

**Lembaga Ilmu Pengetahuan Indonesia  
and  
National Academy of Sciences, USA  
Workshop on Natural Resources  
Jakarta, September, 11-16, 1972**

**A REPORT ON THE  
LIPI-NAS WORKSHOP ON NATURAL RESOURCES**

**VOLUME I**

**OVERALL FINDINGS & RECOMMENDATIONS  
WORKING GROUP REPORTS**

LIPI-NAS WORKSHOP ON NATURAL RESOURCES

VOLUME I

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## FOREWORD

A week long Workshop on Natural Resources was held in Jakarta September 11 - 16, 1972, to formulate recommendations addressed to one of Indonesia's most critical and complex challenges: how to utilize the natural resources of the country in a manner consistent with the needs and rising expectations of a growing population, the attainment of a harmonious relationship with a culture both old and vital, and the stewardship required to insure future generations their rightful heritage of resources while providing a healthy and productive life to members of the present generation.

Jointly sponsored by the Indonesian Institute of Sciences (LIPI) and the National Academy of Sciences of the United States (NAS), the Workshop had these objectives:

1. to suggest policies and procedures for strengthening the integrated planning and utilization of natural resources;
2. to suggest scientific and technological inputs relevant and useful to the planning and utilization of natural resources;
3. to provide a forum for a coordinated and constructive exchange of views by key scientists, policy-makers, and administrators concerned with natural resources in Indonesia.

The recommendations of the Workshop were submitted to the National Development Planning Board (BAPPENAS) for consideration and use in preparation of the Second Five-Year Development Plan (1974 - 1979). A summary of the conclusions and recommendations was presented to President Soeharto and to his cabinet ministers responsible for economic and natural resources programs.

This report, drafted by a group representing the LIPI Steering Committee and the NAS Panel, is based on the conclusions, recommendations, and background material presented by five working groups and also during

plenary sessions. Volume I contains the overall findings and recommendations of the Workshop, along with the reports of the individual working groups. Volume II includes keynote addresses, the agenda for the week, a list of participants, titles of background papers, and other supporting material. Although the conclusions and recommendations were endorsed by the final plenary session of the Workshop, they do not necessarily represent the views of specific individuals or institutions which were represented there.

The Workshop was attended by about 120 Indonesian participants from more than a score of public and private institutions concerned with natural resources. In addition to the NAS panel of 7 specialists, there were experts from a number of other countries including the Netherlands, United Kingdom, Philippines, Australia, Canada, Thailand, Japan, Malaysia and Singapore.

This report is published with the hope that the observations, findings, and recommendations will be of interest and value to a wide audience in Indonesia and the United States, and among planners, administrators, scientists and engineers in developing countries who are concerned with the wise utilization of natural resources within the broad context of social and economic development and environmental harmony. Additional copies of this report may be obtained free, upon request to either the Indonesian Institute of Sciences or the National Academy of Sciences, the addresses of which are given on the title page.

Since Indonesia's independence, close and cordial relations have existed between the National Academy of Sciences and the Indonesian Scientific Community. The Workshop on Natural Resources was the third in a series of Workshops jointly sponsored by the NAS and LIPI. In May, 1968, A Workshop on Food was held in Jakarta, followed by a Workshop on Industrial and Technological Research held in Jakarta in January 1971. These Workshops are part of the overall program of

the Academy's Board on Science and Technology for International Development, concerned with the role of science and technology in relation to national development.

Support for the organization and facilities of the Workshop was provided by LIPI. Participation of the Academy panel members and staff support was made possible through financial assistance from the U.S. Agency for International Development. The generous support from these organizations is greatly appreciated. Appreciation is also extended to several countries and international agencies for arranging participation at the Workshop, including the Governments of Australia, Canada, Malaysia, the Netherlands, Philippines, Singapore, Thailand, the United Kingdom, UNESCO, F.A.O., and U.N.D.P.

Recognition and thanks are due to the many individuals who contributed long hours and dedicated efforts to make the Workshop a success. Credit must go to the members of the Indonesian Steering Committee, the Organizing Committee of the Indonesian Institute of Sciences, the staff of the National Academy of Sciences who helped with coordination of the Workshop in Washington and Jakarta, and to the Workshop participants whose papers and long hours of deliberation were the essence of the meeting.

Two excellent keynote addresses initiated the deliberations of the Workshop: "Natural Resources and Economic Development in Indonesia", by Dr Widjojo Nitisastro, State Minister and Chairman of the National Planning Board; and "Natural Resources and Economic Development: A Global Perspective", by Dr Joseph L. Fisher, Chairman of the NAS panel. These addresses and 48 background papers prepared by Workshop participants were of great value to the proceedings and are very much appreciated.

Assistance in preparing the Final Report was given by members of the Steering Committee, chairmen and rapporteurs of the working groups and plenary sessions, and selected participants. Preparation of Volume II, and of the Indonesian language edition of the entire Final Report, was the responsibility of LIPI.

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I. NATURAL RESOURCES DEVELOPMENT IN INDONESIA:  
OBJECTIVES AND GUIDELINES

Natural resources, along with the Indonesian people themselves, are the main assets of the country and play a most significant role in the economy of the country. This situation will continue into the future. It is, therefore, in the overall national interest to adopt rules and policies for the utilization of the natural resources in the most efficient manner possible to achieve the greatest benefit to the people and the state as required by the Constitution. The Constitution also requires that natural resources, being national assets, be placed under the control of the state so as to secure their full utilization for the people's welfare.

To meet the constitutional requirements, some firm legislative guidance for the development of natural resources is necessary, while existing bodies of rules and regulations dating back to prewar days must be adjusted, and in some cases abolished or replaced by new ones more consistent with national aspirations. Accordingly, for example, in 1960 the Basic Agrarian Law (No. 5/1960), the Basic Mining Law (No. 37/1960, subsequently amended by Law No. 11/1967) and the Oil Law (No. 44/1960) were promulgated. These constitute the basis for the cultivation of land and the development of mineral resources under a new system.

Nevertheless, even under these new basic laws and other regulations of agriculture, forestry, water, etc. the natural resources can not yet be exploited in the manner anticipated. This can be attributed mainly to the political and economic instability that characterized the post-war situation in Indonesia.

From 1945 to 1959 not much was done in the field of exploitation of natural resources. The activities that existed were primarily limited to the rehabilitation of plantation and mineral resources exploited before the war.

During the 1959 - 1965 period there were a limited number of new natural resources projects which, except for oil, were undertaken and controlled by the state. Typical for this period of economic development were state control and ownership of natural resource projects, with very limited private participation, coupled with an anti-foreign-capital attitude. This was the period in which the Dutch properties in Indonesia were nationalized and other foreign interests were taken over by the Government.

Underlying the Government's economic policy at that time was the concept of the guided economy and guided democracy, introduced under the ever-increasing influence of the Communist and left-oriented groups.

There followed then a new era starting in 1966 with the establishment of the New Order under President Soeharto. A new, more liberal economic policy was adopted with the introduction of the Foreign Capital Investment Law (No. 1/1967) to attract foreign capital for the exploitation of natural resources and for other purposes. The adoption of the new economic policy was made possible by the decree of the Provisional People's Consultative Council (MPRS), TAP/XXIII/1966. Underlying the new overall economic policy are, among other things, the following considerations:

- Utilization of natural resources to the fullest extent to achieve maximum benefits for the people, which is an implementation of the basic philosophy of the Constitution regarding the status and utilization of natural resources;
- Increasing foreign exchange earnings to finance resource and other development projects;
- Utilization of foreign capital, modern technical know how and managerial skills;

- Encouraging and improving private foreign and domestic participation in the development of natural resources, both singly and on a joint venture basis;
- Promotion of the national interest through creation of employment opportunities, training of Indonesian skills, regional development, and utilization of domestic material, services, and other facilities for the processing of raw materials to the maximum extent.

It is in light of the present Government policies that the participants in the Workshop on Natural Resources have exchanged views on a variety of topics relating to natural resource development possibilities and have formulated these views in the form of suggestions and recommendations to the Government.

## II. MAIN THEMES

The natural resources of Indonesia constitute one of its most valuable assets that can be used as a basis for overall economic development. The rich land, forest, water, sea and mineral resources, if developed and managed wisely, can stimulate regional development, provide employment opportunities, supply raw materials for indigenous or new processing industries and raise foreign capital required to finance other industrial development.

The natural resources are the property of all of the people and must be developed for the best interests of the nation - now and in the future. This involves a careful balancing of present use with requirements of future generations, of environmental effects with economic needs, of conservation practices with the competitive situation, and of capital requirements for natural resource development with those of other industries. While local natural resource development will provide regional benefits through new employment opportunities and the creation of needed infrastructure, the financial benefits from natural resource enterprises must be used for the maximum public good. Revenues from oil production in Sumatra or forest production in Kalimantan may be used best for purchasing good and services needed to create other industrial enterprises, rather than be reinvested in the natural resource activity from which they were derived.

### Integrated multiple purpose management

The integrated multiple use of resources offers distinct advantages to developing countries. These opportunities should be evaluated in advance of exploitation. Forest lands may not only supply a raw material for further upgrading but may also be a source of important mineral deposits or a place for recreation of wildlife preservation. Moreover, certain type of forest production can cause serious damage to water resources. Effective multiple resources management and development requires trained personnel at all levels and at every stage of resource exploitation.

It also requires adequate institutional and organizational arrangements, along with a favourable climate established by legislation that is fairly and uniformly enforced.

#### Better resource information

Fundamental to the exploitation of any natural resource is a knowledge of the size, grade, location and physical surroundings in which the resource is found and which is to be developed. Indonesia's knowledge of her natural wealth is limited and an expanded inventory would be valuable in determining priorities of resource development, as well as what should be preserved for future use.

A variety of methods and techniques are now available to develop resource inventories. Some will provide simultaneously information useful for several different resources, but others must be used even if they provide data about only one resource. Some methods require sophisticated tools, equipment and training while others can be carried out with minimum initial expense and operator skills. The recognized need for a greatly expanded inventory of all of Indonesia's natural resources will require the use of a mix of tools and techniques in order to develop, at the lowest cost, the maximum amount of the highest priority information. This would include basic mapping, integration of all available knowledge, use of integrated surveys and a means of collecting, storing and retrieving information collected from all sources, public and private.

#### Regional development

Complete resource data will never be available and development decisions must be based on the best knowledge available at any time. The decision to proceed with resource development must include a determination of what other natural goals will be served, one of the most important being the stimulation of regional development in economically depressed and sparsely settled areas. Regional devel p-

ment of resources cannot only enhance the economic growth of a particular area, but it can be used to achieve population migration. For example priority could be given to those natural resource developments that would result in migration to sparsely settled regions.

#### Domestic processing of resources

Most natural resources now being developed in Indonesia are exported as raw materials since the capital requirements for upgrading are large and the demands for this capital from other sectors is so pressing. Ore, forest products, and ocean resources are shipped to other countries for upgrading and treating for final use. As opportunities arise, a policy to upgrade raw materials to the maximum extent possible domestically should be considered. Not only will this provide new employment opportunities, upgrading of skills, and regional development, but it will result in greater overall economic benefits to the nation than if they were exported as raw materials. Methods should be sought to encourage foreign investors to locate their processing plants in Indonesia rather than abroad, and to make use of local resources rather than importing finished materials.

#### Planning resource development

Planning for resource development will require great flexibility to permit accomodation of constantly shifting world markets and the uncertainties in the quality and amount of the resources available. Setting the priority of development among the different resources will require a balancing of the size of capital requirements, the interest of foreign firms, the amount of regional development that will result, and the potential for producing foreign exchange.

For some resources new technology will be required, while for others, for example ocean resources, present technology will permit effective exploitation now. Thus in the case of forest resources, application of such known principles as "sustained yield" should be integrated into programs as they are developed.

### Use of foreign investment

The analytical process utilized during planning should provide for an efficient, internationally competitive development program that can be carried out by private enterprises, domestic or foreign, or by public enterprises. At present, however, the wealth that can be generated by the utilization of Indonesia's vast natural resources requires large capital expenditures for equipment and tools that must mostly be purchased using foreign exchange. Thus, to initiate resource development, foreign capital must be attracted under terms and conditions that permit a fair return to both the investor and resource owner. Mutual respect and cooperation must be developed between the Government of Indonesia and the large international firms with the capital needed for development. Once a negotiated agreement has been reached under terms and conditions agreeable to both parties, the operations of the contractor should be monitored to insure compliance. The Government must set environmental conservation conditions to be met, but the terms should not be altered frequently or capriciously.

### Need for trained personnel

To inventory, plan and manage the development of Indonesia's natural resources for maximum public benefit will require personnel of many types, of many disciplines, and trained to different educational levels. Geologists, foresters, hydrologists, landuse experts, oceanographers and many other scientifically trained personnel, supported by adequate subprofessional staff, are required. Economists and others capable of integrated planning and of determining the possible impacts on other sectors will be needed, along with personnel capable of administering and managing the enterprise. As sophisticated international companies become contractors to the Government, highly trained managers of equal quality and ability in order to protect the public interest will be required. A crash program should be considered to train not only the most highly qualified personnel, but those at intermediate

and lower levels for each of the resources development stages and for each of the different natural resources.

#### Resource conservation and protection

Resources must be developed with due regard to ecological consequences and to conservation of resources for future use.

