Indonesia's Transmigration Program and Its Role in the Loss of Tropical Rain Forests*

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Abstract: *Indonesia's transmigration program is the world's largest government-sponsored voluntary migration program. It aims to move people from areas of degraded or densely populated land on Java and some adjacent islands to areas on the outer islands of Indonesia that have been found capable of supporting some form of agriculture. The major negative environmental impact is the loss of forest. The emphasis on reaching targets has resulted in inappropriate selection of land for settlement, which has in turn led to conditions unsuitable for sustainable agriculture. The loss of tropical rain forest in Indonesia is due to many factors, but the loss attributable directly to transmigration is relatively small. Dramatic reductions in the Indonesian budget resulting from the fall in oil prices have led to a virtual standstill in the movement of new transmigrants. This lull gives an unexpected opportunity to improve the planning of future transmigration settlements and to coordinate these with conservation planning for other development-related activities.*

Resumen: *El Programa de Transmigración de Indonesia es uno de los proyectos más grandes de migración voluntaria auspiciado por el gobierno. Aspira a traslader habitantes de áreas degradadas o zonas densamente pobladas en Java e islas adyacentes, hacia las islas exteriores de Indonesia donde se han encontrado tierras capaces de sostener alguna forma de agricultura. El mayor impacto negativo ambiental es la pérdida de los bosques. El énfasis en alcanzar las metas ha resultado en la selección inapropiadas de tierras para la colonización, lo cual ha producido a su vez condiciones inadecuadas para una agricultura sostenible. La desaparación de los bosques tropicales lluviosos en Indonesia se debe a muchos factores, la pérdida directamente atribuible a la transmigración es relativamente pequeña. Las reducciones dramáticas en el presupuesto de Indonesia, resultado de la caída de los precios del petróleo, han conducido a una detención virtual en el movimiento de nuevos transmigrantes. Este momento de inactividad presenta una oportunidad imprevista para mejorar la planificación de las colonizaciones futuras y para coordinar éstas con una planificación de la conservación para otras actividades relacionadas con el desarrollo.*

Introduction

The Indonesian transmigration program is the world's largest program for voluntary, assisted migration. Since 1905 at least 2.5 million people have been moved from the crowded and environmentally degraded islands of Java, Madura, Bali, and Lombok, to new settlements in the less densely populated outer islands. As a result of population growth and voluntary, unassisted migrations, the actual number of people in the outer islands who are there directly or indirectly as a result of the program must be several times higher than the above figure. It is estimated that the number of unassisted migrants can be up to two to three times greater than the number of government-sponsored migrants, depending on the area concerned.

The transmigration process takes nine years from the allocation of areas to be surveyed and the planning of

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targets, to the handing over of the settlements to the provincial governments (Whitten et al. 1987). Settlement occurs in the fifth year of the process, and by the time the settlement becomes a provincial village (and therefore becomes eligible for village grants) the settlers should have received the title to their land. In many cases, however, this process meets many problems, primarily because of insufficient manpower.

The program is deemed necessary because inappropriate land use in the uplands of Java resulting from the dense human population is endangering the soil, small and large dams, and human lives, as well as creating problems of sedimentation and flooding in the lower reaches of rivers. It is important, however, to understand that transmigration is just one of the means being used to tackle a massive problem; others include family planning and agricultural intensification.

It seems common sense that taking people from these areas must improve their environmental conditions. In fact, the problems of Java's hilly land are directly related to the area of land lying open for agricultural use and are solved only by the introduction of strict soil conservation measures or by allowing a permanent or semipermanent vegetation cover to grow up on the degraded soils. The vast majority of transmigrants own little if any land for their own subsistence needs, and the numbers leaving are less than the annual population increment. The population on Java has thus been increasing throughout the transmigration program, and the departure of transmigrants from Java does not in general seem to have had an obvious or documented positive impact on the environment of most critical lands. Exceptions include Gunung Kidul near Yogyakarta from which nearly 40 percent of the inhabitants have been moved and where critical lands have been held in check. That area is peculiar, however, being located in karst (limestone) country with virtually no surface drainage. The human population had probably exceeded the carrying capacity, and when a serious drought occurred in the early 1970s the conditions became critical.

