; *Shorea leptocladus*; and *koka*, *S. lamellata*.^{xviii} There is only one rattan, *Calamus manan*, which has been gathered for furniture making and exported mainly by non-Mentawai.

The following are some of the species with the most widely recognized and immediately marketable crop, timber, and technology genetic resources on Siberut. The following species are significant for the expansion of agriculture in Sumatra and Indonesia: banana, *Musa* spp.; jackfruit, *pegu*; two species of durian, *Durio graveolens*, *D. zibethinus*; mango, *Mangifera* spp.; mangosteen, *Garcinia celebica*, *G. nervosa*; *lakoma*, another *Garcinia* sp.; wild citrus: *Luvunga sarmentosa*, *Limnocitrus littoralis*, *Paramignya trimera*, *P. andamanica*, *Atalantia monophylla*; *Pleiospermium sumatranum*; and *Merope angulata*. Virtually all of the *Calamus* spp. and *Daemonorops* spp. have valuable genetic resources for the southeast Asian region for rattan cultivation. The following species are significant for the improvement and expansion of agriculture in other parts of the world: *Musa* spp.; durian, *Durio graveolens*, *D. zibethinus*; *Vaccinium hasseltii*, *V. littoreum*, and another *Vaccinium* species; the wild citrus mentioned before, and several wild mango species.

Trends in Mentawai society and culture on Siberut

Siberut is a cultural landscape formed by at least 2,000 years of hunting and fishing, plant gathering, swidden cultivation of taro and bananas, and domestic pigs and chickens. There were three types of traditional Mentawai manipulation of the environment. It was difficult to know whether these had an adverse impact on the survival of some species. Most likely, these activities have only expanded the niches which were associated with secondary

succession. In the least disturbed parts of the island, which often were the most remote from villages, there was only the cutting of trees for canoes as well as the gathering and hunting of various species. There were areas with moderate disturbance, such as with light clearing associated with the gathering of materials for building construction. There were wider clearings for cultivation of banana, sugar cane, taro, and sago, and extensive alteration around villages referred to in Indonesian in *ladang*. In 1976, Siberut had a population of 18,149 (WWF-Indonesia). Since then, the population has increased by roughly 3 % per year though rates may be higher in the less traditional villages. There are a number of land use activities which are expanding and which may eventually threaten some elements of the island's biological diversity. Traditional gathering, hunting and agriculture are being squeezed into smaller areas. In their discussion of the status of human-primate relations on Siberut, Mitchell and Tilson attribute the disintegration of the local system of restraint on the hunting to the resettlement of clans, government assaults on traditional culture such as discouragement of long hair on men, tattoos, and the spread of commercial logging.

Expansion of selective logging has produced the most negative changes in habitat in terms of area. In recent decades, infrastructure necessary for logging operations, such as roads, log dumps, and buildings, have produced the most site-specific and intensive impacts. Mangrove cutting has seriously impaired ecological processes in some shore communities. Intensive rattan collecting has altered the understorey composition of primary rain forest. There had been proposals for transmigration settlements (Davis 1988, Sierra Club 1980) for the east coast of the island.^{xix}

Land use planning and the Indonesian state

In order to consider the options available for reserves for nature conservation, extraction of forests materials, and traditional knowledge, it is necessary to assess the current institutional frameworks for land management. Virtually all of these frameworks are heavily biased against habitat conservation and local land management - particularly by tribal communities and towards control by political forces in national and provincial capitals and their financial allies. Indonesia, as a modern state (RI), has been remarkable in its zeal for planning extending back to the Sukarno years (Humphrey 1962). However, until the late 1970s, there was neither much mention or a framework for the inclusion of concerns for habitat conservation nor the needs and aspirations of traditional communities. Given the rapidly increasing demands which were being placed on Indonesia's natural resources, government policy for conservation is related, directly, to the interests of the apparatuses of the RI and its priorities for the poor and marginalized. Unfortunately, these imperatives have usually only been interpreted in terms of short-term returns and market indicators.

The Dutch declared the Mentawai Islands their colony in 1864, and established a garrison on Siberut in 1904. There was very little contact between Siberut and Java or even Sumatera Barat until after Indonesia independence, *Merdeka*, in 1949. In decisions over the Mentawai Islands, a blend of Javanese (Anderson 1972) and Minangkabau (Abdullah 1972) perspectives have dominated. Neither world views had fostered the kinds of adaptive and locally based management which are ultimately necessary for the conservation of such vulnerable and site-specific biological resources. There are three underlying obstacles to development of effective national programmes of habitat conservation. Firstly, the Javanese

view of history has been of recurrent cycles in contrast to the linear progression which dominates Western perspectives. There is little place for the advent of crises unique to particular eras such as the current massive losses of forest and biological resources. Secondly, there is often a deep almost religious obsession with avoidance of confrontation and for national unity, even when it is at the expense of protection of natural habitat. This cultural perspective can be argued, from the standpoint of Westerners, to have stymied efforts for local political control and may have contributed to the formidable "centripetality" (Anderson 1972) in the current high level of control from Jakarta. Thirdly, the refined bargaining and bluffing, so central to negotiations in Java, *perintah halus*, has been largely unworkable where Javanese sensibilities encounter those of the more confrontive *orang asli* of the outer islands.

For the closest neighbours of the Mentawai, the Minangkabau, there has continued to be an expansionist perspective on their own history, verging on manifest destiny, which has been exaggerated with progressive Islamization. With this sense of gradual enlargement, which verges on a sense of divine providence, the Mentawai Islands have been viewed as one of the last frontiers within the province. But these cultural impediments and biases are comparable to those of other resource frontiers in the world and the RI, as a state apparatus, has made far more extensive and authentic gains in inclusive and "multicultural" decision-making in land use than for example my own country, Canada, or other large countries such as the United States, Brazil, and even neighbouring Australia. But the government ideology, *Pancasila* (Morfit 1986), does not address directly conservation nor the distribution of environmental benefits and costs from development. When there have been environmentally related conflicts, they have often been seen in terms of sectoral and intra-governmental competition. The New Order government (MacAndrews 1986a), of the last two decades, has greatly improved the delivery of basic education and social services which may better support the bulk of the population of Indonesia in having more opportunities to discuss and direct the nature and style of environmental regulation as part of integrated development. There have also been moves to delegate more authority to provincial governments (MacAndrews 1986b) which have both positive and negative implications for cultural autonomy and conservation on *Palau Siberut*.