The primary responsibility for both resource conservation and protection of the environment lies with the Government. Private enterprise, both domestic and foreign, has to be provided guidelines for development to insure that these aims are achieved. Regional considerations and the nature of the resource will vary so that uniform guidelines are not desirable. Incentive to stimulate better resource management could be offered such as special tax advantages, subsidies, special technical aids, and rewards for superior performance.

#### Government organization

The simultaneous use of several natural resources at one location may require that the government organization be altered so that the various resource values can be managed most efficiently. In addition, where substitution among resources is technically and economically feasible - for example substituting wood, coal, or gas for oil - the organizational structure of government should be such that a final decision can be made at a level that will optimize resource use and economic growth. Where existing institutions inhibit rapid and efficient decision making, consideration should be given to re-ordering government structure or providing the means to ensure cooperation and consultation between responsible agencies. Existing organizations for resource development - inventory gathering, planning and managing - should be re-examined in the light of the greatly expanded demands that are anticipated, the need for multiple and integrated use of natural resources, and the potential for substitution among the resources. A survey may be

useful to examine present organizational adequacy and other aspects of resource management such as present capability, training needs, etc.

#### Role of science and technology

The role of science and technology is extensive, basic, and permeates all levels of activity and all of the natural resources. This will be discussed elsewhere, but the special role that Indonesia might have in research and development requires separate considerations. Developed countries spend vast research and development funds to find synthetics and substitutes to replace the raw materials they import. When they are successful, this can have a serious impact on the markets of developing countries. An example is the substitution of synthetic for natural rubber. On the other hand, research and development to upgrade and make more competitive and economically attractive exportable resources could be very helpful in maintaining or even expanding existing markets. Indonesian research and development could be directed toward further upgrading or enhancing the usefulness of resources which are in abundant supply.

#### New legislation

Some of the new proposals contained in the above discussions and the various recommendations below will require new legislation if they are to be implemented. Existing laws were enacted at different times and treat each of the natural resources in different ways. With integrated and multiple use of resources receiving increased attention, a review of the adequacy of existing legislation in each of the resource areas would be useful as a first step in their possible modification, so as to be responsive to the proposals and recommendations of the report.

### III. SCIENCE AND TECHNOLOGY

In the realization of the full potential of Indonesia's natural resources, science and technology will play a major role. The importance of this role relates to the fact that science and technology underlie the techniques useful to natural resources management and development, and thus occupy an important role at each level of these functions -- inventory, analysis, decision, policy -- and are essential to sound conservation and environmental practice.

The current breakthrough in science and technology in remote sensing is used here only for illustrative purposes. Remote sensing is not a cure-all to solve every problem. But it illustrates the crucial role of science and technology in natural resource development. First, it is a new tool which can be expected to provide several new types of information to give fuller data for the inventory of natural resources. Second, this new and more complete data will increase the probability of arriving at an improved analysis of inventory data, with the consequence that the decision making process will be improved. Next, the management, because of repeatability and timeliness of data, has a tool to give closer control of the march of events during the implementation and operational phases. Last, remote sensing will provide inventory data of unexpected changes such as floods, land-slides, etc., which may intrude upon the management plan, and can also monitor polluting by-products.

One of the new remote sensing methods that is now operational is the Earth Resources Technology Satellite (ERTS). Indonesia is the only Asian country which will receive complete coverage of its territory. Primary use of this data will be for the cartographic process, leading to new topographic maps for the entire country at scales of 1 : 1,000,000; 1 : 250,000 and possibly 1 : 100,000. Second, there will be multi-disciplinary interpretation of the ERTS imagery to determine its value to Indonesian surficial resources. Some field work will be required to provide on-the-ground checks of specific sites.

There is an interesting problem of extension education in science and technology. The benefits of new discoveries are of no value if they are restricted to the laboratories. A link is needed to disseminate this knowledge to the practitioners, be they local forest warders, rice farmers, or fisherfolk.

Frequently the results of scientific and technological advances create upgrading of natural resources. Not only are improved rice strains of increasing disease resistance possible, but there are the possibilities, for instance, of more efficient extraction of metals from their ores.

Science and technology will undoubtedly aid in the discovery of new sources of natural resources. New finds of minerals, oil, and fish appear inevitable in the approaching decades. These discoveries may be due to better inventory techniques internally, while some will undoubtedly occur as the result of the evolution of new concepts, methodology, and instrumentation.

Finally, Indonesian achievements in science and technology, in order to contribute to the discovery, development, and management of natural resources, require the continuing production of imaginative, creative Indonesian men and women who have been given appropriate educational opportunities to participate in these events. Technical and scientific education is expensive, but the nation that does not perform the education function properly is doomed to see men from other nations operate freely within their territorial limits, for the world has increasing need of raw materials. The other alternative - withdrawal and isolation - is undesirable and unacceptable. The scientifically and technologically impoverished nation will not have the basis to determine its own course and can only drift like a boat without a rudder.

From the above it is clear that science and technology are extremely important for the exploration, inventory, development, management and orderly production of the natural resources. Frequently, science and

technology represent the forefront of a nation's advancement and progress, and, as such, are constantly offering exciting challenges. If a nation is unprepared to accept these challenges, it can never hope to attain its full potential nor to meet the established goals and aims for its people.

#### IV. MAJOR CONCLUSIONS AND RECOMMENDATIONS

Indonesia, already the world's fifth most populous nation, is experiencing a rapid increase in population, while productivity and per capita income remain at relatively lower levels. The wise use of the country's natural resources is essential, therefore, if progress is to be maintained in social and economic development.

The soil, air, water, forests, ocean, and minerals of Indonesia provide the basis for human activity. These resources give food and shelter to the people. Beyond basic necessities, however, natural resources provide commodities which earn income for the nation and provide jobs. They serve as a source of energy. They absorb and carry the wastes and by-products of human activity and industry. They furnish a place for recreation and the enjoyment of nature. Few aspects of national life and culture are unaffected by the natural resources base and the way in which it is used.

In a very real sense, then, natural resources are part of the wealth of the nation. Like any stored-up treasure, they cannot grow or be useful unless carefully tended, nor can they be easily recovered if they are squandered.

Indonesia has a resource base which in some cases is not fully utilized and in others not fully known. At the same time, certain resources are now being exploited at explosive rates. Given these circumstances, given the constraints on capital, special skills, and physical infrastructure, and given the pressures and demands of a fast-growing, in many cases densely-settled population, natural resources are a critical factor in Indonesia's continuing effort to achieve social and economic progress.

The Workshop concludes, therefore, that the wise and efficient use of Indonesia's natural resources should receive priority attention, from the highest levels of government to the individual citizen. The nation's information about its resources must be expanded, its capacity to plan

and manage its resources must be strengthened, and its policies and laws for regulating resource use continually evaluated in light of changing conditions and needs. Otherwise there is a danger that irreplaceable resources will be expended without the development of suitable replacements, or that potentially renewable resources will be lost unnecessarily.

The following general recommendations are addressed to needs which the Workshop has identified in relation to the best use of Indonesia's natural resources. The recommendations are broad but represent critical areas which embrace a variety of resources, disciplines, and public and private organizations. These recommendations are supported by more than one hundred detailed recommendations which suggest specific ways of implementing the general recommendations. The detailed implementing recommendations, which were prepared by each of the five working groups of the Workshop - Land and Soil, Forest, Energy and Mineral, Water, and Ocean Resources - are contained in Part II of this Volume.

#### INTEGRATED DATA ACQUISITION AND USE

An integrated approach should be used in the gathering storage, and dissemination of data on natural resources; a central facility should be established to coordinate the work and serve the various public and private users.

The acquisition of basic resource data and maps is a prerequisite for national planning of natural resources utilization. Good information is essential to the projection of resource reserves, and thus to relating supplies with future domestic and export demands. Resource information is necessary to guide decisions on future capital investment, on the training of various types of skilled manpower, and on the economic development of various regions of the country. As a nation with a relatively high level of foreign resource investment, Indonesia needs

good sources of resource information in order to negotiate and monitor contracts effectively. These essential functions will best be served if Indonesia establishes priorities for data collection, and insures maximum coordination of information gathering techniques among various governmental agencies. A central facility for the storage, analysis, and dissemination of resource information is essential. Arrangements should be continued and enlarged whereby data are collected from private as well as public sources, and in exchange information is furnished to both sectors.

#### MULTIPLE PURPOSE PLANNING AND MANAGEMENT

The planning and management of Indonesia's natural resources should be approached in a comprehensive way, emphasizing the inter-relations among resources and the effects development for one resource has on other resources.

Resources are part of the whole fabric of the earth and do not exist in isolation from one another. Poor management of a resource may well have adverse effects not only on that resource but on others. The indiscriminant cutting of forests can lead to soil erosion, siltation of streams, destruction of wildlife, and a change in air movements and temperatures; analagous examples could be cited for other resources. It becomes essential then, to plan and manage resources in a comprehensive way, evaluating the costs and benefits of utilizing one resource in relation not only to economic factors, but possible impacts and costs to other resources. In many cases, comprehensive planning and management will require viewing resources in a regional context based on relevant ecosystems. Sound resource planning should also enable the establishment of priorities among competing uses for a particular resource. Such approaches to planning and management will require new types of multi-disciplinary training, new organizational approaches, and new incentives.

### ENVIRONMENTAL QUALITY

The growing and crucial importance of environmental quality should be recognized in all aspects of Indonesian life and throughout the government. A special study of these problems and means for dealing with them is desirable for use in preparing a basic law on the subject.

The protection and improvement of the natural environment of land, forest, water, seas, air, and wildlife have become necessary and will become more so as population and economic development proceed. This subject no longer can be considered as an after-thought, if at all. Denuded land and forest areas make little contribution to the economy or to the livelihood of the people. Polluted streams and ocean areas are a hazard to the health of the people, to aquatic life, and also constitute an ugly nuisance. Air pollution already can be observed in the large cities where, in addition, lack of adequate planning of land uses for housing, transportation, industries, commercial buildings, and water, sewer, electric power, and communications lines hinders efficient urban development. Numerous environmental quality standards will have to be promulgated and enforced covering water and air pollution, forest cutting practices, ocean dumping, location of urban facilities, handling of solid wastes, etc. A national commission made up of government officials, public health experts, scientists, resource managers, and others should be appointed to look into pollution and other environmental matters. This commission should prepare recommendations on how a higher quality natural environment can be achieved. The conclusions and recommendations of this study could be the basis for a comprehensive national law and policy on environmental protection.

### FOREIGN PARTICIPATION IN RESOURCE PROGRAMS

Continued improvement in cooperative arrangements for resource development along lines that have been worked out by the government should be sought, not only for energy and minerals but in forest products and other suitable fields.

The Indonesian mining industry should be expanded from the mining of ores to include intermediate processing and manufacturing of the final consumer products. The current climate of political and economic stability encourages the flow of outside capital and management skills which are available only in limited amounts within Indonesia. The minerals industry in particular requires massive investment. Long-term objectives should be two-fold: the evolution from resource exploitation to fully integrated processing and manufacturing sequences within Indonesia, providing employment opportunities for a larger segment of the population; and decreasing dependence upon foreign contractors, as the production of adequately trained personnel and the means to acquire capital equipment increase. For the non-mineral resources the capital mobilization required is smaller. Foreign participation through contracts with the appropriate government agency might be open on a basis patterned on the minerals model with Indonesian sovereignty as the guiding principle. A climate of long-term economic and political stability will contribute to success for these other natural resources as well.

#### TRAINING OF RESOURCE PERSONNEL

Additional personnel should be trained at all levels for research, planning and management of resources.

As the Indonesian economy grows and diversifies it will be necessary for the resource base for this development to be handled wisely. This means that additional skilled personnel will be needed for research, planning, management, and other important tasks. Among those needed will be more managers for land, water and forest programs; conservation and environmental protection offices; lawyers and accountants skilled in contract negotiation and enforcement; and research scientists in biology, geology, soils, genetics, hydrology, oceanography, engineering, economics, anthropology, geography, and other fields. Especially important

will be an adequate number of persons able to apply broad policies and plans of the government in the various sectors and regions of the country. Training facilities will have to be expanded and new teaching programs created in universities, institutes, schools, and elsewhere. In some instances more teachers will be necessary. In the long run resource conservation and development will depend more on the people charged with doing this work than on any other single factor.

#### ORGANIZATION FOR RESOURCE DEVELOPMENT

The structure and functioning of resource agencies of the Government should be examined to find ways of improving performance in planning, management, and other essential activities.

In view of the rapidity of change in the responsibilities of the Indonesian Government for a variety of resources and resource situations, it is not surprising that there is need from time to time to appraise the suitability of the existing Governmental structure to meet needs and administer programs with increasing effectiveness. This is especially necessary as the pace of development quickens and as concern for the protection of the natural environment and the conservation of depleting resource stocks rises. Particularly pressing is the need for better coordination of the various ministries and agencies having responsibilities for single sectors and programs. Many of the nation's resource problems spread across older organizational boundary lines. The acquisition and storage of data, and to some extent its analysis and presentation, can be done centrally to good advantage. Land, water, and forest programs frequently are closely related, as are the various resources in and under the ocean. New problems of resource conservation and environmental pollution call for new responses in governmental organization. Planning is coordinated by the National Planning Board (BAPPENAS); this should be matched by similar

coordination in administration and operation of programs. A study undertaken by a national commission focusing on problems of governmental organization for natural resources is recommended.

#### RESOURCE SCIENCE AND TECHNOLOGY IN NATIONAL PLANNING

Science and technology for the development and conservation of natural resources should be emphasized in the Second Five Year Plan as providing the foundation for intelligent resource development. LIPI should be given the responsibility for furnishing analysis and recommendations on this subject to BAPPENAS.