It is my hope in this paper to correct misconceptions caused by an influential article on transmigration (Secrett 1986) without losing sight of the ecological imperatives or the responsibilities of donor agencies. I do not believe that the transmigration program will be halted in response to outside criticism, but I do believe that reasoned argument coupled with focused international concern will continue to bring about significant improvements in both the execution of the program and the attitudes of donor agencies.

Problems of Site Selection

When the transmigration program is being discussed it is important to be clear whether one is criticizing the past record of transmigration or seriously evaluating the present efforts. The past has certainly seen some horrific examples of site selection. During the Second Five-Year Plan (1974–79), for example, fishermen transmigrants were settled on white-sand (regosol) soils on Bangka Island, South Sumatra. These soils are amongst the least fertile in the world, and, because they are generally unoccupied, they can lure the attention of the planners of settlement schemes. Reports relating to the planning of this settlement do not now seem to be available, but the natural vegetation of white-sand soils is heath forest, and this is regarded as the most endangered ecosystem in Sumatra with none included in any designated or proposed reserve (Whitten et al. 1984). At another site in southeast Sulawesi, an area of notoriously unsuitable but superficially excellent-looking ultrabasic (ultramafic) soil with a low Ca/Mg ratio, was included in a settlement, and rice planted on it either died or produced no grain. One farmer took the initiative to lime 100 square meters and achieved much improved yields. Unfortunately, his rate of application was equivalent to 10 tons per hectare, clearly quite beyond farmers' or the government's ability to contemplate, let alone sustain (Whitten et al. 1987). These and other sites, such as some parts of the well-known Air Sugihan Area in South Sumatra (Caufield 1985), are acknowledged to have failed, and this has provided stimulus for the improvement of the site selection procedure.

The above examples are from sites whose soils were intrinsically bad for agriculture. There are also sites that have not succeeded because of inadequate land management (soil conditioner, fertilizers, etc.) or because of bad site preparation. This I will consider later. It was clear by the end of the second Five-Year Plan (1978) that much of the land being used for new transmigration settlements was marginal for agricultural activities (Hanson 1981), but the emphasis on reaching the targets rode roughshod over moderation and caution, and over the recommendations of planning guidelines and manuals.

The issue of site selection is so critical that it is in this field that considerable assistance has been provided by, among others, the World Bank. The most basic and crucial stage of site selection is the preparation of reliable maps acceptable to the various agencies concerned with land matters. A project of the Department of Transmigration (DoT) with the Land Resources Development Centre (LRDC) of the British Overseas Development Administration (primarily using funds from the World Bank) is contributing in three ways to this. First, a new and planimetrically reliable topographic base map is being drawn at 1 : 250,000 scale; second, the land resources and their suitability for defined purposes are being mapped and assessed; and third, revisions of the land and forest status are being proposed, and, in relation to

this, areas are being recommended for further study and possible future development (including transmigration).

The LRDC team has completed the maps for Central Kalimantan and Irian Jaya and is trying urgently to produce similar sets of maps for the remainder of Kalimantan, Sumatra, Sulawesi, and the smaller islands. The maps being produced provide the best integrated land resource information yet available and are relevant to a wide variety of planners including those concerned with conservation. Severe problems are anticipated, however, particularly with the degazetting of some unsuitable protected areas, the redefining and physical demarcation of new boundaries, and the gazetting of new areas. The Department of Forestry (DoF) stands to gain as much land as it loses, however, and the new designated forest land would at least all be forested (a situation far from true at present). But it is by no means certain that agreements will be reached easily, and consequently transmigration settlements may still be planned for land of unnecessarily low quality. Compromises between the DoF and DoT in which areas of production forest (forest designated for sustained production of timber) have been exchanged for similar areas of conversion forest (forest designated for conversion to some other form of land use in the future) are not necessarily environmentally sound because this process tends to fragment the area of land held under forest cover. The DoF needs to be brought into the site selection process as an essential component in a high-priority development activity, and ground surveys of both areas and examination of the condition and eventual fate of adjacent forest areas are essential before any exchange is agreed. One recent advance in this is the appointment to the LRDC team of a specialist forester who will coordinate directly with DoF (which includes the Directorate General of Forest Protection and Nature Conservation) in the process of revising the status of forest land. This has already been achieved for Irian Jaya using existing DoF criteria.