The level of comprehensiveness of land use planning has been very low. There has only been modest RI reliance on land use suitability assessment (Scholz 1983). Consideration of the general ecological impacts of selective logging has often involved more rhetoric than factual analysis. As for assessment of the impacts to vulnerable species, emphasis has been on the primates with little data available for other organisms. In such a context, the notion of "sustainability," in terms of continued timber production and the survival of sensitive species, is problematic and often functions more rhetorically, than as a basis for decision-making over particular sites.^{xx}

Commercial logging

The logging has been imposed on the traditional lands of the Siberut Mentawai with little negotiation and only limited compensation. Considerable wild plant resources have been lost either permanently, in the case of roads, or for up to decades in the areas of selective cutting. The logging is a threat to some vulnerable elements of local biodiversity.

Much of the timber harvesting so far has been at the southern end of the island. Major concessions began to be granted in 1969, in the period when multinational companies again were being welcomed in Indonesia.^{xxi} There have been attempts at commercial logging in the area since 1914, but only in the last 20 years have there been on-going operations.^{xxii} By 1980, 4 companies were working on the islands and their concessions included virtually all of the island^{xxiii} except for the nature reserve (WWF-Indonesia 1980).

All of the timber exploitation on Siberut has involved selective cutting.^{xxiv} These methods were defined by Johns (1985) as a programme of forest exploitation where, "the removal of mature, over-mature and defective trees in such a manner as to leave uninjured an adequate number and volume of healthy residuals of commercial species and other tree species necessary to assure a future crop of timber and forest cover for the protection of soil and water."

In his review of the effects of logging on hill dipterocarp forests in peninsular Malaysia, ecosystems similar to those in the hills of Siberut, Burgess (1971) noted that the most problematic impacts of selective logging were from road building, with subsequent alteration of drainage patterns and erosion.^{xxv} Logging roads have also made remote interior areas more accessible for subsistence hunting (Tenaza 1987).

The forest land use plan for Sumatera Barat (Pusat Penelitian Tanah, Bogor 1982) is an indication of the extent of the forest and respective cultural disturbance that was planned for the island and of the still present pressures for habitat conversion.^{xxvi} A breakdown of land disturbance categories as of 1982 (Mitchell 1982) showed 13% of the total area of the island had been logged with another 1 or 2% was probably disturbed for roads, camps and other aspects of operation. For traditional Mentawai communities, any permanent loss of forest habitat has had negative consequence for food availability and local subsistence. Families have often lost wild tree staples such as durian. Under the Indonesian forestry and land ownership system, individuals on Siberut own land but the Department of Forestry owns the trees. The national forestry agency grants concessions for cutting on communal lands such as these. In the case of Siberut, all but 100,700 hectares of the island were granted in concessions with "almost a total lack of compensation" to local people (Whitten and Sardar 1981). While selective logging does not have to create permanent damage to rainforest habitat, the reality has been that legislated regulations to protect residual trees in selective logging in southeast Asia have proven to be almost universally ineffective.^{xxvii} The impacts of forest conversion and selective logging on rainforest biota have been a topic of growing interest in southeast Asia. The 1980 *Siberut Conservation Master Plan* (WWF-Indonesia) listed three factors which cause environmental damage. Land use was poorly planned. There was a lack of control of resource utilization. There were negative impacts from the introduction of some new technologies. The timber companies which have been cutting on Siberut have not always respected their concession agreements.^{xxviii} While the price of timber has increased, in recent years, substantially, there were few new efforts to make the operations conform to the environmental regulations.

Dysfunctional frameworks for habitat conservation

For Siberut, much of the enabling legislation and government directives for conservation are federal in nature, while implementation is carried out through provincial agencies based in Padang, the provincial capital of Sumatera Barat. Modern habitat and

wildland conservation in Sumatera Barat extends back to 1921 but on Siberut, all conservation activities have essentially taken place in the postcolonial period. The basic law for protection of wild animals has its origin in 1931 Dutch colonial legislation forbidding hunting, killing, capturing and trading of certain species (van Strien 1982). Some legislation was established under the Dutch^{xxxix} but concerns for systematic planning of networks of reserves, as representative of the full range of species and habitats, did not emerge until the early 1970s.^{xxx}

Indonesia's 1982, *Basic Environmental Law, Act No. 4* suggests a social obligation to preserve forest as part of forest management.^{xxxvi} There have been few indications of any government interest in the conservation of primary rainforest and local biological diversity, outside of the PHPA Directorate, the national bureau for nature conservation within the Ministry of Forests. A number of non-governmental organizations based in the Jakarta area are very concerned about indigenous communities, conservation of primary forest, and more comprehensive and effective environmental management. But Siberut is a great distance from Jakarta. Of the international organizations, the World Wildlife Fund - International (WWF) has had the most extended involvement in Siberut with an agreement with the RI to assist with conservation planning in Indonesia since 1968.^{xxxvii} Due to the proposals of two American primatologists, Ronald Tilson and Richard Tenaza^{xxxviii}, the Taitai Batti Nature Reserve, with 6,000 hectares, was established in 1976, and was approved as a Unesco MAB biosphere reserve in 1981.^{xxxix} But there was a serious overlap in land use planning which allowed logging to continue in large areas of the northern part of these supposedly protected areas into the 1980s.

A Food and Agricultural Organization (FAO) - funded project to develop a conservation component to land use planning was carried out in the early 1980s (FAO 1981).^{xxxv} In the subsequent, 1982-1988 management plan (Whitten et al. 1979, WWF - Indonesia 1980, Mitchell 1982) proposed three categories of use zones:

- *Development Zones* with logging areas, settlements, rattan collecting, areas with the best potential for sustainable logging and agriculture;
- *Traditional Use Zones* with wildlife reserve, *suaka margasatwa*, buffer zone, village forest and strict protection forest; and
- *Nature Reserve Zone* with forest fruit collection for local consumption only and hunting, *ladang* clearings and new villages prohibited.