The use of scientific and technological information and insights for national planning should be expanded and made as effective as possible. Nowhere is this more necessary than in respect to planning for resource conservation and development. A beginning was made in the First Five Year Plan; more definite status should be accorded to research and development (R & D) in all its aspects in the Second Five Year Plan. Attention should be given to basic and especially applied research, to education and training of personnel, to necessary equipment and laboratories, to field experimental facilities, and to other required research infrastructure. Funds should be made available in appropriate amounts in the relevant sections of the Plan. The concept of long-term planning is especially necessary not only because of the basic importance of science and technology to resource development, but also because of the long lead time between initial expenditures on R & D and the achievement of useful results. As the principal agency in the country for promoting science and technology, LIPI, in cooperation with other agencies concerned with science and technology, should clearly be charged with the task of advising with BAPPENAS on the R & D components of the national plan, as well as with other agencies having significant activities or need for R & D.

## ENERGY POLICY

A comprehensive national energy policy should be established for Indonesia.

The energy industries, especially petroleum, have become exceedingly important in the Indonesian economy. About half the foreign exchange earnings of the country arise from this resource. Larger amounts of foreign capital are being invested in oil exploration and development. Possibilities exist for spreading economic gains through supplying inputs of materials and infrastructure, furnishing employment, and processing of resultant products, or using them in related industries. Although the various sectorial policies relating to energy resources are being improved, especially through the development of the work-contract system (Kontrak Karya) and production sharing, there is need of greater coherence of the numerous elements of energy policy. The growth in demand for energy from the various consumer sectors projected into the future according to the national objectives and practical realities, has to be related systematically to the estimated reserves and production possibilities, with appropriate allowance for sales in foreign markets.

Environmental constraints, increasingly important to all people, need to be worked out in a comprehensive and realistic manner through appropriate laws, regulations, and enforcement .

At the broadest level a national energy policy should aim at efficiency of development, through improved technology management, a proper rate of development (conservation), a sustainable balance between exploitation and environmental protection, fair treatment of foreign firms based clearly upon Indonesian sovereignty, and attention to the special problems of employment and stability.

The comprehensive national energy policy should consider all sources of energy including petroleum, natural gas, coal, hydro-electric

geothermal, nuclear and forest fuels and should strive to achieve a balance between them according to the potential contribution of each.

To implement progress toward a national energy policy, it is recommended that existing efforts by Government officials be increased and expanded to analyze the problem and prepare of necessary laws, administrative orders and regulations.

#### NATIONAL LEGISLATION

The proper development of several natural resources requires the adoption of integrated basic laws for each one.

Presently, no comprehensive basic laws exist for the management of natural resources. The mining law of 1967 is added to several other laws; the basic law for ocean resources exists only in draft form. Landuse, water, and forestry also lack comprehensive basic laws, as does environmental protection. For each natural resource a fundamental law is needed setting forth the national philosophy, aims, objectives, and development requirements to insure the orderly development of the natural resources in accord with fair and equitable guidelines covering the distribution of benefits, the sharing of costs, and the emphasis placed on different regions.

#### IMPLEMENTATION OF THE FOREGOING RECOMMENDATIONS

The major recommendations set forth in the preceding pages should be implemented in the Second Five Year Plan and other appropriate ways. As a follow-up to this Workshop LIPI and NAS should continue their cooperation in advancing the conservation and development of natural resources for the welfare of all Indonesians. LIPI, of course, will also wish to seek cooperation with scientific organizations in other countries - or with international scientific organizations - on natural resources problems.

The Five Year Plans are instruments by means of which the development problems and opportunities of a nation can be examined systematically and put in long-term perspective. The Workshop strongly recommends that each of the foregoing major recommendations be considered by the appropriate divisions or bureaus of the Government (land, water, power, minerals, fisheries, forests, etc.) and of course by BAPPENAS, the overall national planning board. In some instances the implementation will have to be continued over more than one five year plan; in such cases a good beginning should be made in the Second Five Year Plan. To assist in this, LIPI and NAS should continue their cooperation, begun so well in this Workshop, through appropriate follow-up activities. These activities might include consultations on special topics, joint evaluation of progress made along certain lines (for example, establishment of a resource data collection and analysis center, or a comprehensive resource training program), the fitting of resource sectoral and regional factors into national plans, etc.

**REPORT OF THE WORKING GROUP ON**

**LAND AND SOIL RESOURCES**

REPORT OF THE WORKING GROUP ON  
LAND AND SOIL RESOURCES

I. DEFINITION

The terms land and soil resources in this Report are used in two ways:

- a. Land as space, so that the development of land resources implies the organization of land use in ways which bring about optimum productivity in terms of the particular site and its place in wider biotic, hydrologic, social and economic systems.
- b. Land and soil as producing media. Water availability and use is an important factor in analysing land resources from this viewpoint. Land resources should be conserved, enhanced and used in the most effective way to ensure current production and continuous maintenance and growth of production for future generations.

II. BACKGROUND INFORMATION AND FUTURE POLICIES

A. Introduction

Work on land and soil resources in the Government of Indonesia is carried on by a number of different agencies including the Departments of Agriculture, Internal Affairs, Public Works and Power, while topographic mapping is the responsibility of the National Co-ordination Board for Surveys and Mapping, cadastral mapping by the Directorate of Land Registration, geological mapping by the Directorate of Geology, landuse mapping

by the Directorate of Landuse, and soil mapping by the Soil Research Institute.

The status of work in topographic mapping, landuse mapping, and soil studies is reviewed briefly here :

B. Current Status of Topographic Knowledge

1. We must acknowledge as a bitter fact that our knowledge of our natural resources and our national territory is still very minimal. One of the main means for basic inventory of natural resources is the availability of basic maps. The map that fulfills the requirements as a base map for inventory as well as for exploration and feasibility studies is the topographic map at a scale 1 : 50.000.
2. Out of 1,899,731 km<sup>2</sup> of the land area of Indonesia, only 254,345 km<sup>2</sup> or approximately 13% has been covered with geodetic-controlled maps at a scale 1 : 50,000, and approximately 26% of the country has been covered with compiled maps at scales 1 : 100,000 and 1 : 250,000. Some areas in Java and Bali were mapped at 1 : 25,000. The rest of the country has been covered with sketch maps at various scales.

Most of these maps are out-of-date, since they were based on surveys from the first quarter of this century and relatively few have been updated in the last 25 years.

3. Aerial photography has been conducted since 1950. However, only during the last four years have aerial photographs become widely and extensively used in surveying and mapping activities, in conjunction with natural inventories. The most economic photo scale for basic inventory of

natural resources, and at the same time for basic mapping, is the scale 1 : 40,000 and 1 : 50,000. This is partly due to the cloud conditions, only 362,000 km<sup>2</sup> of the land area has been covered with photos at these scales, while about 412,000 km<sup>2</sup> has been covered with photos of scales ranging from 1 : 5,000 to 1 : 20,000. Due to cloud conditions it is very hard to obtain photos at smaller scales.

4. Since the first Five Year Plan, Indonesia has begun a systematic mapping program covering a new area in West Kalimantan (65,000 km<sup>2</sup>) and South Sumatra (121,000 km<sup>2</sup>) using photogrammetric methods. From the available aerial photos, photo-maps can be produced for many purposes, including the inventory of natural resources, before line maps are available (which will take a process of up to 5 years from the start of the survey).
5. As Indonesia is now taking part in the ERTS Program, the space imageries which will be made available to Indonesia by NASA during this last quarter of this year will be a valuable tool for updating maps of 1 : 250,000 and 1 : 1,000,000 scales, besides providing for interpretation purposes.

#### C. Current Status of Land Use Information

1. Types of data available include :
  - (a) rural landuse data emphasizing use classes which have spatial components;
  - (b) urban landuse data;
  - (c) land capability data;
2. Data is presented in the form of maps and will eventually be issued in tables with areas of the respective landuse classes;

3. Scale of production is related to the largest scale of the topographic map coverage.
4. 11 provinces have been completed for landuse mapping and 10 provinces are in progress. Capability surveys are being carried out in 11 provinces where use inventories have been finished.

D. Current Status of Soil Inventory and Mapping

1. Types of data available consist of:
  - (a) soil properties, morphological and chemical data and its distribution
  - (b) land capability classification data
  - (c) soil fertility and productivity data
2. The data is presented in the form of maps at different scales depending on the purpose and the priority areas:
  - (a) generalized soil map with total coverage of all the islands
  - (b) Java, Sumatra, Kalimantan and other islands at the scale of 1 : 1,000,000 with coverage of about 100 million hectares
  - (c) Java, Bali, Lombok, Sumbawa, South Sulawesi, part of West Kalimantan, Lampung, South Sumatra, and part of North Sumatra at the scale of 1 : 250,000 with total coverage of about 33 million hectares
  - (d) Several important areas in Java, Lampung, South Sumatra and other islands at the scale of 1 : 200,000 with total coverage of about 600,000 hectares, and at the scale of 1 : 50,000 with coverage of about 400,000 hectares.

### E. Current Status of Cadastral Mapping

Till the present moment only 5% of landownership has been registered by the Cadaster. For the purpose of registration in a system similar to the Terren System, cadastral maps are needed at scales of 1 : 1,000 to 1 : 5,000.

To speed up this mapping work the policy is as follows:

1. for rural areas where the price of the land is ~~not~~ yet high, rectified photo maps will be used, from which line maps can be derived.
2. for urban areas a combination of terrestrial survey and photogrammetry will be used to produce line maps.

To ensure internal social and political stability, and as a tool for the agricultural/economical development (loans, security landownership, etc.), the registration of land has to be finished in a relatively short period. Priority will be given to urban areas, cultivated lands and fast developing areas.

### F. Future Policies

#### 1. Goals

The preceding outline of the current status of land resource data in Indonesia indicates the most important goals for the future. In order that the country can use its resources wisely, an adequate topographic map base is urgently required. Such a base is a fundamental resource for geological and mining exploration, for irrigation and agricultural development, for forestry inventory and development, and for many other development purposes. An integrated concept of land use and land development is vital to the maintenance of the

resources of all of the country, but is especially vital in Java, Bali, and Lombok, where there are high population densities. Management of land resources equally demands a clear knowledge of current conditions and clear policies for future use and conservation. Soil studies and analysis of land potential are a prerequisite for the development of new agricultural areas and for improvement in production in other areas. The proper registration and demarcation of land is needed equally in order to encourage steady rural programs.

## 2. Considerations

With regards to prevailing conditions, Indonesia can be divided into two parts : (a) Java, Bali and Lombok, (b) the other islands

(a) Java, Bali and Lombok are characterized by:

- (i) dense population that will remain so for a long time to come
- (ii) ever increasing speed and variety of economic activity
- (iii) a large majority of farmers with very small acreages
- (iv) relatively low productivity in agriculture but with a greater possibility of increase in productivity
- (v) conservative attitudes with close attachment to homesteads

(b) the other islands are characterized by:

- (i) low overall density in population
- (ii) localized opportunities for economic progress
- (iii) relatively low productivity in agriculture

To allow continuous increase in the productive capacity of crop lands, to maintain a proper balance between use and conservation in forestry and catchment areas, and in order to create a harmonious and efficient use of land for production, conservation, recreation and man's other activities, the Working Group makes the following recommendations. These recommendations are oriented towards improved knowledge of our resources and better planning analysis, together with efficient management of land resources. Towards these ends, policy and legislative proposals are made.

### III. GENERAL RECOMMENDATIONS

- A. It is proposed that a study group be set up to examine the feasibility of, and set out specifications for, a central data storage and information system for natural resources data.

Information gathering for natural resources development will increasingly rely on integrating mechanisms such as air and satellite photography. As we move to integrating concepts of resource management, data collected by any one agency will become increasingly significant to related agencies. A centrally organized data bank with open access to users could considerably reduce costs of inventory work and provide a necessary integrating focus for natural resources development. Such a central data storage and information system will facilitate development planning and decision making.

- B. It is recommended as a guide line that an integrated approach to resource data inventory should be made through an agreement on objectives, a coordination of activities, and common use and common exchange of the results of surveys.

While it is possible that in the long run it may be necessary to contemplate changes in administrative structure in the resource field, it is felt that for the present it is best to maintain existing departments and to work towards a much higher level of cooperation between them. This workshop has already shown promising trends in this direction.

- C. It is recommended that training of Indonesians in the technical skills necessary for inventory, analysis and management of land and soil resources be given high priority.

Available manpower is inadequate for even the most pressing needs of this sector. Deficiencies are most serious at middle level technical grades. A range of specially focussed training courses, both in-house and institutional, is necessary.

- D. Integrated efforts should be adopted in the management of land to ensure its harmonious and efficient use.

Land use and misuse in one category can affect a whole land or hydrological system; for example, cutting of forest may cause severe erosion and silting of reservoir and irrigational canals downslope. Management practices need therefore to utilize land and water in a coordinated manner for the common good.

- E. Government needs to apply restrictions in the free use of land through appropriate regulations, proper taxation systems, and sounda land administration.

This arises from recommendation (4) and is necessary to ensure integrated land and water management.

#### IV. SPECIFIC RECOMMENDATIONS

##### A. Inventory

1. A national topographic base map at a scale of either 1 : 50,000 or 1 : 100,000 should be made.

Basic topographic data is needed for a wide range of purposes, ranging from forestry and mining studies to the location and execution of water control works. In the long run, full national coverage is needed. The scale of mapping would depend on the development status of the area.

