

Conservation Planning in Indonesia's Transmigration Programme

Case studies from Kalimantan

JOHN DAVIDSON



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TRANSMIGRATION PROGRAMME**

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The Tropical Forest Programme receives generous financial support from the Government of Sweden. It is coordinated by Jeffrey Sayer at IUCN Headquarters in Gland, Switzerland. Mark Collins is responsible for tropical forest monitoring at the IUCN Conservation Monitoring Centre in Cambridge, UK.

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The Commission's Executive Officer, Frederic Briand, is based at IUCN Headquarters in Switzerland.

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by

JOHN DAVIDSON

Based on the work of IUCN's Commission on Ecology

Published by IUCN, Gland, Switzerland and Cambridge, UK, in collaboration with the United Nations Environment Programme, and with financial support from the Indonesian State Ministry for Population and Environment.



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Citation: Davidson, John, *Conservation Planning in Indonesia's Transmigration Programme: Case studies from Kalimantan*. IUCN Gland, Switzerland and Cambridge, UK. 1987. 136 pp., 37 photographs, maps, diagrams.

ISBN: 2-88032-930-2

Printed by: Parchment (Oxford) Limited, UK
Cover design by: James Butler

Available from: IUCN Publications Services,
219c Huntingdon Road, Cambridge CB3 0DL, UK
or Avenue du Mont-Blanc, CH-1196 Gland, Switzerland

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Cover photo: This transmigration area at Mariana, Musi Banyuasin, in south Sumatra, was not planned ecologically. The shallow peat soils, where swamp forests once grew, never dry out. The settlers do not cultivate the land, have no employment, and simply take Government subsidies while they last. Beyond this, their future is unknown.
Credit: Kompas.

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ACKNOWLEDGEMENTS

Since the guidelines contained in this publication are based on a previous IUCN publication (Poore 1976), acknowledgement is made to Dr. D. Poore for inclusion of extracts from his work and from other material he has supplied to the author, and for his assistance while he and the author were both in Indonesia.

The natural forest classification illustrated here is based on the work of Dr. M.S. Ross (Ross 1984) which he compiled after a decade of experience in forestry in the outer islands of Indonesia. Dr. Ross assisted with discussion and arrangement of meetings between the author and senior staff of the Ministry of Forestry.

Thanks go to many Indonesian colleagues in several Institutions and to officials in Jakarta and in the South Kalimantan provincial offices, all of whom made a contribution through discussions or by contributing data, maps and published and unpublished information. They included Senior planning staff of the Ministry of Forestry, Jakarta: Djumra - Director of Program, RRI; Hoesodo Soedartjman; Soedibjo Sartona; Suparno - Foreign Co-operation and Technical Assistant, Bureau of Planning; Soebaglo Hadiseptro - Director of Forest Landuse Planning; the Minister of State for Population and Environment Dr. E. Salim, Assistant Minister Dr. H. Haeruman and senior staff of the Ministry in Jakarta: Kartomo Wiroshardjo - Assistant Minister on Population, Kuswanda - Deputy to the Assistant Minister; Sri Pamoedjo Rahardjo and Sumanoro - Deputies to the Assistant Minister on Population; Arle Djoeardi and Isa Karmisa Ard - on the staff of the Assistant Minister on the Built Environment and Aga Sugandhy - Deputy to the Assistant Minister of the Man-made Environment. Other persons included: Dr. Indra Samiarsa, Director, Planning, Transmigration Department, Project Co-ordinator, IBRD Transmigration Planning Advisory Group, Jakarta; Mr. W. Simms, Team Leader, IBRD Transmigration Planning Advisory Group, Jakarta; Prof. Dr. Ir. F. Gunarwan Suratmo, IPB, Bogor, developing Environmental Impact Assessment for Transmigration Projects; Ir. Hendi Suhaendi, Forest Research and Development Centre, Bogor; Dr. Tjahjono Samling, Ecological Laboratory, Department of Biology, IPB, Bogor; Dr. Sanggen Ny Digt, Dean, Faculty of Forestry, Lambung Mangkurat University, Banjarbaru, S. Kalimantan; Ir. Ruspandi, Department Head, Planning, Department of Forestry, Banjarbaru; Ir. Toga Sialagan, Office of Conservation, Banjarbaru; Dr. Sjachriel Darham, Assistant Governor of South Kalimantan, Banjarmasin; Prof. Dr. Ir. Rubini Atmawijaya, Director General, PHPA, Bogor; and Dr. Ir. Sadan Widarmana, Dean, Faculty of Forestry, IPB, Bogor. The following persons met in a discussion group with the author in South Kalimantan: Dr. Syahrir Y. Panuncak, Chairman, BAPPEDA, South Kalimantan Province; Dr. Sam'ani, Research Leader, BAPPEDA; Dr. Abdul Medis, Staff Member, BAPPEDA; Dr. Ardenan, Bureau of Natural Conservation, South Kalimantan Province; and Mr. Suparman, Transmigration Office, South Kalimantan. Both Dr. Machmud Thohari and Dr. Ir. Hadi S. Alkodra, Department of Forest Resource Conservation, Faculty of Forestry, IPB, Bogor assisted the author in compiling information and in translation of documents and accompanied him into the field in South Kalimantan. They, in turn, were assisted by Ir. Agus Priyono.

Dr. Len Webb and Dr. J. Davie, Members of the Commission on Ecology, IUCN, devoted considerable time to a review of the original IUCN Guidelines and to early preparations for this project.

Numerous draft copies of this Manual were distributed for comment. Several marked up copies were returned, some unfortunately without the name of the reviewer. Some comments were lengthy and much appreciated, such as those by Mr. D. Holmes of the IBRD Transmigration Advisory Group. Others were also constructive and very helpful in editing the final draft.

Funding was provided by the United Nations Environment Programme, through the Commission on Ecology, IUCN.

INTRODUCTION

A Republic in Southeast Asia, Indonesia consists of the large islands of Sumatra, Java, Kalimantan (Indonesian Borneo), Sulawesi (Celebes) and Irian Jaya (West New Guinea) and about 3,000 smaller islands and islets totaling an area of just over 1.9 million km². The population estimated in 1984 was about 160,275,000 persons, up 8 per cent from about 147,500,000 in the 1980 census.

The three provinces of Java and the province of Bali are now home for nearly 70 per cent of the population, but the area of these provinces is only 7 per cent of the total area of Indonesia. Throughout the greater part of the Twentieth Century, it has been the policy of successive Governments to move people from the densely populated islands of Java, Madura, Lombok and Bali to the more sparsely populated "outer" islands. Over five million people have been moved to date, consisting of fully-sponsored and voluntary families. Almost 366,000 fully-sponsored families, about 1.8 million people, were moved during the Third Five Year Plan (mid-1978 to mid 1984).

Major objectives of this transmigration policy have been relief of population pressure in the crowded inner islands, improvement of the standard of living of the transmigrants, the distribution of the benefits of development to the outer islands in order to work towards nationally balanced development and to improve national defence by having more balanced occupancy of Indonesian territory.

Transmigration programmes have been planned with the objective of enabling the transmigrant to achieve a subsistence standard of living as rapidly as possible and not later than the end of a period of Government assistance lasting up to three years. Means are provided to establish a sound basis which is meant to enable later income generation which in turn would allow further improvement of the transmigrants' standard of living and at the same time promote development within and around the settlement area. These programmes are also promoted as a means of heading off spontaneous unplanned and uncontrolled settlements in areas remote from government control.

Up to the present, sponsored settlement has been based mainly on rainfed arable upland agriculture with the provision for possible later development of a tree-crop component on a legal minimum total holding of 2 ha. The maximum budget allocated for the installation of one family is limited absolutely to Rp 5,000,000 (U.S. \$4,500 in May 1986).

Despite early optimism, transmigration has not significantly changed the population distribution pattern in Indonesia while apparently incurring huge negative environmental, social and economic costs. The population problem and resulting pressure on the environment in Java has not been relieved despite the sponsored migration of one million people since 1969. Some Transmigration areas are behind schedule and others have not and will not reach their targets of migrants. Transmigration areas which have achieved their targets have themselves higher population growth rates than the national average and are becoming new foci for further population growth and related problems, despite good voluntary family planning schemes. Creation of large artificial communities of unhappy people far from central government control is not contributing to balanced development but rather to future instability in the nation. Nevertheless, seen from the point of view of a poor migrant family for example, from Java, formerly without land or future, the outlook for many migrant families, though still not without problems, is usually much better than it was at the point of origin.

While planning seems to be adequate and is supposed to take account of possible environmental impacts, implementation by field officers and contractors leaves much to be desired. Transmigration settlement areas have been plagued with problems, many of which could have been avoided from the beginning. Sites chosen are often marginal or submarginal for agriculture because of poor site selection and inadequate

CAUTION

The maps and illustrations given in this manual are for the purpose of example only.

It is likely information on which they are based was either inaccurate or out of date or both, but was the best available at the time of preparation of this publication.

For future planning according to these guidelines collection of up-to-date, accurate baseline information and adequate fieldwork are necessary to produce new definitive maps and plans.

soil surveys. Delays and lax organization have led to out-of-phase arrival of transmigrants and important inputs such as tools, fertilizers and seeds.

Additionally, lack of adequate environmental impact studies during planning has meant some projects have resulted in long term adverse consequences for nature conservation and the environment, in return for short term gain. This is particularly true of those projects initiated in forested tropical moist forest areas on poor, erodible soils. Results have been that settlers have been forced to return to their place of origin or move off the designated settlement blocks to cause further environmental problems with unplanned settlement in adjacent forest areas. Unplanned settlement in forest areas usually results in a destructive form of slash-and-burn agriculture. The forest resource is wasted in return for one or two dryland rice crops before the settlers move to yet another area. This destructive form of shifting cultivation moves in an advancing front. Thus poorly planned transmigration sites provide nuclei for adjacent forest destruction, even if not originally located in intact forest. This deforestation problem is compounded by the fact that people from the inner islands have an innate fear of forest and they consequently have no second thoughts about the negative environmental consequences of forest clearing on and adjacent to transmigration sites.

In South Kalimantan, and reportedly also in other regions, such as South Sumatra and Irian Jaya, the so-called "spontaneous transmigrants" or "local transmigrants" include an increasing proportion of "multiple-timers" - transmigrants who have been through the process more than once, after they have exhausted areas where they were settled previously.

Most of the transmigrants are poor contract labourers and many are illiterate (some even cannot speak Bahasa Indonesia) and do not have the expertise to understand and use the technical inputs supplied (tools, seeds, fertilizer) in order to succeed on the land they are given. Many just give up and exist as migrant labourers setting up adjacent transmigration projects. Transmigrants rarely include people who have previously owned or managed any piece of land no matter how small. The exceptions are experienced landowners displaced by development projects such as highways and hydro-electric schemes. This latter category of transmigrant generally has more success on the assigned plots, no matter where they are located.

Part of the overall problem is lack of resources for proper implementation of transmigration projects according to the designed planning provisions which are already documented. This is recognized by the Government. Settlements implemented under schemes financed by the World Bank (IBRD) usually have more financial resources and better implementation planning input than those organized solely by the Ministry of Transmigration. The IBRD contribution over the last decade totals over one billion US dollars, the fifth generation project, Trans 5, has a budget of about 180 million U.S. dollars. The IBRD is now active in Irian Jaya, East Kalimantan and Jambi and has further proposals for Irian Jaya, but has not been involved in South Kalimantan since the late 1970s. Activities of the World Bank planning teams have had little or no influence on improving the in-house expertise and effectiveness of local transmigration planning units.

Until Trans 5, no ecologists had been employed by the World Bank on planning teams concerned with transmigration site selection. The Transmigration Planning Advisory Group, supported by IBRD, did not have any full-time ecologists or environmental scientists on its staff. Although appropriate planning guidelines existed on paper, they were never translated into action. The IUCN Guidelines were in this category. During this project, only one copy of the Guidelines was sighted in Indonesia and this was carried by one of the Indonesian consultants assigned to assist the author.

In addition to the comments made above, the Transmigration programme has attracted much criticism from both within and outside Indonesia. While many of the critical comments contain a great deal of truth, much has not been substantiated. The transmigration programme will go on in the future, though at a much reduced rate over that achieved during the Third Five Year Plan, because of budgetary constraints.

What appears to be required and what this project is designed to address, is the incorporation of the IUCN Guidelines into Transmigration Planning at all levels. This in turn involves sectors outside of the Ministry of Transmigration such as Forestry and must incorporate nature conservation in land-use planning at all levels of administration and from the beginning in order to be effective.

Ecological guidelines for development in tropical moist forest lands have been available for over a decade (IUCN 1974, Poore 1976) but these have not reached decision makers, or at least have not had any effect when they have. With the problems mentioned in the preceding paragraphs in mind it was decided to choose South Kalimantan, a small Province affected by over 40 separate transmigration projects, as a sample area on which to test and adapt, where necessary, the existing guidelines and produce a manual showing how the guidelines are applied or should have been applied, step by step, in a case study. The aim was to introduce the guidelines into a practical setting which might more effectively promote their dissemination and use and inclusion in the legal framework governing future transmigration and other rural development programmes likely to impact on forest areas.

Satisfying this aim has been attempted here by rewriting and addressing the various guidelines separately to sectoral managers, planners and practitioners within a framework of land classification and land use planning, using the Province of South Kalimantan in Indonesia as an example in the various stages.

The contents of this Manual demonstrate how to arrive at an objective land classification which is independent of any existing or planned future use, how to carry out sectoral land use planning according to certain ecological guidelines and finally to assemble a provincial land use plan, while considering nature conservation first.

Note added in proof: The ecological guidelines developed by D. Poore (1976) have been revised and will be published soon in the IUCN Tropical Forest Programme series. The full reference will be Poore, D. and Sayer, J. (1987). The Management of Tropical Moist Forest Lands: Ecological guidelines. IUCN, Gland, Switzerland and Cambridge, UK. vi + 64 pp., illustrated.

1. GUIDELINES FOR NATIONAL GOVERNMENT POLICY-MAKERS

1.1 Forward Looking Land Use Policies

An environmental policy for Indonesia was launched by the Government with Act No. 4, issued March 11, 1982 on the *Management of the Living Environment*. For the first time the necessary link in policy and practise between the natural and man-made environments and development was made explicit and brought into line with the five basic principles of the State Philosophy, Pancasila. These five principles are the basis of the Indonesian Constitution and comprise:

- (i) belief in God,
- (ii) nationalism,
- (iii) humanism,
- (iv) sovereignty of the people and
- (v) social justice.

Act No. 4 states "it is necessary to sustain the capability of the harmonious and balanced living environment to support continued development by means of an integrated and comprehensive national policy with due consideration of the needs of present and future generations."

To carry out this broad mandate, the Act also specified the responsible institutions (Section V, Article 18):

- (i) The Minister responsible for the Environment;
- (ii) the sectoral Ministries, Departments and organizations, including the Ministry of Forestry and
- (iii) at the regional level, the Provincial and Regency Governments.

"Self-reliant community institutions" were accorded a supporting role. Thus the stage was set for an inter-sectoral and decentralized style of administration and implementation of a national policy for the environment.

The forest policy of Indonesia was also derived from the five basic principles of the Pancasila. This means, in practical terms, the nation's forest policies and forest development programmes reflect the prevailing attitude that the forest resources are to be developed and shared by all the people of the nation.

Until 1983, the Department of Forestry was one of five Departments of the Ministry of Agriculture. In 1983, a new Ministry of Forestry was created from the old Department and its staff much expanded. The Ministry operates under Basic Forestry Law No. 5, which was introduced in 1967.

The Basic Forestry Law lays down a classification system whereby the forest area is delineated according to its intended function. Thus there are "protection forests", "production forests", "forest reservations" and "recreational forests". The Law gives the Government extensive rights for the control of all forests, whether publicly or privately owned, and decrees that a General Forestry Plan be prepared, within the framework of a broader land-use plan, to achieve fully the forests' potential. The multiple benefits of the forests are recognized, including especially those functions regarding watershed protection; soil and water conservation; influence on macro- and micro-climates; production of multi-purpose raw materials for the timber industry and export; the production of minor forest products; the importance of the forest in providing basic needs for the rural populations; protection of unique forests; preservation of scenic landscapes in the interests of recreation and tourism; protection of existing transportation and communication infrastructure and various aspects of national defence.

The Basic Forestry Law authorizes the Government to grant licences to state or private institutions for forest utilization and development (forest concession rights

(HPH) regulated by Forestry Agreements (FA)). Private rights of ownership are recognized, though restricted, as private use of forest land must also be in accordance with national objectives as set down in the Basic Forestry Law. Traditional customary ownership and use rights regarding forest land are respected and take precedence over the modern Basic Forestry Law. These community rights, however, must be conducted so that superior public interests, such as the political goals of the Law are not violated. In this respect the Law authorizes the allocation of forest rights, such as clearing of forest land, timber cutting, collection of minor forest products, forest grazing and hunting, though conflicts between the modern law and customary law pose real problems for tribal communities.

Since the introduction of the Basic Forestry Law in 1967, many subsequent decrees and decisions regarding its implementation and further elaboration have been issued. The following Regulations and Laws are regarded as crucial steps in the development of forestry and forest industries in Indonesia:

- (i) Foreign Capital Law No. 1 of 1967
- (ii) Domestic Capital Investment Law No. 6 of 1968
- (iii) Three Ministers' Decree of May 1980
- (iv) Regulations by Four Director Generals (SKBED)
- (v) SKBED of April 22, 1981
- (vi) Jakarta Consensus on ASEAN Tropical Forestry, 13 August 1982.

Upon examination of both sets of policies, there appears to be insufficient coordination and co-operation between the Ministry of Forestry, the Ministry of Population and Environment and other Ministries to enable a revised set of policies to be put forward which would act together and with other policies such as those for Agriculture to form a National Land Use Plan incorporating the principles of the World Conservation Strategy.

GUIDELINE

The Indonesian Government requires continually updated national policies for forests and conservation of nature, acting together, as an aid to granting tropical moist forest lands to a spectrum of uses which require action from preservation and nature conservation on the one hand to clear felling and conversion on the other.

If the resources of Indonesian forest lands are to be effectively and lastingly conserved, it will not be enough to design answers that only fit the circumstances of today. There will be great changes even in the next few decades and more in the next century. While nature conservation is concerned with attaining stable balances, development is dedicated to change. Policies should be imaginative and designed to adapt to changing circumstances: in the balance between population and resources, in economic well-being, in energy policies, in the balance of trade and in the attitude of people to environmental issues. Many land use policies are obsolete before they are implemented. Nature conservation policies for forest lands must, therefore, look forward, be integrated as far as possible with policies for population and for all sectors of the economy, and aim to hit a moving target (Poore 1986).

GUIDELINE

Environmental effects of alternative courses of action and legislative proposals are to be assessed in advance in order to ensure long-term costs do not outweigh short-term benefits.

1.2 Conflicting Land Use Priorities

At present, the interests and objectives of the mining and petroleum industry take precedence over all sectors, including the forestry sector, in national development

planning. This is a purely economic decision, driven by the fact that the foreign exchange generated by the mining and petroleum sector is many times greater than from the forest products sector (e.g., in 1980 more than 8 times).

The main other competition for land use comes from the agricultural sector, for which two programmes require the opening of new land for expansion. The first of these, the Estates Crop Programme, is too small in area demands to affect to any significant degree land classified as permanent forest. Moreover, this programme does not have to adhere to the strict physical site limitations imposed by the Transmigration Programme. Thus, within the Conversion Forest there is sufficient land to satisfy the land requirements of the Estates.

It is principally with regard to the Transmigration Programme that conflict arises in the demand for land. This Programme at the moment is based mainly on rain-fed dryland food crop production. For this reason, the poverty of the soils and the demanding climate have to be taken into account and strict physical and chemical criteria need to be used to define which areas are suitable for the farm models selected for small farmers. The greatest constraint has been the difficulty of finding sufficient areas of land with slopes of less than 8 per cent, the limit set for Transmigration settlements based on food crops (DITADA, 1983). Other constraints have been remoteness of location and the low nutrient status of most of the soils of the outer islands for practising this type of cropping system.

If the Transmigration Programme is to continue at rates of settlement attained in the Third Five Year Plan, for every future Five Year Plan an additional total area of some five to ten million hectares of land will be needed. In principle this land can only come from the forest estate since this is the only available reservoir of "spare" land. If the Conversion Forest category does not fall within transmigration site selection criteria, then the Production Forest becomes threatened with encroachment by transmigration. Thus, the Production Forest as a whole needs to be re-examined and an inventory of growing stock carried out. The amount of land presently set aside for Production Forest seems inordinate in terms of the actual requirements, especially in light of the demands for land for additional food production. Nevertheless, if forest land is excised from Production Forests on an *ad hoc* basis, there could arise a situation where there may not be enough forest to supply the logs required by the forest industries in the future.

If the Production Forest is much greater than required, the concessionaires, under the present system of management will not have the incentive to protect or upgrade their forests. Silvicultural treatments to improve the yields from the natural forest will not be performed, because the next crop is not necessarily the property of the present forest concessionaire. The best forests will be overcut, and logging damage will ensure that the sustained yield principle will not be achieved within the time frame set. Illegal logging will downgrade areas already logged by concessionaires, achieving the same results. Shifting cultivators and other settlers often excise and destroy large areas of forest, irrespective of its quality. Agricultural settlements established in previously forested areas may fail and be abandoned. Settlers often remain on their failed agricultural settlements and supplement their incomes through illegal cutting in adjoining Protection, Nature Conservation and Production Forests, resulting in even greater adverse impacts for nature conservation.

Clearly, allocation of land has to start with an objective classification of the land itself which recognizes its intrinsic value alone, rather than its preconceived value for particular uses. The ideal would be for the first major developer to have this classification carried out. In Indonesia this means either the Ministry of Forests or the Ministry of Transmigration, supported by donor assistance with expertise and funds, where required.

GUIDELINE

Wise and successful allocation of forest land depends on facts which are best supplied through an objective classification of the land resource itself and supported by environmental assessment surveys, followed later by land suitability classification for various uses, including nature conservation.

1.3 Nature Conservation First

What is nature conservation? A good starting point is to consult the goals and aspirations of the World Conservation Strategy. The main principle of the World Conservation Strategy is that conservation depends on development and that further development in the future is impossible without conservation. In Indonesia the goal must be to achieve development closely linked with nature conservation, and by so doing avoid the pitfalls that development also can be very destructive and conservation under certain circumstances also can be an obstacle to development.

Two of the three objectives of the World Conservation Strategy are to maintain essential ecological processes and to preserve genetic resources. The best way of accomplishing these objectives in the tropical forest would be to maintain the forest untouched and inviolate; then soils would remain intact, water clear and wildlife plentiful and in natural balance (Poore 1986). For these two objectives, preservation is the best form of nature conservation, but such a course is no longer possible in many parts of Indonesia.

Hence recourse must be made to the third objective of the strategy which is to ensure the long-term sustainable use of species and ecosystems. But what is sustainable, how much should be used and how much should be preserved?

Land, water and vegetation can be used in many different ways that are ecologically sustainable. It is possible to exploit parts of the natural forest itself more, or less intensely. The forest can be replaced by an artificial agroecosystem and this, too, can be exploited sustainably at a certain level of intensity with proper planning and investing in it sufficient technology and energy to care for it and maintain it.

At another level, these ecosystems can be in turn replaced by more capital intensive and more artificial forms of land management at a greater cost in terms of energy used and increased risks of pollution and other ecological damage.

In Indonesia, all these alternative ways of managing natural resources must be used if even the basic needs of the growing population are to be satisfied. Further intensification of land use cannot be avoided if the quality of life of the people is to be raised according to the tenets of the Pancasila.

In the words of Duncan Poore, nature conservation must therefore be concerned, first and foremost, with finding an acceptable balance between these different intensities of use from preservation to conversion. How much land is still available for and should be used in these ways? Are there limits beyond which it is unacceptable to go? These are difficult questions to answer.

It is perhaps easier to understand the problem - though no easier to solve it - if it is appreciated that the three objectives of the World Conservation Strategy are different in kind states Duncan Poore. "The maintenance of processes and life support systems is concerned with keeping the whole machine running smoothly and preserving the natural capital of productive soil; the sustainable use of species and ecosystems, with maintaining the capital of natural systems that are cropped; and the preservation of genetic resources, with an insurance for the future. Choices must be made all the time about how much should be invested in each of these."

The only way of providing for nature conservation totally effectively and securely is by leaving natural ecosystems intact, and then only if the intact areas are very large. Once they are managed they are changed. The slightest manipulation alters

the natural balance of populations and species: as intensity of use increases, so does the probability of irreversible change (Davidson 1985a). Populations of plants and animals are affected first; then whole ecosystems go; then soil. So nature conservation is not only concerned with the balance between different kinds of use but also with the way in which one use is changed into another, and with the standards of management at all levels of intensity.

In the last analysis, states Duncan Poore, land, resources and people will reach a balance. Sustainable use is the only ultimate possibility. People and resources may reach equilibrium in a planned, humane manner and in such a way that relatively rich resources remain at the disposal of future inhabitants, or by a series of cataclysmic plunges that cause untold hardship and leave Indonesia eventually an impoverished nation.

GUIDELINE

In order to maintain a stable natural resource base upon which sustainable development depends, national land use planning must accord nature conservation first priority and put in place checks to ensure that sufficient areas of natural ecosystems, in particular rare, unique or representative ones, are left intact and genetic resources preserved as an insurance for the future.

1.4 Land Use Planning Required on a National Basis

The pivot in the implementation of environmental policy process is the Ministry of Population and Environment (KLH) which has overall responsibility for making the policy work. This requires certain in-house activities like preparing follow-up regulations or legislation on environmental quality standards, procedures for implementing the ecological damage and impact assessment provisions of the Act, and so on. But, in the main, the Ministry exerts its influence through various external relationships, such as those listed below:

With the *Cabinet Secretariat* for overall Government policy and priorities, and arrangements for multi-lateral and bi-lateral donor assistance;

With *The National Planning Agency* (BAPPENAS) in the preparation of environmental components of the Five Year Development Plans and for initiation of environmental components (e.g. for mitigation of damage) in the development budgets of sectoral Departments like Forestry and Public Works and Industry;

With the Ministry of Education and Culture, concerning research policy and structures in the universities, funding for research and post-graduate fellowships, and generally concerning the role and development of Environmental Study Centers;

With various sectoral Departments for several aspects of implementation, such as the development with Industry and Finance, of economic incentives for pollution control, and with the Department of Health, the formulation of hazardous waste handling guidelines;

With *Regional Development, Department of Home Affairs* for consultation on the role of the BAPPEDA at both provincial and regency levels;

With the *National Investment Board* (BKMD) and other licensing agencies for the application of guidelines on environmental requirements;

With the *Governor's Office and Regional Development Planning Board* (BAPPEDA) for initiation of guidelines on the roles and responsibilities of regional agencies, like the Office of Population and Environment, Regional Administration (BKLH);

With the *Environmental Study Centers* (PSLs) for the initiation of policy studies and training, for consultation on urgent problems and for participation in national working groups;

With the *National Scientific Documentation Center of LIPI* for national and international information on environmental issues;

With the *Ministry of Forestry* (PHPH) for the Nature Reserves;

With *self-reliant community institutions* for fostering public awareness.

The skills and perceptions that have been mobilized at the Ministerial level are those of the broad view, co-ordination and managerial capacities, and government system know-how. But KLH as general manager depends on others to supply the substantive information for policy and programmes, and in return to apply control procedures set down by the Ministry. Effectiveness depends on the strength of the components - and weak links can have serious repercussions.

Table 1 shows the functions ascribed to various participants. The role of BAPPENAS is critical. For the sectoral and other agencies, both central and regional, a substantial set of functions is indicated which reflect the intention that environmental considerations be built into on-going development processes - for example, by Transmigration authorities in regulating population densities to the carrying capacity of receiving areas and by the Electric Power Corporation (PLN) in encouraging the protection of the water catchment areas of rivers where dams are located for hydroelectric power generation.

In the institutional structure that has been created, it is the intention that the environmental dimension of development be facilitated by an Environmental Coordinator within each Ministry.

Management of state forests, which account for virtually all of the forest area, is under the jurisdiction of the Central Government, which may delegate its authority to the Provincial Governments, but this delegation has fallen into disuse over the last decade.

It seems there is need for a clearer hierarchical administrative structure for national land use planning which should operate from the top down not the bottom up and which can mediate on powerful sectoral interests such as those of forestry and agriculture and at the same time incorporate principles of nature conservation. Communication has to be improved so that the top knows what the bottom is doing. At present, lack of communication is a constraint in a large dispersed nation like Indonesia.

GUIDELINE

Within a framework of enforceable environment and forest policies, broad-scale land-use planning is required on a national basis first, then followed up with provincial and district plans and lastly by local level plans (always working from the whole to the part rather than from the part to the whole and from the top down rather than the bottom up, except where flow of information is concerned).

1.5 The World Perspective

There is an important international element in policies for nature conservation. The effective conservation of tropical genetic resources is a matter for international planning and co-operation in measures for the choice and safeguarding of protected areas. The same is true of measures to protect species. This in no way lessens the duty of each nation to manage its own resources in a responsible way - indeed it enhances it by adding an international dimension.

TABLE 1
ENVIRONMENTAL POLICY IMPLEMENTATION IN INDONESIA
Under Environmental Management Act of 1982

Functions	Participants						
	KLH	Education and Culture	BAPPENAS	EACR	BAPPEDA	BKHL	PSL Universities
1. Planning, budgeting, Coordination	*	*	*	*	*		
2. Resources Management (human, natural, man-made)							
planning programmes projects	*	*	*	*	*		*
3. Studies							
initiation	*	*		*	*	*	*
baseline and monitoring standards				*	*	*	*
ecological damage	*			*	*	*	*
EIA guidelines							
4. Control							
legal processes under Act No. 4, 1982	*	*	*	*	*	*	*
EIA implementation	*	*	*	*	*	*	*
EIA evaluation	*	*	*	*	*	*	*
decision on EIA							
5. Training/Education		*		*	*	*	*
degree							
non degree							
non formal							
6. Information							
within system	*	*	*	*	*	*	*
system to public	*	*	*	*	*	*	*
7. Public activators	*	*	*	*	*	*	*

It should be possible to design a model of the world ideal; to define the limits of what is unacceptable, and to design paths for development with nature conservation. What is required is a set of national policies for the balanced use of tropical forest lands that fit together in a mosaic like the pieces of a jigsaw, into a sensible world picture of tropical forest conservation (Poore 1986 pers. comm.).

GUIDELINE

National land-use planning in Indonesia would be received more favourably internationally if it also took into account the global and regional conservation status of the tropical moist forests biome, rather than be set up in isolation. Rich industrial nations should make funds and expertise available to assist in this through such organizations as IUCN.