Since the management plan was approved there has been little implementation, little monitoring and expanded logging. But very little of this proposed protection has been implemented.^{xxxvi} There have been obstacles in both protocol and internal politics. It remains to be seen whether the initial emphases on endemic species and area primates and more recent foci on rainforest, genetic resources, traditionally important plants and animals and coral reefs can actually lead to a broader framework for protection of all of the "biodiversity"^{xxxvii} of the island.

Impacts of tourism

There has been a tremendous increase in the numbers of (eco)tourists (Book 1990) who wish to have contact with the Mentawai and the forests and marine areas of Siberut.

Very little of this activity has been without negative social or ecological impact. But tourism does provide some cash to some groups and there are forms of cultural "exchange" which are less devastating to traditional values and which allow for local adaptations. One positive example of enhanced local autonomy has been of the Sakkudei communities in the south central part of the island - an area too swampy to allow for roads and logging in the near future. Here, the emphasis was on control of access through lands to adventurous young European tourists who are happy to pay more for the thrill of encountering territorially assertive "natives" with poison arrows. But given the cultural disintegration in many of the other Mentawai communities, such enclaves may be doomed to survive more as rarefied amusement parks for the global cognoscenti than as points of cultural renewal. But sometimes there is a basis for negotiation and for local *laggi* to manage visitors bearing new ideas and technologies thus acting a bridges for Mentawai adaptations. A new international project developed through the Asian Development Bank (1992) commenced in 1994 and will enhance the infrastructure for tourism while retaining some Mentawai autonomy in cash generation.

Requirements for conservation of biological diversity and respective traditional knowledge

The extraordinary richness of Siberut, indeed one of the most diverse points of combined terrestrial and marine biodiversity on Earth, and the linking of protected area design to a myriad of intellectual property issues is daunting. The sheer numbers of species and the complexity of the ecosystems suggest the need for a far higher level of taxonomic research and inventorying work, which could take many decades, before relatively permanent decisions over particular sites for additional RI-initiaed conservation or for short-term economic development could be determined. Given the rapid destruction of the forest and loss of cultural autonomy, the effective use of traditional knowledge becomes central to successful conservation.

The patterns of rarity, disjunctiveness, and endemism across the island have not been fully ascertained. The complexities of the tropical forest structure, successional mosaics, and respective life histories suggest that relatively large tracts of unaltered forest and shallow coastal areas are necessary to support the more vulnerable and rare species.

Much of what is known about the biota of Siberut is from Nineteenth and early Twentieth Century expeditions, such as for flora (Ridley 1926) and birds (Riley 1929, Ripley 1944).^{xxxviii} The more geographically oriented data on biota has come with the recent primate studies (Tenaza and Tilson 1977, 1984, 1985, Tilson 1981, Tilson and Tenaza 1976, 1982, Whitten 1982a). There has been some interest in the island for RI programmes of collection of genetic resources (Sastrapadja et al. 1980) though there have been only tentative efforts to link collecting of plant germplasm with *in situ* conservation.

For the traditional Mentawai, there is tremendous social recognition and valuation of local biological diversity. For the numerous communities that have been displaced and concentrated, valuation of what has been taken away has had a painful dimension. For the neighboring Minang, recognition of biological resources and natural services is perhaps not so immediate. This is where the classic split between an ecosystem-based and biosphere-based decision-making cultures around land use become apparent. The animism of the

traditional Mentawai supported conservation ethics and respective behaviour whereas more secularized ethics along side of Islamic religious fervour have been difficult to maintain. Within this highly charged context, meaningful public discussions on acceptable levels of conservation and development, indeed formulation of province-wide criteria, has been difficult to initiate.

In terms of traditional Mentawai tenure, there has never been sufficient documentation or any recognition by the provincial and RI governments. Village relocations by RI essentially removed people from areas of traditional use and marginalized them economically. In terms of virtually all indicators of economic status and quality of life, the relocated villagers are poorer than their more autonomous contemporaries. The more powerful Mentawai groups are those that have been the least accessible to RI interventions. Within such a hostile context the categories of protected natural areas have come to function as social refuges (Mitchell and Tilson 1986). In the case of Siberut, there are two important "nature reserves" and one has been elevated to the status of a biosphere reserve. But in terms of within Indonesia, and within the international systems of biosphere reserves, there is some of the lowest levels of implementation and real protection. While conservation is an RI responsibility, much of forest land use planning, particularly for harvesting, has been decentralized to provincial capitals.^{xxxix}

What I have seen

How can we negotiate exchanges of information and technology (Schultes 1991) for lands with traditional communities and extractive reserves? It will take a lot of listening from outsiders over extended periods. Based on my limited personal experiences, the following are some of the points for negotiation and possible collaboration with some of the Siberut particularly in the more remote, south central parts of the island, in the watersheds of the Sakkudei people. Each sequence point suggests an opportunity for enhanced negotiation around (cross)cultural difference, a juncture in the normal neocolonial forms of transactions, and an opportunity for innovation and for more authentic collaboration.

- Communal eating in the long house, as part the life of the *uma*, involves some kind of meal or snack about every two hours. There is usually quite a bit of fruit, such as durian and *pegu*, and the major starch is often baked or roasted sago, *sagaike*. There is usually plentiful animal protein at least once a day. The diet is rich and people take a great deal of satisfaction in it. There is an awareness of rice and while it is available, most people prefer forest and garden foods. Our hosts taught us several times to say the south central Siberut word for delicious, *minannum*. There is so much pride in the local diet that some women have offered to teach about their diet and cuisines.