2. As a first step in speeding up the production of topographic and other information before line maps can be produced, it is recommended that rectified air photo maps at scales 1 : 100,000 or 1 : 50,000 (whichever is most economical) be produced.

Line maps are accurate documents which before their final printing need several stages of adjustment and drafting. They normally take up to 5 years to produce, and adequate qualified personnel and facilities are not yet available to step up this production. While air photo maps do not show contours and are less accurate, they can be used for a variety of purposes and can be produced much more quickly than line maps.

3. Cadastral maps at a scale from 1 : 1,000 to 1 : 5,000 need to be produced in much greater numbers in the next five years.

Cadastral maps are usually detailed maps of land holdings. Until such survey work has been done, it is impossible to give proper title to the land. These maps therefore vital for taxation purposes, for laying out plots in development areas, and are also needed for the owners to obtain loans or compensations against their lands. Such loans or compensations may be a vital part of rural progress in some areas.

#### B. Analysis and Planning

1. In terms of priority for land resource analysis it is recommended that first priority be given to areas especially designated by BAPPENAS. At the same time there is both opportunity and necessity for analysis and policy making on Java, perhaps initially tackled in a Workshop.

The priority to designated areas in an obvious one in light of the need to promote rapid resource data development. In Java, the problems are pressing and the data generally available. In this case, a workshop forum would bring a range of technical and other interested agencies together in an initial integrated approach to an urgent national problems.

2. The responsibility for management of land resources at the regional level should be the responsibility of the Badan Perencanaan Daerah (Regional Planning Board).

Management of land resources needs a coordinating forum, which the regional planning board can provide. However, in a number of cases the national resource boundaries don't

coincide with administrative boundaries, and in these cases, coordination and cooperation will be needed, perhaps with formation of joint sub-committees where major catchment areas are involved.

C. Management, Policy and Legislation

1. In order to manage land for the best possible use, the Government needs to obtain the legal right to assign functions to, and/or restrict land use for the common good. In so doing, proper respect needs to be paid to current land title.

The recommendations on management of land use and the urgent development and conservation priorities can only be properly implemented if legal rights of this nature are obtained.

2. The present law relating to land status and land rights, needs to be reviewed to ensure the execution of proper land management, including land use planning.

Although there is a basic law on land, the prevailing conditions on land titles and rights are still in a state of confusion. The situation does not permit the execution of sound land management and use policies.

3. Authority concerning land should come under the Department of Internal Affairs.

In order to ensure a single management of land, the Government should be represented by the Department of Internal Affairs, which due to its structure and function has direct authority in the region.

Included in this management is the right of this Department to grant custodial rights to other Departments, such as the Department of Agriculture for plantation estates, forestry, conservation areas, etc., the Department of Mining for concession areas, etc., the Department of Industry for industrial estates, etc.

4. An accelerated program for inventory and data collection will be needed in the early stages of the Second Five Year Plan. At the same time, a policy and program for resource inventory on a long term and systematic basis needs to be initiated. Both of these should be incorporated in the development budget.

Since the next Five Year Plan proposes many new projects, data collection for the implementation of these projects will be an urgent need. There will also be a need for an accelerated inventory of data to designate and protect critical conservation areas. Knowledge, inventory, and mapping of natural resources of the whole country for proper long term utilization is a prime responsibility of Government. A systematic approach is also the most economical and efficient long term method. Hence, a long term inventory policy is needed.

5. The proposed long and short term planning requirements lead to a need for adequate educational and training facilities both of university graduates and technicians. Maintaining adequate research facilities is equally important.

Once long term plans are developed, training and educational needs will have to be spelled out.

Curricula will need to be oriented toward the needs of the situation and should be reviewed regularly in order to keep pace with changes in technical and scientific knowledge and local needs. Specific training programs need to be developed in each sector, together with more general regionally oriented resource management courses.

6. In school and adult education in the field of resource use, conservation and ecological problems should be encouraged.

Only when local inhabitants, who are often also managers of local resources, are fully aware of their role and responsibility, will it become possible to properly organize and involve them in local resource development and conservation. The importance of this recommendation cannot be over emphasized.

7. An important long term need is to initiate and maintain a campaign to arouse land conservation awareness.

This can be done in a variety of ways, through inclusion of conservation in school curricula, through radio and newspaper media, through village councils and through many other media or agencies which reach down to village level. A significant part of this program needs to be aimed at Government agencies and officials so that they may become examples in land conservation practices.

8. Legislation and policy in matters of land use should be centralised in Central Government, while the implementation in many cases should be the responsibility of the local authority.

In order to prevent damaging overlaps in defining land policies, and especially in the implementation of these policies, directives on land matters must originate from the Central Government; whereas, the implementation should in most cases occur at lower levels of Government, but with full participation of both local authorities and the people concerned.

D. Java, Bali and Lombok

1. Land use planning in Java, Bali and Lombok is necessary to designate areas for the following purposes:

catchment control  
dams, reservoir, and irrigation canals  
recreation  
urban areas  
industrial areas  
highways

These islands are intensively used and the intensity of use is rapidly increasing. Already there are many land use conflict areas, but problems are mainly tackled with ad hoc solutions. Improper and destructive uses of some areas occur. For these reasons, it is proposed that attempts be made, using the existing land-use data base, to designate optimum landuse zoning for these islands. Initial attention should be given to specific problem areas (see also Recommendation 9).

2. It is recommended that continuous effort be made to conserve the land and water resources of Java, Bali and Lombok harmoniously with the social and economic conditions of the islands.

The preamble sets out some of the present problems of land resources which are found in Java. Water

use is closely linked with soil use in the area and both need to be tackled at the same time. Good possibilities exist, but can be realized only if urgent action is taken on a number of fronts.

3. In Java particularly, the possibility of local crop specialization with the development of the attendant marketing structure should be investigated in relation to land potential and water availability.

There is now the possibility of greatly increased yield of rice from some parts of the island, where water, new high yielding varieties of rice and also other crops, and the needed farm management practices can be brought together. If this is achieved, the other irrigated areas may be able to develop alternative crops to rice. Marketing facilities are an essential to any new crop if small farmers are to be encouraged to grow it on a continuous basis.

#### E. Other Islands

1. A land system or similar rapid classification using 1 : 100,000 scale (or 1 : 50,000 if it is more economic) should be considered for the other islands (exceptions Java, Bali and Lombok)

Data on a range of land resource sectors are very scarce for these areas. While detailed all-encompassing surveys would be desirable, neither time nor manpower is available for most areas. Land system or related classifications can be carried out partly from air photo studies and enable important broad features of land resources to be identified and recorded rapidly and comparatively cheaply. Such classifications can be used

for soil, landform, geologic, engineering or forestry reconnaissance work. The applicability of this approach to Indonesian conditions needs to be tested.

2. For transmigration areas soil potential should be assessed and tested by crop trials.

This is a high priority task as crop trials need to be carried out for several seasons. Soil potential and soil mapping is an important device, but only crop trials will give final clues on the suitability of new areas for particular crops.

3. In islands where soils and other conditions suggest a major potential for use of non-irrigated land, particularly for livestock and estate crops, more detailed environmental and agricultural studies should be made.

Most of the low lands outside Java constitute the potentially arable land and are the best regions for agricultural development. To ensure high productivity of land, certain measures such as good cultural practice and proper soil management and conservation must be carried out. For cattle raising, the development of improved pastures, i.e. tropical leguminous grass-pastures is needed. Agricultural development for cattle grazing and upland crops still requires further detailed investigation, especially on soil, agro-climatic, and socio-economic factors.

4. It is recommended that a close study of the Malaysian land development program should be made in relation to its possible adaptation to Indonesian conditions.

This program appears to have been succesful, though the details and particularly the cost are not known to participants in this workshop. Any study should take full account of the differing conditions prevailing in Indonesia, particularly the fact that transmigrants in Malaysia do not, for the most part, have to move to a new island in this development program.

REPORT OF THE WORKING GROUP ON

FOREST RESOURCES

REPORT OF THE WORKING GROUP ON  
FOREST RESOURCES

I. BACKGROUND INFORMATION

The total land surface of Indonesia covers 190.435.000 hectares of which, according to preliminary landuse figures, 122.227.000 hectares, or 60 per cent, is under forest cover. The distribution of forest and agricultural land in the principal islands is shown in the following table:

Island/Group of Islands	Extent of land Area (x 1000)	Population <sup>*)</sup>		Forest Area		Agri-cultural Land (x 1000)	Estate Land (x 1000)	Other uses (x 1000)
		per island (x 1000)	per sq.km	Area (x 1000)	%			
1. Java & Madura	13.217	78.201	583	2.891	21,9	7.578	309	2.439
2. Sumatra	47.361	19.840	38	28.420	60,0	4,543	446	13.952
3. Kalimantan	53.946	5.175	9	41.470	76,9	1.180	12	11.284
4. Sulawesi	18.904	8.925	39	9.910	52,4	1.656	9	7.329
5. Maluku	7.451	990	12	6.010	80,5	-	-	1.451
6. Nusa Tenggara Barat	7.361	6.572	86	2.036	27,6	412	3	4.910
7. Irian Barat	42.195	955	2	31.500	74,6	-	-	10.695
Indonesia	190.435	121.089	60	122.227	64,2	15.369	779	52.060

Notes: Resource: Directorate General of Agriculture (1968)

<sup>\*)</sup> Population density 1970

Resource: Statistical Pocket Book, Indonesia

As might be expected the forest distribution is in inverse relationship to population density. Java and Madura, in particular, with exceedingly dense populations have little forest, whereas Sumatra, Kalimantan, Sulawesi, Maluku & Irian Barat, where the population density is low, have very extensive areas of undisturbed primary forest.

Indonesia, straddling the equator, has in the main a typical equatorial climate, characterized by a relatively high rainfall with no pronounced dry

season (except in parts of Java and islands immediately to the east). This climate permits the growth of typical tropical rain forest over much of the region.

In Java very little primary forest remains and the forests comprise mainly intensively managed plantations; conifers at higher altitudes and teak at low level in Central and East Java. The extensive rain forest elsewhere provides mainly tropical hardwoods, of which the family Dipterocarpaceae (Meranti, Kapur, Keruing, Resak and other timbers) are the most important, though *Conyostilus* (Ramin), *Pinus merkusii*, *Eusidrexylon* (Belian), *Agathis* (Damar), *Diospyros* (Ebony) and *Intsis* (Merban) are of economic importance in certain regions. There are extensive mangrove stands on coastal saline soils.

The Directorate General of Forestry, comprising five Directorates, within the Ministry of Agriculture, is responsible for the overall administration and management of the forests and forest resources in accordance with numerous forest laws, acts and regulations. Within the provinces, forest management is the responsibility of Provincial Governments, though planning and nature conservation remain the responsibility of the Central Directorate General. The teak forests in Java and some forests in Kalimantan are managed by the State Forest Enterprise (Perhutani).

The sustained yield principle is given primary importance in the enacted forest policy, in which multiple usage of forest land is also emphasized. It is further stated that the forest resources should be exploited to provide maximum benefit for the nation, and particular benefit to the local people.

Nature protection and wildlife conservation are the responsibility of the Directorate General of Forestry, and separate Directorate is established for this function. Established nature reserves cover approximately 5 million hectares.

The forest resources of Indonesia are of vital importance to the economy of the nation. Forest products, mainly logs, have since 1970 increased from 10 to 26 per cent of the Gross Domestic Product. Wood-based industries are being encouraged by the Government and when these are established the percentage is likely to increase markedly. The less tangible benefits of proper forest management, such as watershed protection, are given close consideration.

## II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The forests of Indonesia constitute one of her most valuable natural resources. They must be developed in the interest of national economy, yet conservation principles should predominate in forest use planning. Preservation of the renewable forest resources and environmental considerations must take precedence over reckless exploitation. Careful planning and wise use are the keys to needed industrial development and to the maintenance and enhancement of the forest environment.

The first requirement of good forest management is a reliable inventory of the resource itself along with adequate maps to guide its regulated use. A major national project should be initiated as quickly as possible to determine the extent and condition of Indonesian forests and to identify and mark their boundaries. This inventory and mapping program could and should be coordinated with similar projects for other resource groups, using modern techniques to the extent possible.

Research represents a second foundation element upon which a national forest utilization plan must be developed. Silvicultural investigation will provide the facts upon which sound management plans can be made. Research on elimination of waste will extend the benefits of forest production.

Manpower limitations are a serious deterrent to wise forest use in Indonesia. Sufficient trained personnel are not available to inventory and map the forests, to supervise the performance of concessionaires

already under contract, or to plan and execute needed forestry programs. A national program to train both foresters and forest technicians is urgent. Sufficient funds to train and employ the needed personnel must, of course, be provided.

Though economic development of the forest resource is important to the country, equal consideration should be given to other uses and values. Watershed protection, nature preserves, wildlife refuges, recreation and other forest uses and benefits must be considered along with wood production in forest classifications.

Immediate attention should be given to the extent of existing concessions to insure that they are within the sustained capacity of the Indonesian forests. Some observers have expressed the fear that concessions have already been over extended and that depletion of forests could result. Closer supervision to assure compliance with concession contracts also is needed.

The forests of Indonesia should be managed on a sustained yield basis and multiple-use of all forest resources should be practised to the extent possible. A review of existing management programs, administrative procedures, and forest laws is needed to ensure that all forestry programs and activities are consistent with national needs and objectives. Careful planning of future forestry activities is urged.