1.6 An Unsatisfactory Present Land Use Classification

The present method of national forest land use classification in Indonesia is called the Tata Guna Hutan Kesepakatan, the Forest Land Classification by Consensus. It is derived from the Basic Forest Law No. 5 of 1967 which stipulated that the forests should be classified according to their intended function, that is for protection, production, forest reservations and recreational purposes. At the moment, the classification system used goes further than these basic categories in that apart from normal Production Forest (Hutan Produksi) there are two further subclasses, Limited Production Forest (Hutan Produksi terbatas) and Conversion Forest (Hutan Produksi yang dapat dikonversikan).

Use of elevation as a basis of land classification received strong support from the Ministry of the Interior (Agraria) when it introduced an entire land classification system based on it, the Tata Guna Tanah (Sandy 1982a, b). While classification by elevation above sea level does have advantages when defining areas of land suitable for wetland rice cultivation, it is more limited for other uses, particularly those governed by slope since steep slopes can occur at any elevation. Thus this approach has not been followed by the Ministry of Forestry except to set an upper limit of elevation above which logging should not occur. For forest land use planning a Site Index evaluation process is now used. This embodies three criteria, slope, soil erodibility and intensity of rainfall, on areas with slopes less than 45 per cent. Land sloping greater than 45 per cent is automatically assigned to the Protection Forest category.

Relative importance of each criterion is recognized by assigning weights to each value. These are 20, 15 and 10 for slope, soil erodibility and rainfall intensity respectively. There are five classes of each criterion, the highest in each case being assigned to the greatest slope, most erosive soil and highest intensity rainfall. The sum of the three weighted components gives the Site Index. Areas of forest land are classified functionally according to Site Index by reference to the ranges given in Table 2.

For example a site with Class 3 slope (8-15 per cent), Class 4 soil (susceptible to erosion) and Class 2 rainfall (intensity 13.6 - 20 mm/day) will be assigned a Site Index of $140 ((3 \times 20) + (4 \times 15) + (2 \times 10)) = 60 + 60 + 20 = 140$ = Limited Production Forest).

Areas with Site Index below 125 can be allocated also to Conversion Forest and land use decisions in such areas are normally made by consensus between appropriate Provincial Government authorities. The Provincial representatives of the Ministries of Agriculture and Forestry and Departments of Public Works, Lands (Agraria) and Transmigration and the Provincial Development Planning Board with the Provincial Governor as Chairman form the consensus group.

Criteria and procedures for establishing forest reservations for nature conservation and recreation forest have been separately developed (Indonesia, Ministry of Agriculture 1981). As a result of these combined classifications, the forest land of Indonesia has been divided into the functional classes shown in Table 3. The

distribution of these forest areas by Province is shown also in Table 3. The land use plan agreed by consensus for South Kalimantan, for example, is given in Fig. 1 (note the validating signatures).

Of the forest land so far classified by the Ministry of Forestry, only the criteria for Protection and Conservation Forest land (approximately 34 per cent of total forest land) have been actually agreed to by all other Government Ministries. Criteria for determining which shall be Production Forest and which shall be Conversion Forest have not been agreed upon and this has held up reallocation of land for non-forestry development purposes such as, for example, conservation areas and agricultural settlements for Transmigration.

The consensus method, if it could be made to work properly, has the advantage of providing the framework for immediate solutions to land-use conflicts, but may not take into account the long-term desirability of these land-use decisions. For example, there is no objective procedure for taking the quality of the forest into account.

The data which are used in classifying forest land are not sufficient, as many of the areas are extremely remote locations with very few people. Rainfall intensity and soil physical structure, for instance, are not available for mapping scales of less than 1:250,000 because the surveys have not been carried out.

For these reasons, decisions by the consensus group are made without the full knowledge of the characteristics of a particular piece of land. This clearly may lead to inappropriate classifications of forest land. One only can conclude that "consensus", although a traditional and socially acceptable method of resolving land-use conflicts may become unnecessarily subjective and short-term oriented, consequently falling short of wise, rational decision making for present as well as future generations. The possibility of using some other method of land classification has not been explored adequately by the Ministry of Forestry.

1.7 Up-to-date National and Regional Resource Assessment Surveys Required

Planning for nature conservation and wise use of resources must start with the most up-to-date data possible on such subjects as climate, topography, landform, soils, vegetation, fauna, hydrology, mineral resources and social structures.

Where such data are amenable to mapping, national and regional data are best mapped at a scale of between 1:250,000 and 1:100,000. Recent air photography (preferably colour or false colour) and/or side-looking airborne radar (SLAR) or synthetic aperture radar imagery (for mapping landform through cloud) at a scale of about 1:50,000 should be consulted. If aerial products are not available, remotely sensed imagery from space, at least of vegetation cover and landform (Landsat imagery) can be used directly for mapping on regional and national scales, and indirectly as a guide to the likely climatic effects and soil characteristics to be found in an area where these have not been the subject of more detailed studies on the ground.

The survey carried out by the Resources Development Centre of the Overseas Development Administration, U.K., and the Ministry of Transmigration for Central Kalimantan in 1985 is a good precedent to follow.

GUIDELINE

When they are not already available, up-to-date national and regional resource assessment surveys are to be undertaken as soon as possible to provide necessary facts, for example on social structure, climate, topography, landform, soils, vegetation, fauna, hydrology and mineral resources. Until results of detailed surveys are available, satisfactory use often can be made of the results of remote sensing from space, at least of vegetation cover and landform, as a guide to climatic effects and soil characteristics.

TABLE 2

RELATION BETWEEN SITE INDEX AND FOREST CLASSIFICATION

Site Index	Functional Forest Classification
0-124	Production Forest
125-174	Limited Production Forest
>175	Protection Forest

Source: Ministry of Forestry

TABLE 3

LAND CLASSIFICATION OF INDONESIA ACCORDING TO THE FORESTRY DEPARTMENT, 1982

Province	Protection and Conservation Forest 000 ha	Production Forest 000 ha	Conversion Forest 000 ha	Non Forest Areas 000 ha	Total Area 000 ha
Sumatra	10,839	14,412	5,049	16,649	46,949
Java	999	2,014	-	10,206	13,219
Kalimantan	11,025	25,650	8,293	9,857	54,825
Sulawesi	5,273	6,003	1,602	6,783	19,661
Bali	116	10	-	438	564
NTT and NTB	1,426	1,123	2,998	1,207	6,754
Maluku	1,991	3,105	436	3,040	8,573
Irian Jaya	16,960	11,856	11,775	474	41,066
Tim. Tim.	474	216	10	701	1,461
TOTALS*	49,145 (25%)	64,390	30,164	49,414	193,072

Source: Daftar Perkembangan Tata Guna Hutan Kesepakatan. Direktorat Bina Program Kehutanan, Bogor, June 1982.

Note: *Totals may not add due to rounding.

41

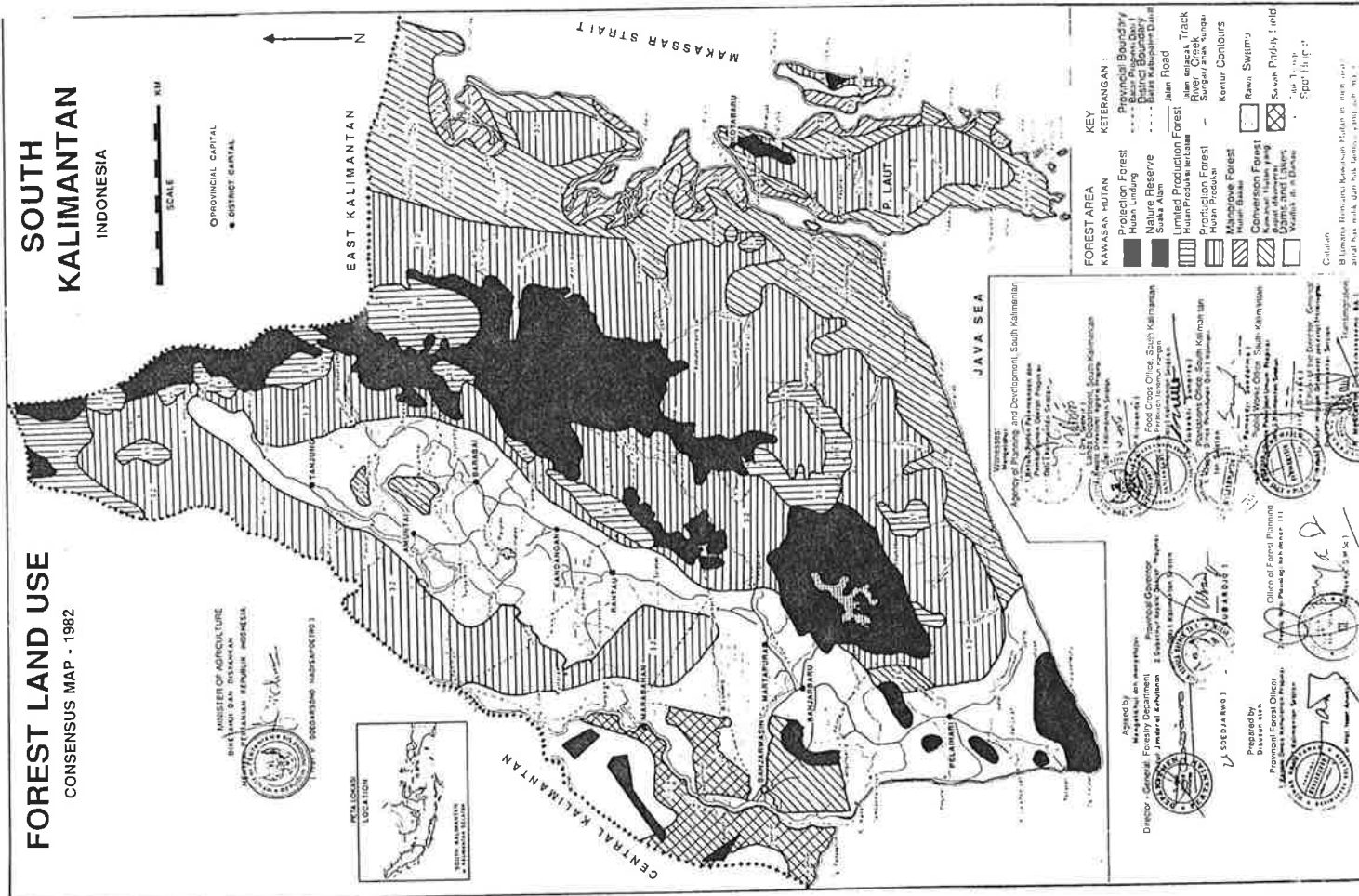


FIGURE 3

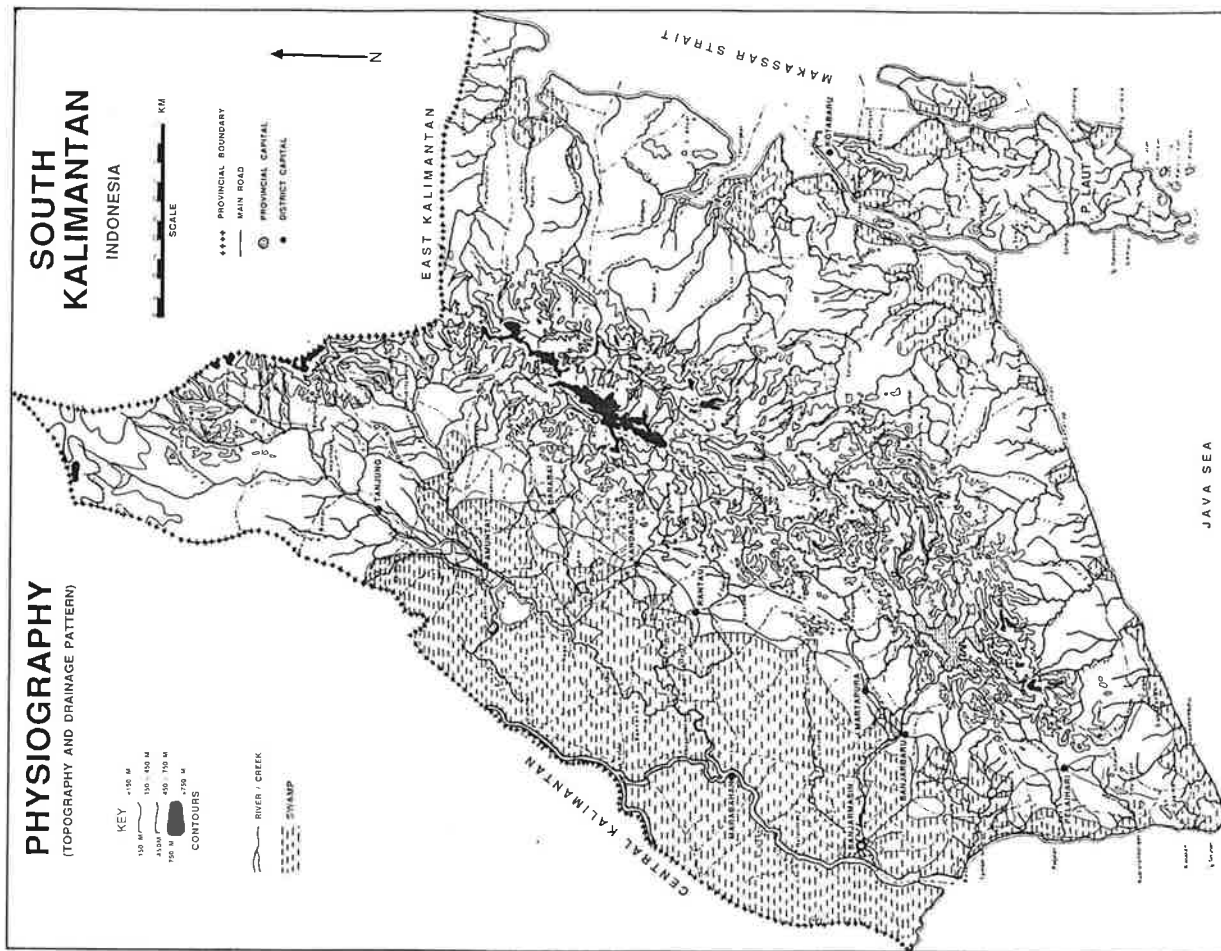
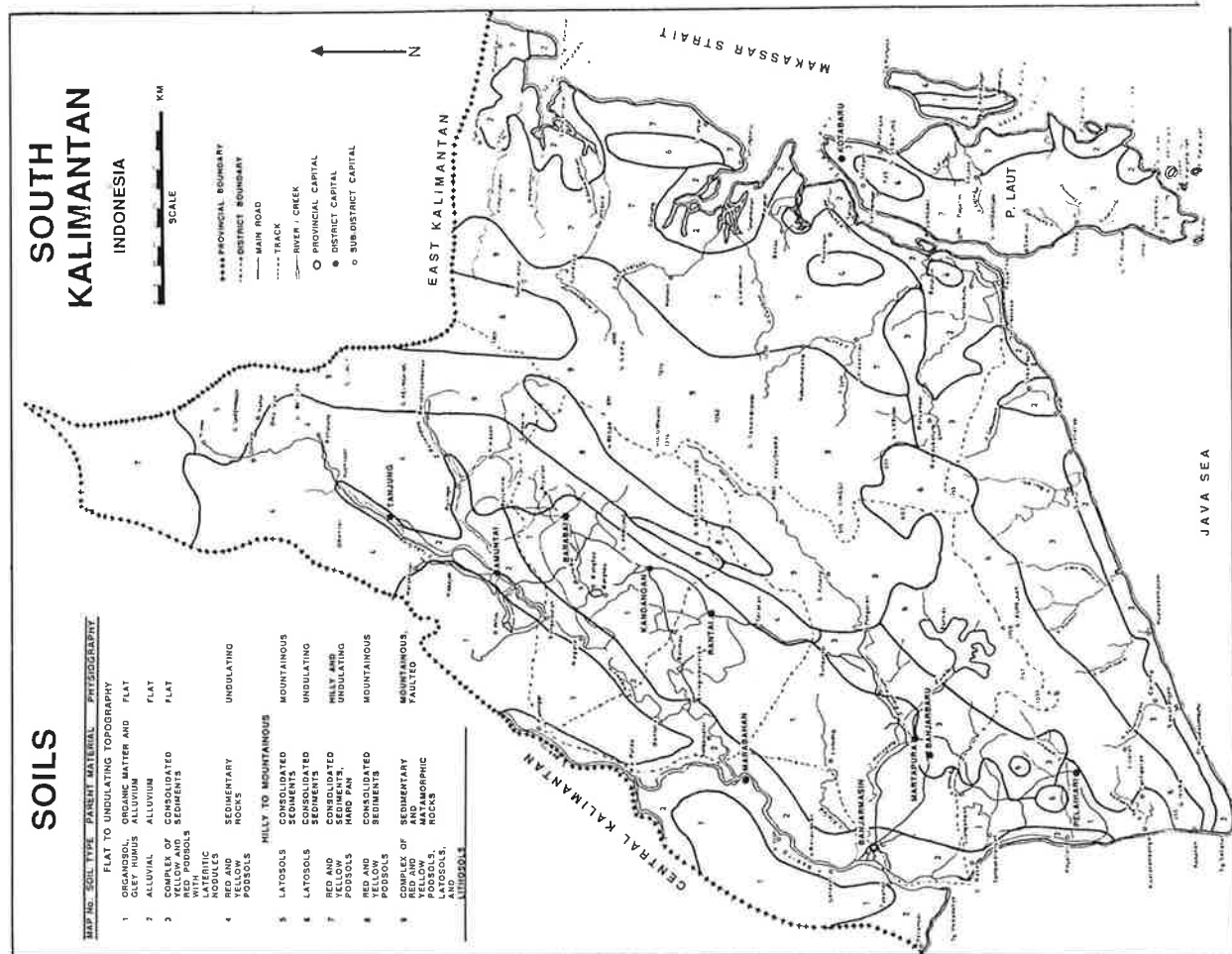
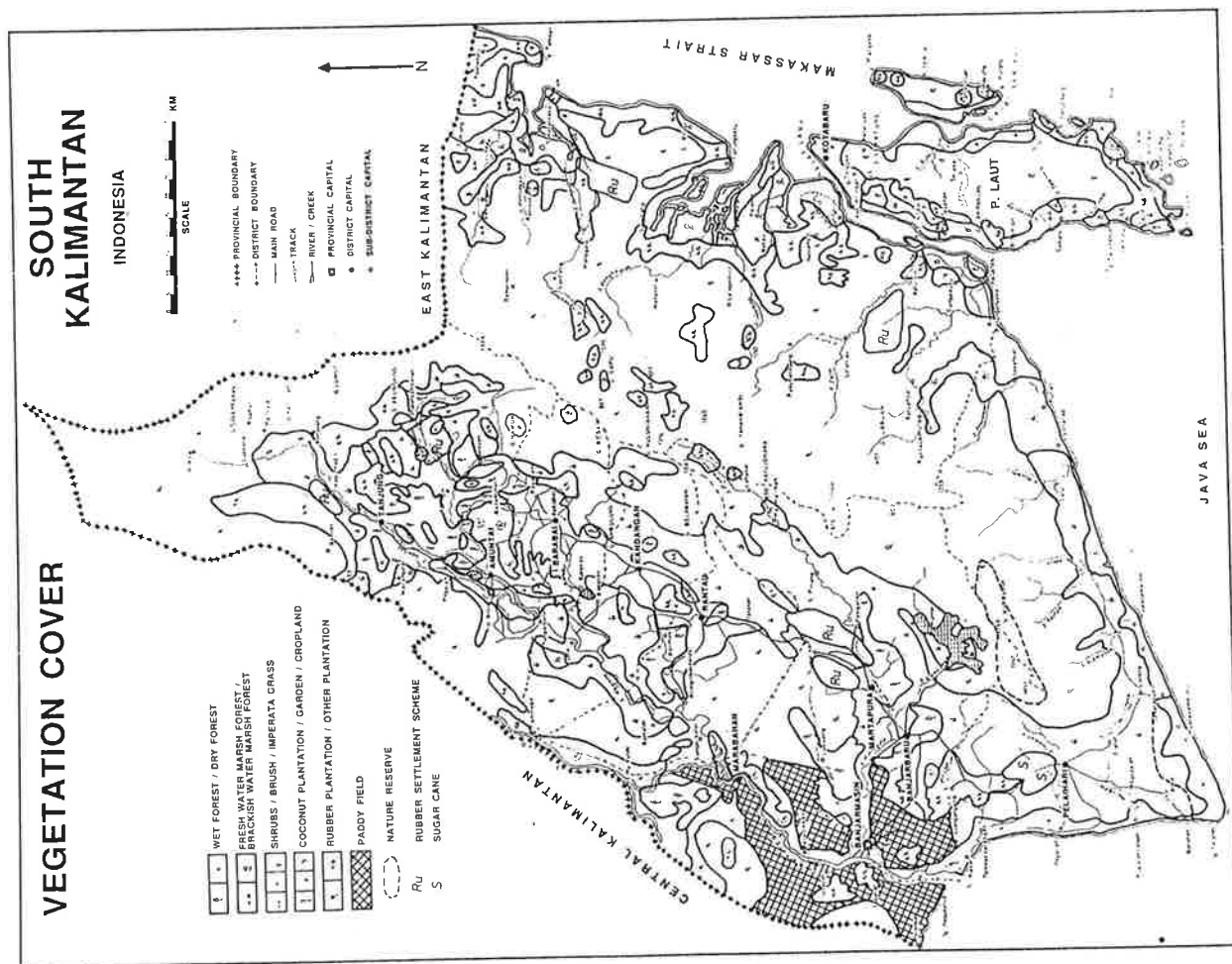


FIGURE 5



[illegible]

GUIDELINES

2.3 Environmental Impact

This level of funding and international markets and policies can very readily encourage unwise and poorly planned use of resources: movement into cash crops, rather than food crops; incentives to over exploit tropical forests to satisfy foreign markets and instability of commodity markets. The generally accepted principle that the "recipient knows best" should be rigorously debated for every project.

International agencies must strive for the harmonization of international policies particularly on trade and aid, so that these provide a real incentive to sustainable use of resources and nature conservation. They must adhere to their own environmental, cultural and wildlife guidelines despite pressure from the recipient.

2.2 Development Not Wanted in Isolation of National Plans

GUIDELINES

Donors should, at the outset of planning, consult the Conservation Monitoring Centre of IUCN, the Ministry of Population and Environment, GOI, and other relevant bodies such as WWF, concerning priority sites for nature conservation in Indonesia.

GUIDELINES

The requirement for environmental assessment prior to project approval is mandatory. It is important that such assessment be extended to embrace the whole system even though linkages are indirect or geographically far removed. Major upstream water development projects for instance, affect mangroves and the

ecosystems which they support. These effects are usually adverse, and must be considered as a cost in any benefit-cost analysis, or in judging environmental impacts.

Funding of projects which convert tropical moist forests to agriculture or grazing should be carefully scrutinized to make certain that the new use is sustainable and that the expected benefits exceed the economic, social and ecological costs resulting from the loss of the forest ecosystem. Existing regulations governing transmigration projects, which, in principle, require 25 per cent of the project area remain as community forest, must be obeyed. Where such forest is lacking, an equivalent area of plantations to provide fuelwood and small poles must be established, or alternatively, an agroforestry land use system introduced on at least 50 per cent of the project area.

Ways to improve natural forest management must be investigated. There are examples of successful enrichment planting carried on in Indonesia. One is in South Kalimantan on the island of P. Laut. Such enrichment would be even more beneficial if it included species for non-timber forest products such as bamboos, canes and medicinal plants.

GUIDELINES

Aid donors must include and support financially components in forestry and transmigration projects which support multiple-use management of natural forest.

Funding of new conversions of mangroves to aquaculture should be examined in terms of the attendant loss of mangrove related fisheries. The rehabilitation or better management of existing ponds should be examined as possibly a better investment. Support of what has become a shifting aquaculture as part of resettlement plans is a questionable activity for funding organizations.

Provision must be made in transmigration and other projects for continuous monitoring of effects during implementation, so that course corrections can be made.

Funding is to be made also for "post-project environmental monitoring" to determine longer term effects so that subsequent projects can be planned more soundly.

Funding should be made available for the protection and suitable management of rare, threatened or representative ecosystems and the homelands of tribal peoples.

Funding for the last-mentioned protective measures could be made available as interest-free loans from developed countries. The Dumog-Bone area is a good precedent.

3. GUIDELINES FOR LAND USE PLANNERS

3.1 Independent Land Classification

GUIDELINES

Rational land-use planning for tropical moist forest land is best undertaken following land classification first and evaluation of suitability for sustainable uses second and independently of the land classification.

A classification of land with nature conservation in mind must start with an ecosystem or landscape approach.

The "landscape approach" has become increasingly used in natural resource surveys and integrated land use planning in the tropics. Categories used are land components, land units, land systems and land zones, at increasing levels of generalization. The land zone is a combination of land systems, the land system is a combination of land units and the land unit is a combination of land components (Davidson 1981 and 1983).

This land classification method has many advantages when considering the present situation in Indonesia. Among these advantages are a classification of ecosystems that is amenable to mapping; allows maximum use of remote sensing and aerial photographic and radar imagery in its application; requires no prior assumptions on agricultural or reforestation techniques, or about any other uses to which the land might be directed; takes nature into account, embodies simplicity of method and has general applicability to nearly all areas of the outer islands of Indonesia.

3.2 Landscape Land Classification Approach (using South Kalimantan as an example)

The approach is from the general to the particular.

Land Zones

This is the coarsest class. An examination of broad climatic and physiographic features of South Kalimantan indicates that there is no compelling requirement to divide the Province into separate zones for land classification purposes. One zone - The Lowland Humid Tropical Zone is sufficient. Separate Zones are only likely to appear on maps showing all of Kalimantan or larger parts of Indonesia. The situation with South Kalimantan is that the coast has an unusually seasonal climate compared with the rest of Borneo, but this is reflected in local variations in flora and in how the forest reacts to disturbance, factors which can be taken into account at a lower level in the classification.

Land Systems

As with hilly lowland areas in the tropics generally, where rainfall comes in a high concentration within a wet season occupying only a few months of the year, the landscape shows an almost infinite variety in slope distributions, stream patterns, and differences in relative altitude from the tops of adjacent hills to the beds of the main streams.

Consequently, classifying landforms in such landscapes remains subjective, but with adequate description of the separately identified systems, the landscape method is a practical one.

In this example for South Kalimantan, five land systems have been identified based mainly on physiography.

1. Very flat land, mainly permanent swamp. Large areas of this land system around Banjarmasin are used for paddy rice cultivation
2. Complexes of flat lowlying, periodically swampy land, flood plains and low river terraces.
3. Low plateaux and terraced fans, rolling lowland foothills located on the high side boundary of the alluvial plains, with an average of 1-30 m, and occasionally up to 50 m difference in altitude between the hills and plateaux and the stream beds.
- Note: "Low", "Medium" and "High" must be understood here as relative terms for local differences in altitude, not as a reference to sea level.
4. Low hills. Sometimes the hills have arisen by intense erosion of fans and plateaux. Differences in altitude usually range between 50 and 120 m but the boundary with the next land system, "Medium hills to high hills" is not definite.
5. Medium to high hills. These have an average of 50 to 150 m altitude difference from hill tops to main rivers.

Note:

- i. The contour intervals of 150, 450 and 750 m on the Topographic Map (Fig. 3) were chosen to assist in the estimation of 50, and 150 m relative differences in altitude and to judge average slopes.
- ii. The same numbers (1-5 above) are used to designate the land systems on the land classification map (Fig. 10).
- iii. Land Systems are often given names, taken from some significant feature or locality within the System. For illustration, here the names Banjarmasin, Pelahart, Barabai, Gandang and Gapu have been adopted, referring to Land Systems 1-5 respectively.

Land Units

The land systems are divided into land units according to three specific criteria: Ridge pattern and upland topography, valleys and low-land pattern and slope class distribution. For the latter, the term "average slope" is not an adequate definition of the landscape type since a wide variation occurs each side of "average". It is better to test in detail some representative samples on the aerial photographs and evaluate the slope class distribution on sample areas equivalent to 25 to 50 ha.

Tables 4 to 8 set out the relationships between Land Units and Land Systems for South Kalimantan. Table 9 gives examples of slope class distributions for each land Unit.

Figure 7 shows the appearance of the Land Units.

Land Components

The next level of classification down is the Land Component. Land variation in South Kalimantan below the Unit level is best understood through the vegetation. Use of vegetation cover at this level of classification is in line with the overall objective of nature conservation since the vegetation is also linked to the occurrence of species of fauna.

TABLE 4
LAND SYSTEM 1 (BANJARMASIN)

Unit	Land Forms	Soils and Drainage Status	Vegetation
1	Swampy land	Poorly drained old alluvial soils dominate. Away from the rivers peaty organic matter is widespread (humic clay, organosol). Near the rivers are found poorly to very poorly drained young alluvial soils including black clays and undifferentiated fine silts.	Swampland forest dominated by <i>Melaleuca</i> , treeless cyperaceous swamps and open water. Herbaceous and woody river bank successions along streams. Large areas converted to paddy fields. Patches of Mangroves occur in places in coastal areas.
2	Fiat flood plains	Young alluvial soils, wet-season flooding but waterable often below ground surface in the dry season. Soils usually high in organic matter.	Alluvial flood plain forest. Herbaceous and woody river bank successions along streams. Patches of reeds, shrubs and <i>Melaleuca</i> .

Geology: Fine textured alluvium and organic matter.

Physical features: Major river flood plain, swamps and open water, meandering river channels less than about 150 m wide in unit 2. Poor drainage and flooding affect both units.

TABLE 5
LAND SYSTEM 2 (PELAIHARI)

Unit	Landforms	Soils and Drainage Status	Vegetation
1	Flat plains	Poorly drained old alluvial soils predominate. Alluvial black soils and young undifferentiated alluvia near streams. Poorly to very poorly drained.	Patches of <i>Melaleuca</i> and reed swamp forest, grassland and poorly drained alluvial forest.
2	Flood plains: up to several kilometres wide, generally 2-3 m above river beds mainly flat but uneven with low flood banks and depressions in narrow tracts adjoining river channels	Young alluvial soils, mostly well drained. Some short wet-season flooding but waterables down to 1 m below ground surface in the dry season.	Alluvial floodplain forest, both well-drained and less well drained. Herbaceous and woody river bank successions along streams. Patches of grassland and gardens common.
3	River terraces: flat or slightly uneven surfaces from 500 m to several kilometres wide, sometimes with steep marginal slopes to streams.	Predominantly young alluvial soils. Mostly well drained. Locally inundated after heavy rain.	Well drained lowland forest. Local gardens, regrowth and secondary forest. Large areas of <i>Imperata</i> grasslands.