The World Bank also instituted, under its third transmigration loan, the Transmigration Settlement Planning Advisory Group (TSPAG) in the Directorate General of Settlement Preparation. This group will be strengthened under the current fifth loan and will continue to monitor the quality of site selection to ensure that sites with inappropriate soils and topography or with high environmental and social risks are excluded. Of the 6 million ha of proposed settlement areas examined, 78 percent have been rejected. It must be remembered, however, that they have rights of review over only those consultant reports produced within the World Bank loans, and the majority of site selection reports have been produced within the Indonesian budget. It is generally agreed that sites that have passed under the scrutiny of the TSPAG are more successful than the others.

Transmigration and Forest Loss

Unequivocal data on Indonesia's forest areas are not available, but currently accepted figures are that 144 million ha have a "closed canopy." This category includes areas that have been selectively logged. Consensus figures as of May 1984 are shown in Table 1, but the interpretation of these data are complicated by the knowledge that some lands designated as some form of forest are badly degraded.

Production forest is forest that is supposed to be exploited under strict rules to ensure long-term sustainable yields, but the enforcement of regulations is so lax that genuine second-cycle logging has yet to be achieved. This owes partly to the conduct of the logging companies but also to the invasion of logged forests by settlers of various origins but only occasionally by transmigrants. Production forest should be more intensively managed and controlled in order to increase production, and jobs need to be created to draw people away from the forest edge. Until a few years ago the land covered by conversion forest was simply cleared and burned rather than logged before conversion to another land use. But concern over lost revenues, apart from the sheer indefensible waste, resulted in the requirement that as much timber as possible be recovered before burning. Even so, this still results in wastage of forest resources, particularly of minor products such as rattan canes.

Table 2 shows how relatively small the area cleared for sponsored settlements actually is. The two columns of figures for transmigration land as a percentage of total and conversion forest have been calculated twice, once assuming 30 percent of the cleared land was forested, and again assuming 50 percent was. In the Third Five-Year Plan (1979–84) about 30 percent of the land cleared was primary forest (a classification that includes selectively logged forest). Thus in almost all provinces the land allocated to sponsored transmigration amounts to less than 10 percent of the conversion forest and *less than 1 percent* of the total forest area. Certain forest types, particularly those on shallow peats, have suffered proportionately more than others. It should be borne in mind that not all land said to be allocated is actually in the process of being cleared and that access roads and ribbon development along them are not included in the figures. It has been suggested that total land cleared as a result of the transmigration program may be five times that originally planned for clearance (Ross 1986). Whether or not that figure is correct, it is nevertheless important that transmigration planning consider the wider and longer-term implications of locating settlements anywhere near primary or relatively intact logged or even secondary forest that can support a wide range of wildlife if further disturbance is prevented. Secondary forest can also be used as a corridor by certain wildlife

Table 1. Land use by province based on forest land use; consensus up to May 1984 (preliminary figures). Based on FAO/World Bank (1985).