Stabilization of forest boundaries is needed to prevent undesirable conversion of forests to agricultural lands. All forest lands should have adequate protection from fire, unauthorized grazing and illegal cutting.

It is important that the people of Indonesia understand and support their national forestry programs. Jurisdiction over public forests should be clearly defined. Regulations should be fair and strictly enforced. Financial incentives should be provided to ensure active participation in reforestation and other management practices on forest lands.

The exportation of raw forest products should be phased out as soon as practical. Foreign exploitation is not likely to show the same concern

for sustaining forest production as would be shown under Indonesian management. Added economic benefits will accrue to the country as local industry and labour begins to take over the conversion and manufacture of forest products.

#### A. Inventory of Natural Resources

1. It is recommended that the Government initiate a project to develop a plan for the inventory of all forest resources.

Maximum benefit in utilizing the forest resources can be obtained only if we have as much information as possible about the wealth contained in the forests. Data accumulated so far are considered insufficient to fully evaluate the forest resources, or to plan their management according to the sustained yield principle. Many areas are still unexplored scientifically and the available information on plants and other resources with economic potentials is meagre.

2. Priority in the inventory should be given to determining the true extent of forests in Indonesia.

The existing figures on the extent of the forests in Indonesia are based on data collected in a non-systematic way over different periods of time. Some data are still up to date whereas others are incomplete or need revision. Information on the continuous changes of the forest areas due to the opening of forest land in many parts of the country is not reported regularly. Based on available data, however, it is roughly estimated that the forests in Indonesia cover an area of over 120,000,000 hectares. The certainty and the reliability of this huge extent of forests must be supported by up to date and complete data.

3. A determination should be made as to which forest areas might be converted into agricultural lands, and which presently non-forested areas should be reforested.

Due to the steady increase of population, more agricultural lands will be required in the near future. Certain forest lands can be suitably converted into agricultural lands but these must be

carefully selected by taking into account all natural resource requirements. There are many non-forested areas on the other hand, which should be reforested to provide better water resource and landuse management.

4. It is recommended that immediate priority be given to surveying areas not yet granted to concessions.

The regenerative ability of production forests haphazardly exploited cannot be ascertained, and many life forms living there may be irretrievably lost because of changing of ecosystems. In areas which have been granted to concessions, forest reclassification cannot be executed without legal difficulty. Intensive surveys, therefore, should be concentrated first on areas not yet granted to concession, so that these forests can be classified according to their functions and their multiple use can be carefully planned.

5. There should be identification as quickly as possible of natural areas which of once exploited cannot be restored, and they should be conserved in their natural states.

Poorly managed forest exploitation often results in the destruction of the forests themselves with far-reaching consequences to the human environment. Even a properly managed exploitation may still bring about changes which cause complete destruction of certain ecosystems. Since these sensitive areas may contain economically important genetic resources and unique types of plants and animals, or may represent the last refuge of almost extinct flora or fauna, their preservation is urgently needed.

6. The inventory of forest resources should be conducted through an integrated approach by as many government agencies as possible, and a central depository for data should be established.

The participation of many agencies with different fields of specialization is imperative in undertaking this inventory, since the estimate of the forest resources should include not only tree resources but also the undeveloped genetic resources,

wildlife resources, water resources, land and soil evaluation and so on. For efficient utilization and dissemination, data accumulated should be deposited in a centralized data bank.

7. Where appropriate, it is recommended that modern techniques be utilized in the forest inventory. For accurate evaluation, however, certain forest types must be subjected to ground survey.

In the execution of the inventory, all available modern techniques such as remote sensing and aerial photography should be utilized. These techniques will greatly accelerate the time of execution and could also cover the inventory of many other resources at the same time. The ground surveys are frequently needed to check and evaluate more accurately certain forest types, especially lowland tropical rainforests. With coordination and cooperation between LIPI, LAPAN and BAKOSURTANAL, remote sensing techniques are now being introduced to Indonesia.

8. It is recommended that standardized methods be used in the inventory of forest resources.

The methods of inventory and collecting of data need to be standardized in order that the results and the data obtained are comparable, repeatable, easily analyzed, and available for processing for various purposes. Standardization should also include the scale of aerial photography (e.g. 1 : 20.000) and maps.

9. A surcharge should be levied on concession holders sufficient to make an inventory of standardized quality under Government supervision.

In the agreement between the Government and the concession holders, it is stipulated that the latter should initiate surveys and inventories of forest resources granted to them. It is desirable that the quality of these surveys should meet a set standard. To ensure the attainment of this requirement, it is considered necessary that the inventory and survey be executed by established research institutions under government supervision, but fully financed by the concession holders.

10. It will be necessary to provide sufficient trained manpower to conduct the inventory of forest resources.

It is said that the forests of Indonesia cover an area of 120,000,000 hectares. To conduct the inventory of this very large forest area sufficient qualified manpower is needed. Special education and training to provide manpower with knowledge and ability in various techniques of remote sensing, areal photography, ground survey, mapping, forest type classification, etc. is absolutely necessary. At present the number of trained workers of this kind in Indonesia is very limited and insufficient to conduct these jobs.

#### B. Analysis and planning of forest resources

1. It is recommended that the present utilization of forest resources in Indonesia should be improved so that various functions, such as protection forests, production forests, nature reserves, and recreation forests, will be fully attained in accordance with the sustained yield principles.

Up to the present, the utilization of forest resources has been focused primarily on the extraction of timber with little consideration of other uses. The practice of exploitation has been on a short term maximum yield basis with little attention paid to continuous production to the long range (sustained yield).

The logging operations in Kalimantan, Sumatra and other islands outside Java have taken place not only on production forests but also on protection forests and nature reserves. In many areas, especially densely populated areas, illegal cutting of forests for firewoods and shifting cultivation have been and are still taking place. These irrational operations have resulted in recurring national problems, such as floods during rainy seasons and shortage of water during drought seasons.

2. It is recommended that after the forest inventory has been carried out, classification of forest areas should be conducted on a geographical basis by taking into account the watershed boundaries.

Geographically, Indonesia consists of islands that form natural units. Each unit has its own types of vegetation, soils, geology, and climate unique unto itself. Productivity of the forests within these geographical units depends fully on these ecological factors. Hydrologically all parts of each unit are regulated by its watershed system. Indirectly, therefore, the prosperity and economic potential of the entire region within each unit are conditioned by the ecological system in the unit. Furthermore, since an important function of forests is hydrological, even in the production forests, the watershed should be taken as another important basis for forest land classification.

3. Forest utilization especially in regions outside Java should be aimed at:
- a. optimum utilization of forest products through processing;
  - b. increasing the value of forest stands, in terms of tangible as well as intangible benefits;
  - c. supporting regional development;
  - d. conversion of low value forest stands into high value ones;
  - e. well managed forests after the concession period ends.

Forest resources, especially those in the regions outside Java, constitute natural resources to be utilized for benefit of the nation and the community or regions where the resources exist.

Present logging operations are aiming only at producing logs for export so that much waste is left in the forests, either as exploitation waste or as trees not suitable for export. By establishing wood processing industries, these wastes may possibly be utilized.

By applying selective logging practices, it is possible that the existing natural forest stands can be changed into

man-made forests in which valued tree species will dominate the new forest stands with large volumes. These regulated forests will at the same time function hydrologically.

In logging operations, roads need to be built to transport logs. In this connection the road map plan should coincide with the development of the region concerned. On the other hand, infrastructures used for logging operations should be upgraded.

Delegation of forest utilization to private companies has included the objective that presently unmanaged forests become managed forests.

4. The Government should intensify its control over the exploitation and utilization of forest resources by private companies, with special attention to the enforcement of laws and regulations concerned.

Laws and regulations concerning the exploitation and utilization of the forest resources are adopted by the Government. However, enforcement of these laws and regulations is not exercised to the fullest extent. This is particularly true in the field, where control is far from satisfactory. Many timber concessionaires, for example, do not comply with the restrictions on the forest cutting operation imposed by the Government in various regulations. These, in effect, have resulted in undesirable consequences, such as severe damage to the forests, in terms of loss of potentially commercial tree species and erosion. Such damage will make it difficult to maintain the sustained yield of the forests and maintenance of the cut over for future utilization.

5. The Government should give more emphasis to research, training, education, and extension activities in forestry by providing more funds and facilities for these activities.

Past and present irrational utilization/exploitation of the forest resources is the result of a lack of basic ecological

knowledge, poor management, shortage of trained manpower to exercise law enforcement, and lack of understanding on the part of the people as to wise use of the forest and the benefits of the forest in their every day life.

Good forest management requires a great deal of ecological, taxonomic, silvicultural knowledge so that optimum yields can be obtained, and maintained for a long term use with little damage or loss of potential productivity. However, in order to obtain this basic knowledge, a sufficient number of trained persons in forest science is required to conduct research. In Indonesia the number of trained persons along this line is far from adequate. Likewise, good management also requires trained persons at lower levels (forest rangers, technicians) to execute routine operations. Forestry extension service activities and trained persons to do this work of disseminating information to people are almost non-existent. Therefore, it is no surprise that misuse of forest occurs, such as shifting cultivation, cutting trees for firewood and poor agricultural practice on poor forest soils. With the present budget and facilities provided by the Government it is very difficult, if not impossible, to solve these problems.

6. In increasing the value of forests, attention should not be focussed only on timber, but should also take into account those plants which have potential importance in agriculture, horticulture, pharmacy and other industries for future use.

The tropical rain forest is characterized by a rich number of life forms varying from a few timber tree species with known high market value, to many hundreds of species considered to have potential economic importance as sources of germ plasm, and thousands of little-known organisms which may or may not have future economic significance. The wild relatives of cultivars currently used in agriculture (such as beans, tubers, rice and so on), horticulture (fruit trees, vegetables, ornamental plants such as orchids), pharmacy (many species of Zingiberaceae, Apocynaceae, Rubiaceae, etc.) and other industrial plants (gum, dammar, campher etherical

oil producer and so on) occur in abundance in the forest. It is felt that in increasing the value of the forest, undue emphasis has been placed on the management of the few timber species to the neglect of the large majority of forest potentials.

7. In planning for forest products industries, close coordination with the forestry service is required.

The establishment of a paper industry in Celebes has met with difficulties, because the source of bamboo supply for its raw material was not well planned. To avoid further undesirable consequences like this, the forestry service should be consulted in future industrial ventures related to forestry.

### C. Managing Natural Resources for National Development

1. The utilization of forest resources should be aimed at optimum benefits to the people.

Forestry cannot be practiced as a science by itself. Forestry is based upon application of principles laid down in the fields of physical, biological and socio-economic sciences.

In spite of many timber licences, the local people do not always realize the benefits of the lumbering activities within their area. To the contrary, many people miss the opportunity to earn money, because they lose their rights to use of the land (timber cut, collection of minor forest products, cultivation, hunting, etc.). These people should be employed in the logging operations wherever possible.

In Java people also should be helped to obtain timber at a price compatible with their income.

2. The sustained yield principle must be reflected in management practices of renewable resources in terms of equilibrium between

harvest and reforestation, soil and water conservation, and other environmental measures.

The forests are set aside as part of the natural heritage of Indonesia. They should be managed so that they yield in perpetuity. Cutover areas should be replanted or re-generated within the shortest possible time.

Some forests are located on steep slopes, therefore are more prone to erosion. Forest management practices (e.g. cultivation, planting, thinning, and logging) should be conducted in such a way, so as not to cause accelerated erosion and excessive runoff.

3. Management practices should produce the highest return per unit of area by applying sound silvicultural techniques for the right species according to climate, soil and the goals of management.

Production forests should be managed on economic principles either to achieve:

- a) the highest money value per hectare per year giving the highest interest rate in invested capital or,
- b) the highest volume of wood per hectare per year, giving more commodities and job opportunities to people.

Choice of species to be planted should be based on ecological and economic principles. For protection forests, it is sufficient to have trees that are capable of covering the soil as quickly as possible, yet low in their water demand.

4. Production forests should be managed for the production of timber, fuel and other forest products to meet quantitative as well as qualitative demands.

Production forests should be managed so that they will supply wood and other forest products (charcoal, naval stores) in the quantity and quality demanded by consumers.

Portions of production forests are still idle because of inaccessibility (Kalimantan) or other reasons.

5. Existing production forests should be managed for the production of timber and other raw materials for export and for domestic industries (e.g. sawmilling, plywood, pulp and paper) so as to avoid waste.

Present logging practices are focused more on export rather than on the establishment of local forest industries. Royalties paid are based mainly on logs delivered alongside vessels. Much timber is lost either through felling damage or being intentionally left behind and not paid for.

In order that forests may function more fully, steps should be taken to reforest cut over and bare lands. Particular attention should be paid to wood-scarce regions such as South Sulawesi, Lesser Sunda Islands and Bali and to areas with degraded soils.

6. During forest operations greater care should be taken to avoid damage to forest lands, pollution of air and waters, and other adverse environmental impacts.

Skidding of logs should be conducted so as not to increase erosion. In West Kalimantan chemicals must be applied in the ramin logs because this timber is highly susceptible to borer's attack. Complaints are heard from local people that fish population in rivers diminish. Although not very serious so far, the possibility exists that with the establishment of more wood processing industries, pollution of waters is likely to increase.

Rafting of chemically treated logs and pulp mill wastes constitute particular hazards.

7. Research and training should be coordinated with private companies operating in forest utilization and with other institutions dealing with research in forestry.

Education in the past has not been geared to the present needs in the forest industry (i.e. tractor drivers, timber cruisers, log graders etc.). In order to obtain the necessary

number of Indonesians to do these jobs private companies and other institutions should provide this type of education.