Geology: Fine-textured alluvium.

Physical features: Tributary valley plains, with narrow flanking terraces up to 5-7 m above riverbeds, meandering river channels. Poor drainage and flooding affect Units 1 and 2.

TABLE 6
LAND SYSTEM 3 (BARABAI)

Unit	Landforms	Soils and Drainage Status	Vegetation
1	Flood plain and terraces: discontinuous alluvial terraces up to 5 m above water level, narrow flood plains about 2 m above low water level.	Mainly young alluvial soils, black gleyed soils on flats and a complex of red and yellow podsolics on the terraces and colluvial slopes. Often flooded in the wet season. Water table still high in the dry season. Lateritic nodules present in the podsolics.	Well-drained lowland forest, patches of secondary forest, grassland, reed swamp and mangroves.
2	Lower hills and ridges: broad rounded crests and short moderately steep slopes 10-25°; relief up to 30 m.	Strongly weathered red and yellow podsollic soils. Weathered gleyed clay soils in the depressions.	As for Unit 1 but no mangroves, and more secondary forest and grassland.
3	Higher hills and ridges: rounded crests and moderate to gentle slopes 4-12°, locally hummocky lower slopes, relief up to 50 m.	Strongly weathered red and yellow podsollic soils, thin on ridges, undifferentiated residual soils. Well drained to poorly drained.	Well drained lowland forest with much secondary forest, grassland and gardens.
4	Limestone karst topography: limestone cappings, platforms and blocks - margins up to 7 m high, uneven rocky surfaces.	Undifferentiated residual soils (lithosols) and, very locally, limestone soils.	Well drained lowland forest.

Geology: Sedimentary rocks, minor coral limestone and overlying gravels. Hardpan of lateritic nodules often present.

Physical Features: Often closely set, low rounded hills and ridges flattening out into adjoining alluvial plains, fine dendritic patterns of incised minor valleys tributary to more open valleys with discontinuous narrow floodplains and terraces; relief up to 50 m.

TABLE 7
LAND SYSTEM 4 (GANDANG)

Unit	Landforms	Soils and Drainage Status	Vegetation
1	Colluvial aprons: gentle slopes below 2° and up to 1 km long slightly gullied by small channels from backing hills, locally marshy due to seepage.	Well drained red and yellow podsollic soils on old alluvium, and young alluvial soils along lower slopes and streams. Mostly well-drained but locally high water tables.	Well drained lowland forest and hill forest.
2	Colluvial aprons, slopes to 20°, deep gullies caused by headwater channels.	As for Unit 1.	As for Unit 1, and areas of gardens, young regrowth, secondary forest, and <i>Imperata</i> grasslands.
3	Range foothills and spurs: slopes and gullies between parallel ridges.	As for Unit 1, soils shallow on ridges.	As for Unit 2.
4	Limestone karst topography: uneven rocky surfaces and cliff margins.	Podsols and undifferentiated residual soils (lithosols) and limestone soils. Overdrained.	Hill forest and secondary forest.

Geology: Sedimentary and alluvial deposits.

Physiography: Widely spaced short ridges and hills and a few higher strike ridges, dendritic drainage pattern of narrow valleys and streams, relief up to 120 m.

TABLE 8
LAND SYSTEM 5 (GAPU)

Unit	Landforms	Soils and Drainage Status	Vegetation
1	Hills and ridges: narrowly rounded undulating crests, and steep slopes 15-35°, locally irregular due to minor landslips.	Complex of red and yellow podsollic soils. Shallow latosols and lithosols on ridges. Well to excessively drained.	Hill forest. Large local areas of secondary forest garden regrowth and <i>Imperata</i> grassland, as a result of shifting cultivation.
2	Steep hills and ridges: strongly dissected with very steep slopes, 25-50°; deep gullies in higher parts.	Latosols and skeletal soils. Excessively drained.	Hill forest. Areas of garden regrowth and <i>Imperata</i> grassland.

Geology: Sedimentary and alluvial deposits.

Physical Features: Closely spaced short ridges and hills and a few higher strike ridges; dendritic drainage pattern, narrow valleys; relief up to 150 m.

TABLE 9

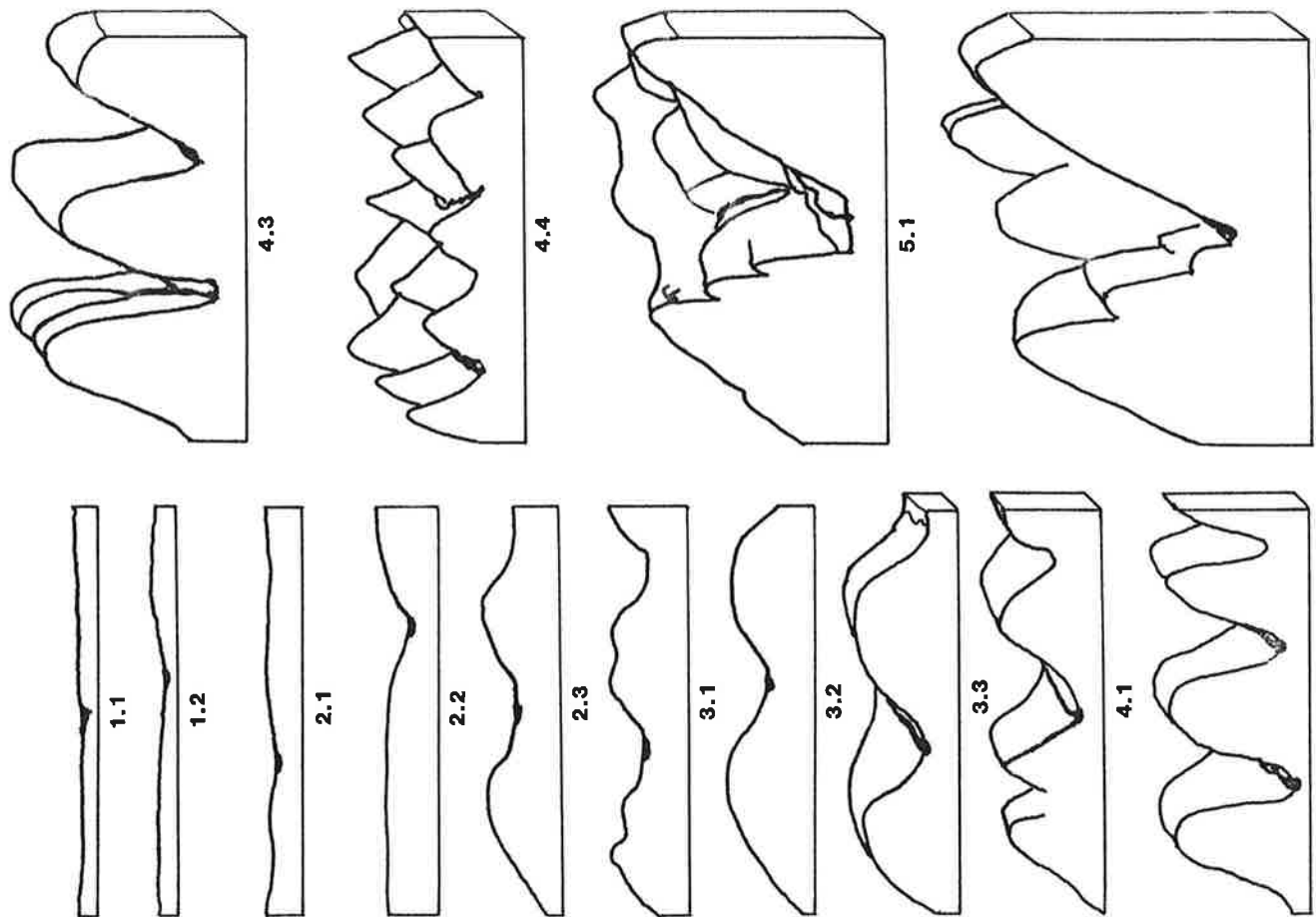
SLOPE CLASS DISTRIBUTION FOR LAND UNITS

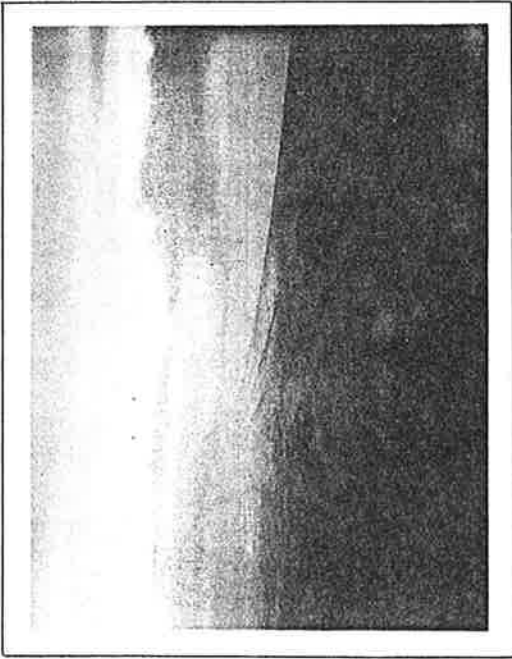
Land Systems	Land Units	Ridge Pattern and Slope of Ridge Top	Valley Pattern	Slope Class Distribution				
				0-12% lowland	12-25% ridgetop	25-50%	50-100%	>100%
1	1	Slight microrelief	Open and flat	100	-	-	-	-
	2	Slightly undulating	Open and flat	90	10	-	-	-
2	1	Flat 0-5%	Flat	20	50	15	10	5
	2	Flat 0-5%	Open and flat	10	50	25	10	5
	3	Undulating 2-5%	Open	10	20	30	30	10
3	1	Rolling 5-25%	Open	15	15	30	25	10
	2	Rolling	Open to narrow	10	15	25	20	10
	3	Separated by valleys	Narrow	5	10	20	25	20
4	1	Rolling to separated	Narrow	5	15	15	25	20
	2	Separated ridges	Very narrow	5	10	10	25	30
	3	Strongly separated to broken	Very narrow	-	15	15	20	30
	4	Broken, blocky	Not distinct	-	-	20	25	30
5	1	Separate ridges	Open to narrow	5	5	10	20	30
	2	Separate ridges	Very narrow	-	5	10	25	30

FIGURE 7

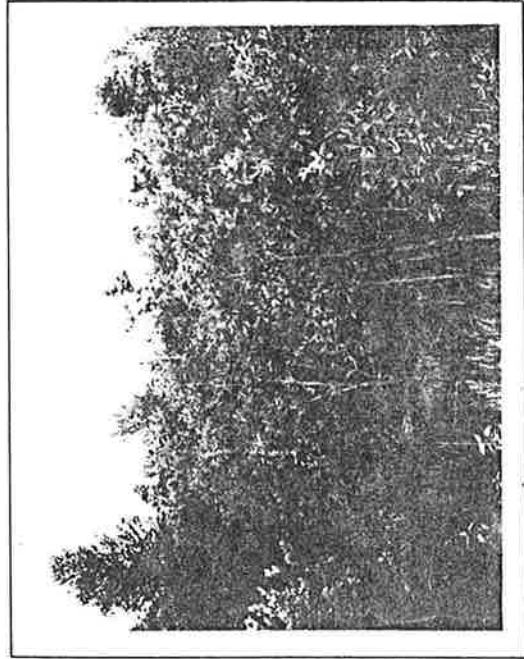
LAND UNITS IN SOUTH KALIMANTAN

(Vertical scale exaggerated)





The south-west coast of South Kalimantan. Land System 1 and the ocean are on the right and Land System 2 to the left.



Metaleuca dominated reed/shrub swamp (Land Component 1.1.9) near Banjarmasin.

Variation in vegetation in South Kalimantan may, in turn, be understood in terms of the effects of four environmental variables on what may be considered the "climatic climax" vegetation of the area (Fig. 8).

In as much as the Land Components represent an area in which the macro- and micro-climate, parent material, topography, soil and vegetation are uniform within certain limits, the vegetation types are directly equivalent to land components (Fig. 8). Environmental variables usually change gradually, and it is impossible, even after detailed study, to achieve absolute uniformity throughout a land component. This range of variability is taken into account more or less during the later phase of suitability assessment.

The vegetation types shown in Fig. 8 were reduced to ten for mapping purposes at 1:500,000 scale, and these became the final land components (Table 10). The numbers given in Fig. 8 and Table 10 for the land components correspond to the numbers used on the land classification map (Fig. 10). The number of components/vegetation types chosen is subjective and depends mainly on the map scale. Too few means a loss of detail in the information, too many means difficulty in the interpretation of the map. Normally more components would be used than shown in this example which is restricted by the need to keep the map small enough to fit on an A4 page.

In this example, mapped at 1:500,000 scale, but presented here at about 1:1.43 million scale, 5 land systems, 14 land units and 65 land components have been included (Table 11), resulting in about 425 separate mappable segments varying in size from a few square millimetres to several square centimetres.

At the scale of mapping used, recognition of different land components depended primarily on terrain (i.e., steepness of slope, drainage pattern and flood susceptibility) and vegetation cover, largely discounting the impact of human settlement except for recognizing the large expanses of grasslands which are partly human-induced and partly the result of a seasonal climate.

Consequently, the pattern and location of land components were related to land units which, in turn, had rational and identifiable places in the land systems for South Kalimantan (Fig. 9). The resulting land classification map is presented here as Fig. 10. Such a classification of land into components may be used for evaluation of the suitability of the land for many different purposes, including nature conservation first.

3.3 Land Evaluation and Suitability Classification

GUIDELINE

Decisions on the designation and allocation of land for various uses are to be made following land evaluation for those uses and preparation of land suitability classifications based on as much relevant information as possible, gathered and held at the place where the decisions are made.

3.3.1 Structure of the classification

The results of an evaluation are presented partly in terms of land suitability classifications. The suitability is the fitness of a given type of land for a defined use. The land may be considered in its present condition or after improvements. The process of land suitability classification is the appraisal and grouping of specific areas of land in terms of their suitability for defined uses.

To enable comparisons to be made between various land utilization types (LUTs), it is necessary to standardize on one kind of structure for land suitability classifications.

RELATIONSHIP BETWEEN VEGETATION AND FOUR SEPARATE ENVIRONMENTAL VARIABLES IN SOUTH KALIMANTAN

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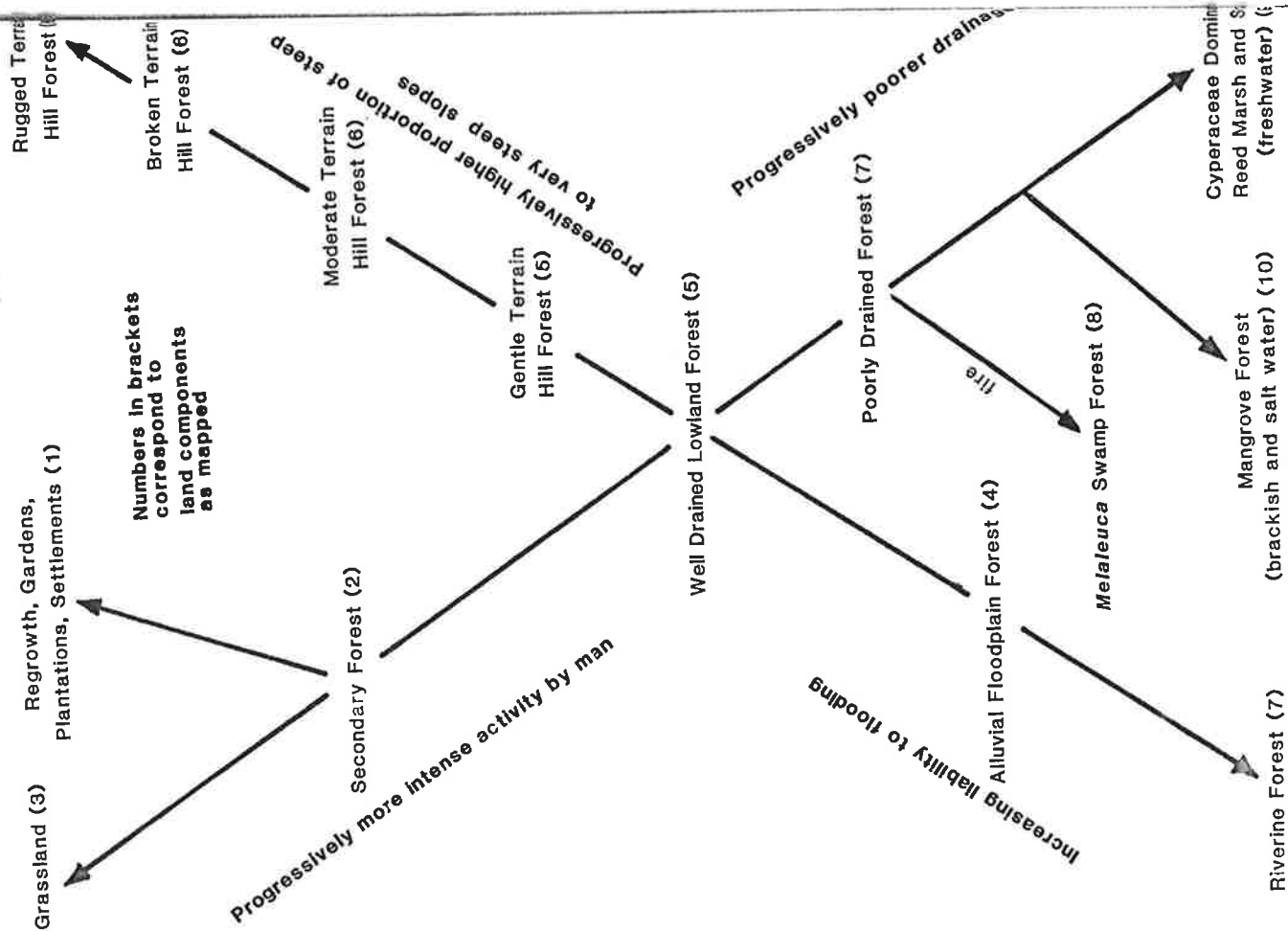


TABLE 10

LAND COMPONENTS FOR MAPPING PURPOSES

1. Gardens, young regrowth, plantations (rubber, coconuts, other plantation crops), settlements.
2. Secondary forest (including shrubs, bushes).
3. Grassland (mainly *Imperata*).
4. Alluvial flood plain forest.
5. Well-drained lowland forest (including gentle terrain hill forest).
6. Hill forest (including moderate terrain hill forest, broken terrain hill forest and rugged terrain hill forest).
7. Poorly-drained forest (including lowlying riverine forest).
8. *Melaleuca* forest.
9. Reed/shrub swamp.
10. Mangroves (Brackish Marsh Swamp).

TABLE 11

LAND SYSTEMS, LAND UNITS AND LAND COMPONENTS IDENTIFIED AND MAPPED FOR SOUTH KALIMANTAN

1.1.2*	2.2.2	3.2.2	4.4.2
1.1.3	2.2.3	3.2.3	4.4.6
1.1.4	2.2.4	3.2.5	5.1.2
1.1.7	2.2.5	3.2.7	5.1.3
1.1.8	2.2.7	3.2.9	5.1.6
1.1.9	2.2.8	3.3.2	5.2.1
1.1.10	2.2.9	3.3.3	5.2.2
1.2.2	2.3.3	3.3.4	5.2.3
1.2.3	2.3.5	3.3.5	5.2.6
1.2.4	2.3.7	4.1.5	
1.2.5	2.3.9	4.1.6	
1.2.7	3.1.1	4.2.2	
1.2.8	3.1.2	4.2.3	
1.2.9	3.1.3	4.2.5	
1.2.10	3.1.5	4.2.6	
2.1.3	3.1.8	4.3.1	
2.1.7	3.1.10	4.3.2	
2.1.8		4.3.3	
2.1.9		4.3.5	
		4.3.6	

* First digit = land system; first and second digit = land unit; all three digits = land component.
There are 5 land systems, 14 land units and 65 land components.

RELATIONSHIP BETWEEN LAND SYSTEMS, LAND UNITS AND LAND COMPONENTS IN SOUTH KALIMANTAN IN A GENERALIZED WEST TO EAST PROFILE

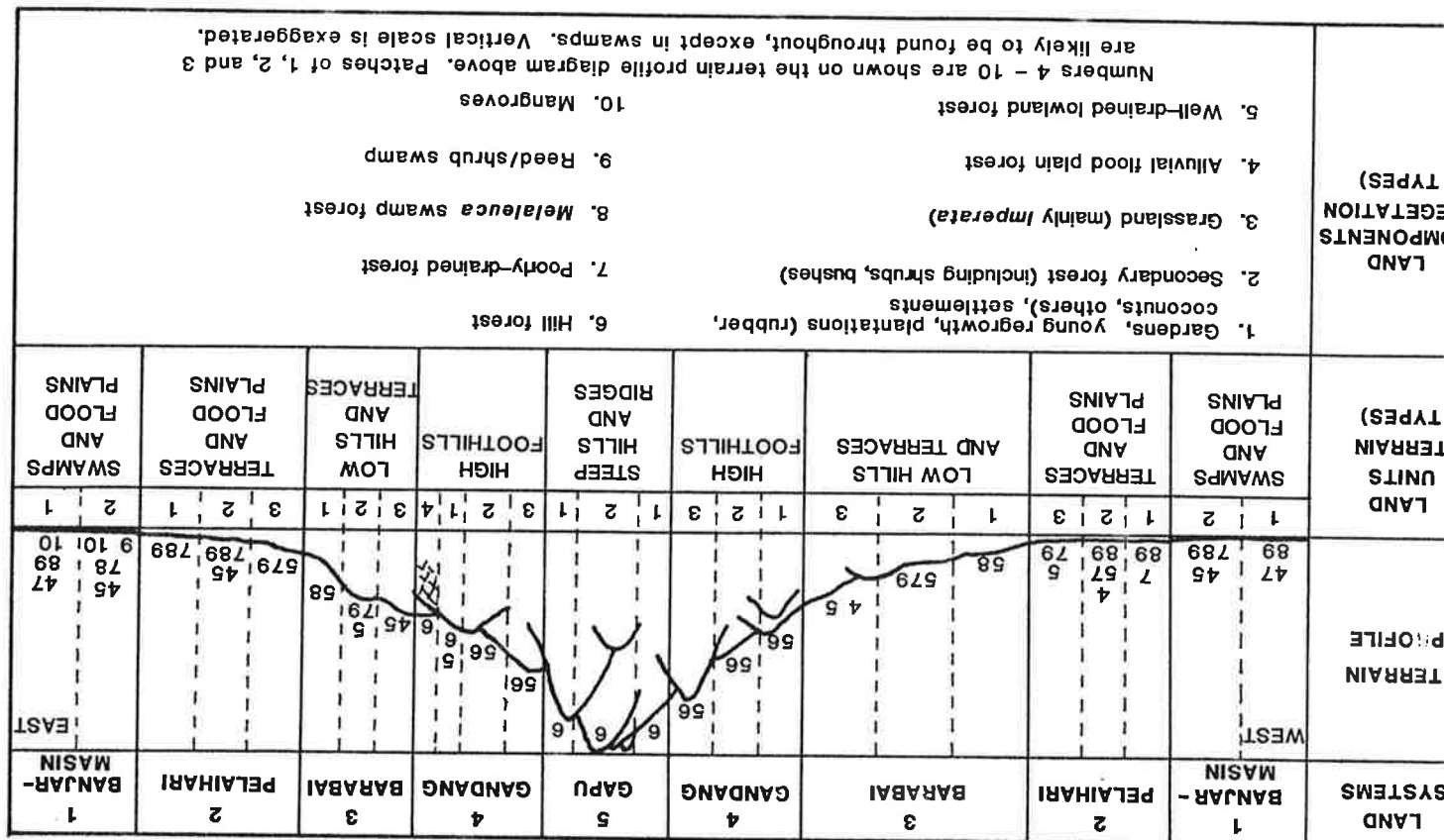
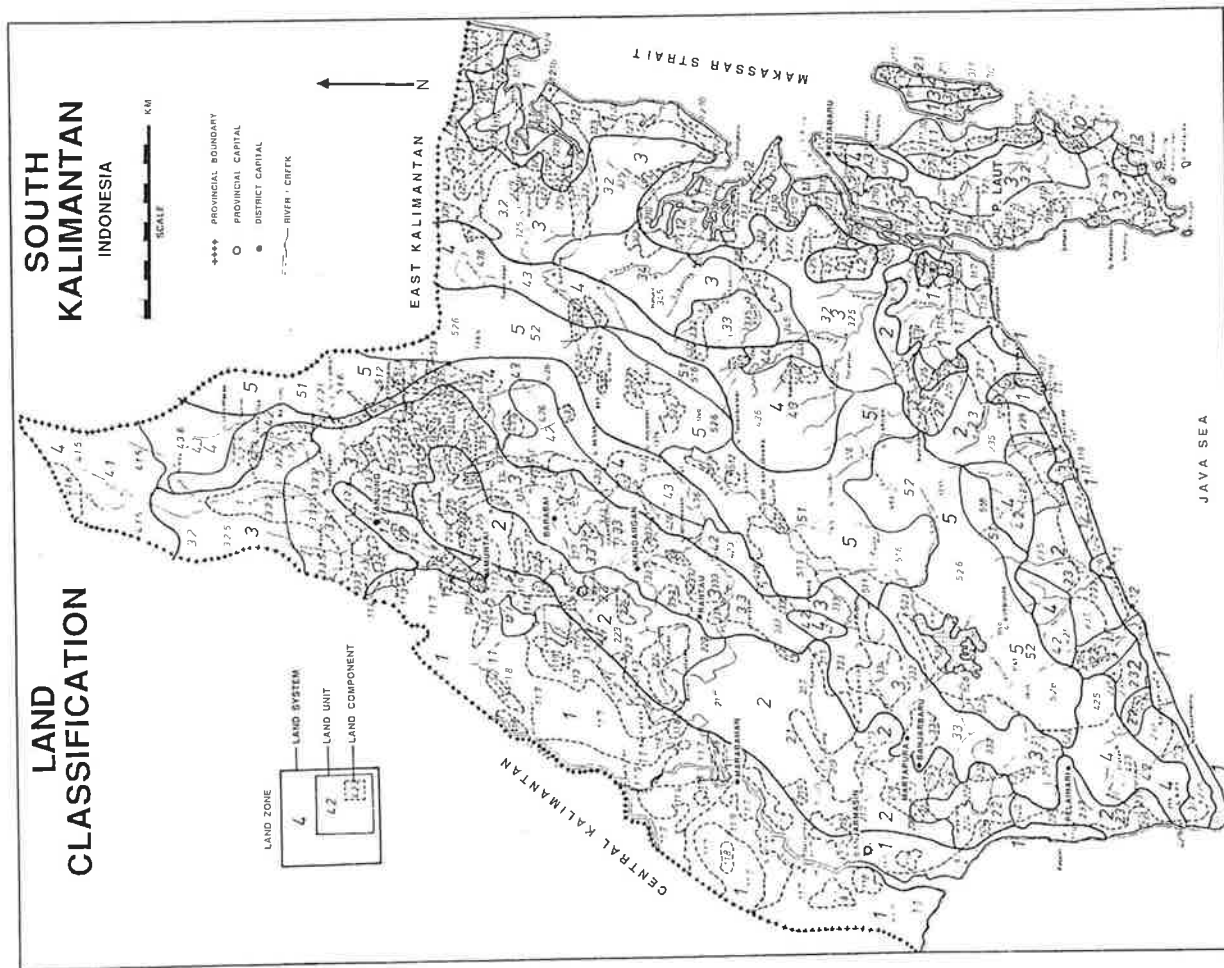


FIGURE 10



An area located about 30 km south of Banjarmasin after extensive clearing and mostly failed attempts at growing paddy rice. Probably this was poorly drained lowland rainforest and alluvial floodplain rainforest only 20 years ago. Now it has been classified into Land Components 2.1.2., 2.1.3, 2.1.7 and 2.1.8.

In the foreground is Land Component 2.1.9 (reed/shrub swamp), in the background apparently undisturbed Land Component 2.1.8 (*Melaleuca* swamp forest).

GUIDELINE

Always use a standard structure for reporting land suitability ratings, so that comparisons between competing land uses can be made more easily.

Four categories of land suitability are normally recognized (FAO 1984):

- i. Land Suitability Orders reflecting kinds of suitability
- ii. Land Suitability Classes reflecting degrees of suitability within Orders
- iii. Land Suitability Subclasses reflecting kinds of limitation, or main kinds of improvement measures required, within Classes
- iv. Land Suitability Units reflecting minor differences in required management within Subclasses

Land suitability orders indicate whether given types of land are suitable or not for the land utilization type concerned. This is the first thing the user wants to know and by eliminating unsuitable land early, much time and effort can be saved. There are two orders, represented by the symbols S and N:

- | | |
|-------------------------|---|
| Order S
Suitable | Land on which sustained use of the kind under consideration is expected to yield benefits which justify the inputs, without unacceptable risk of damage to land resources |
| Order N
Not Suitable | Land which has qualities that appear to preclude sustained use of the kind under consideration. |

Areas which have not been assessed for a given use because that use is precluded by the assumptions of the evaluation are shown on maps and in tables as NR, Not Relevant.

Land Suitability Classes reflect degrees of suitability. Within the order Suitable, three classes are normally recognized: Highly, Moderately and Marginally Suitable, indicated by symbols S1, S2 and S3 respectively (Table 12). For the general case, there are no quantitative definitions of the S1, S2 and S3 boundaries; defined limits, e.g., in terms of relative yields, costs or economic return, may be adopted for particular evaluations.

Within the order Not Suitable there are two classes: N1, Currently Not Suitable, and N2, Permanently Not Suitable. Land is assessed as Currently Not Suitable if its limitations cannot be overcome at currently acceptable cost. In the case of Permanently Not Suitable land, the limitations are so severe as to make the use so clearly impracticable or uneconomic that detailed analysis of inputs and outputs is unnecessary.

The boundary of Class N2, Permanently Not Suitable, is normally physical and permanent. In contrast, the boundary between Classes S3 and N1 is set by economic conditions and will vary in time with changes in relative costs of inputs and prices of outputs.

Land Suitability Subclasses reflect kinds of limitations, e.g., moisture deficiency, erosion hazard. They are indicated by lower case letters, e.g., Subclasses 2n, 2e. Only the most important limitation, or where necessary, two of equal importance

TABLE 12
DEFINITIONS OF LAND SUITABILITY CLASSES

Class S1 Highly Suitable	Land having no significant limitations to sustained application of the given land utilization type, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.
Class S2 Moderately Suitable	Land having limitations which in aggregate are moderately severe for sustained application of the given land utilization type; the limitations will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use will be appreciably inferior to that expected on Class S1 land.
Class S3 Marginally Suitable	Land having limitations which in aggregate are severe for sustained application of the given land utilization type and will so reduce productivity or benefits, or increase required inputs, that this expenditure will only be marginally justified.
Class N1 Currently Not Suitable	Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained application of the given land utilization type.
Class N2 Permanently Not Suitable	Land having limitations which appear so severe as to preclude any possibilities of successful sustained application of the given land utilization type.
NR, not relevant	Land which has not been assessed for a given use because the application of the use to that area is precluded by the initial assumptions of the evaluation.