Province	*Province area (ha)*	*Protection forest (ha)*	*Parks and reserved forest (ha)*	*Production forest (ha)*	*Total definitive forest (ha)*	*Conversion forest (ha)*	*Other use (ha)*
Aceh	5,339,000	1,051,400	666,800	1,564,000	3,282,200	192,700	2,044,100
North Sumatra	7,168,068	1,391,100	253,900	1,881,400	3,526,400	253,700	3,387,968
West Sumatra	4,228,730	1,206,600	599,700	1,135,700	2,942,800	437,700	849,230
Riau	9,456,156	741,800	267,200	5,537,100	6,546,100	1,754,100	1,155,960
South Sumatra	10,277,500	774,700	796,500	2,457,000	4,028,200	1,186,500	5,067,800
Jambi	5,100,000	1,147,500	493,000	974,000	2,614,500	1,013,200	1,472,300
Bengkulu	1,978,870	465,500	249,900	376,100	991,500	193,600	793,770
Lampung	3,200,000	315,000	356,000	573,000	1,244,000		1,956,000
West Java	4,630,000	229,500	196,400	547,980	873,800	—	1,456,200
Jakarta	59,000	—	15	1,100	1,115	—	57,885
Central Java	3,421,000	65,500	3,000	605,100	673,600	—	2,747,400
Yogyakarta	317,000	3,200	200	33,200	16,600	—	300,400
East Java	4,791,970	255,800	245,300	847,100	1,348,200	—	3,443,770
West Kalimantan	14,680,700	7,047,100	1,336,700	4,988,700	7,695,500	1,508,700	5,476,500
Central Kalimantan	15,300,000	800,000	729,400	9,468,000	10,997,400	3,000,000	1,302,600
South Kalimantan	3,700,000	432,700	66,000	1,531,000	2,029,700	284,700	1,385,600
East Kalimantan	21,144,000	3,643,900	1,968,600	10,339,200	15,951,700	3,500,000	1,697,300
North Sulawesi	2,753,501	285,400	326,600	971,700	1,583,700	699,400	468,401
Central Sulawesi	6,803,300	1,156,900	616,700	2,392,100	4,165,700	335,000	2,302,600
Southeast Sulawesi	3,814,000	420,800	273,400	1,496,000	2,190,200	699,400	924,000
South Sulawesi	6,292,650	2,004,100	189,600	1,158,100	3,351,800	259,400	7,681,450
Bali	563,286	84,100	32,000	9,600	125,700	—	437,586
West Nusa Tenggara	2,015,315	481,700	134,800	446,900	1,063,400	195,900	756,015
East Nusa Tenggara	4,738,820	677,600	131,900	677,100	1,486,600	2,801,600	450,720
Maluku	8,572,800	1,550,400	441,000	3,105,500	5,096,900	436,400	3,039,500
Irian Jaya	41,055,000	8,648,500	8,311,800	11,855,800	28,816,100	11,775,400	474,500
East Timor	1,468,937	435,300	38,800	215,700	689,800	10,000	761,137
Total	*193,871,707*	*30,316,100*	*18,725,215*	*64,391,900*	*113,433,215*	*30,537,400*	*49,101,092*

species crossing between two areas of better quality forest. Thus roads should be sited with due consideration of their possible incidental effects.

But it must be remembered that the forest being lost has in almost all cases been taken from areas that were scheduled by the DoF as conversion forest. Thus the focusing of ire upon the transmigration program misses the point that the fate of forests in almost all areas of Indonesia has been determined. Plantations of oil palm and rubber have probably caused at least as much forest loss as the transmigration program in recent years.

Spontaneous or unassisted transmigrants who have left Java in response to the news sent by friends and relatives are a major threat to the integrity of nature reserves, national parks, and protection forests. It is these people who, generally untouched by formal planning processes, and by dint of virtually nonexistent policing of forest boundaries, contribute to the piecemeal but unrelenting and ubiquitous destruction of forested lands. Migration within and between areas of Indonesia began long before the transmigration program was conceived and has caused considerable environmental damage. The detailed planning of new settlements together with an effective DoF could have a more positive impact on forested lands than no planning at all.

As already stated, the sponsored migrants are followed by perhaps twice as many unassisted migrants (the ratio is different among areas), and the damage they can inflict is not yet taken into account during the planning stage. Their presence is anticipated and tacitly encouraged inasmuch as the transmigration settlements are viewed officially as foci of growth and development. The potential environmental consequences of this are dire, and the degradation of hillsides and forested land in Lampung, Sumatra's southern-most province that has received the most transmigrants and spontaneous migrants, has become so critical that some of its migrant population have had to be resettled either within Lampung or in neighboring Bengkulu province. If institutional and legal changes are not made, the experience of Lampung will increasingly become the experience of other provinces. The integrity of the Barisan Selatan National Park between Lampung and Bengkulu is being threatened as a result of illegal land clearance, and with policing being so lax the end is not in sight. It would be reasonable to incorporate into the economic analysis of projects the

Table 2. Forest resources by province compared to land allocated for transmigration in third Five-Year Plan (in thousands of ha). Based on FAO/World Bank (1985).