- In walking in the forests near villages with a group of males, the women tending to stay near the lodges, a tremendous number of useful plants species are found. They are "monitored" regularly for the best time for their use. I have seen quite a number of wild banana, *Musa* spp., and some other fruit trees such as durian. With the high

species diversity in the forest and low numbers for an individual species in sparse densities, each individual or clump of a useful species is recognized and considered for the appropriate future use. These was particularly the case with the large Dipterocarps, the *koka* and *atarat*. The perception of associated landscapes is closely linked to projections of future needs and I had to wonder about the growing instability brought by the logging of traditional Mentawai landscapes of hopes and expectations.

- I find the tobacco addictions of virtually all of the Mentawai guides that I have employed to be particularly vexing. I have conducted plant and biodiversity surveys in many countries and settings and have never been hustled so aggressively for tobacco as on Siberut. I try to keep a sense of humour but to use the current North American vernacular, it "pisses me off." Plans are changed with the weather. Villages are avoided because of interfamily feuds. Changes in itineraries occur with little advanced notice. With the guides, one of the only points of negotiation has been around tobacco. I tend to have to buy my way with tobacco. It gets expensive and heavy. Yet if I could find guides less "strung out," I might have less of a means to negotiate through those very damp and vast forests.
- The saddest experience that I have had on Siberut have been in the villages relocated by the government where traditional *uma* and *laggi* structures have broken down. People are crowded into smaller houses spread over larger areas and local carrying capacity is often breached. As extended families fragment, some groups suffer - particularly women and children when men are absent. In 1989, I saw an adolescent male Kloss' gibbon, a *bilou*, *Hylobates klossi*, butchered for a female headed household with little access to meat. Traditionally, this species, one of the closest to *Homo sapiens* and the closest primate that is monogamous (Tilson and Tenaza 1976), was revered with only an occasional *bilou* hunted and eaten, ritually, by young male Mentawais.
- Few modern drugs are available on a regular basis and most Mentawai rely on the medicines of the *sikerei* who tend to hold the accumulated knowledge of plant food, medicine, and technology. To their credit, the traditional Mentawai are some of the most vital and healthy appearing people with whom I have ever worked. But I have met too many sick elderly people, often fairly solitary in the day in their family lodges, who beg desperately for medicine. There are limits to what even a *sikerei* can do about aging, anywhere, and less by a wayward conservation planner. Siberut ethnosience may not have placed a priority on dealing with the illnesses of the elderly and perhaps it is worth augmenting these systems with some pharmaceuticals.
- Because it is low-lying, Siberut seems, at first, to be flat. But the heavy rains on the soft parent material has created fantastically incised and deep ravines the complexity of which is difficult to conceive from a map. The cognitive maps of the locals are very

different from those of outsiders attempting to glean clues from topographic maps of limited accuracy. It is these topographic maps and not traditional spatial knowledge of the intricacies of particular watersheds, that have provided the basis for the conservation plans. The boundaries of these (paper) protected areas have been difficult to ascertain on the ground - for the Mentawai, for the logging companies, and for outside conservationists. Day-to-day conservation has been barely spatialized and remains an imposed concept. Yet the concerns over ownership of traditional sites and the management of traditional plant and animal resources, which are obsessions in the traditional villages, have barely been connected. Traditional management is so site-specific that it has been largely ignored in the "official" transactions about space while the blocky conservation areas, with the boundaries so difficult to discern, remain a largely alien mythology.^{x1}

- My most embarrassing time in an *uma* was when I gave some gifts to individuals instead of to the male head of the household. I was swiftly, firmly, and graciously corrected. This incident left me with even more respect for my hosts but with a nagging sense that I still probably conduct many transactions incorrectly in Mentawai terms. Therefore, I often look for guidance and am tentative. I rarely commit to "done deals" and I think that I have been perceived as wavering just as I have perceived some of my guides and informants, to use the current North American pejorative, as "flakes."
- I have had only one "bad scene" on Siberut and it was mainly comical. I had a guide who grew up off-island and who had some experience with "timber cruising" on Siberut. It was difficult for him to adapt to environmental research. He tried hard to please but had only limited patience with long days of scientific observation.^{xli} He got bored and drunk and became sexually aggressive with a young teenaged girl. If I had not been there, the villagers probably would have really hurt him. When young men chased him with spears, they showed me that the tips had not been dipped in the traditional poison. Subsequently, that *uma* kindly took responsibility for guiding me out of their territory.
- The Amsterdam-based ethnography Reimer Schefold (1972, 1973, 1980) has worked in the Sakkudei area. Many people in south central Siberut, as a gesture of friendship to me, had asked if he and I were related even though there is not much of a resemblance. At times, people talked about "Reimer" a bit too much for comfort. But what emerged is that he had been one of the few outsiders who had maintained regular contact and had prepared the more remote groups for the coming of other foreigners some of whom might be able to help them prosper. The "Reimer" cult was something of a codeword for being able to negotiate between cultures. For example, the Sakkudei have been able to charge cultural visitor fees even to people who claimed that they were not just tourists or plant collectors.

Each of these episodes involves a set of intercultural questions that must be successfully resolved, through consensus of the major parties, if there is to be adequate conservation and "sharing" of information. All of these issues have questions of linkages between spatial documentation, ownership, land management, "information storage," transfer of sufficient material for financial returns, and empowerment of the Mentawai. It is these webs of subtle issues, that often seem deceptively interpersonal, that flag areas for negotiation around intellectual property, transfers of germplasm and information, and land management.

Adaptive systems of traditional knowledge & transmission of information

"Possession is nine-tenths of the law" a North American saying

What would motivate a *sikerei* to share traditional plant knowledge with an outsider? Not much that I have mentioned so far. Certainly, it is possible to acquire tantalizing clues by offering cash, tobacco, transport, gadgets, western medicine, cheap thrills, and even friendship. A few Ph.D. theses can even be generated particularly for people from the developed world.^{xliii} But what will motivate the *sikerei* to work together to form new "institutions" for information management and security for the communal good? What could provide the basis for watershed or island-wide systems of intellectual property? The tourists and biodiversity prospectors, who in Indonesia are all under the rubrics of national institutes, may provide some ideas, some more myths and dreams, for some new arrangements even if fundamentally improved frameworks are still years away. The following is a very optimistic speculation on the linking of genetic resources, local autonomy, environmental management, and exchange of information.