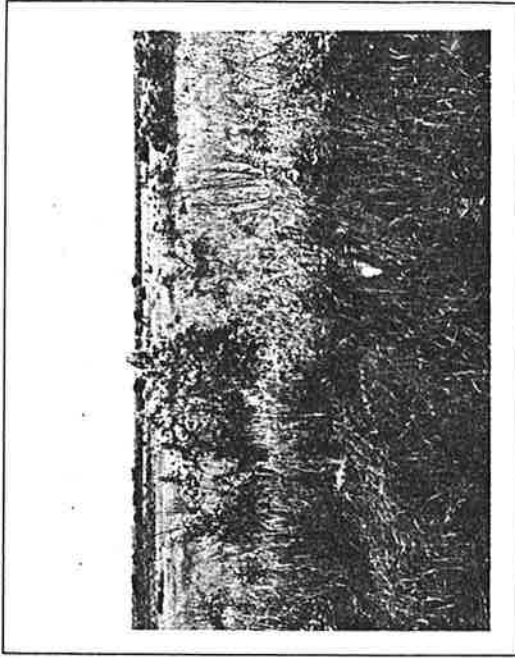
Source: FAO (1984).

TABLE 13
ADDITIONAL PROPERTIES OF LAND UNITS

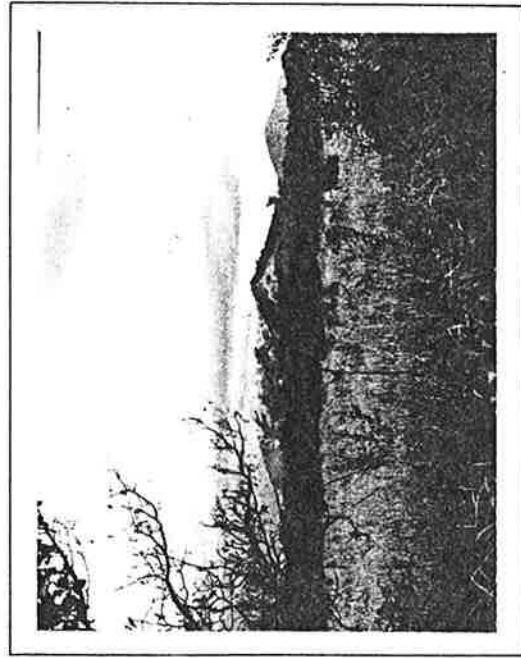
Land Units	Water-logged Soils (d)	Open Water Ponds (w)	Broken Relief (r)	Steep Slopes (t)	Soil Concretions (c)	Stoney Soils (s)	Over-drained Soils (o)	Erosive Soils (e)
1.1	+++	+++						
1.2	+++	++						
2.1	++	+						
2.2	+							
2.3								+
3.1								++
3.2				+	+	+	+	+++
3.3				+	++	++	++	+++
4.1			+	++	++	++	++	+++
4.2			++	++	++	+	++	+++
4.3			+++	++	++	++	+	+++
4.4			+++	++	++	++	++	+++
5.1			+++	+++		+++	+++	+++
5.2			+++	+++		+++	+++	+++

Notes:

- One, two and three pluses are meant to indicate increasing intensity or severity of the property.
- Lower case letters in brackets indicate symbols which could be employed in a land suitability classification (d = drainage, w = water table, r = relief, t = topography, c = concretions, s = stoney, o = overdrained, e = erosive soils).



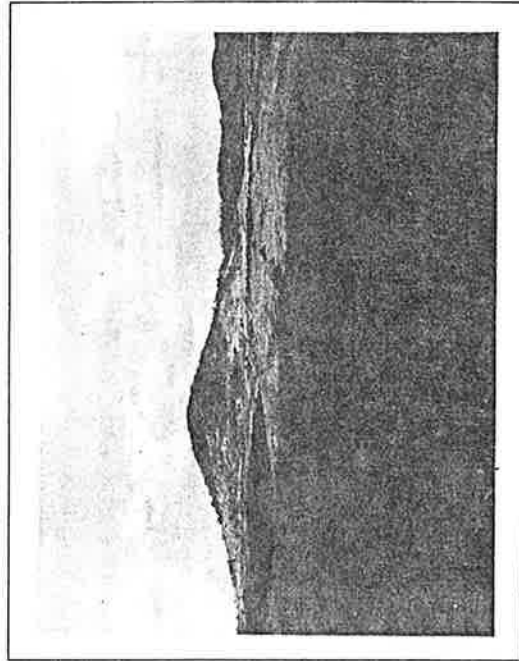
Land Component 2.1.3, south of Banjarmasin looking west. In the far distance is Land System 1. Vast expanses of alang - alang (*Imperata cylindrica*) grasslands are found throughout Land System 2.



Located east of Goreja, Land Component 2.1.3 is in the foreground, Land Units 3.1 and 3.2 in the background. The area on the hills in the background is mapped as "protection forest" on Provincial forest maps but has been reduced to scrub and grassland.



An area of advanced secondary forest on Land Component 2.1.5, 40 km south of Banjarbaru.



Extensive clearing has converted large areas to grassland east of Pelaharl. Land in the foreground is classified 2.2.3 and in the background 3.2.1, 3.2.2, 3.2.3 and 3.2.5.

should be shown. There are no subclasses within Class S1 as, by definition, this has no significant limitations. The symbols for subclasses are not standardized and will vary from one evaluation to another. Properties of the soil, particularly its erodibility, are important in South Kalimantan, since they determine the risk involved in some of the major conversions to non-forest uses such as roads, settlements, agriculture and tree plantations.

For example, in Table 13, various properties, mainly soil properties, are listed against the Land Units. The properties are largely adverse and increase the risk of removal of tree cover in most cases and place constraints on many potential uses of the land, such as for dryland agricultural cropping.

3.3.2 Types of land suitability classification

Land suitability classifications may be qualitative, quantitative or economic. In a qualitative classification the suitability classes are defined in qualitative terms only. The economic and social context is taken into account as a broad background to the evaluation but there are no detailed calculations of costs and returns.

It should be noted that the description 'qualitative' refers to the definitions of boundaries between suitability classes, not to the procedures employed in evaluation which should always be in quantitative terms wherever possible.

Qualitative classifications allow the different kinds of consideration contributing to the evaluation to be combined in a more flexible manner. Economic classifications provide essential information required as input data to project analysis where investment is expected to follow. If an economic suitability classification is produced, it is important to ensure that it is not allowed to outweigh or dominate suitability considerations based on other aspects.

GUIDELINE

A nature conservation classification always must be produced and it should take precedence over all other classifications.

In a quantitative classification the distinctions between classes are defined in common numerical terms. In certain limited circumstances these may be quantitative physical terms, e.g., growth rates of timber species, it being assumed that management costs are approximately uniform. Most commonly, however, comparison between land use and land units requires an economic basis, both to compare different kinds of output and to compare production costs with benefits. If the class boundaries are defined in economic terms, it becomes an economic suitability classification.

Land suitability units are subdivisions of a subclass. All units within a subclass have the same degree of suitability at the class level and similar kinds of limitations at the subclass level. The suitability units differ from each other in their production characteristics or in minor aspects of their management requirements. Land within the Order N, Not Suitable, is not subdivided into units. Units are distinguished by numbers following a hyphen, e.g., S2m-1, S2m-2. There is no limit to the number of units recognized within a subclass.

A phase of Conditionally Suitable may be added to cater for circumstances where small areas of land may be unsuitable or marginally suitable for a particular use under the management specified for that use, but suitable given that certain conditions are fulfilled, e.g., leaching out of salts. The employment of conditional suitability complicates the presentation of results and should be avoided where possible.

Nearly all evaluations are taken at least to the level of suitability classes and subclasses but most reconnaissance and some semi-detailed surveys do not subdivide in more detail. For the purpose of examples given in this Manual neither the detail of information nor the mapping scale allowed division below sub-class. Land suitability

units are mainly employed in detailed surveys and where management specifications for different kinds of land are required.

3.4 Land Allocation to Various Uses

Tropical moist forest land normally will be allocated to one or more uses, depending on its suitability for those uses:

- for the *preservation* of species, ecosystems or landscape
- for *protection* of soils and water catchments
- for *conservation* of flora, fauna, spiritual, aesthetic and cultural values necessary to survival and welfare of peoples living inside and adjacent to the forest
- for *harvesting* forest produce in sustainable (desirable) or non-sustainable (undesirable) ways
- for *conversion* to non-forest uses, such as roads, settlements or agriculture, and new forest uses such as man-made plantations.

GUIDELINES

Land suitability must be assessed separately for each land use type.

Land which is capable of allocation to many uses is to be carefully husbanded in order to maintain the widest available range of choices for future generations whose needs, aspirations and skills may be different to those prevailing at present.

Land allocation can be carried out by land components singly or in aggregation of similar land components, or by larger parcels, such as complete land units, a number of which make up whole catchments.

GUIDELINE

Allocation of land may be on the basis of a complete ecosystem or part of an ecosystem, but always sustainable and multiple uses are to be preferred.

In many cases, such as finding land for forest plantations or transmigration settlements, land other than previously untouched forest can be found by close examination of all of the land components.

GUIDELINES

Before deciding to modify or transform untouched areas, every consideration is to be given to alternatives. For example, adapting to more productive uses areas that already have been changed (e.g., using savannas for *Pinus* plantations or grasslands for *Acacia* plantations), intensification of existing uses, and using areas for more than one purpose where compatible uses can be found (such as in agroforestry land management techniques).

Great care is to be taken over any decision that will, or can be foreseen, to lead to irreversible change.

When, after careful assessment, it has been decided forest land should be transformed to some other use, all possible ecological knowledge should be brought to bear on (i) the choice of that future use, (ii) the methods used to carry out the change and, (iii) possible incidental side-effects.

The land components (Fig. 10) and their properties (Table 13) are the tools which assist such assessments. It is easier to contemplate possible adverse off-site and downstream consequences of land transformation and conversion if whole catchments are considered at the one time.

GUIDELINE

A total catchment area is recommended as an appropriate unit for sub-regional land use planning. Plans should include the infrastructure of settlements, roads, dams, water supply, siting of sawmills, processing plants for agricultural produce and other industry.

3.5 Nature Conservation First

GUIDELINE

In the cases of national parks, nature reserves and protection forests, land is to be allocated specifically for these purposes at the beginning and not left as a general reserve of unallocated land which might be diverted as a whole or piece by piece to other than those special uses in the future.

In South Kalimantan elements of land components 1.1.10, 1.2.10 and 3.1.10 are worth special attention since they are mangrove ecosystems of value for coastal protection and for their critical link with the viability of estuarine and near shore fish, shellfish and crustacean production.

In the freshwater swamp areas to the east there is a need for reserving relatively large areas of components 1.1.9 (reed swamp and patches of open water) to protect the habitat of aquatic wildlife, particularly birds. If the location of these same areas could be manipulated so as to also contain areas of 1.1.7 (poorly drained swamp forest i.e., with patches of open water) and 1.1.8 (*Melaleuca* swamp forest), the conservation value would be enhanced. The most suitable locations are west of Amuntal and west of Marabahan towards the border with Central Kalimantan. This is an example of where two provinces could contribute to a larger nature reserve if similar suitable ecosystems exist on both sides of the border.

Turning to the mountainous terrain, land units 5.1 and 5.2 must be forested to prevent erosion. This is particularly important in the catchment area of the major reservoir in the Province. Where these land units are not adequately forested, they must be reforested, preferably with native species. The remaining natural forest on these units must be given the status of Nature Reserves, at least.

The boundaries of the two present Nature Reserves must be altered to enclose mainly intact natural areas of forest and other vegetation and exclude large areas of degraded land (mainly *Imperata* grassland).

3.6 Consultation with Local Communities

In areas already occupied by people, changes in land use could have an adverse effect on their present way of life. Likely impacts would be more severe on indigenous (tribal) people, involving social and cultural upheaval, unless lengthy discussions are held leading to compromises agreed by both sides.

GUIDELINES

Land use planning is to be undertaken, as far as is possible, in consultation with those likely to be affected. This may have to be done gradually and by stages. Local

consultations are to be initiated at each stage of planning in order that the full social benefits and costs of various alternatives may be evaluated.

When indigenous (tribal) people are to be affected by change, all measures are to be designed with the greatest possible consideration for the interest and values of the indigenous community and in full collaboration with them.

3.7 Shifting Agriculture

It is evident that much of the so-called "shifting agriculture" now carried on in South Kalimantan is of the "advancing front" type and thus is harmful to the environment, causing a moving wave of forest destruction leaving behind it impoverished grasslands. People practising this detrimental form of shifting cultivation must be diverted into more settled and environmentally appropriate activities, since their actions are now concentrated in the steepest hills (Fig. 11) and are promoting deforestation and soil erosion there which are detrimental to nature conservation.

GUIDELINE

When shifting agriculture is not in harmony with the environment it is to be discouraged and efforts made to intensify use of such areas by transforming them into settled agriculture, agroforestry and plantation forestry singly or in a planned mixture.

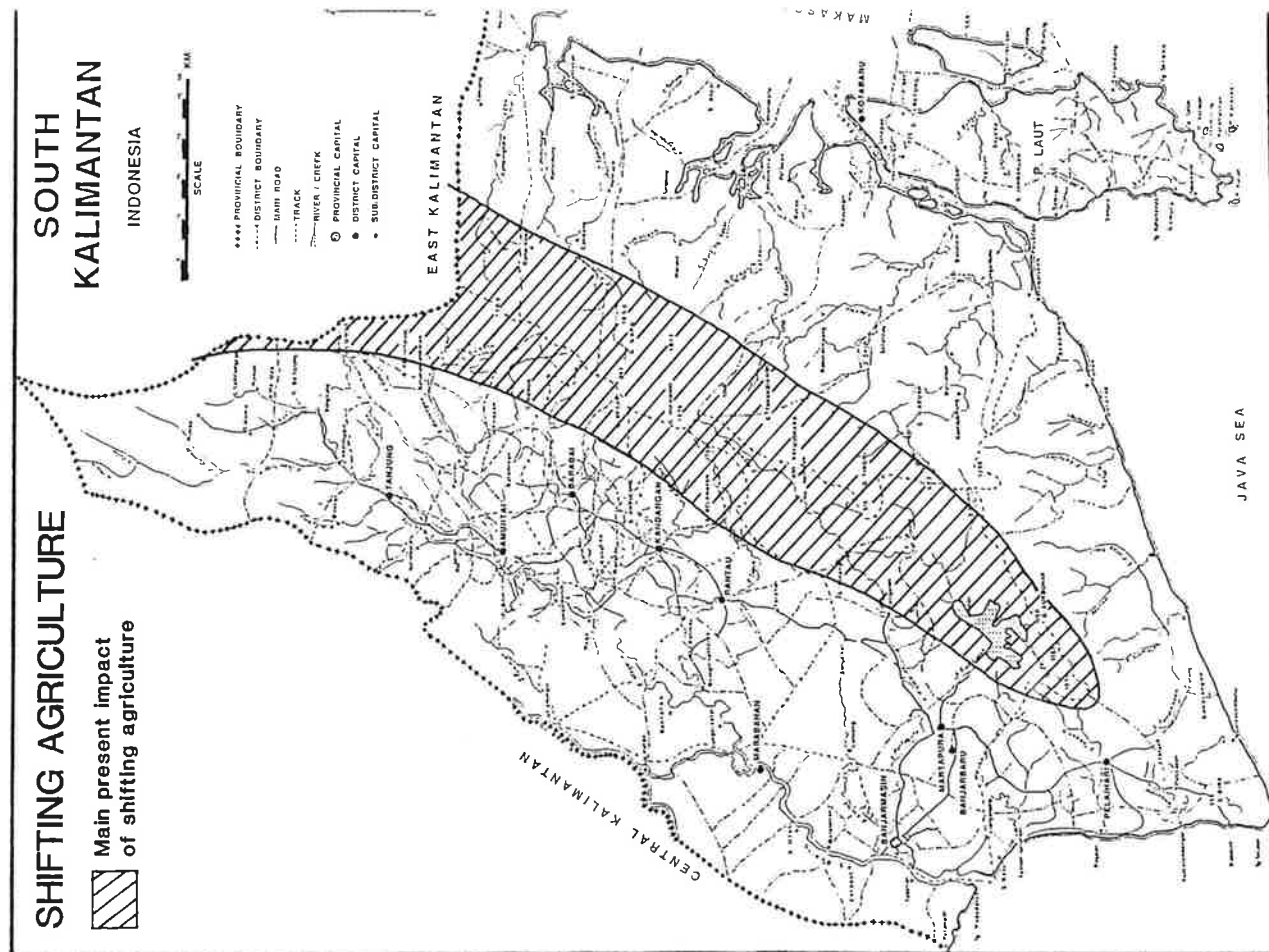
3.8 Monitoring Change

With some kinds of development, lack of experience on similar sites elsewhere will mean that development proceeds without sufficient means of prediction of what the likely adverse environmental impacts will be (if any). In these cases continuous or periodic monitoring will be necessary in order to react in time to change the way the development is being conducted in order to protect the environment from lasting damage.

GUIDELINE

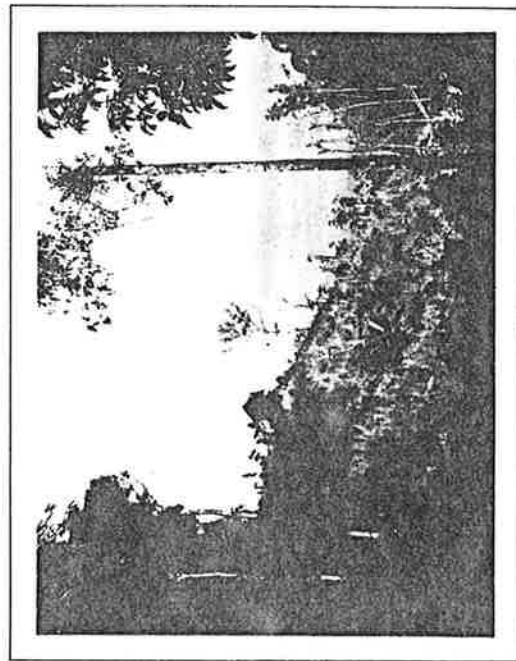
As part of the planning process, arrangements are to be made to monitor and evaluate the effects of any major development by periodic collection of new data to compare with baseline data collected from the site before any alteration has taken place.

FIGURE 11

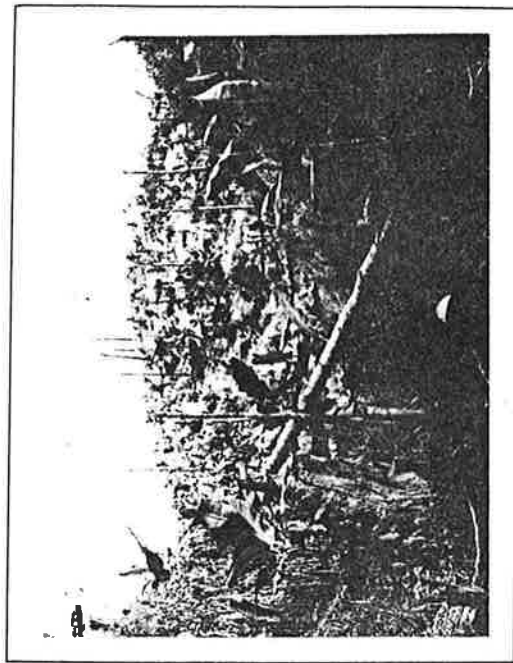




This area east of Kandangan is presently mapped as "production forest" on Provincial maps but is entirely *Imperata* grassland as far as the eye can see. Land Unit 3.3 appears in the foreground, Land Units 4.1 and 4.2 in the background.



Destructive form of shifting cultivation on Land Unit 4.1. The area appears as "production forest" on Provincial maps. Only one or two crops of hill rice are grown before the site is abandoned.



Shifting cultivation. A crop of hill rice and bananas is being grown here in the first season after clearing. Because of the inherently poor soil, and steep slopes affected by erosion on large open spaces, only one crop and, at best, two crops can be grown before the land is abandoned.

4. GUIDELINES FOR NATURE CONSERVATION PLANNERS

See also Section 3.5.

4.1 Land Evaluation for Nature Conservation

It is possible to evaluate the land systems, units and components mapped in Fig. 10 for "suitability" for nature conservation in the same way as for any other use. Fig. 12 shows an example of how this might be carried out for South Kalimantan. In Table 14 the suitability classes are explained.

Intact ecosystems receive at least a moderate rating, modified ecosystems receive a low rating. As a guide for the most important aspects, the following questions (Ewel 1981) should be raised for each land component:

- Is it a habitat for indigenous people whose life style is dependent upon its preservation?
- Is its biota uncatalogued?
- Is it the habitat of endangered species?
- Does it contain species of restricted ranges and potential economic importance?
- Is it the last remaining example of a community?
- Would manipulation have a detrimental impact on neighbouring ecosystems?
- Is the proposed change irreversible?

A "yes" answer to one or more of these questions would warrant consideration of a higher conservation rating. This provides a check to ensure that areas of biological uniqueness are not destroyed. The appropriate authorities should be warned in good time when a unique ecosystem/land component is threatened. In Indonesia, the appropriate authority is the Ministry of Population and Environment (KLH). Various surveys and guides already exist to help determine priority areas for conservation in nearly all parts of Indonesia.

GUIDELINE

The Ministry of Population and Environment is to monitor reports of threatened unique ecosystems and introduce measures to ensure their conservation or protection.

Provided the land classification and land evaluation for nature conservation are completed first and these precede land use planning by other sectors, the land classification maps could already be annotated with conservation areas marked NRC (not relevant, conservation) to emphasize the mandatory "nature conservation first" principle. Disputes could be settled later when all sectors meet together for creating a "consensus" plan (Section 13). Similarly, protection forest could be marked NRP on a map intended for a production forest suitability classification. Inventory of forest for commercial timber volume in conservation and protection forest areas should be discouraged as an unnecessary expense.

GUIDELINE

As an integral part of land-use planning, suitably large examples of natural ecosystems and of populations of plant and animal species are to be protected.

FIGURE 12

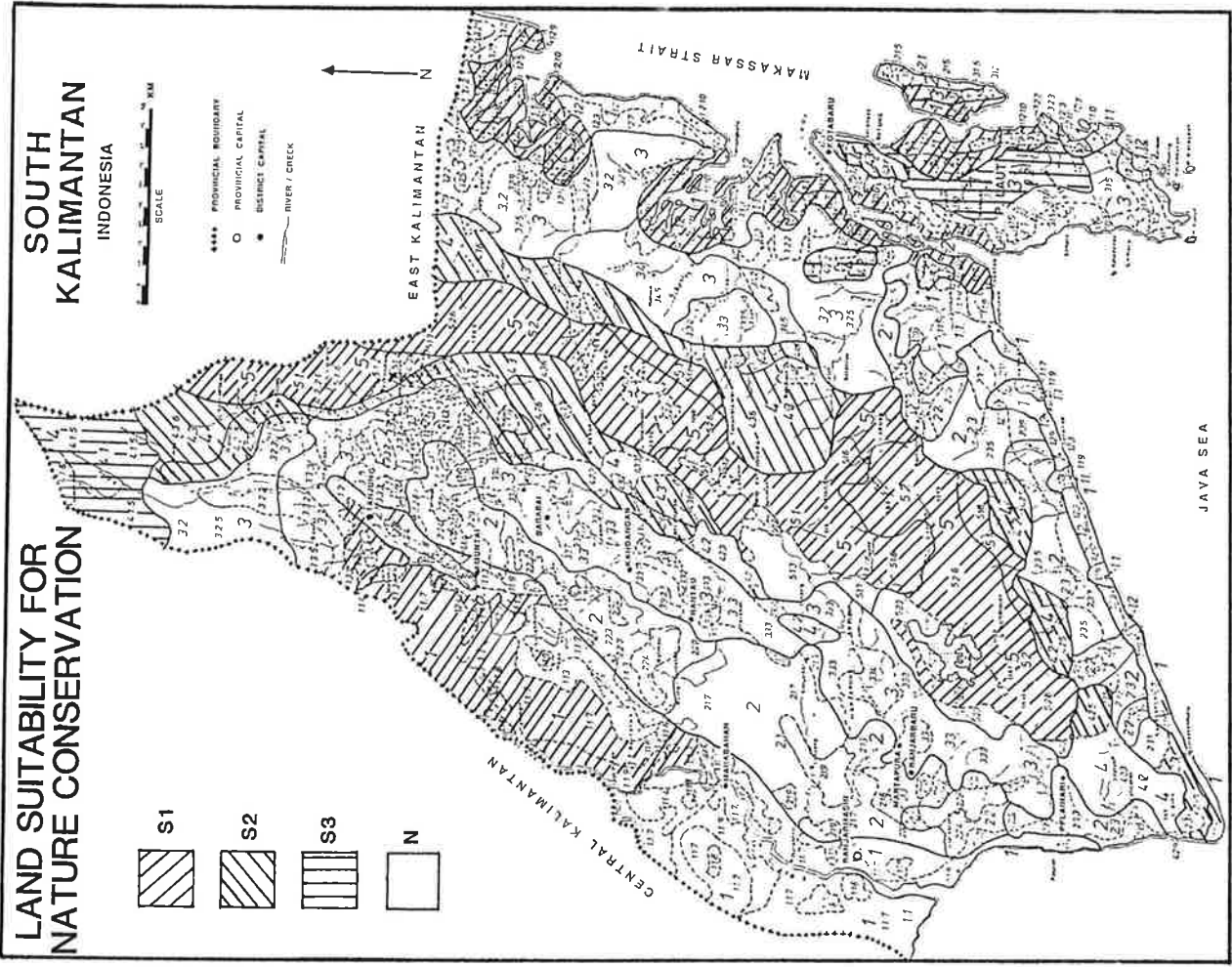
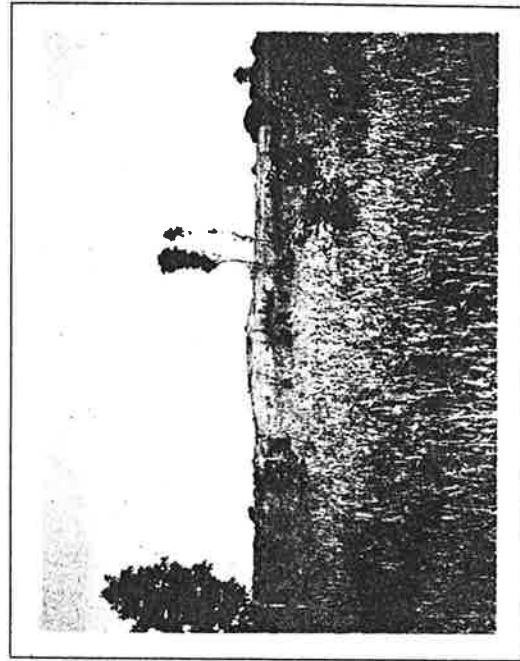


TABLE 14
LAND SUITABILITY FOR NATURE CONSERVATION

Order	Class	Sub-Class
S suitable	S1	highly suitable; no human interference
		S1-m mangrove forests S1-s swamp forests S1-r riverine and floodplain forests S1-h hill forests S2-h hill forests S2-s swamp forests S3-h hill forests
	S2	moderately suitable; some human interference
	S3	marginally suitable; subject to human interference
N not suitable	N1	currently not suitable; able to be rehabilitated
	N2	permanently not suitable - all nature conservation value lost.



Looking south into Pleihari Nature Reserve from the northern border, indicated by the sign.



The northern half of Pleihari Nature Reserve, now completely deforested and covered with *Imperata* grass.

This should be done following an assessment of the intrinsic value of the land in relation to the conservation of flora, fauna and natural ecosystems.

GUIDELINES

In specific situations where there are areas of outstanding and possibly unique value, high priority is to be given to their protection and this function once decided should be given preference over other forms of land-use.

Wherever possible the size and characteristics of areas protected should be related to the needs of the plant and animal communities they are intended to protect.

Large areas are preferred in order to include examples of different ecosystems, representing, for example, different altitudinal zones on a mountain or gradations of climate. Whole catchments make ideal protected areas because of the range of ecosystems normally included.

GUIDELINES

Whenever possible, areas set aside to safeguard samples of natural ecosystems are to be surrounded by buffer zones, taking advantage of physiographic and other natural protective features. These are to be maintained under natural vegetation but can be used for any form of economic land-use which does not interfere with the integrity of the protected area.

Objectives of management for such protected areas are to be carefully defined and followed exactly. At least 50 per cent of the area in the core should remain completely undisturbed but, in the remainder, uses such as for scientific study, for education and for recreation are to be encouraged, provided these activities do not conflict with the primary purpose of protection.

A management plan is required for each protected area, and the course of management is to be monitored to assess whether the original objectives were reasonable and the management has been unsuccessful.

In South Kalimantan, both nature reserves have deteriorated. Boundaries need to be redrawn and proper management plans drawn up.

GUIDELINES

In planning the overall development of any area, provision is to be made for the migration of animals and dispersal of plants between protected areas. Where there are several small invulnerable reserves close to each other, land-use can be regulated in the areas between them so that migration is possible.

If at all possible, management of land outside protected areas should be carried out in such a way that reasonable populations of wild plants and animals can survive there.

The protection of plant genetic resources in natural protected areas (*in situ* conservation) should be supplemented by documented collections in botanic gardens, arboreta, seed banks, and field gene conservation areas (*ex situ* conservation), as an additional insurance against extinction in the wild, even though *ex situ* conservation is not a substitute for *in situ* conservation, since, in *ex situ* areas it is impractical to provide for all species and thus natural evolution is curtailed.

5. GUIDELINES FOR TROPICAL MOIST FOREST MANAGERS

5.1 Objectives of Forest Management.

GUIDELINE

Be explicit about objectives of management.

Apart from their importance as a significant part of the world's stock of forested land, areas of tropical moist forest are valuable as:

- sources of forest products, both plant and animal, e.g., timber, fruit, latex, drugs, bamboo, rattan, honey, fish animal skins and so on (production forest),
- a guardian of soil fertility, preventing erosion, regulating run-off of water and other moderating influences (protection forest),
- samples of forest ecosystems containing the genetic resources of the plant and animal species (and the varieties of these), many of which are likely to have future economic potential (ecosystem reserves, biosphere reserves, forest preservation),
- examples of untouched natural landscapes (national parks, nature reserves),
- places having cultural, scientific, educational and recreation values (scientific reserves, wilderness areas),
- control areas against which the effects of future alteration to similar adjacent areas can be compared and assessed (benchmark reserves).