8. Research directed toward the maximum utilization of the forest resources harvested is needed.

At present 90% of the wood species growing in a tropical forest are not marketable. Research might prove them useful for specific purposes. (Some time ago, for example, ramin and kuku were considered weedtrees).

9. Programs in manpower training and extension in the fields of conservation and management of protection forests and nature reserves should be accelerated.

Forestry education in the past has not trained people sufficiently for conservation purposes.

10. Existing regulations and instructions in the field of forest management should be strictly enforced.

Because of insufficient numbers of controlling forest officers and the extent of concessions, it is impossible to set up an effective enforcement system, yet much could be attained if controlling officers were more numerous and capable.

11. For proper management, the boundaries of forest estates must be distinctively identified and marked.

Since 1945 the maintenance of delineated forest boundaries has been neglected. Many boundary marks, if not all, have disappeared. Many forest estates exist only on paper.

12. Adequate protection of forest resources from fires, grazing, illegal cutting and other disturbing anthropogenic influences should be provided.

The job of getting forest lands covered by forest vegetation is extremely difficult if these disturbing factors occur

continuously. Man seems to be the biggest culprit. Physical measures could be taken (e.g. fencing, manpower), or legislation. This is especially needed in arid regions where people are allowed to freely graze their cattle anywhere and anytime (Timor, Flores, Sumbawa, Sumba, Lombok).

13. Shifting cultivation should be investigated to find ways and methods to avoid destruction to the forests.

In certain regions (Kalimantan, Sumatra, etc.), shifting cultivation still threatens the existence of forests causing far-reaching consequences of environmental imbalance and worsening hydrological and orological conditions.

14. There should be adequate supervision of timber concessions so as to assure compliance with contracts.

Some obligations laid down in agreements are not carried out by some concession holders (e.g. to employ Indonesians only, or to avoid over-exploitation ).

15. Present illegal practices of issuing timber licences in protection forests and nature reserves should cease and timber licences issued therein should be cancelled.

In South Sumatra, a nature preserve has been given out for timber concessions.

#### D. Policy and Legislative Aspects of Natural Resources

##### P o l i c y

1. It is recommended that the forests of Indonesia be managed on a sustained yield basis for the production of all goods and services they can provide. Whenever possible, compatible uses should be accomodated on the same land, but not at the sacrifice of primary management objectives.

The sustained yield principle is in accord with current laws and regulations and it should be emphasized as the basic policy of forest management in Indonesia. This recommendation further recognizes that it may be possible to use a given forest area for several purposes (e.g. watershed, wildlife protection and recreation), provided that such uses are compatible with the sustained yield principle.

2. Every effort should be made to achieve a balance of uses and products which, in total, will best serve the long-term needs of the people of Indonesia.

Indonesian forests are vital to the economic growth and to the welfare of the developing nation. Commercial development should be encouraged if done under good land-use management principles and if it does not destroy nature reserves or other intangible values considered to be of greater value to the people as a whole.

3. A basic principle of forest management in all instances shall be to maintain and enhance the quality of the environment.

It is recognized that needed forest harvest will at times cause some environmental damage, but air and water pollution, soil erosion, and other adverse environmental effects should be minimized to the greatest extent practical. This is also in accord with the sustained yield principle.

4. It shall be an objective of forest management to maintain forests in a thrifty, productive condition and to restore those that have been depleted.

This recommendation is in accord with the sustained yield principle, and furthermore expresses the concept of restoration and reforestation of forests which have been overexploited in the past.

5. A review of forest land classifications now provided by law should be made for the purpose of evaluating their adequacy in terms of present and future needs.

Current Law recognizes such categories as production forest, protection forest, and different kinds of nature reserves. The time has come to review this system of forest land classification to determine if it is still adequate, or if it needs to be revised.

6. Forest reservation plans, proposing that certain areas be assigned as permanent forests, should be evaluated by advisory boards including representatives from both national and provincial levels. The members of this board should include not only foresters but people from other disciplines (biology, agriculture, irrigation, energy, etc.) as appropriate to the individual proposal.

This is to ensure an integrated and interdisciplinary evaluation of each proposal in order to develop optimal resource management. It is necessary to involve both national and provincial levels of Government since the influence of forests extends beyond provincial boundaries. For example, the presence of forest cover on a watershed in one province may be of great importance in controlling flooding in another province downstream.

7. The present systems of forest utilization should be reexamined with the objective of developing better practices, both for the benefit of the forests, and to provide more job opportunities for the people of Indonesia.

In harvesting forests, frequently only small parts of the trees cut are utilized fully. It may be possible to promote greater utilization of forest products and by products which could increase economic growth, or could maintain current levels of economy while using less land area.

8. There is need to examine the present system of organization, whereby the local forest services are made subordinate to the provincial governments.

The present system could lead to unwise forest use in terms of the national interest, since it places greatest emphasis on provincial interests. As we have suggested, a balanced policy of forest management, on a national basis, is desirable. Furthermore, it is evident that land management problems are not always confined to individual provinces, but tend to follow natural rather than political boundaries. Therefore, it seems appropriate to examine this organizational problem at this time.

9. It is necessary to designate as soon as possible (perhaps on an interim basis) the needed forest land area (combination of all forest classes) in every watershed, while waiting for an integrated landuse plan, at which time permanent designation should be made.

In some areas forest is disappearing so rapidly that if completion of integrated landuse programs is awaited before designation of forest areas, there will not be sufficient forest remaining. Therefore, it is recommended that forest lands be designated on an interim basis while awaiting the completion of landuse plans.

10. It is recommended that appropriate steps be taken including education and provision of financial incentives, to ensure active participation of the people in replanting denuded forest lands.

The success of the reforestation movement depends on the support and understanding of the people in the areas concerned. It is important that the people in these areas become involved, and the group feels that both educational and financial assistance programs should be utilized to

develop public support for reforestation. The situation is particularly critical in the heavily overpopulated areas of Java, Bali and Madura.

11. The Government should review existing regulations on forest exploitation and make such improvements as the review indicates may be necessary. At the same time, enforcement of regulations should be strengthened.

There are two general types of problems in regulating forest exploitation. One involves the lack of regulations in certain areas, while the other, perhaps more important problem, is the lack of enforcement of existing regulations. Heavy sanctions should be placed on those who do not comply with existing regulations, and even minor violations should be subject to appropriate sanctions.

12. The present policy with regard to forest concessions should be examined to determine whether some other system would be more advantageous, or in what manner the present system may be improved.

While not prepared to make specific recommendations on this subject at this point, we do feel that present policy should be reevaluated, and that the advantages and disadvantages of other systems should be considered.

13. It is recommended that the Mahakam River basin be used as the site for a pilot project in integrated research in resource management.

The Mahakam River basin has many vegetation and forest types and differences in topography, is rich in floral variation, and offers many challenging problems related to water, land, and forest re-

sources. Thus it would seem an ideal site for a pilot project in integrated research in land management.

It is suggested that university, government, and private agencies be encouraged to cooperate in this research, and that local authorities play a prominent role in the operation of the project.

### Legislation

1. It is recommended that all laws, regulations, and Presidential decrees relating to nature reserves, wildlife, hunting, and nature protection should be reviewed and incorporated in a single revised nature ordinance, and that the policy in regard to administration of this ordinance should be reviewed.

There are now a series of laws, regulations, and decrees relating to nature conservation. Some are 30 to 40 years old, some are in conflict with others, some do not accurately reflect current conditions. Therefore, it is recommended that there be a general review, and development of a single, integrated ordinance appropriate for the current situation. Moreover, any law is only as effective as its administration, and special attention must be given to developing methods to assure effective administration at all governmental levels.

2. It is recommended that legislation be developed to regulate grazing in order to permit reforestation and prevent soil erosion in critical areas.

Current unrestricted grazing in some areas of the country has had adverse effects on reforestation projects, particularly those aimed at control of soil erosion and flooding. It is suggested that appropriate legislation be developed, also

taking into consideration the social implications of the problem.

3. It is recommended that legislation be developed to control the use of wood for fuel.

Firewood is the major source of fuel in Indonesia. It is estimated that about 55% of the current energy used is supplied by wood. However, data indicate that for Java alone the annual consumption of firewood exceeds the total amount of wood produced by all the forests on the island. Thus, as a national energy policy is developed and implemented, and as other energy sources become available, the use of firewood should be decreased and appropriate legislation developed to control the use of wood for fuel.

4. It is recommended that legislation be developed to regulate the practice of shifting cultivation.

Shifting cultivation has caused considerable damage to the forest resources of Indonesia, and is presently showing an accelerated expansion as a consequence of the growing population. The proposed law should aim at the gradual but progressive diminishing of shifting cultivation so that within a reasonable period of time this wasteful practice is abolished. It is recognized that this legislation would have major social consequences, and that it will be necessary to involve social scientists, agriculturists, and workers from other disciplines to develop the educational and agricultural programs necessary for resettlement of shifting cultivators.

5. It is recommended that legislation be developed to encourage wise use of land on the part of those owning or occupying it.

Such practices as reforestation, regular replanting of firewood species in appropriate areas, prevention of soil erosion, etc., should be encouraged. It is suggested that, in addition to development of extension-type educational activities, material or technical aid and other incentives should be made available to land owners to encourage wise use of the land.

6. It is recommended that legislation be developed to insure that most forest products will be exported from Indonesia in the form of semi-finished or finished commodities.

Much of the timber produced in Indonesian forests is now being exported in the form of logs or unfinished products. The economic development of Indonesia would be assisted if legal requirements existed which would provide that more of the steps in the manufacturing processes were to take place before export. Current forestry regulations are moving in this direction, but further legislation seems to be needed.

7. All existing legislation concerned directly or indirectly with forestry should be reviewed. This review should be followed by a compilation of all regulations in a system-

atic arrangement, which should, in turn, lead to development of such additional legislation as may be needed to allow enforcement of good forestry practices.

Existing forestry legislation is found in a series of laws, regulations, and Presidential decrees. The basic forestry law, Law No. 5 of 1967, provides a good framework, but a thorough review and codification of all legislation relating to forestry is needed as a basis for making those improvements which may be necessary.

REPORT OF THE WORKING GROUP ON

WATER RESOURCES

REPORT OF THE WORKING GROUP  
ON WATER RESOURCES

BACKGROUND AND FUTURE DIRECTION

Water is an essential resource for most forms of economic development and is vital for human life and well being.

At this moment, water resources development has been the concern of a number of independent Government departments, where activities have not always been coordinated. The result has been that conflicts of interest have frequently occurred among the various users and consumers of water.

In order to avoid the continuation of these problems, and in order to achieve the greatest national welfare, it is important that directives be formulated coordinating all activities concerned with water resources conservation and development.

A. Data Collection and Inventory

At the present, time data collection for water resources development is the responsibility of the following Institutes and agencies:

- (i) the Directorate of Meteorology and Geophysics,
- (ii) the Institute of Hydraulic Engineering,
- (iii) the Directorate of Geology,
- (iv) the Forest Institute,
- (v) the Soil Institute,
- (vi) the Energy Institute, and
- (vii) other agencies.

No organization exists for recording of data in a national inventory.

## B. Analysis and Planning

The departments concerned with the use of water resources data, and responsible for planning, are:

- (i) the Directorate General of Water Resources,
- (ii) the Directorate General of City Planning,
- (iii) the Directorate General of Electric Power,
- (iv) the Directorate General of Mining,
- (v) the Directorate General of Industry,
- (vi) the Directorate General of Agriculture,
- (vii) and others.

Although there is consultation between Ministries, Departments and other Government Organizations, no permanent coordinating body exists.

## C. Management

Present management of water resources is inadequate, and there is a vital need to improve conservation of both the quantity and quality of water, and its proper and efficient use.

## D. Policies and Legislation

Fundamental water resources policy and legislation are in Article 33 of the Constitution of the Republic of Indonesia, in terms of the ownership of water resources by the state and its utilization for the welfare of the people. However, the water regulations date back to the Dutch administration and are not entirely adequate for present needs. A new basic water law was prepared since 1968 and is now awaiting amendment and approval by the Parliament.

## GENERAL RECOMMENDATIONS

- A. The Government should ensure a careful management, development and conservation policy for water and other natural resources.

This policy is necessary because water and other natural resources are essential for most forms of economic development. Furthermore, water is vital for human life and well beings.

- B. Coordinating bodies should be set up which ensure that an integrated approach is made to all aspects of natural resources conservation and development. This recommendation is also made, with particular reference to water resources, under separate headings of specific recommendations. It is stated here to emphasize, the inseparable nature of natural resources, particularly land, forests and water, and is necessary because such coordination is entirely lacking at present.

- C. Research programmes should be evolved which will help to indicate the best means of utilizing and conserving water resources.

There is a need in Indonesia to firmly establish the proper place of research in Government policies. At present research programmes lack the necessary encouragement, coordination and finance.

- D. It is recommended that an organization be set up within the existing national planning authority which formulates policies for natural resources development utilization and conservation.

Although there is an urgent need for coordination of water resources development policies, such coordination should be carried out within the existing National Planning Authority in order to avoid duplication of

responsibility and to ensure concentration of the decision-making process.

- E. A Workshop on Water Resources should be held at an appropriate time to discuss the progress achieved in coordination, and further elaborate the best means of achieving the beneficial development of water resources.

The present workshop deals with natural resources as a whole and must therefore be very general in its conclusions and recommendations.