I do not think that the *sikerei* have been sufficiently impressed with much of the intrusions of the modern world into their communities to be motivated to sharing their secrets. For much of that "lore," this will remain the case for a long time. The *sikerei* can see too clearly, especially now with the increasing presence of cultural tourists, how their knowledge can become appropriated and devalued and yet is in increasing demand. Only the informants of Wanda Avé and Satyawan Sunito have had the patience and interest to want to begin to transfer a *system* over an extended period. But then again, few questions have been asked persistently and it is clear to the *sikerei* that the global marketplace for traditional knowledge and germplasm involves many contradictory motives, demands, and means of exchange. But planners and researchers are still dealing in vague paradigms and mythic sequences: "debt swaps for nature," information for "conservation," conservation for "sustainable development" etc. Rarely have these colonial and postmodern myth cycles been site-specific, linking place, people, culture, survival, and prosperity, particularly in reflecting the ways that the information has emerged and has been stewarded.

The *sikerei* are acutely aware that they possess something of value because they make their living from its exchange under the rubrics of **their** communities. But to make transfers without a communally managed framework, without autonomous institutions that might not even appear to outsiders as intact or stable, would have no purpose. I doubt that

much of the current increase in world interest in intellectual property for traditional knowledge (Yasin and Posey 1993) will change this. The prospectors, the national institutions, and the conservationists have still not provided a credible, indeed practical basis, for the participation of the *sikerei* in such globalizing transactions (Alexander 1993). We are all still in search of authentically postcolonial frameworks for uses of transactions around biodiversity.

Genetic resources, biodiversity prospecting, and exchange values

At this point it is necessary to reconsider the notion of "genetic resources" and its relationship to use value for particular groups and "stakeholders." We can ask just how are these 'resources,' in what way they are 'genetic,' and why are they important and for whom. We can develop lists of genetic resources for particular economic and research sectors as well as for particular social groups and regions.^{xliiii} The nature of the priorities of the combined lists of genetic resources as they affect economies, land management, and public policy reflect the extent of the research and inventories and, more importantly, the power relationships between the various social groups vying for many different resources. Dasmann's 1975 essay provides the seminal outline of "ecosystem" versus "biosphere" level societies and respective patterns of reliance on biological resources. The traditional Mentawai use a tremendous number of species, and respective genetic resources, "lightly" whereas the global economy places heavy emphasis on a smaller number of plants. Therefore, the genes used by this latter group become particularly valuable for societies and political entities that want to accumulate globally generated wealth. But in this framework, many species of importance to the Mentawai are effectively devalued.

Traditional cultures like the Mentawai may be able to obtain cash, technology, information, and other resources for knowledge and germplasm of certain genetic resources of significance to globalized biosphere peoples via global markets. For example, there has been considerable interest in the genes of the wild citrus species of the Indo-Malayan forests because of the temperature zone fruit industry and its breeding programs and the need to find new genes for disease resistance. But for a local food resource, wild citrus has very low significance since these particular species rarely bear fruit Siberut. In contrast, a local staple like sago, which is heavily managed, locally, illicitly very little interest from groups and organizations aligned

with the world economy. "Prospecting" (Clifford 1993), therefore, usually involves a meeting of two distinctly different but fluid set of valuations as well as divergent spatial, environmental, and social signifiers. "Biodiversity prospecting" (Reid et al. 1993) can involve a kind of reductionist "imperialism" and at the least an inversion of local values and knowledge systems. This devaluation can engender a lack of willingness, on the part of the *sikerei*, to discuss certain species. And without their support and participation, thorough surveys are impossible.

While conservation and procurement of genetic resources of wild and traditionally utilized species does not involve the destruction of habitats, cultural landscapes, and traditional societies, to suggest that biodiversity prospecting, without regulation, is neutral and is not part of the tightening grip of the 'New World Order' is naive. Differentials in valuations of biological diversity have subtle influences on the nature of information

exchange and the *sikerei* are acutely aware of this. Until these differentials are less severe, the bulk of traditional knowledge on valuable species will not flow into the global information net.

Intellectual property, protected areas, and transmission of traditional knowledge

Biosphere peoples and our global economy need as much access to biodiversity as possible. The *sikerei* do as well though they have enough to deal with and steward on Siberut. For ecosystem peoples, protection through the zoning of biosphere reserves involves the distinctly neocolonial concepts of "reserve," whether it be extractive, traditional, or ecological. Biosphere peoples need the knowledge of the *sikerei* which is in turn embedded, indeed encoded, in Mentawai lands, traditional communities, and cognitive maps in order to be assured that the resources are secure and accessible. The postcolonial narrative is that traditional landscape as a dynamic adaptive cultural system. But there are still few state programs^{xliv} and "incentives"^{xlv} for the *sikerei* to share their perspectives on their terms and little more than shells of various international agreements^{xlvi} to link profits from prospecting in order to allow the Mentawai to more securely conserve their lands. This contradiction limits the flow of information and there is presently a global race to increase the market value of such cultural / biodiversity reserves in order to counter the pressures to liquidate respective ecosystems for unsustainable export of raw materials. But without new Mentawai-based institutions, for transmission, use, and exchange of knowledge, both the spectres of forest destruction and wanton or corporate biodiversity prospecting could both be threats to the entire cultural fabric of the *sikerei*.

For the Mentawai, ownership of biodiversity as intellectual property^{xlvii} is, therefore, profoundly linked to the autonomous management of their traditional lands. The respective conditions vary greatly between watersheds and with the impacts of the village relocations. A nature reserve, a biosphere reserve, an extractive reserve, a zone of traditional knowledge all involve heightened competition between national and global stakeholders. Indonesian government institutions and nongovernmental organizations are increasingly positioned to mediate between local and global stakeholders especially when there are still unresolved contradictions between local and international interests. Without the upper hand in these shifting frameworks of flow of knowledge and technology, the *sikerei* will be reduced to being underpaid suppliers of forest compounds in these social "contracts."^{xlviii} But why would traditional healers accept such little compensations unless their traditional lands, forests, and social economies, are under assault and individuals are reduced to worrying about personal survival.