GUIDELINE

Since uses may be complementary to or compete with each other, the use of areas in the fullest interest of the community is to be encouraged and imaginative and innovative ways of incorporating "multiple use" are desirable.

In South Kalimantan, for example, on land units 5.1 and 5.2 and land components 1.1.4, 1.1.7, 1.1.8, 1.1.9 and 1.1.10, there are opportunities for combining compatible uses mentioned in paragraphs b, c, d, e and f above.

GUIDELINES

For each particular area a primary objective of management is to be stated and any other uses which are inconsistent with the primary use are not to be allowed.

Where it has been decided an area should be allocated for preservation (e.g., of an endangered species), this use is to take priority over all other uses.

5.2 Protection Forests

GUIDELINE

Where slopes are so steep or unstable that disturbance of them would lead to soil erosion and accelerated run-off of water, these areas are to be reserved primarily for catchment protection. Such areas may be used for harvest of certain forest produce or

for some other uses provided these do not interfere with their primary function of protection.

Land Unit 5.2 in South Kalimantan is required to be left undisturbed because of broken relief, steep slopes and rocky, erosive soils (Table 13).

Land Unit 5.1, because of less steep slopes than Unit 5.2, could be used for harvest of non-timber forest products, such as rattan, honey, fruit and nuts, but logging for timber production is not to be permitted. Land Units 5.1 and 5.2 therefore receive a high rating for suitability as protection forests (Table 15 and Fig. 13). Other protection forests are the riverine forests and coastal mangroves.

Areas presently not suitable as protection forests but must have that function must be reforested (Table 15 and Fig. 13).

5.3 Production Forests

The present forest classification system based on function according to primary intended use (Protection Forests, Conservation Forests, Production Forests and Conversion Forests) does not promote rational decision making with regard to landuse. There is no objective evaluation system which takes into account the quality of the natural forest with regard to timber production, the ability to regenerate naturally and, at the same time, quality of the environment, i.e., a natural forest suitability classification.

Other methods of forest land evaluation such as those advocated by FAO (1984) stop short of being useful for native tropical moist forests.

A system of natural forest suitability classification is required which incorporates environmental factors (climate, slope, soil type and elevation), biological factors (such as growth rates of trees and regenerative potential) and operational factors (such as access and location) which affect economic feasibility. Of these only the environmental factors have been taken into account in the land classification (Fig. 10).

Since it has been shown by Ross (1984) that there is far more land currently classified as permanent productive forest than is justified to provide logs required by industry, a better evaluation and classification system for the forests would aid nature conservation - in allowing more forested land to be set aside as conservation and protection forests. Rational decisions could be made on conversion to other uses by identifying areas of forest land which have low suitability for producing forest products and low value for nature conservation.

A productivity classification can begin with a primary division (Fig. 14) into Limited Production Forests (Hutan Produksi Terbatas) - defined as areas on Land Units 4.2, 4.3 and 4.4 (Fig. 10) - or Production Forests (Hutan Produksi) - defined as areas on Land Unit 4.1 and Land Systems 1, 2 and 3 (Fig. 10).

Production Forests are further subdivided (Fig. 14). Grassland and young secondary regrowth, presently not suitable for log production, have a special classification of Not Suitable (N). This "N" classification category is a near approximation to present "Conversion Forests" but the other classes differ from the present system of classification because additional factors are taken into account.

Forest class can be qualified according to the level and the quality of the current standing stock of timber and the potential ability of the forest to regenerate (Ross 1984). Stocking volumes, which give an indication of the amount of commercial logs available on a given site, have been divided further into four classes (high, moderate, low and negligible) differentiated by stocking levels and bole diameter size. Regeneration levels have been considered here because of their importance in indicating the sustainability of timber production.

TABLE 15
LAND SUITABILITY FOR PROTECTION FORESTS

Order	Class	Sub-Class
S suitable	S1	highly suitable
	S1-h	prevent erosion on steep slopes and high hills
	S1-s	protection of river banks by riverine forest
	S2	moderately suitable
	S2-h	prevent erosion on lower slopes and hills
	S2-c	coastal protection by mangroves
N not suitable	None	
	N1-f	presently not suitable: must be reforested
	N1-r	presently not suitable: should be reforested
NR not relevant	None	Not relevant for "protection"

FIGURE 13

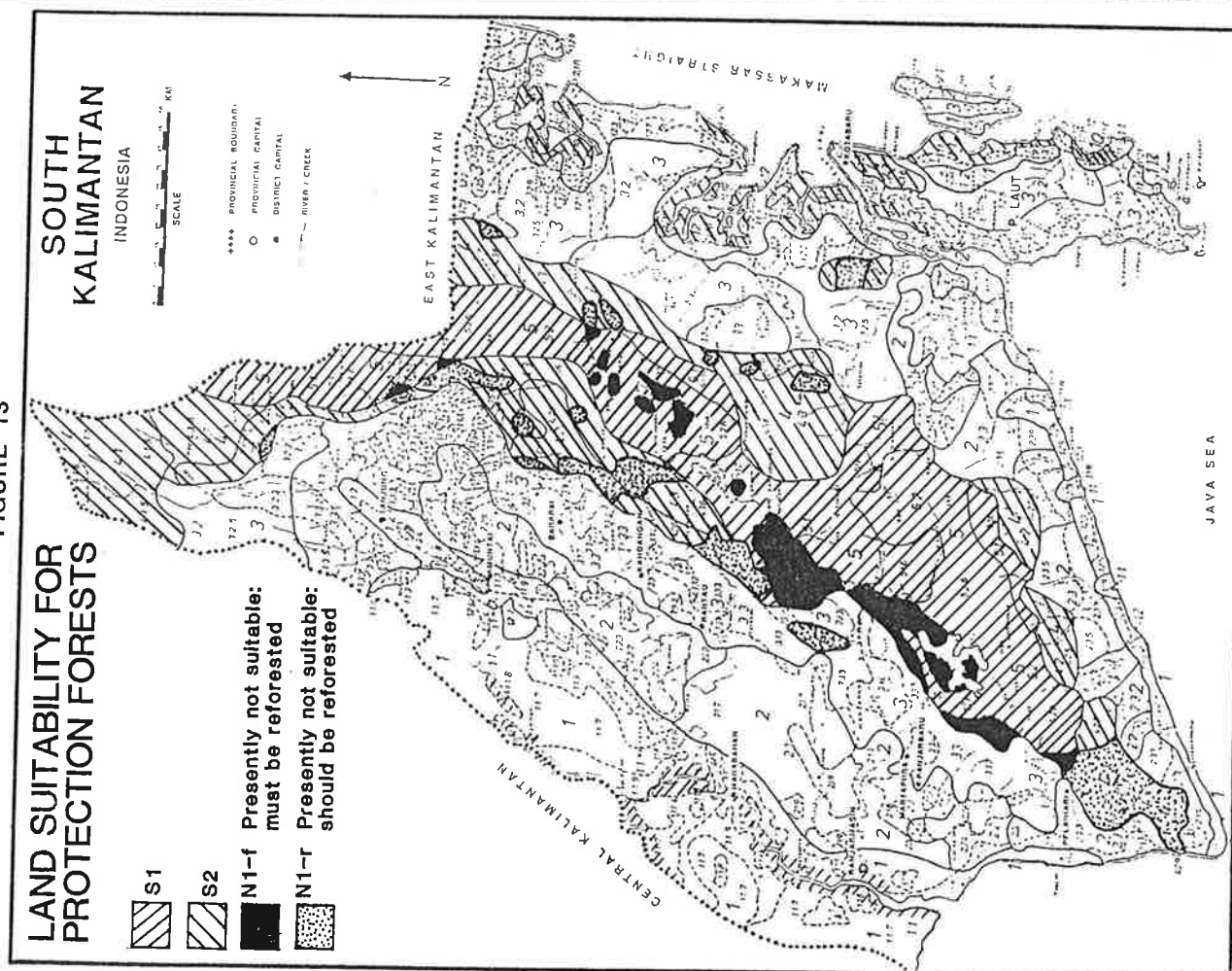
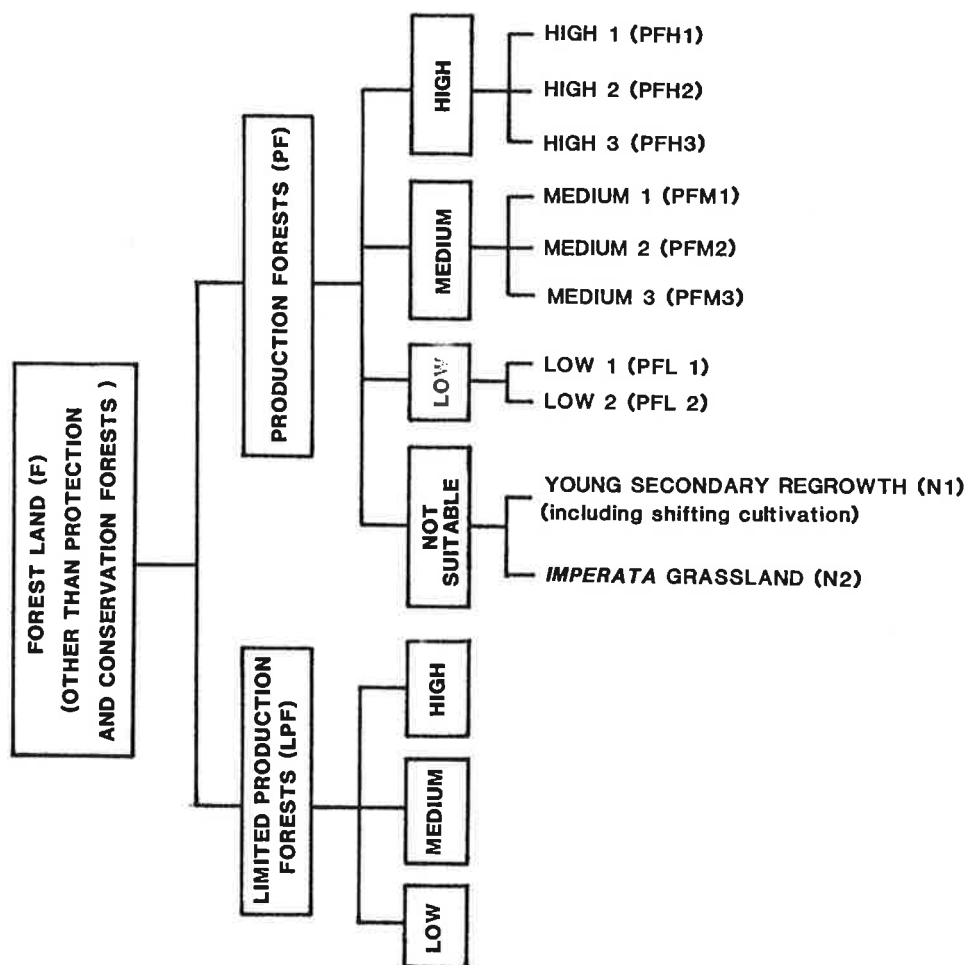


FIGURE 14

NATURAL FOREST PRODUCTIVITY CLASSIFICATION



Source: Modified from Ross (1984)

Stocking volumes:

High stocking volume: 70 $\text{m}^3 \text{ha}^{-1}$ or more, all species, size greater than 70 cm dbh

Moderate stocking volume: 35-70 $\text{m}^3 \text{ha}^{-1}$ all species, greater than 70 cm dbh

Low stocking volume: 10-35 $\text{m}^3 \text{ha}^{-1}$ all species, size greater than 70 cm dbh

Negligible stocking volume: below 10 $\text{m}^3 \text{ha}^{-1}$ all species, size greater than 70 cm dbh

Regeneration potential: These stem numbers refer to all species except protected trees.

High potential: more than 44 stems ha^{-1} 35-60 cm dbh

Moderate potential: 22-24 stems ha^{-1}

Low potential: less than 22 stems ha^{-1}

The number of immature trees between 35-60 cm dbh can affect a forest's class rating, by upgrading or by down-grading it. Upgrading is effected by having a predicted increment of at least 2 $\text{m}^3 \text{ha}^{-1} \text{a}^{-1}$. This attracts a "bonus" of 25 $\text{m}^3 \text{ha}^{-1}$, which is added on to the existing standing stock volume of trees above 70 cm dbh. Thus, a forest in Class M with a standing stock of 45 $\text{m}^3 \text{ha}^{-1}$, but with a potential to regenerate above the 2 $\text{m}^3 \text{ha}^{-1} \text{a}^{-1}$, will move up to class H with the addition of the 25 $\text{m}^3 \text{ha}^{-1}$ "bonus". For dipterocarp forests (those with more than 30 per cent by volume of dipterocarp or like species), which have a potential to regenerate more than 2 $\text{m}^3 \text{ha}^{-1} \text{a}^{-1}$ up to the next scheduled harvest, this 25 $\text{m}^3 \text{ha}^{-1}$ bonus is replaced by a 35 $\text{m}^3 \text{ha}^{-1}$ bonus. This is to ensure that a moderately suitable forest with a high potential to regenerate dipterocarp species will always be upgraded to a high suitability classification. If the predicted increment is between 1-2 $\text{m}^3 \text{ha}^{-1} \text{a}^{-1}$, then the class is not influenced. Down-grading is effected by a forest having a predictable increment for the next harvest of less than 1 $\text{m}^3 \text{ha}^{-1} \text{a}^{-1}$, resulting in a deduction of 25 m^3 from the standing stock volume of trees above 70 cm dbh.

Each of the subclasses can be modified by the three factors: species composition, access and location, which affect the profitability of harvesting operations and, thus, the financial feasibility of the forestry alternative as a whole:

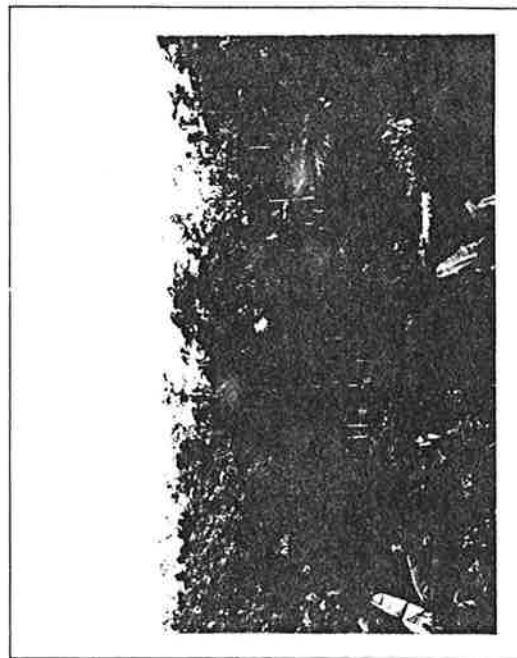
Altering subclasses due to species composition: Only the classes H and M are affected by the species composition of the forest. In each of these classes, forests with an expected harvest volume of more than 30 per cent of logs of dipterocarp or other high quality species are delineated.

Altering subclasses because of location: The location of a forest in relation to the Wallace Line, assumed, for the purpose of this analysis to lie between Sulawesi and Kalimantan (Whitmore 1981), can affect the rating of a forest. Forests to the east of this line should be penalized 15 $\text{m}^3 \text{ha}^{-1}$ from the standing stock of large trees. This is to accommodate the extra costs involved in export and transfer to national forest industries in the west of the nation and the poorer quality of the logs east of the Wallace Line.

Altering the forest subclass because of ease of access: Class M, Moderately suitable forests, may be upgraded at subclass level with a "bonus" of up to 15 $\text{m}^3 \text{ha}^{-1}$, if access makes delivered cost of logs to the point of consumption or of further transportation by water significantly cheaper. Thus, 20 km or less of roading would qualify for a "bonus".



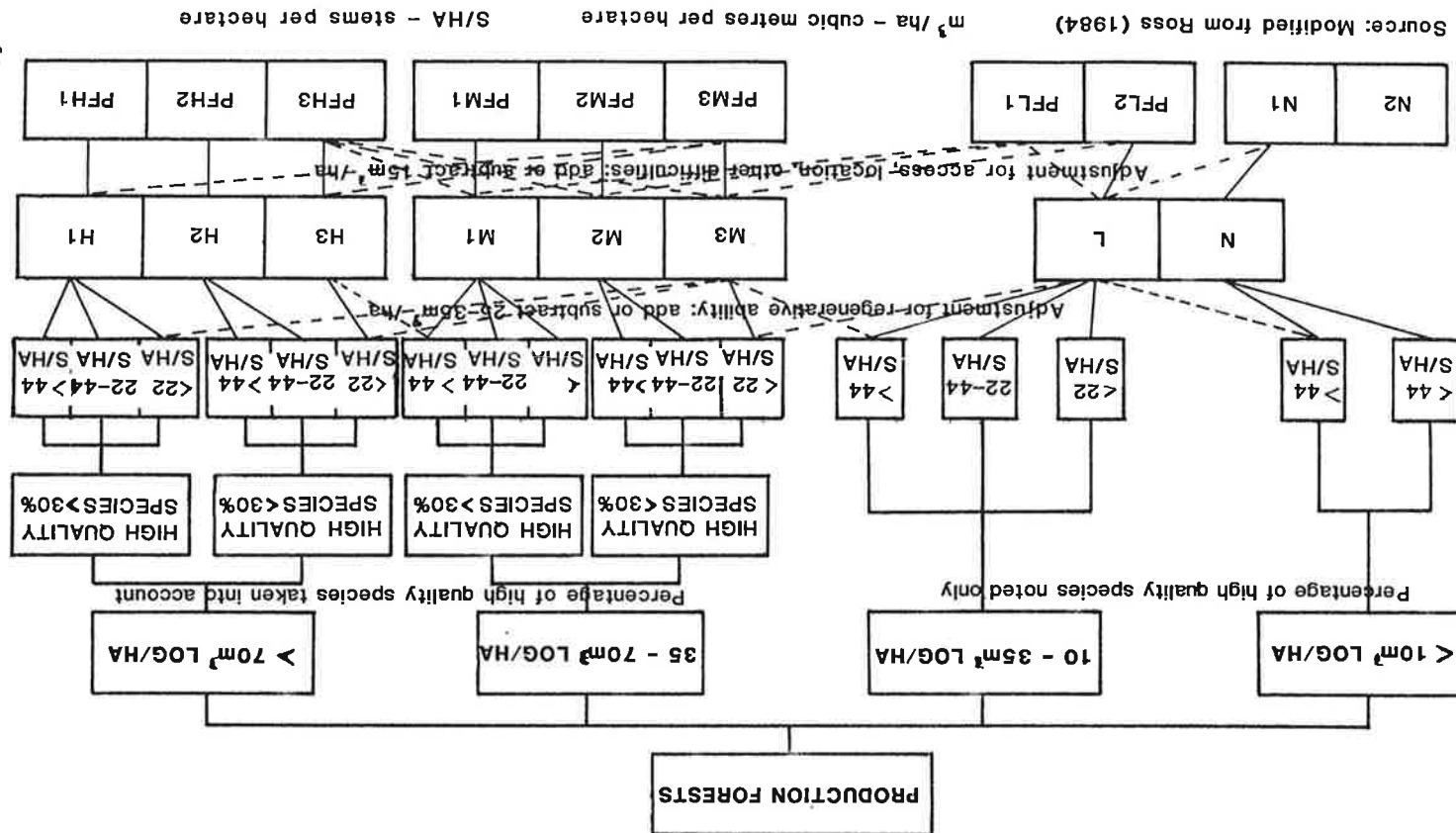
Large areas of advanced secondary growth are labelled "production forest". Rubber trees occur in this stand because of the former practice of beginning a fallow period by planting rubber following the cropping phase in a cycle of shifting cultivation.



Unless the forest is evaluated and classified it will be difficult to judge its worth as a sustainable resource for timber production. Here, a large area presently mapped as "production forest" is now a mosaic of settlements, grassland patches and forest in various stages of degradation.

Only Production Forests are subclassified (Fig. 15), a process which accommodates the financial impacts of various characteristics of the forest such as species composition, accessibility and location as mentioned in detail earlier. Thus, both Highly Suitable and Moderately Suitable Classes are divided into three subclasses: forests of Low Suitability are divided into two subclasses. Forests regarded as presently being not suitable for the supply of logs are subclassified into areas of primarily *Imperata cylindrica* grasslands (N2) or secondary forests (N1) (Fig. 14). As with Classes, each of the diagnostic criteria can affect a Subclass rating. The various subclasses are defined as:

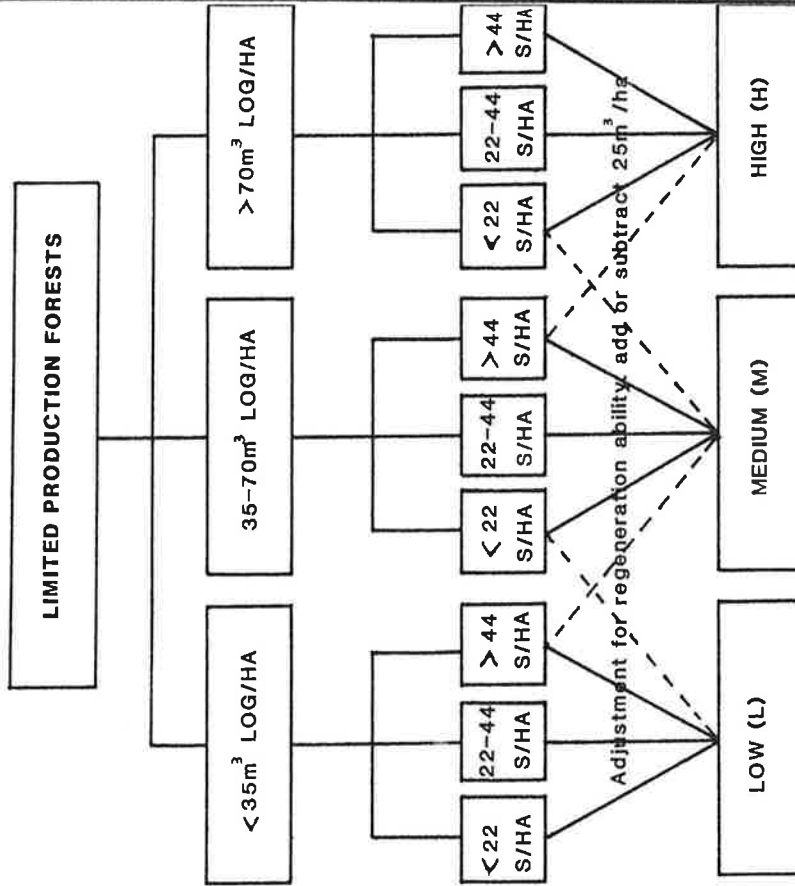
FIGURE 15



Source: Modified from Ross (1984)

m³/ha – cubic metres per hectare
S/HA – stems per hectare

FIGURE 16
CRITERIA FOR THE DEFINITION
OF CLASSES OF LIMITED PRODUCTION FORESTS



S/HA - stems per hectare

m³/ha - cubic metres per hectare

Source: Modified from Ross (1984)

PFH1: highly suitable subclass one (HPT1)

Class H, in dipterocarp or other high quality species forest, with stocking volumes of greater than 70 m³ ha⁻¹, where access is not more than 40 km by road to forest industries (Ross 1983) or a place where logs can be further transported by water. The stock of immature trees should yield 2 m³ ha⁻¹ a⁻¹ when the forest is expected to be harvested next, and this will be determined in part by the management system in use. Location does not cause a significant increase in extraction costs.

PFH2: highly suitable subclass two (HPT2)

Class H, in mixed species forest with stocking volumes, access and location similar to H1.

PFH3: highly suitable subclass three (HPT3)

Class H, any forest type, of stocking volumes greater than 70 m³ ha⁻¹ where access, locational or other operational difficulties would increase FOB or CIF (by road only) costs considerably. This would be the case where haulage distances are greater than 40 km by dry weather roads, or where a particular physical barrier would significantly increase costs. Geographic location may also add significantly to extraction costs.

PFM1: Moderately suitable subclass one (HPM1)

Class M, subclass M1, dipterocarp, or other high quality species, forest, with stocking between 35-70 m³ ha⁻¹ and where access is similar to H1. Location would not increase logging costs significantly.

PFM2: Moderately suitable subclass two (HPM2)

Forest stocking between 35-70 m³ ha⁻¹, where access is similar to H1, and location would not add significantly to logging costs.

PFM3: Moderately suitable subclass three (HPM3)

Forest stocking between 35-70 m³ ha⁻¹, where access could cause increased log production costs similar to H3, or where location may significantly increase logging costs.

PFL1: Low suitability subclass one (HPR1)

The limiting factor here is that the forest will have a standing stock of between 10-35 m³ of industrial logs of any species and is not expected to yield more than 2 m³ ha⁻¹ a⁻¹ for the next harvest under the management system in use. Access is not a problem.

PFL2: Low suitability subclass two (HPR2)

As for L1, except neither access nor location is a problem as defined in H3.

Forests presently not suitable for classification as Production Forests, because of their low standing stock (less than 10 m³ ha⁻¹) and their low potential to regenerate represent the forests formerly classified "Conversion Forests". Here they are termed

"Not Suitable". They may, at a cost, be rehabilitated to productive forests by appropriate silvicultural treatments and artificial regeneration, or converted for agriculture.

N1: Not Suitable Subclass One

Predominant vegetation of this classification is young secondary forest species.

N2: Not Suitable Subclass Two

Predominant vegetation of this classification is alang alang (*Imperata cylindrica*).

In Table 16, these classes and subclasses are arranged in the form of suitability orders, classes and subclasses in regard to "sustained production of industrial logs by natural regeneration".

GUIDELINES

Tropical moist forests are to be managed to obtain forest products according to the best principles of silviculture and in such a way that the natural composition and structure are altered no further than is necessary. Genetic resources in production forests should be maintained at the highest levels possible.

Management is to be directed at achieving the best total return from all forest products consistent with maintaining the future potential of the forest resource.

Relative values of products, services and other benefits from tropical moist forests are likely to change with time and new uses may be discovered, requiring flexible responses now, capable of change in the future.

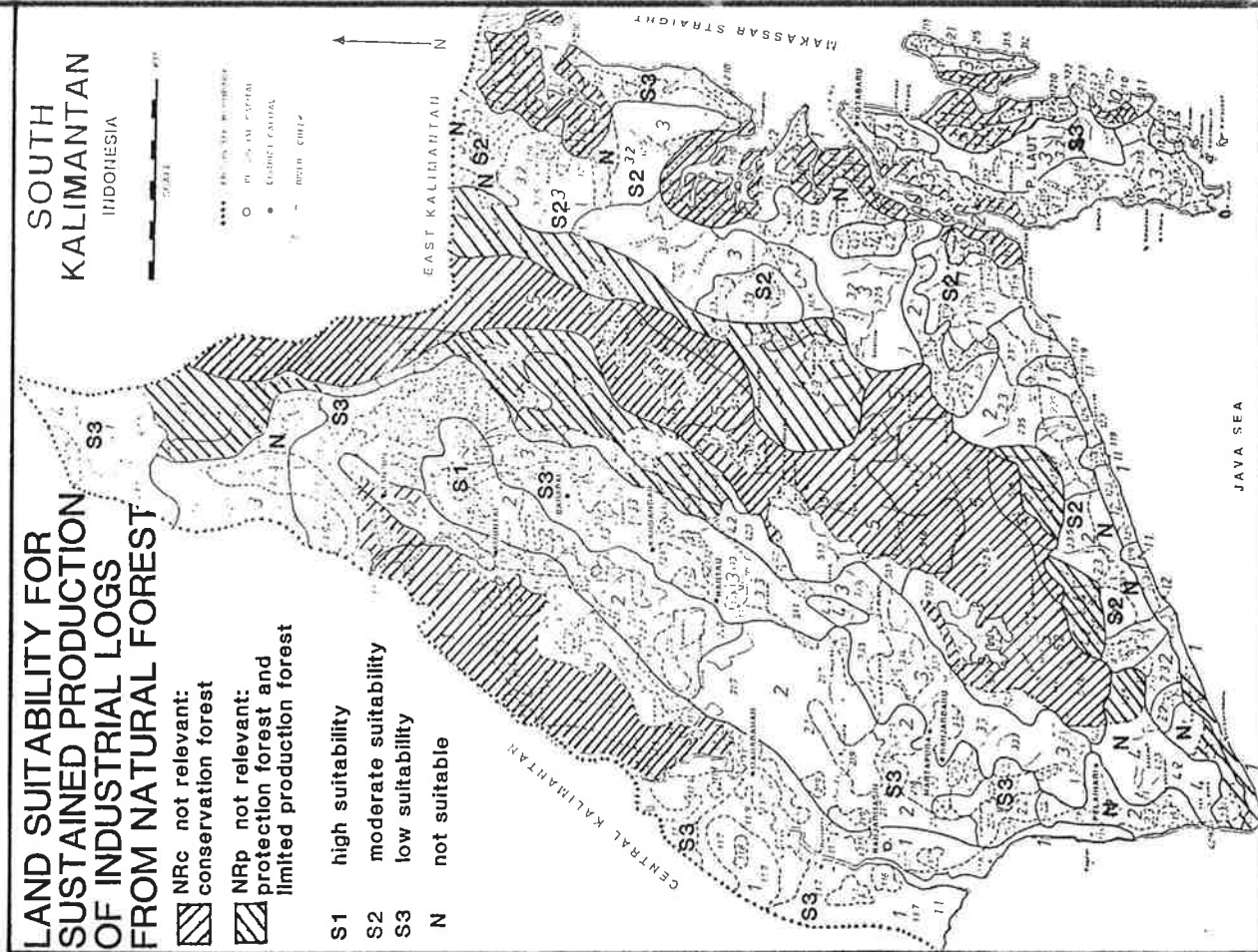
Land suitability for sustained production of industrial logs from natural forest can be mapped. In Fig. 17, conservation, protection and limited production forest have been taken out first with a "not relevant" (NRe and NRP) classification. The remaining land components can then be typed according to the criteria given in Fig. 15. In Fig. 17, only some land components have been labelled to show the technique, since no actual forest inventory or survey has been carried out in order to provide a factual example.