	Province area (ha)	*Defined forest (ha)*	*Conversion forest(ha)*	*Forest as a % of province land (ha)*	*Transmigration land (ha)*		*Allocated as a % of total forest land (ha)*		*Allocated as a % of conversion forest (ha)*	
					Available	*Allocated*	*30%*	*50%*	*30%*	*50%*
Aceh	5,339	3,282	192	59	27	17	0.1	0.2	2.7	4.5
N. Sumatra	7,168	3,526	253	49	15	13	0.1	0.2	1.5	2.5
W. Sumatra	4,229	2,942	437	70	12	9	0.1	0.1	0.6	1.0
Riau	9,456	6,546	1,754	69	80	58	0.2	0.3	1.0	1.7
Jambi	5,100	2,614	1,013	51	53	38	0.3	0.5	1.1	1.9
S. Sumatra	10,276	4,028	1,186	39	174	171	1.0	1.6	4.3	7.2
Bengkulu	1,978	992	193	50	22	23	0.6	1.0	3.6	6.0
Lampung	3,200	1,244	0	39	102	100	2.4	4.0	—	—
Subtotal	*46,949*	*25,174*	*5,028*	*54*	*489*	*429*	*0.4*	*0.7*	*2.6*	*4.3*
W. Kalimantan	14,600	7,695	1,508	52	57	25	0.1	0.1	0.5	0.8
C. Kalimantan	15,300	10,997	3,000	72	51	48	0.1	0.2	0.5	0.8
S. Kalimantan	15,114	2,029	284	55	47	37	0.5	0.8	3.9	6.6
E. Kalimantan	3,700	15,951	3,500	75	30	26	0.0	0.1	0.1	0.4
Subtotal	*54,824*	*36,672*	*8,292*	*67*	*187*	*136*	*0.1*	*0.2*	*0.5*	*0.8*
N. Sulawesi	2,751	1,583	699	58	8	7	0.1	0.1	0.3	0.5
C. Sulawesi	6,803	4,165	335	61	38	30	0.2	0.3	2.7	4.5
S.E. Sulawesi	3,814	2,190	699	57	39	36	0.2	0.5	0.5	0.8
S. Sulawesi	6,292	3,351	259	53	12	12	0.1	0.2	4.2	7.0
Subtotal	*19,660*	*11,289*	*1,992*	*57*	*97*	*85*	*0.2*	*0.3*	*1.3*	*2.1*
Maluku	8,572	5,096	436	59	18	15	0.1	0.1	1.0	1.7
Irian Jaya	41,066	28,816	11,775	70	34	13	0.0	0.0	0.0	0.1
Subtotal	*49,638*	*33,912*	*12,211*	*68*	*51*	*28*	*0.0*	*0.0*	*0.1*	*0.1*
Total	*171,071*	*107,047*	*27,523*	*63*	*824*	*677*	*0.2*	*0.3*	*0.7*	*1.2*

costs of protecting the closest protected and reserve forests to each major settlement.

It should be remembered that the settlers themselves are no lovers of forest. Forest is alien to most Javanese and is perceived as a source of spirits, ghosts, and pests. As a result, they themselves are quite happy to see it felled, even though the scrub is probably a more serious source of pigs and rats than the forest.

The role of shifting cultivators in the permanent loss of forest is extremely complicated and is plagued by a lack of agreed definitions. It is discussed here because of the suggestion that much of the damage done to forests is at the hands of "shifted cultivators" (the hapless victims of the transmigration program), rather than shifting cultivators (Secrett 1986).