Information exchange, the Convention on Biological Diversity, and the State

To make an understatement, the *sikerei* are on "the periphery of state power" (Tsing 1993, page 5) and they will probably want to keep it that way. The *Convention on Biological Diversity* is an accord between nation states^{xlix} while the institutions of the traditional Mentawai are not exactly on "equal" terms with those of the RI. There are not yet formalized pathways for assuring the flow of funds from Mentawai knowledge and biological resources back from national institutes¹ to Siberut. Therefore, "why in the world" would the *sikerei* want to give information that would benefit a national or provincial agency

that is perceived as contributing to the disempowerment of local institutions? Guardians of traditional knowledge would have to be pretty desperate or opportunistic. But despair is not a basis for the trust and continuity necessary for "sustaining" (Holloway 1993) the primary forest nor for maintaining knowledge bases with the onslaught of potentially genocidal cultural change.

The following are some possibilities and lost opportunities for making the Convention contribute to the security of the "reserves" on Siberut as zones of overlapping and semi-protected jurisdictions involving local owners, state apparatuses, and international stakeholders and organizations.ⁱⁱ

- Article 7 is on "Identification and Monitoring" and emphasizes the need to find and track vulnerable elements of biodiversity. The crucial role of traditional knowledge in the inventorying and location of such species, many of which are poorly known in settings like those on Siberut, and its relationship to modern science was not clearly outlined.
- Article 8 is on "In-Situ Conservation" and outlines the need for expanded networks of protected areas "or areas where special measures need to be taken to conserve biological diversity." This suggests that in some cases, the modern forms of parks and other protected areas that are managed by state frameworks, may not always be adequate. The concept of protected areas as points of autonomy for traditional societies with high levels of biological and environmental knowledge was not addressed.
- Article 12 outlines efforts for "Research and Training" "taking into account the special needs of developing countries" but does not address the resources necessary for the traditional communities with the most biological knowledge to manage those resources and areas.
- Article 15 is on "Access to Genetic Resources" and recognizes "the sovereign rights of States over their natural resources" and emphasises that "access to genetic resources rests with the national governments." There are no provisions for international recognition of traditional ownership nor respective traditional knowledge. In fact, traditional owners do not necessarily have rights to those resources except through often indifferent or hostile States.
- Article 16 is on "Access to and Transfer of Technology" and outlines a commitment to intellectual property rights but does not recognize a basis for traditional groups, outside of the State, for asserting these rights or based traditional ownership.
- Article 17 is on "Exchange of Information" and indicates a commitment by States to "facilitate" the exchange of information, including "indigenous and traditional knowledge," for conservation purposes. But there is no mechanism to tag this

information and identify it with its sources.

- Article 18 is on "Technical and Scientific Cooperation" and asserts the primacy of "national legislation and policies" including those for regulating collaboration involving "indigenous and traditional technologies."
- Article 19 is on "Handling of Biotechnology and Distribution of its Benefits" and outlines a commitment to "equitable" access to genetic material for contracting parties (States). But there is not a mechanism for **exchange** between the access for traditional owners and informants and the procurers.

The Convention does not address traditional tenure or differences between local and global cultures of science nor the nagging problems of scales and the needs for greater site-specificity of conservation. It would be easy to dismiss the Convention as irrelevant to the *sikerei* but I think that it will have a major influence on the nature of transactions, adjustment mechanism and even limit attempts at postcolonial collaborations, in general, until such time as a transnational convention on traditional knowledge were forged by indigenous communities and nongovernmental organizations. And there is still the very compelling argument that the superseding of indigenous intellectual property rights, by national States, is necessary in order to effectively counter the grip of the biotechnology interests of the developed world. However, this position, regardless of its realism about the monopolistic trends of the "First World," is still fundamentally neocolonial if not subtly complacent in more indefinite forms of cultural genocide.

Conclusions: Prospects of *sikerei* mediation of global pressures

The *sikerei* already are "actively engaging in their marginality" (Tsing 1993, page 5) but as Bhabha (1990) suggests "the colonized can parody but never remake" (Tsing 1993, page 16). The *sikerei* represent one of the major Mentawai institutions that are still resisting internal colonization from the RI. But now the outside interests are coming for the most lucrative commodity yet: information. The Mentawai, particularly those not relocated, remain adaptive rather than imitative. But it remains to be seen whether biodiversity prospecting and the various "protected" zones that are required will be beneficial for traditional communities or just more "pacts of semi-colonization" (Virilio 1990, page 45).

Have I outlined a basis for a postcolonial narrative of transactions? Only partially. As a scholar of conservation, I now have a heightened sense of the frameworks from which information I use comes from and how it could be misused when I disseminate it. I still find it difficult to define incorrect use of information except where an outsider makes considerable money with virtually nothing going back to the traditional communities. The decisions of the *sikerei*, on transactions around knowledge, will continue to be framed within their local economies and ecosystems. The position of the *sikerei* will probably be to hang on to as much information as possible until life on the island deteriorates further; until the cultural landscapes in which the bulk of their information is inextricably imbedded are further destroyed. It is in a heightened engagement in averting this fate of loss of

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(bio)cultural diversity that there are the beginnings of a truly postcolonial paradigm for conservation and decision-making over land and living resources.