TABLE 16
LAND SUITABILITY FOR SUSTAINED PRODUCTION OF INDUSTRIAL LOGS FROM NATURAL FOREST

Order	Class	Subclass
S suitable	S1 - high suitability	PFH1 high quality species forest, with no operational difficulties
		PFH2 mixed species forest, with no operational difficulties
		PFH3 any species forest with operational or other difficulties
S2 - moderate suitability		PFM1 high quality species forest with no operational difficulties
		PFM2 mixed species forest with operational difficulties
		PFM3 any species forest with operational or other difficulties
S3 - low suitability		PFL1 forest with good access
		PFL2 forest with operational or other difficulties
		N1 secondary forest, including shifting cultivation
N not suitable	none	N2 alang alang (<i>Imperata</i>) grasslands

Source: Modified from Ross 1983.

FIGURE 17



6. GUIDELINES FOR FOREST PRODUCTS COMMERCIAL HARVESTERS AND PRODUCERS

6.1 Dryland Forests

GUIDELINES

When an area is to be managed for the production of timber or other forest produce, including wildlife, this is to be done in such a way that the potential for maximum sustained yield is maintained and the resource capital is not depleted.

Production of timber and other forest produce is to be planned to meet predicted demands as closely as possible. Over-production makes an unnecessary impact on the forest estate while under-production leads to possible illicit felling and other misuse of the forest.

Predicted timber requirements are to take into account the local needs for fuelwood. When the viability of the forest is threatened by fuelwood collection, special plantations are to be established near the site of demand but outside intact tropical moist forests and preferably on land already altered or degraded. Alternative sources of energy (e.g., bio-gas, natural gas, rural electrification) are to be investigated.

In order to help meet predicted demands for timber and wood, trees are to be planted in non-forested areas wherever there are suitable sites. These need not be confined to large blocks of plantations, but rather might include homestead groves, village woodlots, roadsides, canal banks, railway embankments and so on.

Where failed agricultural land has been abandoned, that land should be used for plantation forestry rather than clearing other land still under natural forest.

Before felling or major harvesting of forest produce an assessment of the possible final use of the land is to be made in order to enable proper phasing and planning for development based on the present and likely future needs of the community as determined by its chosen life style.

Responsibility for setting policy according to these guidelines rests with the Ministry of Forests. Cost of implementation should be borne by concessionaires.

Large scale clearcutting presents serious and varied problems in maintaining an area as productive forest. Intensive woodchip operations are particularly prone to problems, and as presently practised constitute a "mining" of the resource rather than sustained management for future harvests.

Control over the area must not be relinquished when the last tree has been cut and removed. Clearcut areas are very prone to conversion to other uses. Control should be extended through the regeneration establishment phase.

GUIDELINE

Where replanting is required, such as after clearfelling for log ramps, temporary camps or intensive utilization such as for pulpwood, this is to take place immediately after logging so that trees become established ahead of weed growth and a tree cover is re-established as quickly as possible to arrest possible degrade of the site and reduce the risk of encroachment and conversion to other uses.

6.2 Mangroves

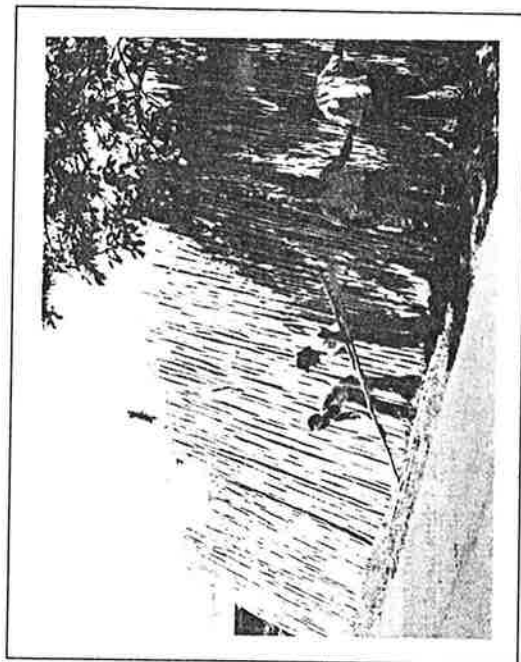
The value of the mangrove ecosystem may indeed be greatest in terms of its support for nearshore and estuarine fish, shellfish and crustacean production. Destructive clearfelling with its usual consequential degradation or conversion spells the end of this support system.

GUIDELINE

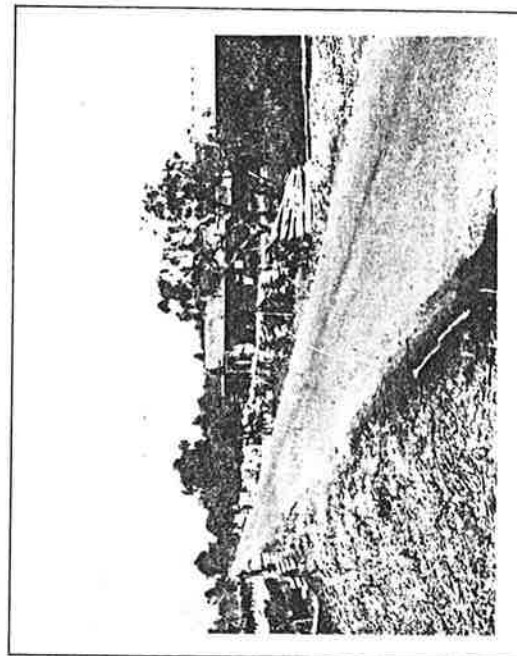
Concession permits should require that regeneration of mangroves be obtained by natural or artificial means, with appropriate standards of stocking and composition.

6.3 Swamp Forests

In South Kalimantan heavy pressure for fuelwood and small poles is brought to bear on the *Melaleuca* swamp forests. Every effort must be made to provide for alternative supplies from dryland plantations to enable the swamp forest to regenerate.



Large quantities of small-diameter *Melaleuca* poles are harvested from the swamp forests in the south east of the Province.



As well as poles, firewood is also harvested from the *Melaleuca* swamp forests in large quantities. Here firewood and poles are being sold by the roadside just south of Banjarmasin.

7. GUIDELINES FOR FIELD FORESTERS AND TREE GROWERS

7.1 Land Suitability for Tree Plantations

Suitable land evaluation procedures for arriving at a land suitability classification for forests raised by artificial regeneration methods have been set out by FAO (1984). A large number of different suitability ratings can be given depending on the land utilization type, e.g., fuelwood production from short rotations with manual harvesting; timber production from exotic softwoods with mechanical harvesting; timber production from native dipterocarps with mechanical logging and reforestation for catchment protection.

GUIDELINE

Land is only to be used for tree plantations when sufficient survey of the ecological conditions has shown the area is suitable for such plantations if appropriate methods of silviculture are used, and adequate field trials or observations have confirmed this assessment.

Among the constraints for any kind of forest plantation are steep slopes and related restrictions (Table 17), suitability of the terrain for access roads (see Section 10) and soil limitations (Table 18). Most of these can be identified from the original land classification and/or from further interpretation of aerial photographs.

7.2. High-Yielding Trees Correctly Matched to Site

GUIDELINE

Improvement in tree plantation production can be achieved by proper species and site matching, selection of high-yielding provenances and breeding of improved varieties, all of which will help reduce the need for further alteration of natural moist forest.

A preliminary selection of plantation species can be made on the basis of land components (Fig. 10) related suitability for access roading (because short rotation species of low value should be near markets on good roads, long rotation, more valuable species can be further away from roads and markets) and soil limitations (Table 19).

Matching species to sites is helped by reference to tabulations of species properties (e.g., Webb *et al.* 1980, Davidson 1985b).

GUIDELINE

Trial plantations are the most satisfactory method for ensuring correct species/site matching and for selecting suitable provenances and varieties.

7.3 Rehabilitation of Degraded Lands

GUIDELINE

The importance of rehabilitating degraded lands must be recognized. It is in the interests of everyone to improve such lands so that they can be used wisely and sustainably in support of society.

TABLE 17

SLOPE CLASSES AND CORRESPONDING RESTRICTIONS FOR FORESTRY PURPOSES

Slope Class	Soil Restriction	Maintenance (pruning, weeding, thinning)	Harvesting
0-12%	Well to over-drained	Easy	Easy, restricted in the rainy season
12-25%	Located on ridges and uplands	Easy	Easy
25-50%	Located on lowlands and valleys	Sometimes under-drained	Easy
50-100%	Over-drained and high susceptibility to erosion	Easy	Fairly easy
100% and over	Ditto, with frequent landslides (unstable slopes)	Fairly easy	Difficult
	Irregular soil depth	Very difficult	Very difficult for mechanical logging

Note: See Table 9 for slope class distribution within Land Units.

TABLE 18
IDENTIFICATION OF SOIL LIMITATIONS BY FURTHER INTERPRETATION OF AERIAL PHOTOGRAPHS

Symbol	Definition	Geographical location	Typical vegetation	Remarks
o	High density of over-drained sites with or without limiting layer in the soil.	Hill ridges Consolidated rocks, Eroded hill tops.	Abrupt changes in secondary vegetation.	Estimate percentage of "o" in the land unit. Example 30% of "o" = 03
e	Evident general sheet erosion	Plateaus and low hills near cultivated areas. Locally ridges or slopes in medium hills.	Degraded brushland, grazed and often burnt.	Estimated percentage shown as per "o" above.
l	Probably leached, acid and concreted soils. (To be checked in soil survey)	Flat, drained plateaus.		
d	Probably local drainage limitations (to be checked in soil survey).	Flat or slightly undulated low lands, located at foot of hills; alluvial plains.	Natural forest with small canopy	Generally used as paddy land.
m	Very complex mosaic site distribution.	Low hills with small flats, imperfectly drained. Low land at the foot of the hills.	Heterogeneous plantation or natural vegetation.	Classed only if many abrupt changes occur in site conditions at map plot scale.
u	No evident indication of particular soil limitations different from normal hazard of erosion, site complexity, particular to each landscape land component.			

Note: "o" = overdrained soils, "e" = erosion, "l" = leached/acidic soils, "d" = drainage/flood hazard, "m" = mosaic of limitations, i.e., an erratic complex distribution which is not separately mappable, "u" = unknown.

TABLE 19
EXAMPLE OF A PRELIMINARY SELECTION OF PLANTATION SPECIES ACCORDING TO
SOIL LIMITATIONS AND ROADABILITY

Land suitability for forest roads	Soil Limitation	Rotation	Main species*	Remarks
S1	l e e + l	S M S M	<i>Eucalyptus</i> , <i>Pine</i> <i>Gmelina</i> <i>Eucalyptus</i> , <i>Pine</i> <i>Leucaena</i> , <i>Albizia</i> <i>Gmelina</i>	Flat land (erosion) Slopes or flat land Flat land (erosion) Slow growing
S2t	u d	S M L	<i>Eucalyptus</i> <i>Eucalyptus</i> Teak	After soil survey
S2dt	m	S M L	<i>Eucalyptus</i> <i>Pine</i> , <i>Eucalyptus</i> Teak	After soil survey
S2t	u	M L L	<i>Gmelina</i> , <i>Pine</i> <i>Dipterocarpus</i> Teak	Select best sites
	o	M L	<i>Gmelina</i> <i>Dipterocarpus</i>	Slow growing
	e + o	S M	<i>Leucaena</i> <i>Gmelina</i>	<i>Dipterocarpus</i> , after soil regeneration
S3t	u	L L	Teak <i>Dipterocarpus</i>	Select best site
	o	L	<i>Dipterocarpus</i>	Slow growing
	o + e e	To be determined by appropriate field trials		
N1t	u	L	<i>Dipterocarpus</i>	Scattered plantation. Natural forest to be protected (slope 100%)
	o o + e	To be determined by appropriate field trials, if necessary		
N1T		No plantation	Protected natural forest	

S: Short term rotation (less than 20 years); M: Medium term (20-40 years); L: Long term (more than 40 years). Soil limitation symbols are defined in Table 18. Land Suitability for roading is explained in Section 10.1.

*These species represent only a preliminary selection used here as examples only. Additions would be identified through future ecological classification of species and by field trials.

By degraded lands is meant barren lands, grasslands, low secondary forests and degraded (damaged) logged forest. Much of the landscape of South Kalmantan consists of these land types.

GUIDELINE

Rehabilitation measures must be specific to the type of degraded land and be capable of reversing the cause(s) of degradation.

IUCN (Lovejoy 1985) has produced recommendations for rehabilitation of degraded lands (Table 20). A conceptual model for rehabilitation of forest fallows (following shifting cultivation crop phase) and other degraded lands is given in Fig. 18.

7.4 Use of Exotic Trees

Because of specific difficulties of establishment on many degraded sites, use of exotic, fast-growing pioneer species may be necessary at first to bring a site to a condition where suitable native species are able to grow. While in most cases vegetation composed of indigenous species is to be preferred, there may be some special cases, such as for fast-growing fuelwood plantations and special buffer plantations, where a final vegetation composed entirely of exotic species may be desirable, but the initial introduction of exotics should be carried out with caution.

GUIDELINE

Special attention is drawn to the danger of introducing exotic species of trees which may, eventually, compete with nearby indigenous forest.

7.5 Agroforestry

Much of the land in South Kalmantan is unsuitable for annual cropping because of leached, acid, infertile soils. A more appropriate land utilization type would be greater use of tree crops and animal husbandry.

GUIDELINE

Ways of involving integration of livestock, crops and trees (agroforestry, agro-silviculture) are to be considered, particularly in areas of high population and where the land is unsuitable for intensive agricultural cropping.

7.6 Minimize Conversion of Natural Forest to Plantations

GUIDELINES

Further areas of tropical moist forest are not to be cleared to make way for artificial tree plantations while areas of already degraded forest land remain available for reforestation.

Any unavoidable modification or transformation of the existing tree vegetation is to be carried out in such a way that the least possible harm is done to the soil by solar radiation and rainfall, in order to retain organic matter, soil fertility and adequate soil structure.

TABLE 19

EXAMPLE OF A PRELIMINARY SELECTION OF PLANTATION SPECIES ACCORDING TO SOIL LIMITATIONS AND ROADABILITY

Land suitability for forest roads	Soil Limitation	Rotation	Main species*	Remarks
S1	I	S M	<i>Eucalyptus</i> , Pine <i>Gmelina</i>	Flat land (erosion) Slopes or flat land
	e e + l	S M	<i>Eucalyptus</i> , Pine <i>Leucaena</i> , <i>Albizia</i> <i>Gmelina</i>	Flat land (erosion) Slow growing
S2t	u d	S M L	<i>Eucalyptus</i> <i>Eucalyptus</i> Teak	After soil survey
S2dt	m	S M L	<i>Eucalyptus</i> Pine, <i>Eucalyptus</i> Teak	After soil survey
S2t	u	M L L	<i>Gmelina</i> , Pine <i>Dipterocarpus</i> Teak	Select best sites
	o	M L	<i>Gmelina</i> <i>Dipterocarpus</i>	Slow growing
	e + o	S M	<i>Leucaena</i> <i>Gmelina</i>	<i>Dipterocarpus</i> , after soil regeneration
S3t	u	L L	Teak <i>Dipterocarpus</i>	Select best site
	o	L	<i>Dipterocarpus</i>	Slow growing
	o+e e	To be determined by appropriate field trials		
N1t	u	L	<i>Dipterocarpus</i>	Scattered plantation. Natural forest to be protected (slope 100%)
	o o + e	To be determined by appropriate field trials, if necessary		
N1T		No plantation	Protected natural forest	

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Any unavoidable modification or transformation of the existing tree vegetation is to be carried out in such a way that the least possible harm is done to the soil by solar radiation and rainfall, in order to retain organic matter, soil fertility and adequate soil structure.

TABLE 20

TYPES OF DEGRADED FOREST LAND AND SUMMARIES OF CAUSES OF DEGRADATION AND OF REHABILITATION MEASURES

Type of degraded forest land	Cause of degradation	Rehabilitation measures
Barren land	Surface compaction, toxic excess minerals, e.g. salinization; major pH change, nutrient deficiencies, air pollution and animal damage.	Stabilization crops (exotic species may be necessary); soil treatment; protection from fire, grazing, harvest, subsequent establishment of useful tree species may be possible.
Grassland	Forest clearing by agriculture or grazing of which fire is a part.	Establish forest plantations, agroforestry, desirable species characteristics include nitrogen fixing and deep tap roots, exclusion of fire, grazing controlled.
Low secondary forest	Natural elements destroying primary forest cover - fire, forest clearing, earthmoving, and overgrazing.	Planting of (preferably mixed) species to improve soil and also to give: economic yields, e.g. fruit, coppice; agroforestry with shade tolerant species, exclusion of fire and heavy browsing, research is needed.
Degraded logged forest	Damage to soil and biota from heavy machinery, inappropriate logging sites (steep slopes), non-directional felling, skidding, and poorly designed access roads.	Enrichment planting and rapid re-establishment of vegetative cover on cleared areas.

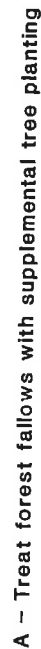
Source: Lovejoy (1985)

Particular attention is to be paid to possible public health problems arising following removal of forest cover.

Underplanting with seedlings and wildlings (natural seedlings) in forest fallows and scrubs has been tried in Pulau Laut, South Kalimantan on an area of 125 ha in 1978. The survival is reported high, though the further growth and yield of the regeneration has not been monitored.

Reproduction, adequate in stocking and composition must be obtained in both wetland and dryland forests. Where natural regeneration is not obtained, reinforcement planting should be carried out, preferably using more than one species, to maintain biological diversity. Consider the mix of possible uses from a variety of species.

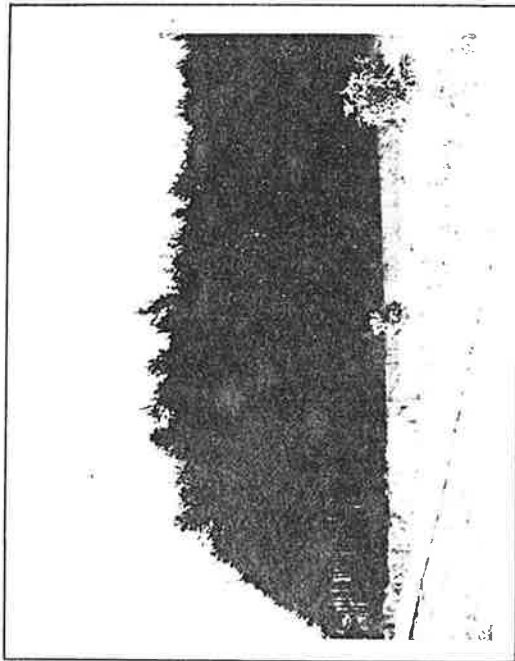
Slash management or disposal may be required in some instances to prevent mechanical damage to new seedlings or sprouts. Weeding may also be needed in particular cases.



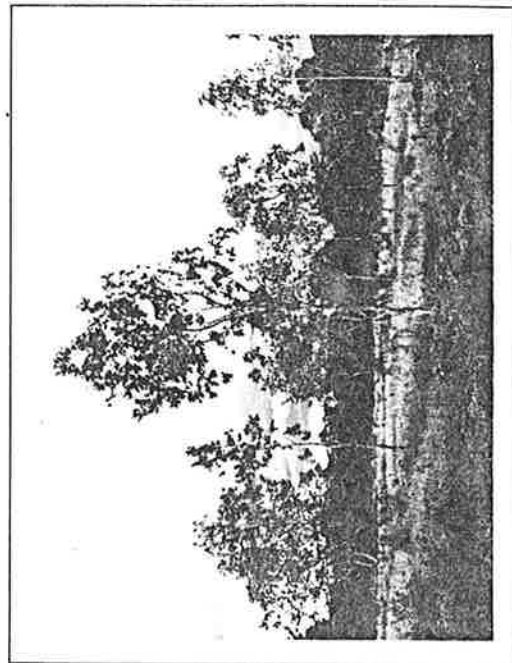
C – Use agroforestry techniques

D—No treatment until after A, B and C have been completed

Source : Altered from Sumitro (1985)



Pine plantation established on grassland. Lack of thinning and poor protection against fire have reduced the quality of this stand. However, planting *Pinus* is a feasible option on these acid soils.



Eucalyptus alba plantation, eight years after planting in grassland near Pelahhari. The seed origin is probably lowland Timor. There are several species of eucalypts and acacias, some of them native to Indonesia, which could be used successfully to reforest such sites.

9. GUIDELINES FOR AGRICULTURISTS

9.1 Land Suitability for Agriculture

GUIDELINE

Land is only to be used for food crop cultivation or plantation crops when sufficient survey of the ecological conditions has shown the area is suitable for such crops, if appropriate methods of cultivation are used, and field trials or observations have confirmed this assessment.

Land for agriculture normally has been assessed from the point of view of "capability", i.e., the capacity to produce a particular combination of plants or animals. Land capability classification, developed by the USDA Soil Conservation Service is a well established form of survey, applied mainly in agricultural land use planning, with emphasis on its conservation requirements. It places land into a graded series of capability classes, from Class I, land with low limitations to agriculture, to Class VIII, land with no potential for agriculture, forestry or grazing. Capability classification indicates which land is 'capable' of being used for a major kind of use, without comparative assessments of the desirability of different uses. This system has never found favour in forest land use planning, since it carries an underlying implication that agriculture is to be the preferred form of use wherever possible. Whilst, in principle, Classes I to IV have a capability for forestry as well as agricultural use, in practice forest land is nearly always placed in capability Classes VI to VIII.

If this capability classification is applied to South Kalimantan the Classes range from IV to VII indicating most of the Province has little, marginal or no potential for agriculture based on dryland food cropping (Fig. 19).

Using the Land Components mapped in Fig. 10 and the standard land suitability classification, it is possible, in this example, to relate the suitability classes to the capability classes (Table 21) and construct a map showing land suitability for agriculture (dryland cropping) (Fig. 20).

Even heavy fertilizer application would have little effect in improving the soil. High iron, manganese and aluminium contents coupled with very acid soil reaction tend to reduce the effectiveness of added fertilizer.

GUIDELINE

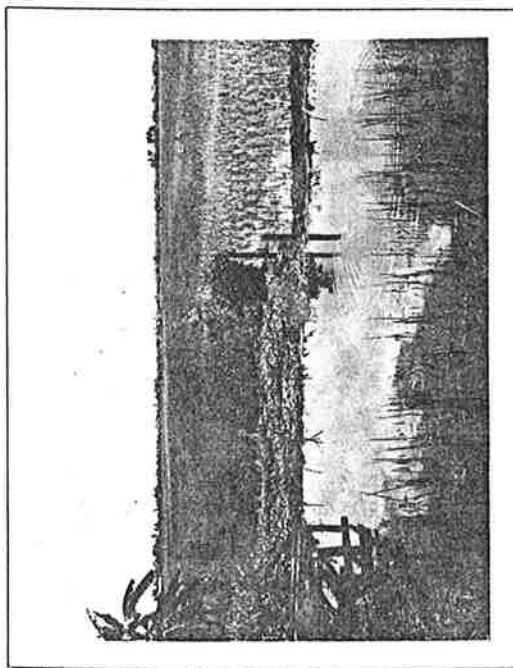
As far as possible systems of agriculture should be favoured that do not rely heavily on the impact of energy and fertilizer inputs.

9.2 Traditional Agriculture and Agroforestry

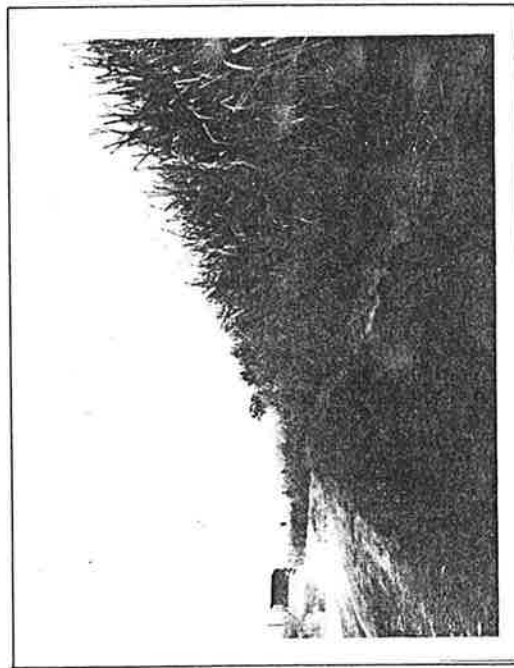
The nature of most of the well-drained soils in South Kalimantan seem to indicate agriculture based on tree cropping would be superior to agriculture based on upland rice farming and would lead to more stable land use (Fig. 21) for transmigrant settlers.

GUIDELINE

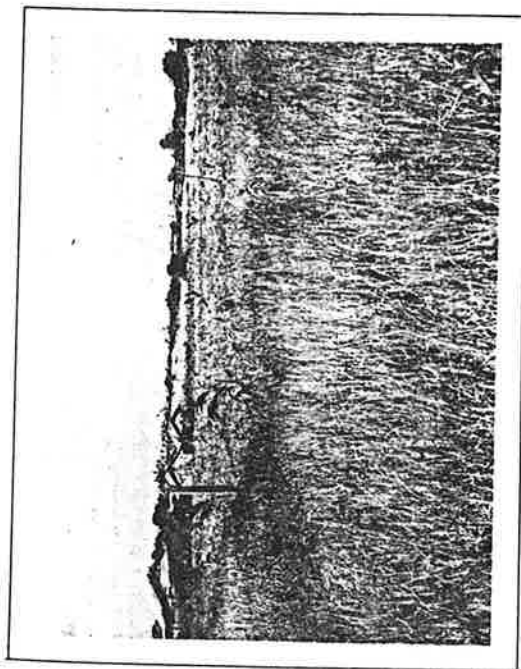
Careful studies must be made of local traditional and indigenous systems of agriculture which have produced a sustained yield within those systems. Every attempt



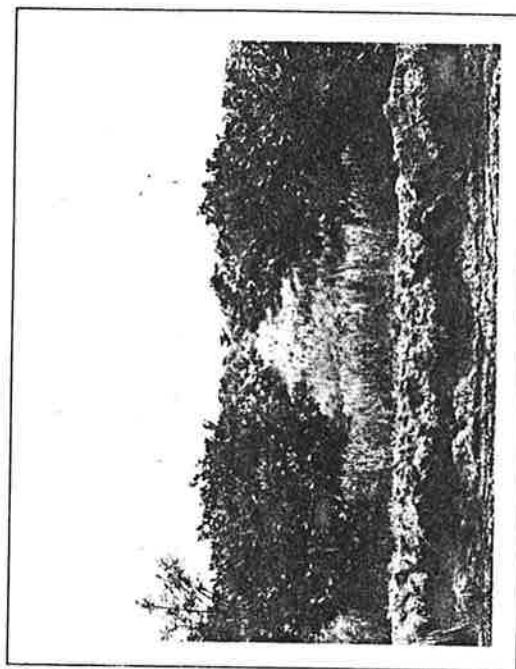
Large areas formerly covered by *Melaleuca* swamp forest and scrub around Banjarmasin have been converted to paddy fields.



Sugar cane is being tried as an alternative to dryland rice near Pelahhari.

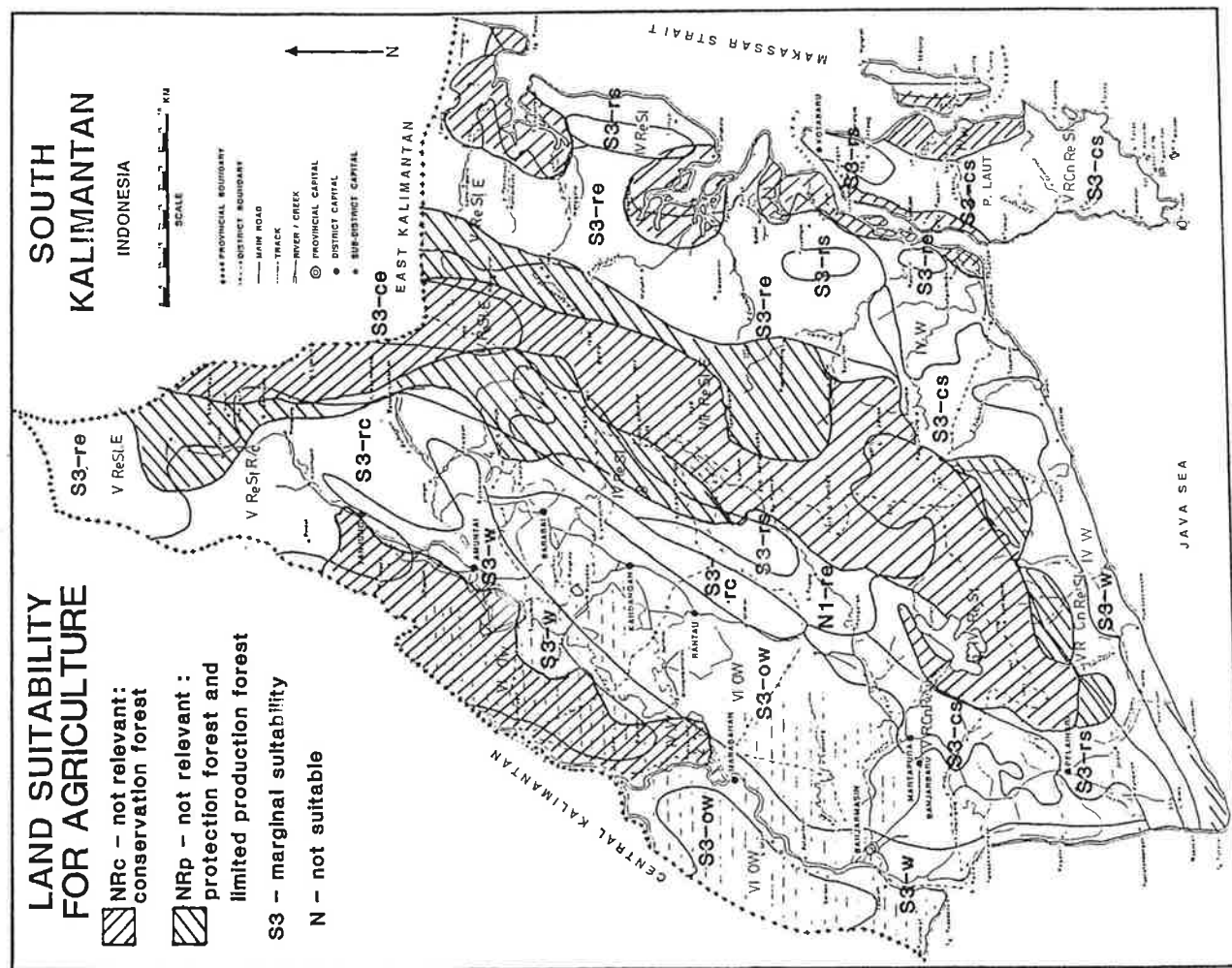


Failed attempt at growing coconuts on *Imperata* grassland.