### III. SPECIFIC RECOMMENDATIONS

#### A. Inventory

1. All information and data should, as far as possible, be presented in a standardised form to facilitate processing and analysis.

At the present time data is being collected in a variety of forms which makes the task of comparison and analysis time consuming and expensive.

2. An organization should be set up, or an existing organization should be strengthened, which will have authority for carrying out Government policies concerning the collection of data and the preparation of inventories. This same authority would be responsible for the issue of directives and supervision concerning inventory activities.  
The activities of existing organizations which are gathering data for limited purposes are at present not coordinated, so that standardisation and availability of data are not ensured.

3. Two categories of data collection should be given priority attention :

(a) Selection of representative river basins where water resources data can be collected and applied to similar basins where development will occur.

(b) Collection of data in specific river basins in accordance with the national development programme, since this is the only means of obtaining sufficiently accurate data.

With limited financial resources available, data collection cannot be widespread, and must be selective.

#### B. Analysis and Planning

1. Based upon the social and physical conditions of Indonesia, a development strategy is recommended which divides the nation into three zones :

(a) Java and Bali,

(b) Sumatra, Kalimantan, Sulawesi, Maluku and Irian Barat,

(c) Nusa Tenggara.

Each zone would receive development in accordance with its needs; Java having a pressing food and population problem with limited water, soil and forest resources; Sumatra, etc. needing an influx of people to open up their abundant natural resources; and Nusa Tenggara requiring attention because of arid conditions and the need for the economical use of water.

2. Within the existing water resources system, where water use is already competitive for various objectives, an optimal allocation policy should be set up.

This is recommended because delay of such decisions means a crude economic loss. Examples are, the Djatiluhur system and the Karangates reservoir.

3. The course of development up to the optimal level of development of a basin or sub-basin should be delineated as soon as possible. This is recommended because the rapid population growth in many river basins in zone 1 (Java and Bali) are such that a river basin development is substantially lagging.

4. As in the case of inventories, the analysis and planning of water resources requires a central coordinating body which will ensure that only integrated plans are produced. It is recommended that such a body be established.

No permanent coordinating body exists to integrate the activities of the Ministry of Cooperatives and Transmigration and other Government organizations dealing with water resources.

5. A reservoir of highly trained personnel capable of working in water resources, and related development, should be maintained by formulating sound training policies.

There is a need for the Government to formulate definite manpower policies which will ensure a steady flow of trained personnel.

6. In the field of energy, water is a non-consuming, renewable resource and therefore basin development should take into account the potential of hydro - electric power development.

The development of hydro-electric power may result in the conservation of non-renewable energy sources, such as oil and coal.

### C. Management

1. The proper management of the nation's water resources, both surface and groundwater, requires the setting up of a coordinating body with authority to formulate guidelines and establish standards. At the present time management of separate water resources projects are liable to conflict one with another, e.g. power and irrigation needs, industrial water disposal and recreational use, etc.
2. In managing the nation's water resources, special attention should be given to the following aspects:
  - (a) Preservation and re-establishment of forest cover in the watershed areas
  - (b) Economical use of water and the prevention of salinity in the irrigation areas
  - (c) Prevention of pollution of water courses from domestic, industrial, and mining waste water
  - (d) Proper control over the extraction of ground water, so that the optimum benefit is obtained
  - (e) Any other measures that maintain or improve the quantity and quality of water

At present the management of water resources does not secure the conservation and preservation of the quantity and quality of water.

## Policies and Legislation

1. The Government should establish policy for :
  - (a) Evolving standards and criteria for the analysis and planning of water resources
  - (b) Evolving standards and procedures for the allocation and distribution of available water resources
  - (c) The conservation of water resources

Existing policies and laws are inadequate and do not allow the nation to make the best use of the water resources available.

2. In order to ensure that the above policies are implemented, the following acts should be passed by the legislative :
  - (a) A Water Act, which deals with the regulation of water resources and their utilization, distribution and conservation. The act, or subsequent ones, would include consideration of public safety, land acquisition, right of way and other related subjects
  - (b) A Landuse Act, which deals with the regulation of landuse. The act would lay down standards for soil and water conservation and preservation, and the maintainance of the ecological balance.
  - (c) An Environmental Control Act, which deals with pollution control and other environmental protection measures,
  - (d) Other regulations on particular subjects when necessary; for example, mineral and thermal waters, inter basin transfer of water, international agreements, water resources problems,

Existing laws are inadequate to ensure that Government policies to make the best use of water resources are implemented.

3. In drafting new laws and amending existing laws concerning natural resources utilization and conservation, due regard should be given as to how the law should be enforced so that it can be effective in its intention.

There is little value for the Government to make new laws, unless they can be enforced.

**REPORT OF THE WORKING GROUP ON**

**OCEAN RESOURCES**

## REPORT OF THE WORKING GROUP ON

### OCEAN RESOURCES

#### BACKGROUND AND FUTURE DIRECTIONS

Two-third of the area of Indonesia is covered by seas, but because relatively little is known about the nature and resources of these seas, they have not yet received strong emphasis in planning and development. However, with improving knowledge and advances in technology, the role of the seas as one of the major environmental units and as a source of a wide variety of resources is beginning to be recognized.

The natural resources which are a part of the ocean environment include:

- a) living resources - fish, crustacea, molluscs, seaweed, etc.
- b) mineral resources, broken down into:
  - i) those recovered from the sea bottom (tin, gold, and possibly phosphates and manganese)
  - ii) those recovered from sea water (salt, iodine, etc.)
  - iii) those recovered from rocks beneath the sea bed (petroleum, natural gas, etc.)
  - iv) the sea as a possible source of fresh water
- c) energy resources from the use of tidal flows or currents to generate power.

Beyond the specific resources which are found within the ocean environment, there are a number of other ways in which the seas make a significant contribution to the long term development and stability of the nation. These include such factors as transportation, communication, recreation, employment, and defence.

The geographical environment of Indonesia is somewhat unique, consisting of thousands of islands surrounded by a complex system of

shallow seas (the Sunda Shelf between Java, Sumatra and Kalimantan and the Sahul Shelf between West Irian, Sulawesi and Australia) and bordered by deep sea trenches. The shallow seas, which form a part of the physical structure of the country are a rich potential source of living organisms and minerals, and the deep seas may also provide resources in the future.

Any consideration of the ocean environment must take into account the land-sea relationship which is particularly critical in the case of living organisms. The ocean is ecologically connected with the land in several ways: meteorologically through the medium of the atmosphere; through the nutrients and other chemical substances carried by water run off from land to sea; and of graving critical importance the needs (particularly for animal protein) and activities of the human population.

Consideration must also be given to the fact that many of the ocean resources (living organisms and chemicals in the sea) are mobile resources which are usually regarded as common property resources belonging to whoever recovers them. Within the country this highlights the need for regional planning, and for involving provincial and local units in development. Beyond this, the seas which form the boundaries of the nation can be an area for effective international cooperation through agreements in such areas as fisheries, pollution, and navigation, through cooperated surveys and research; and through sharing of information on resources.

It is felt that the ocean environment offers a unique opportunity for integrated development in the future, taking into account that many areas and aspects of the oceans are relatively unknown and little exploited and a large part of the resource is renewable. Here it should be noted that population growth in Indonesia will place increasing pressure on the land for a variety of uses including urban and industrial development, thereby cutting down on the land available for agriculture and other resources development. This can be expected to lead to propor-

tionately greater demands on the resources of the sea.

Development must be aimed not only at increasing resources utilization but also carrying out a broad development program to improve the well-being of those people who rely upon the sea for their living, and of the people in general. In Indonesia, the major present exploitation is of fish and other living organisms using traditional methods in limited areas with real little application of modern technology, and the recovery of minerals.

The requirement exists to carry out a broad inventory of ocean resources and other resources of indigenous human skills, aimed at developing integrated policies and plans for the rational utilization of these resources. Such an inventory should take into account not only the interrelationship of the resources themselves, but also other ecological factors which must be given full weight if the ocean resources are to make the optimum contribution to the well-being of the nation, and to provide employment for the people. The Government has already taken steps in these directions through enacting legislation, supporting research and surveys, and setting up of joint ventures aimed at systematic development and it is felt that the time is ripe to take steps towards integrated development of ocean resources.

These steps would include among their aims:

- a) to determine the directions and magnitudes that development can take;
- b) to reveal specifically and in local detail the constraints that have inhibited development (c.q. market, harbour, technological and other deficiencies);
- c) to provide necessary information and understanding for management to regulate resource utilization within principles of long term ecological harmony including the local human economy.

GENERAL RECOMMENDATIONS

1. Facilities for inventory, training, analysis, planning and management concerning ocean resources should be strengthened through expanding and strengthening existing ocean science and technology programs such as LPPL (Marine Fisheries Research Institute), LON (National Institute of Oceanology), HIDRAL (Naval Hydrography Unit) and Universities.

Studies on the ocean environment are presently concentrated at LON, LPPL, Directorate General of Fisheries, and HIDRAL with a few scattered investigators in universities such as IPB (Bogor Agricultural University), ITB (Bandung Institute of Technology), UGM (Gadjah Mada University), and UNPAD (Padjadjaran University). These can serve as the nucleus for assessment, training and research for Indonesia, and can also act as the link to international activities in ocean studies. It is felt that at this stage investment and efforts should be concentrated on these institutions to raise the level and amount of their activities. In the case of resources now being exploited there should also be provision for improving data gathering and dissemination of information (extension) at the local level.

2. Coordination of the above programs should be promoted by strengthening the linkages between the above institutes and other groups concerned marine activities (transportation, mining, defence) through the establishment of a national committee on the ocean environment which might be a sub-committee of a broader committee dealing with the whole field of natural resources and environment.

The question of coordination on all levels has been one of the dominant threads running through all sessions of the Workshop. This applies in the case of ocean resources because a variety of a number of resources are involved, and because the ocean environment interacts with other areas of resource development.

### SPECIFIC RECOMMENDATIONS

1. The initial steps in development of ocean resources must include a thorough inventory and analysis of existing data.

It is recognized that a great deal of information already exists in the Government Agencies, private companies, and joint ventures on various aspects of the ocean environment and that much of this information has not yet been systematically compiled, analyzed and evaluated. As a first step in an integrated programme of ocean resources development, it is necessary to know what data is already available and to use this as the basis for identifying priorities for investigation and development in the next 5 to 25 years.

These data should be analysed to:

- a) order priorities
  - b) indicate directions of both investigation and development
  - c) provide a basis for improvement of data collection and analysis systems.
2. The resource inventory of the ocean environment should include information not only specific resources and commodities but also on aspects of the environment which are of cross-sectoral interest including compilation of data and charts of sea bottom topography, tides, salinity, temperature, chemicals, sedimentation and meteorology.

In order to make efficient use of the resources of the ocean environment, it is necessary to have information on the environment itself which is of value not only in resource development but also in other uses of the oceans such as transportation, communications, elimination of pollution, etc. Studies of the various aspects of oceanography which may be carried out by a number of scientific agencies should be coordinated and integrated.

3. Considering the breadth of problems of the ocean environment, the groups or agencies dealing with individual resources categories should be charged with the drawing up of recommendations for immediate actions in their respective areas.

Here it is noted that the ocean environment covers a wide and varied range of resources which are the responsibility of a number of specific agencies and institutions.

4. Plans for studies to be carried out in the ocean environment should be circulated to all concerned agencies in advance so that expeditions and surveys can gather information for a number of agencies.

Ocean research is extremely complex and expensive and it is felt that there is much danger of waste of effort through different groups sending out ships and expeditions to gather limited information, thereby not taking full advantage of limited budgets and scientific manpower. Efforts should be made to make each expedition or surveys serve as many purposes as possible.

5. Although initial emphasis on development of ocean resources should concentrate on upgrading of existing activities, a long-term programme should be prepared making allowance for expected advances in aquaculture, ocean mining, chemical extraction, etc.

Long range planning must allow flexibility for continuing modification and adjustment to take into account changing technical, economic, and social factors, as well as increased knowledge.

6. Educational and training facilities related to all aspects of the ocean environment should be strengthened, including not only marine sciences but also management of the development of ocean resources.

In Indonesia the present facilities for education and training in areas related to the ocean environment are weak when compared with facilities in other resource areas (mining, forestry), and also when considered in terms of the potential of the ocean environment. The nucleus of good facilities exists in a number of institutions such as the IPB, ITB, and ITS (Surabaya Institute of Technology).

7. The management structure and pattern of responsibility of ocean resources development should be identified and strengthened, paying due attention to traditional pattern and involving management units on the local and provincial levels.

Management is to optimize resource utilization while maintaining ecological balance, and to restrict the use of improper or damaging practices. This involves overcoming constraints such as: lack of skills and equipment; marketing, transportation, preservation and processing problems including quality control and lack of support facilities such as harbours and maintenance. It also includes applying restraints necessitated by such factors as over exploitation, alteration to the ecosystem, and conflict in resource utilization.

8. During the formulation, modification or amendment of policies concerning the rational use of the resources of the ocean, the closest possible collaboration and consultation should be developed with other Government Agencies and policy making bodies of related or associated disciplines.

Policies and legislation exist or are being developed for some of the ocean resources and in other related areas, and such policies such be consistent. Policies relating to the rational exploitation of ocean resources should make allowance for increasing knowledge and understanding of the resources and the introduction and adoption of new technology from all sources and directions.