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Notes

i. For discussions of the emergence of the term "biodiversity" and the range of often contradictory scientific and social perspectives that it involves, see Argawal (1984), Wilson (1988), WRI / IUCN / UNEP (1992), and J. H. Vogel. and G. B. Ingram (1993).

ii. I adapted some of the frameworks used by Anna Lowenhaupt Tsing on "marginality." In her work on Kalimantan she notes that "The dominant frameworks for understanding recent encroachments, however, ignore long histories of marginality to posit conditions of "before" versus "after" - of pristine isolation, on the one hand, and rapid cultural destruction or modernization, on the other" (Tsing 1993, page 7). Instead, she emphasizes "shifting, multistranded conversations in which there never was full agreement" (page 8) and which suggest more indefinite mechanisms for adaptation to marginalization.

iii. See Ingram (1989, 1990, 1992, and 1994a).

iv. Siberut is part of the Mentawai Island and is in the Indian Ocean. I am considering Siberut part of the Pacific Rim because the island is on the edge of Indonesia which has one of the most dynamic economies in the Pacific.

v. My notions of "extractive reserve" are similar to those perspectives in the essay by Nancy Lee Peluso (1992) that emphasizes the site and cultural-specificity of such zones. She notes that for her study areas in Kalimantan, that "the politics of forest management, at both the national and local levels, are more conducive to village level extractive reserves than to regional, labour-based organizations" (abstract).

vi. For a theoretical discussion of the relationship between intellectual property, environmental management, and biodiversity conservation, see Alexander (1993) and The Crucible Group (1994).

vii. For some indication of the reasons in the interest in Siberut, see Margot Cohen's essay "Return to tradition: The medicine man's renaissance (Siberut, Indonesia), *Wall Street Journal* (Tuesday, February 23, 1993: A16, A18).

viii. The counterproductivity of the frameworks of the "noble savage" and the "primitive" for support for the survival and autonomy of traditional communities was illustrated in Davis' work with the Penan of Sarawak (Davis and Henley 1990).

ix. For a discussion of the negation of site and ties to the land in contemporary Canadian portrayals of the culture of indigenous communities, see Ingram 1994a. A tentative discussion of postmodern 'site-specificity' and its relation to both marginalized and colonized cultures can be found on page 186 of Douglas Crimp's 1992 *On the Museum's Ruins*.

x. The Mentawai Islands extend in a string from the 1 degrees N to 3 degrees 30'S with the most westerly point being 97 degrees 30' E and the most easterly point being 100 degrees 45' E.

xi. Siberut lies between the Equator and 98 degrees 30' E; the Equator and 99 degrees E; 2 degrees S and 99 degrees 45' E; and 2 degrees S and 98 degrees 30' E.

xii. The Mentawai Islands first become isolated from Sumatra about 500,000 years ago. The final separation of Sumatra from the Asian mainland took place about 20,000 years before present. At various times in the Pleistocene, with lower sea levels, Siberut was connected to other Mentawai islands and nearly to Sumatra by the Batu, Tanahbala, Tanahmasa and Pini Islands. Subsequently there has been a "progress of insulation" (Marsden 1811).

xiii. The soils of Siberut are the weathering products of limestones and volcanic materials and are highly erodible. There are also some pockets of *organosols*, labelled *dystric fluvisols* in the FAO system, along the north and east coasts (Scholz 1983). These soils have developed in recent marine deposits and alluvium. There are some pockets of *gleysols* and alluvium associated with partially submerged lowlands and mangroves.

xiv. The major language groups on Siberut are the Togilitte, Simalegi, Simatalu, Paipajet, Sagulubbe, Sirileeu, Sabirut, Sarareiket, Sakuddei, Silaoinan, Saibi and Sarabua, Sempungan, Sirabalan, Pokai and Sikapona.

xv. None of the medicinal plants are mentioned here because this information has not been given to outsiders to disseminate. The information is not "public knowledge." An extensive study on traditional Mentawai medicinal plants was filed with the WWF and IUCN by Avé and Satyawan in 1990. There are too many species of potential value as pharmaceuticals to be discussed in this essay.

xvi. The terms in italics that follow the English words for these species are from dialects of Mentawai. The terms have not been standardized for a particular language group though most terms are recognized in south central Siberut.

xvii. For a full list of the sources of plant information and confirmations, see Part 6 and the Appendices for Ingram 1989.

xviii. For the sources of the information on local Dipterocarps, see Part 6 and the Appendices in Ingram 1989.

xix. Whitten and Sardar (1981) noted that 35,700 hectares of Siberut had been allocated by the government for transmigration and other rice-growing settlement. Various types of political and fiscal resistance to funding transmigration settlements emerged in the mid-1980s (Whitten 1987). The decline in financial support by the multilateral banks (Colchester 1987) suggest that the establishment of transmigration settlements on Siberut, in the near future, are highly unlikely. The types of ecological impacts of transmigration that could have occurred on Siberut include forest clearing that precludes regeneration, habitat conversion, soil erosion, and an array of secondary effects (Secret 1986) related to intensive agriculture and increased densities of human population. Most of the potential agricultural development in the region has involved rice farming and estate crops such as cloves (Scholz 1983).

xx. The future for site planning, landscape architecture and the spatial precision of decision-making for Siberut will continue to be problematic. The island is so enshrouded in clouds and forest and so deeply incised by stream systems that precise spatial data is very difficult to obtain and to verify. As for prospects of better integration of conservation plans into regional planning, it will first be necessary to develop and promote a more socially and ecologically integrated concept of local development. There may be some progress in integration of criteria for biodiversity conservation into landscape planning but only at the broader scales for zoning such as at 1:50,000.

xxi. By 1980, 4 logging companies were working on the islands and their concessions included all of the island except for the nature reserve, the cultivated land and settlements.

xxii. As with much of the logging in southeast Asia, logging on Siberut have shifted from domination by multinational concerns on Siberut to regionally based and domestically owned firms (Gillis 1988).

xxiii. The areas on Siberut, which had been selectively logged as of 1978 (pages 20 and 21, WWF-Indonesia 1980), greatly expanded between 1980 and 1990 though formal survey data has not been made available.

xxiv. On Siberut, logging has involved the cutting of 6 to 8 trees per hectare with an average of 25% of those cut not removed because of rotten cores.

xxv. Logging roads on Siberut are often 60 meters wide. Logging roads also bring with them such several secondary impacts as soil erosion.

xxvi. The entire eastern coast of Siberut was zoned as *Hutan produksi yang dapat dikonversi* for conversion to intensive agriculture particularly rice growing. Along with the agricultural zone, and with it taking up over half of the island, was *Hutan Produksi*, a zone allowing for timber plantations and intensive cropping of perennials. Around the protected areas, were areas for supposedly sustained timber production called *Hutan Lindung* and *Hutan Produksi Terbatas*.