An example of a successful tree crop growing on acid grassland soils in South Kalimantan. This is *Eugenia* sp.

FIGURE 21



Source: Modified from Sumitro (1985)

is to be made to extend such stable and productive indigenous systems, or sustainable elements of them, particularly for incorporation into agroforestry systems of sustainable land management.

9.3 Animal Husbandry

A greater emphasis on animal husbandry would improve the chances of transmigration settlers becoming self sufficient. However, such projects must not involve further clearing of forest. In view of the huge areas of grassland already existing in Indonesia further conversion of forests to grazing land normally should be prohibited.

GUIDELINES

Conversion of tropical moist-forests to open grasslands for the grazing of ruminant livestock, where permitted, should be approached with caution since such pastures have only sometimes proved productive on more fertile soils than is the norm under tropical moist forests. More often these ventures have failed, resulting in degradation of the areas as well as low productivity of livestock.

Every effort is to be made to improve the productivity of existing savannas and rehabilitate denuded lands by the introduction and testing of new forage species, the solution of the problems of year-round feeding and overall improvements in management.

Special attention is drawn to the danger of introducing species of animals for domestic purposes under range conditions where there is any opportunity for them escaping into the wild (animals such as buffalo and goat have caused considerable and economic damage in many situations after escape from domestic control).

Improvements in ruminant livestock production can most suitably be obtained by:

- (a) development of new and suitable breeds,
- (b) increasing the productivity and hence the carrying capacity of existing pastures by the use of multispecies forage and emphasis on improvements in management,
- (c) integration with field and tree crop production (agroforestry), and
- (d) the utilization of all available by-product feeds.

Improvement of non-ruminant livestock production can probably best be accomplished by ensuring continuous and economic supply of suitable feeds, which should include as many locally produced by-product feeds as possible. There are also possibilities for integrating pig, chicken and duck production with fish production.

Efforts should be made to domesticate indigenous animals for sustained production (e.g., deer and crocodile).

9.4 Agriculture and Mangrove Forest Areas

Mangroves are part of an interacting coastal complex, and effects of agriculture will cross ecosystem boundaries. Acid sulphate soil conditions in converted mangroves may cause fish kills in adjoining estuaries. Similarly, clearing of freshwater and/or peat swamp forests nearby may have deleterious effects on inter-related mangroves which were not the planned targets for alteration.

10. GUIDELINES FOR CIVIL ENGINEERS

10.1 Transport and Communications

Greatest environmental risks and problems are likely to arise from road construction in South Kalimantan. Roads are required for forestry, agriculture and transmigration settlement access.

GUIDELINES

Decisions on the placing of new settlements, roads, industry, engineering works and other such developments should be based on as much relevant information as possible. A proper understanding of environmental conditions will enable such developments to be sited most advantageously and minimize the risk of environmental damage.

As far as possible civil engineering works are to be sited in areas where

- (a) environmental conditions are most favourable for them, and
- (b) their local effects on the social and physical environments can be absorbed successfully.

A suitability rating for roading can be evaluated from the land classification (Fig. 10). Suitability sub-classes (Table 22) are described as follows:

Sub-class S1:

Permanent roads: River terraces, plateaux or terraced fans without topographical limitations; drainage fairly good in the wet season; relief no more than slightly undulating 0.5 per cent slope; mainly sand to loam texture in the soil surface. A high density road network can be developed to service forest plantations and transmigration settlements. The main problem is road water drainage without erosion (Fig. 22).

Sub-class S2-d:

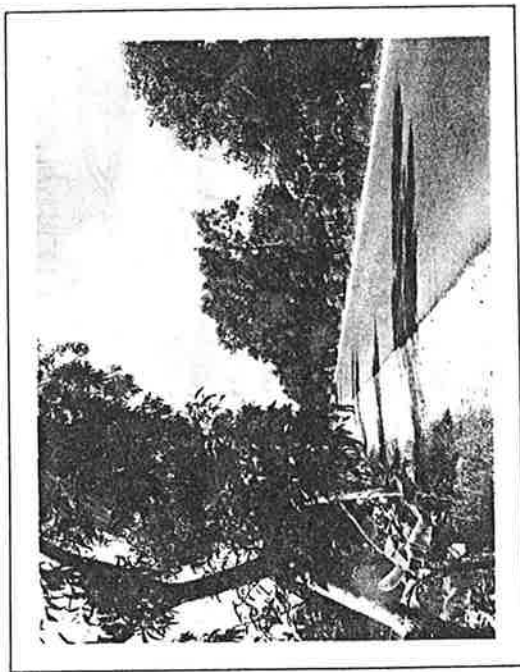
Permanent roads with restrictions in the wet season: slight drainage limitations with sometimes strong restrictions in the wet season. The road network must be designed to follow the best-drained alignment. Therefore permanent roads will have an irregular pattern. Crossing small streams or imperfectly drained areas is an additional restriction (Fig. 22).

Sub-class S2-dt:

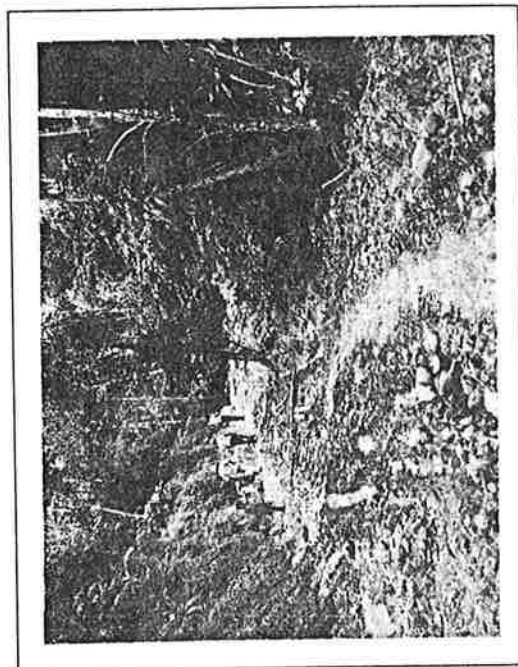
Permanent roads with restrictions in the wet season and, locally, topographical limitation: located in the low hills landscape, separated by low-lying land, the road system is required to cross successively occurring small stream channels, imperfectly drained valley bottoms and hills with undulating slopes (Fig. 22).

Sub-class S2-t:

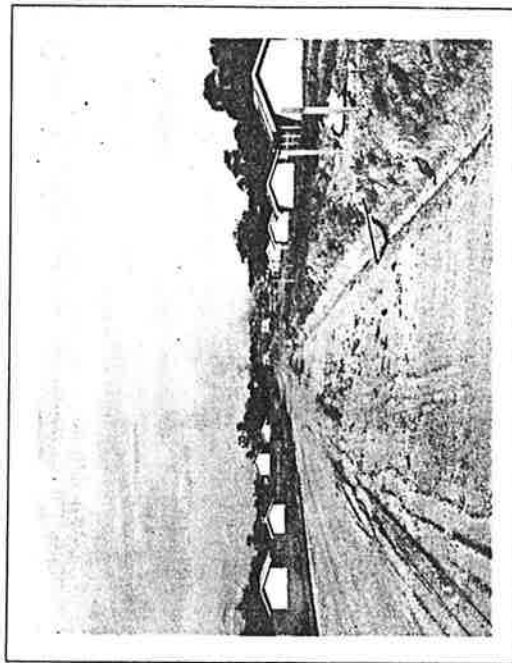
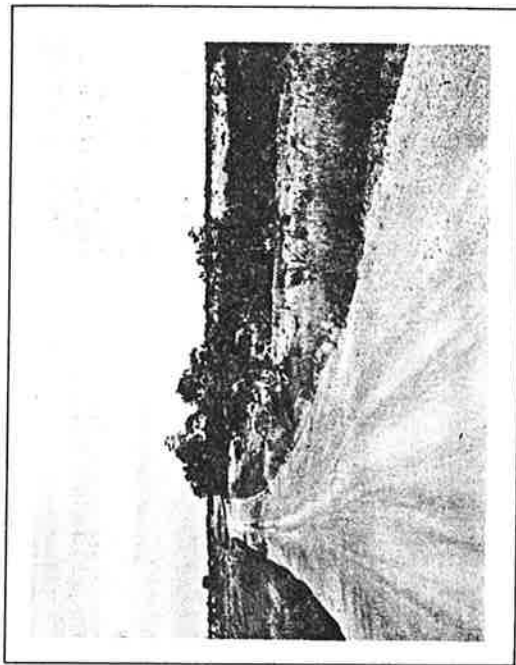
Permanent roads with topographic limitations: roads are required to follow the natural ridge pattern on gently sloping ridges (0-12 per cent slope). Some topographical difficulties will be experienced in connecting such ridge road networks to main roads on the plains. If necessary, temporary roads could be constructed on slopes for harvesting timber but these would be unsuitable for development into permanent roads (Fig. 22).



This tree-lined, sealed section of the main road between Banjarmasin and Banjarbaru is in sharp contrast to the roads provided as access to new settlements such as the track illustrated below.



An eroded, muddy track, impassable to vehicles, is the only access to the settlement at Matanggapi Rahmat.



Both the approach road (top) and internal roads (bottom) for the Alu Jorong Transmigration Centre seem to have been overdesigned. They are wider than necessary and have no cross drainage. The surface is natural, the surface layers of soil have been scraped away to reveal a hardpan of ironstone nodules. Erosion is severe. The engineering layout of the Settlement does not conform to the natural grain of the land.

Sub-class S3-t:

Restricted for permanent roads because of steep topography: being able to be located only on undulating ridges (5-25 per cent slope), this type of road pattern has many curves and has a high erosion hazard. There is no capability for roading in narrow and steep valleys. Temporary roads could be constructed for timber harvesting (Fig. 22).

Sub-class S3-td:

Restricted for permanent roads because of steep topography, poor drainage and flooding: located in small valleys in high hills (Land Units 4.2 and 4.3) and mountainous landscape (parts of Land Unit 5.1), the road must follow generally meandering streams, it requires numerous bridges and/or has to be cut through unstable foothills in valley bottoms which may be subject to flash flooding or in places have perched waterables and swampy patches. Erosion hazard is severe. It would be possible to build temporary roads for logging access on the slopes during the dry season (Fig. 22).

Sub-class N1-t:

No capability for permanent roads, restricted for temporary roads: roads could be located along ridges but great difficulty would be experienced in connecting such a road network to main roads at lower altitude. Erosion hazard is severe on Land Unit 5.1 and a large percentage of the area cannot be served by a road system.

Sub-class N1-t:

No capability for permanent roads or temporary roads under present economic conditions. A landscape of high and very dissected hills (Land Unit 5.2) with a high erosion hazard. A specific survey would be required to evaluate the economics of harvesting timber in these locations.

GUIDELINES

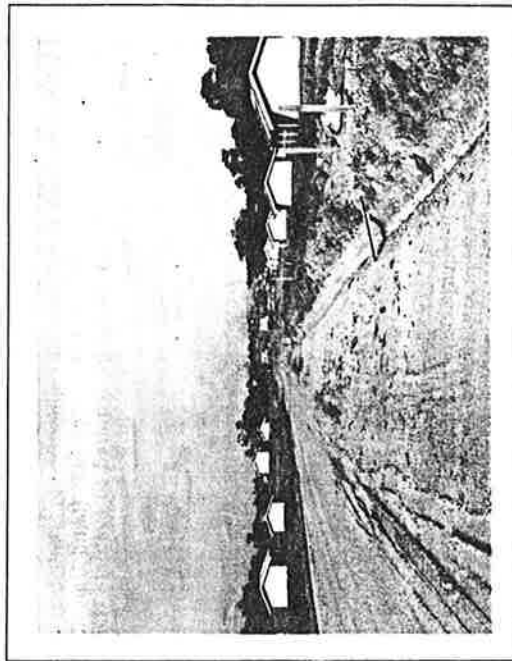
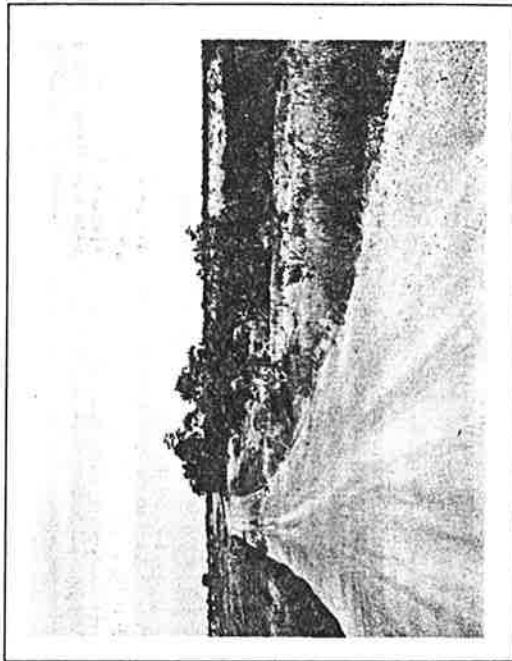
Since the effects of opening up communication into hitherto remote country are far-reaching, planning for transport and communications is to be an integral part of any regional development plan taking into account the capacity of the environment and, especially, any long-term or incidental effects.

Careful consideration is to be given to a choice of mode of transport which will minimize damage to the environment and best enable the course of development to be regulated.

Allocation of land and land management along new routes of communication are to be in accordance with land capability and the area development plan. All land clearing and other activities which are not consistent with these are to be strictly forbidden, and the prohibition rigorously enforced.

If possible, no roads are to be routed through sensitive areas, especially those designated as parks or reserves, but, if special considerations make this unavoidable, management plans are to be drawn up for buffer zones before the roads are built, and no activity is to be permitted which is not in accordance with the plans.

The construction of roads through mangrove areas poses a number of engineering and ecological difficulties. If it is not possible to avoid locating roads through these areas, the following guidelines should be observed to minimize the adverse ecological consequences:



Both the approach road (top) and internal roads (bottom) for the Alu Jorong Transmigration Centre seem to have been overdesigned. They are wider than necessary and have no cross drainage. The surface is natural, the surface layers of soil have been scraped away to reveal a hardpan of ironstone nodules. Erosion is severe. The engineering layout of the Settlement does not conform to the natural grain of the land.

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GUIDELINES

Minimize interference with water flow. Roads and temporary access should whenever possible be parallel to surface flow patterns, including tides, and not perpendicular. Any unavoidable obstructions to flow should follow natural water divides, when present, or be designed with culverts of sufficient cross-sections to accommodate 50-year flood levels. Culverts should be sited as closely as possible to the original major flows, and be deeper than the natural surface.

In demucking and/or grouting operations, waste muck and clays should not be discharged into adjacent mangrove areas, or otherwise allowed to flow into intertidal or nearshore environments.

Consider mitigation measures to compensate for areas lost or adversely affected. If a seed source is available, planting may not be necessary if a suitable physical environment is maintained or created. On the other hand planting of embankment margins would provide not only bank stability but a protection buffer to the exposed inner mangrove system.

10.2 Industries and Pollution

GUIDELINE

Planning, design, construction and operation of industries are to take into account the possible adverse effects of industrial pollution (physical, thermal, chemical, biological) and other harmful ecological consequences. Standards of quality for water, soil and air are to be based on proper ecological criteria.

10.3 Dams and Barrages

GUIDELINES

The downstream impacts of upstream impoundments or diversions extend all the way to the estuary. Mangrove and swamp forest ecosystems are likely to be adversely affected or even destroyed by consumptive or diversion uses, or changes in timing of freshwater delivery. These external, offsite costs must enter into any benefit/cost analysis.

Mitigation releases of freshwater from dams and barrages may be required to maintain mangrove and swamp forest ecosystems downstream.

Impoundments may cause increases in the salinity and may reduce sediment inputs to the lower estuary, and through a reduction of the estuarine surface area, alter tidal currents in the lower estuary; the effects of these on mangrove forests must be considered in the initial feasibility/planning phase of the project.

Just as the engineering and construction professions follow strict performance standards in the actual construction of dams and barrages, so should planners and design engineers follow strict standards to ensure perpetual functioning of affected downstream ecosystems such as swamp forests and mangroves.

11. GUIDELINES FOR TRANSMIGRATION PLANNERS AND MANAGERS

Transmigration planning involves several disciplines. Therefore it is necessary for transmigration planners and managers to refer also to other sections of this Manual, particularly 3, 4, 5, 7, 9 and 10.

11.1 Land Suitability

It is possible to use the land classification (Fig. 10) to help select suitable terrain for transmigration settlement. Key criteria are slopes less than 8 per cent for dryland cropping and less than 18 per cent for other uses including tree plantations and agroforestry. For other land constraints see also Section 9 on Agriculture, for tree crops see Section 7 on Forestry and Agroforestry, for other land utilization types, for example, see Section 12 on Fisheries.

The land suitability example presented here is for transmigration settlements based on tree crops (Fig. 23), since virtually no land in the province is suitable for dryland agricultural cropping.

It is interesting to examine the locations of present transmigration settlements (Fig. 24) in relation to the land classification (Fig. 10) and the land suitability for tree crops map (Fig. 23). Understandably, Centres 2, 4, 5, 7, 17, 22, 23, 24, 28 and 39 (numbers refer to Centre locations in Fig. 26) are on land unsuitable for tree crops because it is swampland (Land System 1) largely now converted to paddy rice. Centres 11, 14, 15 are on land not suitable (N) or marginally suitable (S3) for tree crops. Settlements 6, 8, 9, 10, 12, 13, 16, 19, 25, 29, 31, 32, 37 and 40 are on land moderately suitable (S2) for tree crops. Centres 18, 20, 21, 26, 27 and 33 are on land of which about half is highly suitable (S1) and half marginally suitable (S3) for trees. A large part of Centre 1 and Centre 34 are located on land having a high suitability (S1) for tree crops. Settlements 3 and 38 and part of 36 appear to encroach on areas which should have been set aside for conservation, particularly the mangrove areas. However it is reported these areas were already encroached and cut over before the transmigration projects were started. It was hoped formal settlement would stabilize the situation but damage to nearby mangroves and dryland forest has continued.

GUIDELINES

Be specific about the objects and expected outcomes of settlement. Land is only to be used for transmigration settlements when adequate survey of the ecological conditions has shown the area suitable for the major land utilization type to be employed, and adequate field trials or observations of farming systems have confirmed this assessment.

Previously cleared land or land under poor secondary forest must be considered for use for settlement first, before clearing intact tropical moist forest. Since the soils under such forest or cleared areas normally will have limited fertility, uses other than dryland rice or other food cropping, e.g., agroforestry and tree plantation crops, would be more suitable.

Management of transmigration settlements is to be directed at achieving the best total return from the site consistent with maintaining the future potential of soil, water and other natural resources. Settlements must not be overpopulated at the beginning or allowed to become so later. Settlement targets must fit the carrying capacity of the site.

FIGURE 23

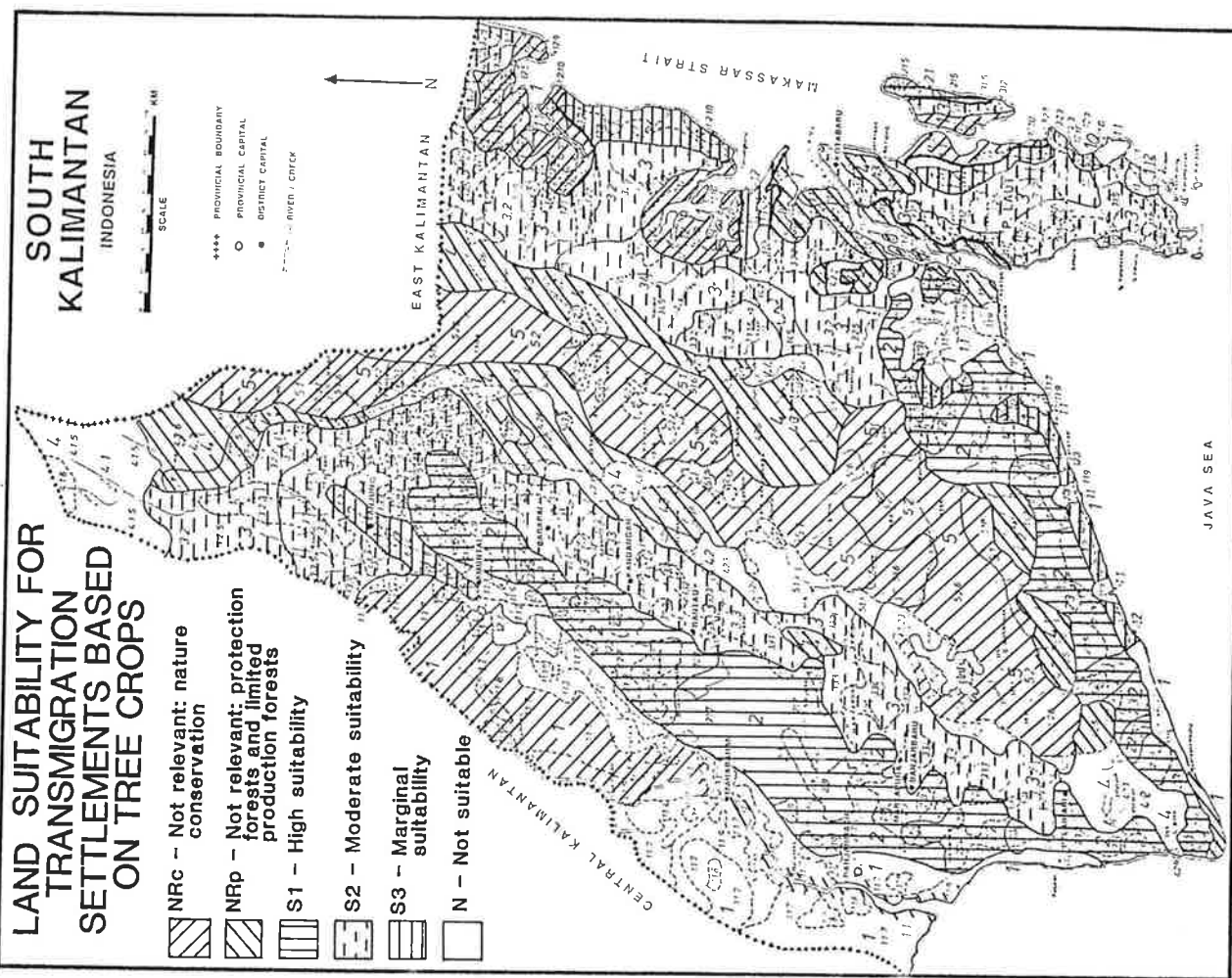
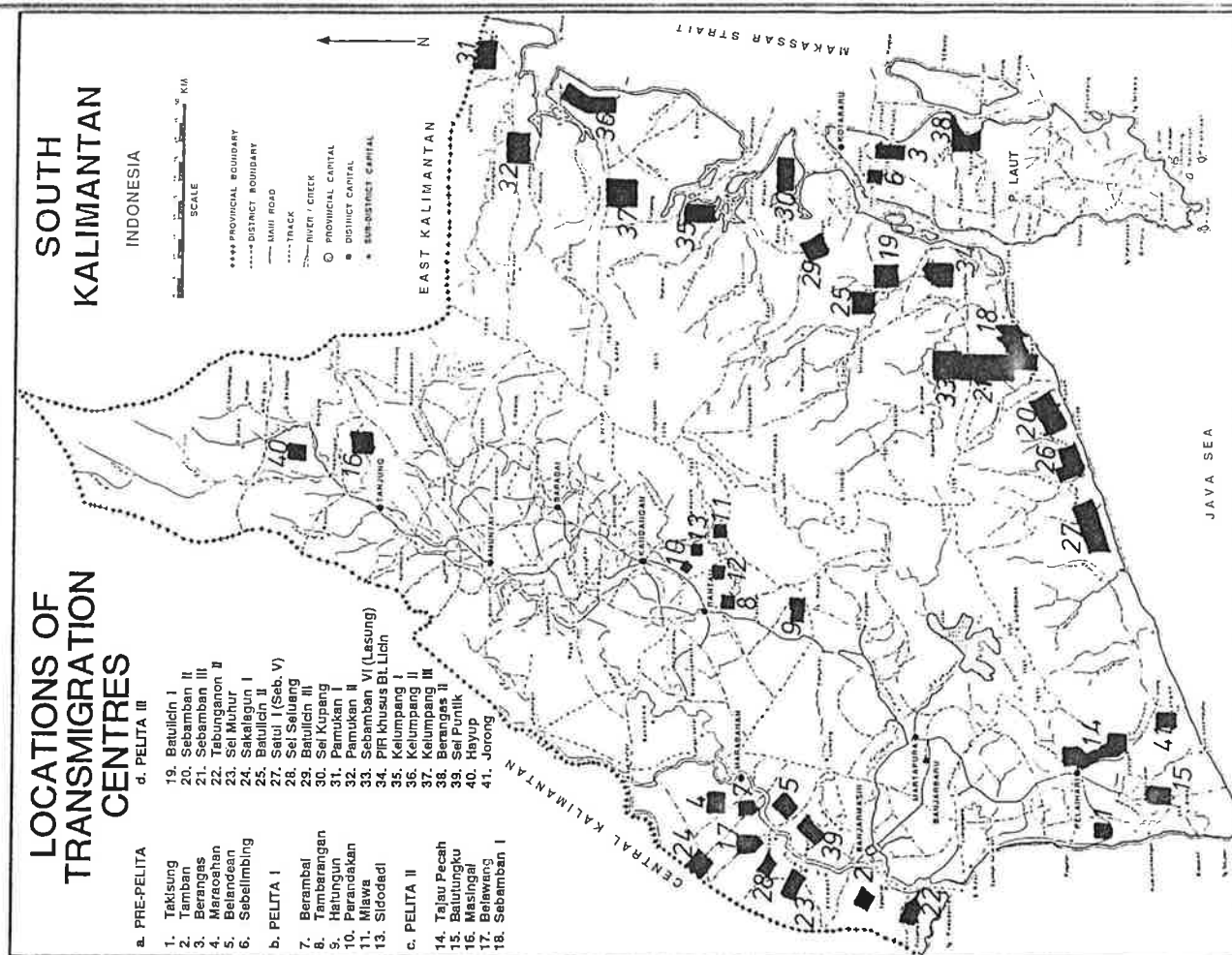


FIGURE 24



11.2 Nature Conservation in Settlement Areas

GUIDELINES

Whenever possible, areas set aside to safeguard samples of natural ecosystems are to be separated from transmigration settlement areas by buffer zones, taking advantage of physiographic and other natural protection features. These are to be maintained under natural vegetation (or artificially planted with trees where the area has been denuded previously). Buffers may be used for any type of economic land-use which does not interfere with the integrity of the protected area.

Settlement areas must not be stripped of all tree and shrub vegetation. Buffer strips are to be left along water courses to a minimum distance of two times the height of the dominant trees.

Housing and roads (see also Section 10) should follow the natural grain of the landscape (on the contour), rather than be laid out as a mathematically ordered rectangular grid laid over the countryside. They should be established with minimum disturbance to the soil and to streambeds.

Avoid forcing all of the alterations to the environment into one Land Component or forest type or into an area defined by one particular species. Determine the minimum permissible area and distribute proportionately over all land types, where possible.

Choose crop models to suit the site.

Minimize interference with water flow. Roads and temporary access should whenever possible be parallel to surface flow patterns, including tides, and not perpendicular. Any unavoidable obstructions to flow should follow natural water divides, when present, or be designed with culverts of sufficient cross-section to accommodate 50 year flood levels. Culverts should be sited as closely as possible to the original major flows, and be deeper than the natural surface.

Avoid filling areas to meet minimum grade requirements. Consider building houses and facilities on stilts, poles and pilings to allow for continued surface water circulation and normal sediment movement.

Selective planting of mangroves and other salt-tolerant plants can be a desirable type of landscaping and resource replenishment in lowland coastal areas inadvertently cleared.

11.3 Social, Cultural, Economic and Health Conditions

GUIDELINES

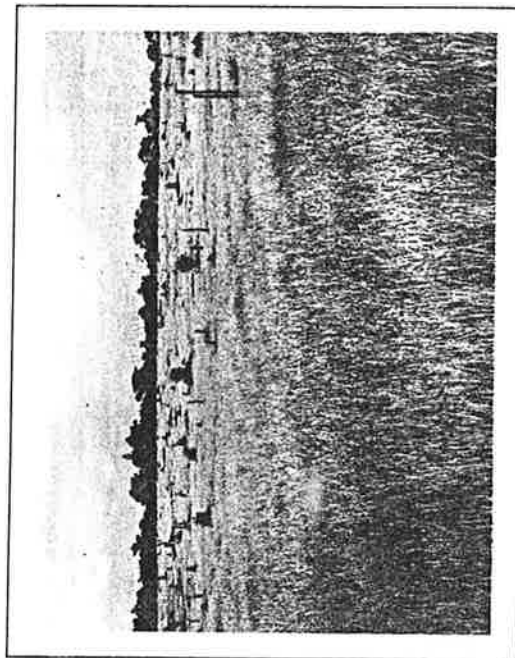
Any proposed resettlements or development of new centres of population are to take into account the present social, cultural, economic and health conditions of those to be resettled and their future needs. Resettlement is to be carried out in consultation with the new settlers and should be planned and timed carefully.

As well as the socio-economic effects, the probable ecological impacts of resettlement are to be assessed in advance and the changes which occur afterwards are to be kept under observation and monitored.

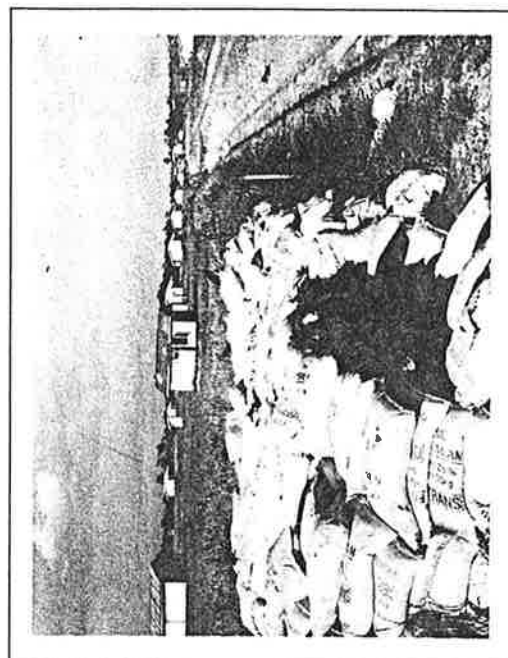
Established settlements must be given the necessary back-up support to ensure settlement failure does not occur in the future.

Migration flows into successful settlements must be controlled to prevent overspill into adjacent unspoiled ecosystems and cause their subsequent degradation.