In areas of low population density, shifting cultivation can be a perfectly viable and appropriate form of land use (Dove 1985). The density has to be really quite low, however, because there are many relatively remote areas (e.g., South Tapanuli and Tanah Karo in North Sumatra, the eastern and southwest arms and parts of the main body of Sulawesi, and parts of Central Kalimantan) that are now steep and largely unproductive grasslands as a result of the practices of indigenous farmers. This condition has nothing to do with transmigrants as has been suggested elsewhere. The steady encroachment into Mount Leuser National Park from the Alas Valley is being caused by displaced people, but these are primarily from the Toba and Karo plateaux to the south. Transmigrants who have abandoned their settlements certainly do account for a possibly significant amount of unsustainable shifting cultivation, but the general conclusion of informed observers is that the protected and reserved forests of Indonesia are under great threat by many forces other than the transmigration program. Concern therefore needs to be directed toward the institutions whose responsibility it is to protect the forests.

The World Bank, the major source of assistance for the transmigration program, has published its own environmental policies (World Bank 1984). Two critical sections state that the Bank will:

> 9a. Endeavor to ensure that each project affecting renewable natural resources (e.g. as a sink for residues or as a source of raw material) does not exceed the re-

> generative capacities of the environment (for example, forest projects should prevent over-cutting and agricultural projects should prevent unsustainable rates of soil erosion).
>
> 9b. Will not finance projects that cause severe or irreversible environmental deterioration including species extinctions without mitigatory measures acceptable to the Bank.

It has been stated that the involvement of the Bank in transmigration is entirely incompatible with its stated policy (Secrett 1986). However, as mentioned previously, the forests being cleared are not considered to be renewable natural resources because they are scheduled for conversion to other land use, and regeneration in this context is irrelevant. The slope limit of 8 percent is an internationally recognized standard for minimal soil erosion, and this is one of the first criteria examined by survey teams and checked by the TSPAG. The "mitigatory measures acceptable to the Bank" are presumably the gazetting of reserves and national parks intended to safeguard the major Indonesian ecosystems, and if the reserved and protected forest system is believed to be unacceptable then the DoT is not the right institution to approach.

But it is absolutely correct that there is currently no way in which anyone can tell whether the extinction of species is occurring as a result of the transmigration program, but this ignorance could be rectified if money was made available. It was agreed at the negotiations for the World Bank's fifth transmigration loan that forestry and wildlife reserves as well as areas of particular ecological importance (primary rain forest and areas judged to contain rare flora and fauna) would not be considered as sites in the World Bank project areas of Kalimantan and Irian Jaya. Because consultant teams are not required to employ botanists or wildlife biologists capable of determining the presence of rare species, one is forced to conclude, despite assurances, that important ecological areas may be lost and rare species may become rarer.

The National Conservation Plan for Indonesia produced by the United Nations Food and Agriculture Organization (FAO) in 1982 was extremely timely in identifying areas that should be proposed for reserve status, and without this identification important areas could have been lost. Virtually no reserve or protection forests have been directly affected by the establishment of sponsored settlements. There are problems, however. Certain important areas are not yet gazetted as reserves, such as the area around Danua Bankau in South Kalimantan, and these can be threatened by settlements. In Irian Jaya some sites in conservation areas have had site surveys conducted before the plans were dropped, and 150 ha of another reserve were cleared, but the contractors were soon expelled and officially condemned (Petocz, in press).

Anyone acquainted with reserves or other protected forests in Indonesia will vouch for the meaninglessness of the majority of so-called boundaries: the sound of chain saws near the forest edge is ubiquitous. It would be technically possible for the DoF to request loan funds for assisting the development of capabilities to enforce regulations or police boundaries, but it is not simply a case of finding funds: the Directorate General of Forest Protection and Nature Conservation of the DoF has been host to a cooperative program with the World Wildlife Fund for 10 years and with FAO for eight years, but the results have been disappointing to all sides. For example, management plans have been produced for most of the major reserves and national parks, but for one reason or another none has been fully implemented.