xxvii. For a discussion of the problems of regulating selective logging in similar forests in Malaysia, see (Johns 1985).

xxviii. On Siberut, trees smaller than 50 centimeters in diameter have been illegally cut. There has been some logging near rivers and watercourses and on steep slopes.

xxix. Modern programmes of habitat conservation in Indonesia began with the Society for Nature Protection of the Dutch East Indies in 1900 (Kartawinata 1975, Hardjasoemantri 1985).

xxx. A United Nations report examined the problems in Indonesia resulting from the lack of integration of concerns for the conservation of habitat and wild species into planning for forest utilization (UNDP / RI 1983). It suggested that as much as 16.5% of the forest area of Indonesia might need to be classified as "Nature conservation forest" and that management planning for each protected tract was necessary.

xxx. The central legislation for conservation as part of forest management has been *Undang-undang Pokok Hukum Kehutanan No. 6 Tahun 1967*. The provincial-level offices within the Ministry of Forestry carry out the policies of the central government and were also responsible to provincial governors.

xxxii. IUCN and WWF supported efforts for a conservation master plan beginning with field work in 1976 (Whitten et al. 1979, Whitten 1981, WWF - Indonesia 1980), subsequent land use proposals beginning in 1979 (Mitchell 1982), and a management plan in 1982 - 1988 (Mitchell 1982).

xxxiii. The research on the primates of Siberut, an area with some of the rarest primate species on Earth (Eudey 1987), has involved social structure (Tilson 1977, Tilson 1981, Tilson and Tenaza 1976, Tilson 1981), behaviour (Tenaza 1976, Tenaza and Tilson 1977, Tilson and Tenaza 1976, 1982), and ecology and anthropology (Tenaza and Tilson 1984, Mitchell and Tilson 1986).

xxxiv. Unfortunately, the quality of the habitat of this area was relatively low because of past land use and the presence of a village. In response to the WWF proposals, a 50,000 hectare extension to the nature reserve was gazetted in 1979. The actual document establishing the conservation area is listed as *Surat Keputusan Menteri Pertanian No. 758 / Kpts / Um / 12 / 1979* and there is an elaboration in English on page 32 of Mitchell (1982). An extension to the nature reserve was proposed (Mitchell 1982, FAO 1982).

xxxv. Unfortunately, the FAO study was at a scale that made it difficult to consider the needs of small communities - even those destined to be within designed protected areas.

xxxvi. Even after the initial international focus on Siberut as a globally important conservation area, in the mid-1980s, there was an awareness that additional intervention would be necessary. For example, a task force of the World Resources Institute (International Task Force of World Resources Institute, UNDP 1985) listed as one of its priorities for Indonesia to, "identify additional conservation areas and establish proposed reserves on Siberut."

xxxvii. It has been the visions of Whittens (Whitten et al. 1979, Whitten and Sardar 1981) and Art Mitchell (Mitchell and Tilson) which have laid the basis for a holistic framework of conservation of both culture and habitat. Piecemeal and cosmetic conservation has been the obstacle to development of a comprehensive framework for habitat conservation and management and thus the Siberut Biosphere Reserve has been the least implemented of these international designations in Indonesia.

xxxviii. The taxonomies for virtually all plant and animal groups have contentious areas, and identification for many groups will continue to be problematic. Fortunately, the Mentawai ethnobiologies are extremely rich and relatively comprehensive for local knowledge bases. Inventorying of the protected areas has been difficult, though there have been some attempts such as by Harun and Tantra (1980).

xxxix. As for possibilities of any local government agencies and politicians invested in conservation, it is highly unlikely as long as the PHPA is part of the Forestry Ministry. Whereas timber harvesting has made this a relatively well-funded ministry, conservation has not generated funds for its coffers. As for environmental non-governmental agencies, what little conservation occurred has been largely due to their efforts. There have been few clashes between local Mentawai communities and RI authorities.

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The *sikerei* of Siberut, intellectual property, and reserves for traditional knowledge
A report to the Rainforest Alliance Natural Resources and Rights Program

xl. In stating the need for on-going revision of a management plan, for Siberut, Mitchell and Tilson stressed the imperative of taking into consideration "local attitudes" and "creation of systems of land and resource use that extend beyond the boundaries of the nature reserve."

xli. I have yet to apply for a permit to collect genetic material and traditional knowledge associated with it though have worked on Sumatra with national and international agencies. My work on Siberut has been related to surveying biodiversity to consider options for conservation.

xlii. For two examples of theses that could not have been completed without reliance on Mentawai traditional knowledge, see Whitten (1980) and Ingram (1989).

xliii. See the groupings of genetic resources for social groups for the case studies in Ingram 1989.

xliv. The most ambitious program for the state coordination of conservation, inventorying, and prospecting of biological resources is Costa Rica's National Biodiversity Institute (INBio) (Gómez et. al.). The institute is for a small and relatively centralized country and its structures are less relevant to large and less centralized states such as Indonesia.

xlv. For a discussion of the State, traditional rural communities, and incentives for conservation, see Nancy Peluso's 1991 essay.

xlvi. For a discussion of international instruments on intellectual property, that this relevant for discussions of traditional knowledge, see Yasmin and Posey (1993) pages 143 to 145.

xlvii. For a discussion of intellectual property rights frameworks for prospecting, see Gollin's 1993 essay.

xlviii. For a discussion of contracts in biodiversity prospecting, see Laird 1993.

xlix. The writing of the Convention involved considerable involvement from Indonesian national institutes and the RI was the eighth government to sign the Convention, on June 5, 1992. The Convention was ratified on December 30, 1993.

l. For a discussion of the permitting processes for biodiversity, that increasingly involve more than one national institute, see Sarah Laird's 1993 article.

li. For an example of one aspect of the growth of international groups involved in conservation and procurement of genetic resources and traditional knowledge, see Palmberg and Esquinas-Alcazar (1990) on the initial involvements in the United Nations organizations.