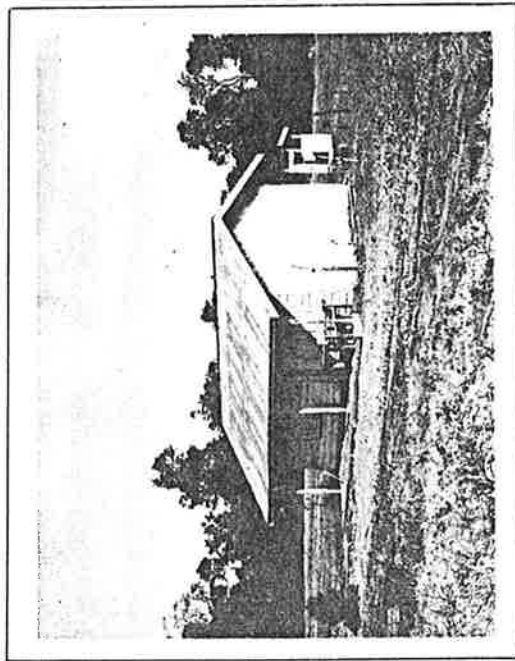
Where waste dumps are established on flatland outside swamp forests and mangroves, but upstream from them, materials leaching from solid waste dumps can be toxic to plant and animal organisms. Containers with chemical wastes gradually deteriorate and leak, and this may lead to serious food chain contamination. Ecosystems and people must be protected from these contaminants by appropriate siting of waste dumps or by leachate collection and disposal.



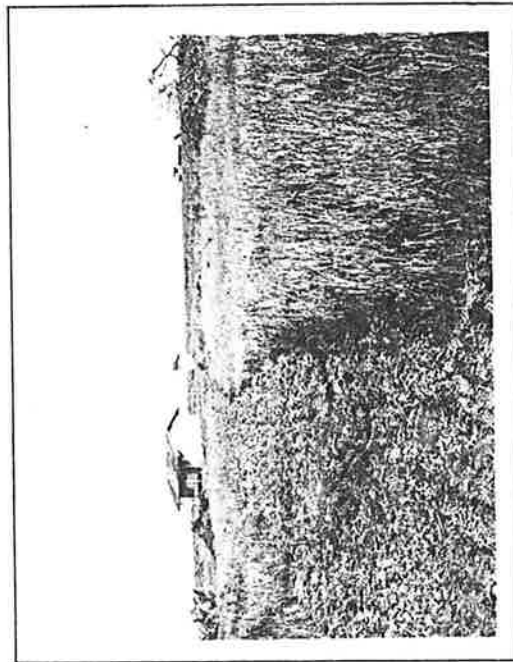
In the majority of cases, transmigration settlements have been located on land such as this which is already in an advanced stage of degradation. Families have been unable to raise sufficient food by practising agriculture based on dryland rice farming on these sites.



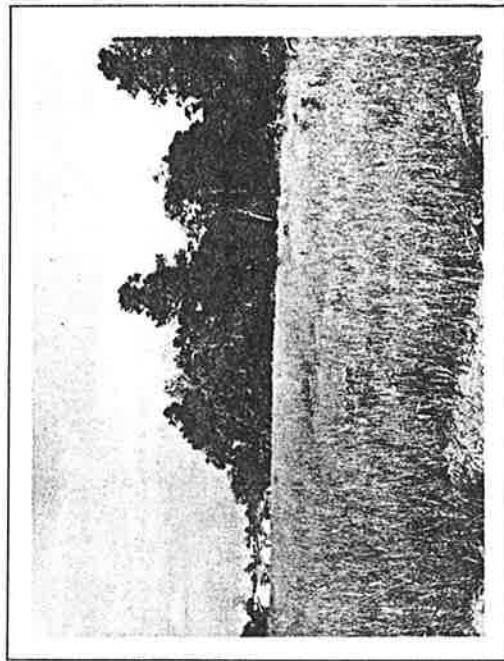
Essential inputs, like these bags of rock phosphate lying rotting in the sun at Alu Jorong Settlement Centre, often arrive out of phase with the transmigrants. Here only one house is occupied.



House and home garden plot provided for a transmigrant family at the Alu Jorong Transmigration Centre, South Kalimantan.



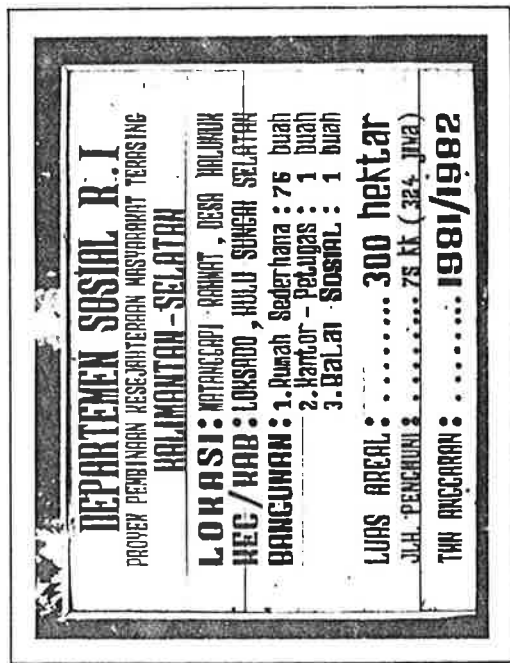
The few remaining trees at Alu Jorong have been pushed over and lie in piles to the left and right hand sides of this photograph, leaving an unbroken landscape of *Imperata* grassland on which, at 2 ha per family, settlers are expected to become self-sufficient in one year.



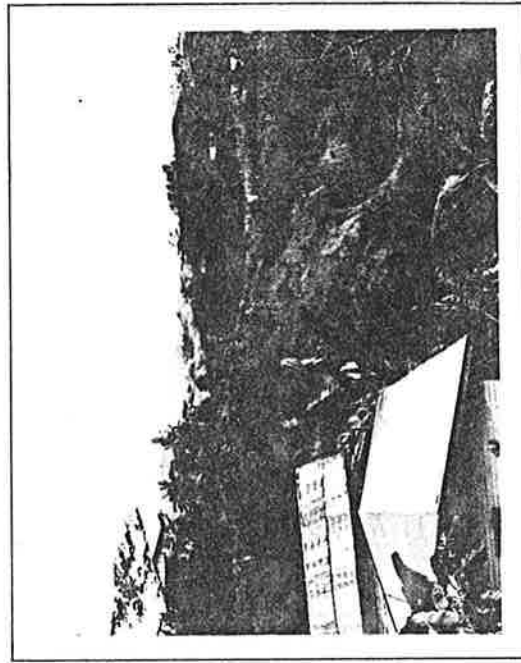
Insufficient streamside buffer vegetation has been left for nature conservation in this transmigration centre. The cleared area being invaded by *Imperata* grass in the foreground is meant for home gardens.



Roughly prepared stream crossing with no culvert or side drains is leading to erosion of the banks and high turbidity of the water at this location within the Alu Jorong Centre.



Not all transmigration is sponsored by the Ministry of Transmigration. This signboard indicates a settlement area sponsored by the Social Affairs Department. The area is 300 ha and 75 families totalling 324 persons were settled there in 1981/82, according to the information on the sign.



A settlement area designed to mix tribal people from South Kalimantan and Javanese in a permanent arrangement. The social pressures thrust on the tribals are enormous and there are usually desertions after a few months.

12. GUIDELINES FOR FISHERIES MANAGERS

12.1 Land Suitability for Aquaculture

Land suitability assessment can be carried out in the normal way by selecting those land components which contain open water at low elevation or are flat enough for pond construction (Fig. 25).

Many mangrove areas are not suitable for aquaculture because of tide, land elevation and soil problems. For example, acid sulphate soils, which are common, are quite unsuitable.

GUIDELINES

Every effort is to be made to retain the natural species diversity in natural water bodies, unless these are allocated for intensive fish cultivation purposes. This is to insure against unpredicted and harmful changes in the river systems which might be caused by reducing the number of species. It is also to buffer the fish fauna against changes of environment and to provide for possible future changes in demand for products.

Introduction of exotic species into water systems is only to be considered after all other possibilities of increasing production, such as the encouragement of selected native species, have been exhausted, and should only then be carried out after careful trials and with stringent precautions. The procedure is risky and chances of escape of exotic flora and fauna into the wild and pollution of natural ecosystems are very high.

In large river systems, regulations for fisheries management are to take into account the riverine spawning migration of many species. Protective legislation designed to maintain a breeding population of such species may need to apply to large portions of any river system and to include also the estuaries.

In planning for any dam or other significant change in river regime, preparations are to be made in advance to manage the fisheries in the period following impoundment or alteration.

12.2 Destruction of Mangroves

GUIDELINES

Mangrove destruction for extended fish pond development may eventually result in decreased natural fish and shellfish production in estuarine and nearshore areas. Maintain mangroves rather than replace them with ponds. Floating cage culture has proven to be a viable method.

The mangrove forest is an extremely productive ecosystem which should be utilized as it is, not replaced unless no other alternative exists.

Intensify culture in existing ponds wherever possible in order to maintain as much mangrove area as possible.

Ponds with decreasing production must not be abandoned and new ponds constructed, but instead pond management practices should be improved to maintain production at economic levels.

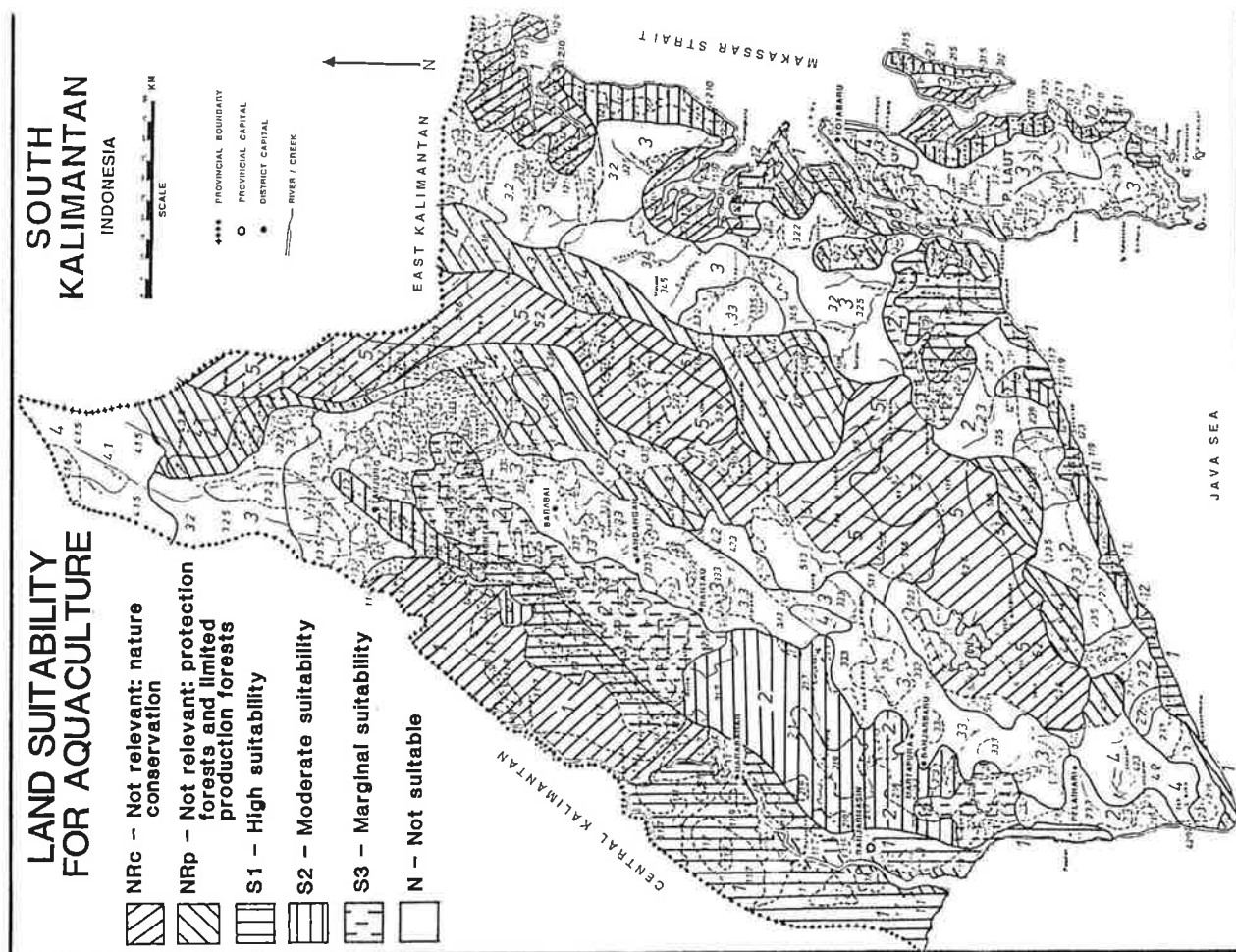
When ponds have to be abandoned, the bunds must be broken open to allow renewed natural flushing and mangrove recolonization of basin areas.

Well designed and constructed aquaculture projects provide conserved buffer zones over 10-30 per cent of the area. Bank stability provided by these mangroves may be very important where large ponds experience wave action.

If there is a choice, pond development must be made first in degraded or severely damaged mangroves before it is made in undisturbed mangrove forests.

Because any harvesting within the mangrove system (e.g., for crabs or oysters on the roots) means frequent re-entry by people, precautions must be taken against cumulative damage to vegetation or soil surface structure for example by provision of carefully located and installed board-walks. The mangrove system is very sensitive to physical disturbance.

FIGURE 25



13. A PROVINCIAL LAND USE PLAN WITH NATURE CONSERVATION FIRST - THE CONSENSUS

13.1 Introduction

Indonesia, which will be primarily an agriculturally-based nation for the foreseeable future, has to bring more land under cultivation to feed its large and rapidly increasing population.

The perceived need to redistribute the population in order to attempt to correct current inequalities in development has put great pressure on the authorities to develop some of the land in the outer islands such as Kalimantan. Much of these outer islands is covered by tropical moist forest and up until recently they have been relatively sparsely populated.

Owing to the diversity of forest land capabilities and locational problems, only a small proportion of the forest lands set aside for conversion according to the present system of land classification are actually suitable for sustained agricultural use. Consequently, there is not sufficient land available for the largest programme of agricultural development, the Transmigration Programme. The reasons for this are largely threefold (Ross 1984):

Firstly, land set aside for conversion to non-forestry uses, agriculture in particular, has been selected on the basis of its unsuitability for forestry, not its suitability for agriculture. Consequently, much of the officially available area is unsuited for Transmigration based on agriculture.

Secondly, more than half of the potential transmigration sites selected by the Ministry of Transmigration on the basis of spatial planning criteria cannot be investigated for their agricultural potential, much less development, because they have been assigned in the past a forest classification which prescribes the retention of permanent forest cover, irrespective of the quality of that cover at present.

Thirdly, the present system of forest classification is deficient in that it does not take into account either the quality of the forest or its potential for sustained production and the development of its productive capabilities. An examination of the forestry potential of some Conversion Forests indicates that they should be retained, either as Protection Forests or as Production Forests. Conversely, some Production Forests are virtually unproductive in terms of their functionally assigned use.

The present "consensus" forest land use plan for the Province (Fig. 2) is inadequate because it contains two major flaws: one, it is primarily a forest land use map, but the quality of the forest for timber production has not been taken into account, as mentioned earlier, and two, little account has been taken of nature and nature conservation in drawing up the map. Besides these two major flaws the plan is also out of date and has been based on inaccurate information concerning actual vegetation cover. The plan should be replaced using the following procedures, with general Indonesian priorities taken into account.

13.2 Sector Bidding

What is required is that, once the various sectors have drawn up their maps and plans giving suitability ratings of the particular sector land utilization types (prepared following land classification and by following the sector guidelines such as can be found in the examples given in the various sections of this Manual), these are submitted to BAPPEDA as "bids" representing their requirements for land.

13.3 Preparation of Provincial Land Use Scenarios

It would be the task of BAPPEDA to juggle the mosaic of land utilization types, trying to arrive at a compromise, or, preferably, derive a number of draft scenarios which attempt to allocate to the various sectors the land they require, starting with each sector's Class S1 land, working down through S2 and so on as required. Political inputs from the Provincial Governor's Office and other information collected by the Research Officers in BAPPEDA would be used in drawing up the scenarios.

One of the first steps is to take each land component from the initial land classification and list against each the suitability classification for each land utilization type, with nature conservation in the first (left-hand) column (Table 23). This table will act as a check-list to assist allocation to each land component of a land utilization type.

It is then possible to begin to build up one or more Provincial Land Use Scenarios accompanied by maps. Here, construction of one example of such a map will be explained.

Using the principal of nature conservation first, the first areas allocated concern nature conservation areas and areas to be set aside for the protection of soil and water resources (Protection Forests).

A place is then found for each sectoral interest in turn, weighted by political and policy considerations, so that the scenario might eventually look like Fig. 26, which might be only one of several realistic suggestions for land allocation in the Province.

13.4 Fine-Tuning-Towards a Single Agreed Scenario

Sector managers and officials must now begin to meet for discussion on the various Scenarios with a view to eliminating all but one. It may be that none is quite acceptable and supplementary Scenarios may be requested to be prepared. In an example of this kind of process given by Davidson (1983) eight Scenarios were prepared for a forest area in Papua New Guinea of which none was exactly like what was felt to be required, but one (No. 3) was close. Another Scenario (No. 3a) was prepared, this went back into discussion again and some further minor adjustments were requested leading to preparation of Scenario No. 3b which was adopted finally as the agreed version by all parties to the Plan.

13.5 Consensus

In the past, decisions by consensus have been made without the full knowledge of the characteristics of a particular piece of land. This has clearly led to inappropriate classification of land and incorrectly assigned land uses in South Kalimantan and elsewhere in Indonesia.

Although "consensus" in Indonesia is a traditionally and socially acceptable method of resolving land use conflicts, until now it has become unnecessarily subjective and short-term oriented, consequently falling short of wise, rational, decision making for present as well as future generations (Ross 1984).

The methods and guidelines presented here are put forward as an objective path to follow. Land classification must be carried out in the beginning independently of any perceived use for the land. Nature conservation must be considered first, as future productivity of natural resources and well being of the people has to be considered.

The traditional method of "consensus" can then be brought to bear at the final stage in arriving at an agreement on a particular Scenario for a land use plan, chosen from among perhaps a number of such Scenarios, prepared according to the ecological guidelines given in this manual, by the technical and professional people who have the most appropriate expertise in such matters.

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15. GLOSSARY AND ABBREVIATIONS

cf.	compare with.
q.v.	see term elsewhere in this Section.
Adat	prescriptive customary law of Indonesia.
Agroforestry	a collective term for systems of land use in which woody perennials (trees and shrubs) are intentionally maintained in association with crops and/or livestock; in agroforestry systems there is both an ecological and an economic interaction between the tree and non-tree components.
Alang-alang	<i>Imperata cylindrica</i> grasslands.
ASEAN	Association of South East Asian Nations.
BAPPEDA	Badan Perencanaan Pembangunan Daerah (Regional Development Planning Board).
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Board).
Benefit:cost ratio	the present value of benefits divided by the present value of costs.
Bina programme	planning directorate in a GOI Department.
BKJH	Regional Office of the Ministry of Population and Environment
BKMD	National Investment Board
Clf	Cost, Insurance, Freight
Compound land utilization type	a land utilization type consisting of more than one kind of use or purpose, either undertaken in regular succession on the same land, or simultaneously undertaken on separate areas of land, which for purposes of evaluation are treated as a single unit (cf. multiple land utilization type).
Concession	An area of forest land over which felling rights have been issued (see HPH).
Concessionaire	the owner of a concession.
Conditionally suitable	a phase of the land suitability order suitable, employed in circumstances where small areas of land within the survey are unsuitable or poorly suitable for a particular use under the management specified for that use, but suitable given that certain other land improvements or management practices are employed.

Conservation forest	(Hutan Lindung dan Cagar Alam). Legally delineated forest which has been selected to preserve unique ecosystems.
Conservation requirements	the land use requirements (q.v.) largely or entirely related to conservation and sustained use (q.v.).
Conversion forest	(Hutan Produksi yang dapat dikonversikan) Legally delineated forest which is not required for the sustained production of wood for industrial purposes, may be converted to other land use, must lie on land below Site Index 175 according to present classification rules.
Critical value	a value of a diagnostic factor (q.v.) which forms the boundary between classes of land suitability rating (q.v.).
Diagnostic factor	a variable, which may be a land quality, a land characteristic, or a function of several land characteristics, that has an understood influence on the output from, or the required inputs to, a specified kind of land use, and which serves as a basis for assessing the suitability of a given type of land for that use. For every diagnostic factor there will be a critical value (q.v.) or set of critical values which are used to define limits of classes of factor ratings (q.v.) or suitability class limits.
DITADA	Directorat Tata Kota dan Tata Daerah (Directorate of City and Regional Planning, Ministry of Public Works)
EACR	Executive Agency: Central, Regional
Economic land suitability classification	a land suitability classification in which the boundaries between classes are expressed, at least in part, in economic terms.
Exploited forest	forest that has had logs extracted in the last 20 years.
Factor rating	a set of critical values (q.v.) which indicate how well a land use requirement is satisfied by a particular condition of the corresponding land quality. (Note: suitability rating refers to the land use requirement; when this rating is combined with the value of a land quality possessed by a given land unit, it becomes a land suitability rating, q.v.).
FAO	Food and Agriculture Organization of the United Nations
FOB	Free on Board (Selling Price)

Forest	
(1) Ecology	an ecosystem characterized by a more or less dense and extensive tree cover; more particularly, a plant community consisting predominantly of trees and other woody vegetation, growing more or less closely together, normally with at least 10 per cent crown cover by trees.
(2) Silviculture/management	an area managed for the production of timber and other forest products and/or maintained under woody vegetation for indirect benefits such as protection of catchment areas or recreation.
(3) Law	an area of land proclaimed to be forest under a forest act or ordinance, but not necessarily covered by trees.
Forest land	
(1) Silviculture/management	land carrying forest (q.v.) or, if lacking, bearing evidence of former forest and not now in other use.
(2) Law	land that has been legally designated as forest land, but not necessarily now carrying trees.
Forest land utilization type	a land utilization type (q.v.) based on forest trees (q.v.).
Forest plantation	forest stands established artificially by afforestation, on land which previously did not carry forest, or on land which carried forest within the past 50 years, or within living memory and involving the replacement of the previous crop by a new and essentially different crop of trees.
GOI	Government of Indonesia
Growth requirements	the land use requirements (q.v.) specifically related to the growth of trees and shrubs.
House lot	a standard area of 0.25 ha on which the transmigrant family is housed (part of the 2.0 ha total).
HPH	Hak Pemegang Hutan (Logging Concession Right)
Inputs	the material inputs (e.g. seed, fertilizers, fuel, chemical sprays) and other inputs (e.g. labour hours) applied to the use of land (cf. outputs).
IUCN	International Union for Conservation of Nature and Natural Resources
KLH	Menteri Negara Kependudukan dan Lingkungan Hidup (Ministry of Population and Environment, Government of Indonesia)

Land

an area of the earth's surface, the characteristics of which embrace all reasonably stable, or predictably cyclic, attributes of the biosphere vertically above and below this area, including those of the atmosphere, the soil and underlying ecology, the hydrology, the plant and animal populations and the results of past and present human activity, to the extent that these attributes exert a significant influence on present and future uses of the land by man.

Land capability classification

(i)

a system for classifying land which is based on its capacity to support agriculture, grazing, forestry or recreational/ conservation use. The system is concerned with the fitness of land to support land use, rather than with productivity, and places emphasis on the risk of soil erosion.

(ii)

description of a landscape unit (q.v.) in terms of its inherent capacity to provide a combination of plants and animals.

Land characteristic

an attribute of land that can be measured or estimated and which can be employed as a means of describing land qualities or distinguishing between land units of differing suitabilities for use.

Land classification

employed here to refer to the system of grouping land (q.v.) on the basis of its landscape characteristics (including vegetation) without explicit assessment of suitability for kinds of land use.

Land component

land (q.v.) with climate, landforms, soils and vegetation characteristics which for most practical purposes may be considered as uniform. A subdivision of a land unit (q.v.), usually the smallest unit used for mapping purposes.

Land evaluation

the process of assessment of land performance when used for specified purposes, involving the execution and interpretation of surveys and studies of landforms, soils, vegetation, climate and other aspects of land in order to identify and make a comparison of promising kinds of land use in terms applicable to the objectives of the evaluation.

Land improvement

an alteration in the qualities of land which improves its potential for land use.

Land mapping unit

see land component.

Land quality

a complex attribute of land which acts in a manner distinct from the actions of other land qualities in its influence on the suitability of land for a specified kind of use.

Land suitability

the fitness of a given type of land for a specified kind of land use.

Land suitability assessment

the subsequent rating of the response of a landscape unit under a certain use, specifically whether that use on that unit will cause unacceptable degradation of resources and therefore not be sustainable.

Land suitability category

a level within a land suitability classification. Four categories of land suitability are recognized:

Land suitability order : a grouping of land according to whether it is Suitable or Not Suitable for a specified kind of use.

Land suitability class : a subdivision of a land suitability order serving to distinguish types of land which differ in degree of suitability.

Land suitability subclass : a subdivision of a land suitability class serving to distinguish types of land having the same degree of suitability, but differing in the nature of the limitations which determine the suitability class.

Land suitability unit : a subdivision of a land suitability subclass serving to distinguish types of land having minor differences in management or improvement requirements.

Land suitability classification

an appraisal and grouping, or the process of appraisal and grouping, of specific types of land in terms of their absolute or relative suitability for a specified kind of use.

Land suitability rating

the partial suitability of a land unit for a land utilization type, based on one land quality or a partial set of land qualities. Land suitability ratings are combined to give a land suitability class (cf. note on factor rating).

Land suitability unit

a subdivision of a land suitability subclass serving to distinguish types of land having minor differences in management or improvement requirements.

Land system

a land area (q.v.) with relatively uniform climate and with a repeating pattern of landforms, soils and vegetation. A land system may be divided into land facets (q.v.) or land units (q.v.).

Land unit

an area of land possessing specified land qualities and land characteristics, which can be demarcated on a map and which is employed as a basis in land evaluation. Land units may have various degrees of homogeneity, according to the scale of survey. A land unit may be divided into land components (q.v.). Note: In FAO (1978) this was termed a 'land mapping unit'.

Land use

a phrase employed in a general sense to refer to any form of use of land by man, in contexts which do not necessarily carry the technical connotation of land utilization type (q.v.).

Land use system	a specified land utilization type practised on a given land unit and associated with inputs and outputs.
Land use requirement	the conditions of land necessary or desirable for the successful and sustained practice of a given land utilization type (cf. growth requirements, management requirements, conservation requirements).
Land utilization type (LUT)	a kind of land use described or defined in a degree of detail greater than that of a major kind of land use (q.v.). A land utilization type consists of a set of technical specifications in a given physical economic and social setting (cf. forest land utilization type).
Landscape unit	a mappable area, roughly homogeneous as to soil, topography, climate and biological potential, whose margins are determined by change in one or more characteristics. A landscape unit is characterized as an ecosystem unit, i.e., the physical structure and relationships of soil, water, nutrients, energy, plants and animals. Delineation of a geographical area as a landscape unit requires differentiation from adjacent units and recognition of similarity to the same type of unit recurring elsewhere.
Limitation	a land quality or land characteristic which adversely affects the potential of land for a specific kind of use (= land constraint).
LPI	Institute of Life Sciences of Indonesia
LUT	Land Utilization Type (q.v.).
Major kind of land use	a major subdivision of rural land use, such as rainfed agriculture, forestry based on natural forests, forest plantations, grazing, irrigated land use.
Management requirements	the land use requirements (q.v.) largely or entirely related to management of a land utilization type.
Mapping unit	The smallest area of land that can be delineated on a map of a particular scale.
Matching	this term is employed in two senses, broader (i) and restricted (ii): (i) the process of mutual adaptation and adjustment of the descriptions of land utilization types and the increasingly known land qualities. (ii) the (specific) process of comparing land use requirements with the land qualities of land units.

Multiple land utilization type	a land utilization type consisting of more than one kind of use or purpose simultaneously undertaken on the same land, each with its own inputs, requirements and outputs.
Multiple use forestry	any practice of forestry which fulfils two or more objects of management, whether products, services or other benefits. (= multipurpose forestry)
Outputs	the products (e.g. wood products), services (e.g. recreational facilities) and other benefits (e.g. wildlife conservation) resulting from the use of land.
Parallel approach	a land evaluation methodology in which economic criteria are included throughout the process of identifying land use requirements and land suitability classification.
Plantation	see Forest plantation.
PSL	Environmental Studies Centre
Production forest Produkt (HP)	legally delineated forest to be used for the (Hutan sustained production of wood for industrial purposes. Selected forest land under Site Index 175, and confirmed by consensus by Provincial Governor.
Protection forest (Hutan Lindung)	legally delineated forest whose function is to protect watersheds from erosion and which is not to be disturbed except in special circumstances. Land over Site Index 175 or on greater than 45 per cent slopes.
Products	see outputs.
Qualitative land suitability classification	a land suitability classification in which the results are expressed in qualitative terms only, without specific estimates of outputs (e.g. timber yields), inputs, or costs and returns. Note: the description 'qualitative' refers to the suitability classification, not to the land evaluation, which is always conducted in quantitative terms as far as possible.
Quantitative physical land suitability classification	a land suitability classification in which the results are expressed in physical numerical terms (e.g. timber yields, amounts of fertilizer inputs) (cf. economic land suitability classification).
Site	an area considered in terms of its environment, particularly as this determines the type and quality of the vegetation the area can carry. Sites are classified either qualitatively by their climate, soil and vegetation, into site types, or quantitatively, by their potential wood production, into site classes (q.v.). Sites may constitute the land units (q.v.) employed in a land evaluation.

SKBED	Surat Keputusan Bersama Empat Dirjen (Regulations issued jointly by four Director Generals).
Sustained use	continuing use of land without severe or permanent deterioration in the resources of the land.
TGHK	Tata Guna Hutan Kesepakatan (Forest Land Classification by Consensus)
Two stage approach	a land evaluation methodology in which a first approximation of land suitability is made on the basis of physical criteria and in which economic and social analysis is carried out as a second stage on the land use alternatives which appear most promising on the basis of physical evaluation (cf. parallel approach).
USDA	United States Department of Agriculture
Wallace line	Imaginary line dividing the Asian and Australian flora and fauna.

Note: Most of the definitions in this section are based on those used by FAO (1976a, 1983a and 1984). Others come from Ford-Robertson (1971), Ross (1984) and Carpenter (1981). Slight modifications have been made to some to fit the context of this Guidelines Manual.