At present, there are few signs that most areas gazetted as reserves are able to maintain their integrity in the face of inadequate enforcement of regulations regarding settlement and logging, and insufficient employment opportunities. Without any surety of which land is to be protected, it is impossible to formulate meaningful management plans for wildlife such as elephants, animals that are in the peculiar position of being protected pests. Clearly Sumatra's elephants cannot continue to be herded into ever-decreasing areas of forested land. A management program might include judicious culling of selected herds, but doing that once would set a precedent that would only be reasonable if it were known that elephants in other areas did not exceed the carrying capacity of the forests, and that those forests were permanent.

If it is possible to assume that the populations of animals within forests are at the optimum density, then when a neighboring area of forest is felled all the animals within it are likely to die even if some do flee to surrounding forests for a time. To make the effects of clearing 10,000 ha of lowland forest for transmigration or any other purpose more easily understandable, the following would be among the subsequent losses in Sumatra: 30,000 squirrels, 5000 monkeys, 15,000 hornbills, 900 siamang (large gibbons), 600 small gibbons, 2 tigers and 10 elephants (Whitten et al. 1984). A recently published map of the vegetation of Malesia (southern Thailand, Malaysia, Philippines, Indonesia, and Papua New Guinea) (Whitmore 1984) shows clearly how much like an archipelago are the remaining lowland forests of Sumatra, the island most affected by plantation development and transmigration.

Recent Developments and the Future

The 1982 No. 4 Act of the Republic of Indonesia concerning Basic Provisions for the Management of the Living Environment requires that every development plan considered to have likely significant impacts on the environment must be accompanied by an analysis of en-

vironmental impacts. Regulations for these analyses were formally passed by Parliament in 1986, but analyses were also conducted in the intervening years. For example, in 1984 the Sub-Directorate of Environmental Impact Analysis and Environmental Rehabilitation in the DoT contracted out environmental impact analyses of planned settlements in 4 of 12 major settlement areas under consideration to university environmental study centers. The Sub-Directorate is currently being assisted in its implementation of the regulations by the Environmental Management Development in Indonesia program funded by the Canadian International Development Agency. Monitoring and evaluation are repeatedly mentioned as essential elements in project design, but they have yet to take shape, at least in the environmental field, in the transmigration program. There has been almost no commitment from any internal or external institution to support sustained research in the ecology-development interface to allow the necessary criteria for development to be established. Since a proportion of environmental impacts will not become obvious until after the settlements have been handed over to the district authorities, some mechanism must be established by which the necessary long-term monitoring programs can be continued. The obvious agency is the State Ministry for Population and Environment (SMPE). Indeed, one of the components of the World Bank's third transmigration loan was a monitoring and evaluation study by SMPE to establish a framework and methodology for monitoring. Various problems have led to the length of the study having to be shortened from three years to 18 months, and the original scope of the project has had to be reduced. The team, including an Australian consultant, was finally formed in early 1987.

In December 1983, the price of Indonesian oil was about $28* per barrel. This plummeted through 1986 to reach $9.83 by August. Since then it has risen but is hovering around $18. This dramatic fall in price required the Indonesian government to formulate a drastically revised development budget in 1986 with departmental funds being reduced by an average of 22 percent and with those for the DoT being cut by 44 percent. In early 1987 a further 54 percent cut was made leaving the allocation for 1987–1988 at $68 million, 43 percent of which would be met by the donor community, primarily the World Bank. This has resulted in the cessation of land clearing and the virtual cessation of the movement of sponsored transmigrants; in 1987–88 it is likely that only about 1000 families will be moved, and those will go to settlements relatively close to Java. As a consequence, in March 1987 there were 30,000–50,000 officially empty transmigration houses throughout the country, most of which are unlikely to be filled even by local transmigrants. DoT activities will now emphasize rebuilding roads and replacing broken bridges among other projects.

These decisions have provided an unexpected opportunity to those concerned with the environment both within and outside Indonesia to provide maximum input for the planning process for transmigration in the fifth Five-Year Plan (1989–94). Given the numerous constraints mentioned in this paper, particularly the availability of accessible suitable land, the kind of transmigration program seen during the third Five-Year Plan (1979–84) will almost certainly not be seen again. By the time the fifth Five-Year Plan ends, the DoT will have had to determine how its nature will change and how the program for second-stage development can best be executed. Increased environmental concern during these discussions is essential, so that full consideration is given to the major issues and pragmatic alternatives. It would be senseless to force the program forward until every available marginal parcel of land had been settled, thereby reducing future options of resource use.

The failures of many coastal swamp settlements and the limited land available for wet field agriculture will probably lead to an emphasis on different models of dryland farming, particularly tree crops that can be grown on steeper land than arable crops. The model of nucleus estates with a plasma of small holders (in some cases transmigrants) has been generally successful, but it is expensive, and the managerial capacity to implement many such schemes is sorely stretched even now. There are also the problems of having to pay wages before the crop is productive, of realistic credit schemes, and of low commodity prices.

Unassisted or partially assisted migration is likely to be encouraged, and planning is likely to begin to seriously consider the needs of such migrants. However, much will have to change if the impacts of these people are to be controlled. The DoF has shown itself unable to enforce fully the regulations concerning the use of designated forests. The DoT should be able to control the unassisted migrants who settle in planned settlements, but what of those for whom there is no room? Responsibility for these is on the shoulders of both the DoT and DoF.

The Sub-Directorate of Environmental Impact Analysis and Environmental Rehabilitation in the Directorate of Environmental Utilization will continue its program of analysis, but this analysis will concern the second-stage developments rather than new settlements. It will also pay attention to the impacts that the settlements have already had with the hope that, should the budget eventually allow for the planning of new settlements, unsound farm models, unnecessary forest destruction, etc., would be avoided. Because of this, it is hoped that future settlements will be sited in accessible areas with no

*Costs here and throughout the paper are expressed in U.S. dollars.

forest cover, or else in a development zone of a particular region.

Studies on transmigration in the context of regional development of southeast Irian have recently been completed, and the team that produced the report included consultants experienced in wildlife management and environmental conservation. This type of regional planning exercise is overdue, and the benefits will be that the existing and planned transmigration settlements will be seen as components of the development process, focusing on just a few major development centers rather than on a large number of relatively small and separate settlements.

Conclusions

Various agencies are involved with physical and social studies related to transmigration, but virtually nothing is being done to strengthen the ecological data base. Inventories, population studies, differential habitat use, and effects on species of hunting and habitat modification are urgently required. These are generally regarded as projects financed by charities (e.g., World Wildlife Fund), but it is about time this attitude were changed and aid agencies accepted responsibility for incorporating these into project costs or for financing them as a separate exercise. Support is also required for long-term detailed research and monitoring programs concerning the impact of transmigration on ecological systems, giving priority to swamps.

There are very few long-term ecological doctoral studies (a major source of sound, interpreted data) being conducted in natural or seminatural environments of Indonesia. Foreign students are welcomed to study in Indonesia although a clear six months is generally required for the appropriate visa to be processed. The potential and academic challenges of working in Indonesia are exceptional.

Although the loss of forests owing to the sponsored transmigration program may be relatively small, it is an issue of utmost urgency that the government should simplify the currently complicated and expensive procedure of land transfer, registration, and tenure. Giving opportunities to unregistered transmigrants to buy the plots of land they occupy at subsidized prices, but only if the land has a maximum slope of 8 percent and is outside the boundaries of designated forest land, may give some control over currently unplanned settlement. Given the significant damage these people can inflict on forested lands and the fact that they will tend to settle near forest edges, it is necessary to encourage village- and settlement-level involvement in legal and sustainable forest-product industries and acceptance of forest status boundaries.

Finally, the existing levels of awareness and concern for environmental and social issues in the DoT and funding agencies has been stimulated not least by the activities and statements of nongovernmental organizations both within and outside Indonesia. Some of this is not well informed. The DoT has become very open about past mistakes, but perhaps it needs to extend this to present plans. Meanwhile pressure on the *appropriate* agencies should be maintained so that there is constant examination of environmental policies and of the manner in which they are implemented. Not all of Indonesia's loss of forest can or should be blamed on transmigration.

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