**REPORT OF THE WORKING GROUP ON**

**MINERAL RESOURCES**

## REPORT OF THE WORKING GROUP ON

### MINERAL RESOURCES

#### I. INTRODUCTION

1. Among Indonesia's abundant natural resources, minerals have become an important and growing factor in national development. Although still far from being extensively exploited, minerals already provided the main thrust of economic advance and a significant part of foreign exchange earnings. So far it has only been established that Indonesia possesses vast resources of oil, coal, tin, lateritic nickeliferous iron and low-grade nickel ores, but, indeed there are reasons to believe that this country possesses more diverse mineral wealth than has actually been discovered.
2. When the Second World War broke out in the Pacific and for the 25 years that followed, our knowledge on the mineral potential of Indonesia was limited. Of a total land area of more than 1,900,000 square kilometers, only about five percent had been mapped geologically in some detail, about 75 percent had been only cursorily reconnoitred, while the remaining 20 percent was still completely terra incognita. Practically nothing was known of the offshore regions, except for those shallow coastal areas surrounding the Indonesian tin producing islands (Bangka, Belitung, Singkep) which were explored for their tin potential.
3. Although there has always been a great interest in Indonesia's mineral development potential, economic and political conditions in the past were not conducive for private undertakings and capital investment, especially for such risky ventures as mineral exploration and mining.

From past experience it was obvious that government initiative and political attitude constitute the most essential factors in creating the right environment for a minerals industry to develop indigenous mineral resources. Maximum ultimate recovery for a nation's mineral wealth can only take place if the government

stimulates and encourages mineral resources development.

4. With the new economic policy adopted by the Government in 1967, there has been a revival in mineral exploration and development in Indonesia. A great number of major foreign companies are today participating in a country-wide effort in mineral investigations, and there are reasons for optimism regarding the possibilities of extensive explorations revealing the presence of economic mineral deposits. Firstly, many mineral occurrences which have never been adequately investigated or occurrences which may indeed have been investigated 25 to 50 years ago with negative results may still warrant re-evaluation. Modern mining techniques, mineral extraction and metallurgical processes, and market conditions may have changed completely the economics of developing certain mineral deposits within these last 10 to 20 years. Secondly, there are large areas in West Irian, Kalimantan, Sulawesi and parts of Sumatra, in which geological reconnaissance work in the past has indicated that the general geological conditions are favourable for the occurrence of mineral deposits. Remoteness, ruggedness of terrain and heavy forest cover were the main obstacles in carrying out surveys in the past. Now, however, by employing modern prospecting and exploration methods, supported by adequate budgets, those previously inaccessible areas may open up new perspectives.

## II. MINERAL PRODUCTION

1. At present oil and tin constitute Indonesia's most important mineral products, while other Indonesian exportable minerals include bauxite, nickel and manganese. In addition a variety of mineral commodities has always been produced for the domestic market which include coal, rock asphalt, gold, silver, etc. Since 1971 there has been production of iron concentrate for

export, and from 1973 on Indonesia will also produce copper concentrate for the international market. Table 1 shows Indonesia's mineral production for the years 1969 - 1971, and Table 2 shows Indonesia's export earnings from petroleum and other mineral commodities for the years 1970 and 1971.

Table 1. Crude Oil and Mineral Production of Indonesia, 1969 - 1971

Commodity	1969	1970	1971	unit
Crude Oil	270,951,236	311,551,834	325,672,500	barrels
Tin	17,514	19,090	19,765	kg ton
Bauxite	756,282	1,229,168	1,237,610	kg ton
Nickel Ore	256,213	600,000	900,000	kg ton
Gold	257	237	344	kg
Silver	10,590	8,615	8,876	kg
Coal	198,214	172,352	198,256	kg ton
Manganese	2,943	11,030	11,958	kg ton
Rock Asphalt	31,215	61,483	104,303	kg ton
Iron Concentrate	-	-	270,935	kg ton

Table 2. Indonesia's export earnings from petroleum and other mineral commodities, 1970 - 1971

Commodity	1970		1971	
	US \$	%	US \$	%
Petroleum	435,495,731.77	84.98	589,471,436.07	88.33
Tin	62,424,605.48	12.12	60,148,152.28	9.01
Nickel Ore	8,315,266.02	1.62	9,989,972.07	1.05
Bauxite	6,039,222.02	1.17	5,835,763.73	0.87
Iron Concentrate	-	-	1,170,911.93	0.18
Manganese	246,750.00	0.11	294,710.00	0.04
Silver	-	-	468,174.03	0.07
Total	512,521,575.29	100	667,379,120.11	100

2. Given the proper development climate and the general high level of interest in Indonesia's mineral resources, it is reasonable to assume that mineral exploration in this country will intensify in the near future and that mineral production, which has increased gradually within these last few years will continue its upward trend, provided market conditions are favourable.

In order to get a better understanding on the prospects of mineral resources development and the contribution minerals can make to Indonesia's overall development effort, a brief summary of facts and figures pertaining to petroleum and natural gas and other minerals in Indonesia follows.

### A. Petroleum and Natural Gas

1. Production of hydrocarbons in Indonesia started around the beginning of this century. Until 1971 total production of crude oil amounted to nearly 4,000,000,000 (4 billion) barrels of oil. Of this total only 210,000,000 barrels (or 5.4% of produced crude) have been obtained from fields discovered after 1942, notably some of the Central Sumatran fields. It is apparent that in 25 years after the end of the war only few additional accumulations, have been discovered. Offshore fields, Ardjuna and Cinta, began production only in 1971.
2. Indonesian crude oil reserves are estimated at  $10.400 \cdot 10^6$  barrels, or 1.5% of the total world crude reserves of about  $631.000 \cdot 10^6$  barrels. Daily production of  $1.5 \cdot 10^6$  barrels, predicted in 1973 - 1974, or about  $550 \cdot 10^6$  barrels annually, may theoretically last for the next 20 years. Technically, this rate during 20 years is impossible to maintain due to depletion of the reservoir pressures of the oil accumulations. a continuous addition to newly discovered oilpools should be necessary to maintain stability of platform production during a long stretch of time. Increase of this platform production should necessitate more new discoveries in addition to discoveries already needed to maintain this level.
3. Petroleum exploration activities since 1960 show a low in the early sixties. A moderate increase took place after 1963 culminating in the last three years. In the case of seismic surveys and exploration drilling this recent increase is almost tenfold. The present stepped up effort is the first noteworthy exploration campaign since the Pacific War, being the first phase of modern prospecting for hydrocarbons in Indonesia.

4. Future development of petroleum resources will be influenced by the extent of potential areas to be explored, as summarized below:

Prospective area with sedimentary cover	Estimated Extent in $10^6 \text{ km}^2$	% of total area
Total area	5.1	100.0
Onshore	1.7	35.2
Offshore	3.4	64.8
Extensively explored:		
- onshore	0.172	3.3
Being extensively explored:		
- onshore	0.260	5.0
- offshore (shallow water)	1.9	36.8
Awaiting to be explored:		
- offshore (deeper water)	1.5	29.4
- onshore	1.268	24.8

It is concluded that some 54.2% of prospective area will be available for future development.

5. Onland possibilities of hydrocarbon accumulation in Indonesia remains an important aspect of future development. In the main islands (except Sulawesi), prolific production was established chiefly before the beginning of World War II, indicating the large areal extent of potential acreage. Some  $172,000 \text{ km}^2$  were completely explored before 1965. From this effort about  $4.10^9$  barrels of crude had been recovered during approximately 72 years. Present reserves are  $10.4.10^9$  barrels. Exploration efforts during 1965 - 1980 will probably

cover about 260,000 km<sup>2</sup> of surface area. It is expected that the results will be, at least, similar to those of the pre 1965 play.

6. Offshore has yet seen limited exploration activities in Indonesia compared to worldwide efforts. The important role of the "offshore play" in the world was only established some 2 decades ago. Since then a phenomenal growth in hydrocarbon production in offshore areas has taken place. In Indonesia, the offshore physiographic provinces are restricted to the Continental Shelf, the Continental Slope/Rise and Abyssal Plains and Hills. A very rough estimate of the extent of these areas is as follows:

Provinces	Area in 10 <sup>6</sup> km <sup>2</sup> (est.)	Approximate depth
Continental Shelf	1.9	1 - 200 m
Continental Slope & Rise	2.7	200 - 5000 m
Abyssal Plains	0.4	5000 m

Geographically it can be observed that the shelf areas are dominant in the West and East. The Continental Slope & Rise are confined to the area between the shelves and away from the shelves into the Indian and Pacific Oceans. Abyssal plains are scattered between both shelves being of minor areal extent.

7. The first offshore hydrocarbon producing fields in Indonesia came on stream in 1971. Those belong to the early results of the first phase of exploration in the continental shelf offshore. This phase, from 1968 - 1973, is presently coming to an end. The discovered and producing fields point out that commercially attractive offshore areas are present. Several additional phases of exploration should be

carried out to evaluate the shelf decisively, but it can be safely assumed that the presence of bonanza class of prospective areas are definitely not impossible in these shallow seas.

8. Exploration of deeper seas (continental slope & rise) awaits actual application of technological research which has been undertaken successfully by private industry abroad. It is estimated that petroleum exploitation until 1500 mtr. sea-depths may be conducted at the end of this decade. The technological achievement should open additional petroleum prospective area in the deeper seas of this country, adding to potential increase of petroleum reserves.
9. Natural gas reserves are found associated with oil accumulations as well as in separate gaspools. Since the commencement of the oil industry in this country, utilization of gas has been mainly for the purpose of increasing oil production and as fuel. In 1959 natural gas began to be used as a petrochemical feedstock for production of ammonia as basestock of urea. During the last 5 years additional plants using natural gas as feedstock have come on stream, with several more planned.
10. Main non-associated gas reserves are situated in South Sumatra. The present exploration campaigns for hydrocarbon have discovered an appreciated number of non associated gasfields onshore North Sumatra, South Sumatra, West Java and Kalimantan. Offshore, significant associated and non associated reservoirs have also been found.
11. Future projection of gas development is considered very encouraging. The appreciable amount of this natural resource discovered as non-associated gas indicates strongly that the sedimentary basins are also capable of generating separate gaspools. The potential thus is present. Development of

this energy source seems only dependent on possible effective utilization prospects.

## B. Other Minerals

1. Next to petroleum, Indonesia's traditional mineral production includes tin, bauxite, nickel ore, gold, silver, coal and manganese. Besides there has always been a small production of a variety of industrial minerals and rocks for the domestic market, which include limestone, rock asphalt, kaolin and various clays, quartz sand, diamond, sulphur, phosphate rock, iodine, volcanic trass, pumice, and marble. Nearly all of Indonesia's mineral production today comes from Government-owned mines. Activities of domestic private enterprises at present are limited to small scale mining and quarrying of industrial minerals, precious stones and precious metals, mainly due to lack of capital and technical know-how.
2. Although the bulk of the minerals produced is exported without prior processing, mining has already become a substantial foreign exchange earner for the Government. Revenues generated from the export of mineral commodities, excluding crude oil and petroleum products, amounted to US \$ 76,782,836 in 1970 and US \$ 78,839,894 in 1971, and this amount is expected to triple in ten years time. Looking at the tremendous effort now being carried out by Government as well as private foreign companies, such expectation is needed far from being too optimistic, as the following may indicate.
3. Following the issuance of the Foreign Capital Investment Law in 1967 the Government launched a worldwide announcement soliciting competitive bids from private companies for the exploration of 53 separate units of potential mineral bearing land in various parts of the country, each averaging 9,000 to

10,000 square kilometers. This most unusual governmental action was part of its mineral exploration policy that included the issuance earlier in the year of two other international tenders for the exploration and development of tin resources in the western part of the archipelago and the extensive lateritic nickel deposits in several regions in the eastern part of the country.

4. A little more than five years have passed since the Government announced the tenders for large scale mineral explorations in Indonesia. So far a total area of some 400,000 square kilometers is covered by prospecting and exploration activities employing all sorts of modern techniques. Investigations for nickel ore cover a total area of 107,500 square kilometers; for tin 30,000 square kilometers; for bauxite 125,000 square kilometers; and for general mineral explorations 137,500 square kilometers (see Table 3). Seventeen foreign enterprises, involving more than two dozen major international companies, are engaged in these activities. In addition, the Government of Indonesia, working through the Indonesian Geological Survey and the National Atomic Energy Agency (BATAN) partly in cooperation with agencies of other governments - have engaged 116,500 square kilometers for general mineral prospecting and 175,000 square kilometers for radiometric mineral survey.
5. Encouraging results have been obtained from exploration activities in these few years. At least one project initiated since 1967 will start up soon; in the first quarter of 1973 Freeport Indonesia, Inc. will begin production from its Ertsberg Project in West Irian at an annual rate of 250,000 tons of copper concentrate (25% Cu). Other projects in Southeastern Sulawesi and the Waigeo area, West Irian, are in the feasibility study stage for the development of low-grade lateritic nickel deposits, including the establishment of multi-million dollar nickel processing plants.

Three years of country-wide bauxite prospecting has resulted in the discovery of extensive deposits of aluminous laterite and bauxite in West Kalimantan. For many of the other projects now under way, it will take at least another two or three years before definite results are available.

### III. MINERAL RESOURCES DEVELOPMENT STRATEGY

1. In reviewing present activities and developments in the field of mineral resources, it is obvious that Indonesia is rapidly moving from its former position of one of the least explored to one of the most extensively investigated countries in the world. Therefore, the formulation of a basic strategy at this stage of development is of utmost importance for the rational exploitation of Indonesia's mineral resources.

In the context the convening of a Minerals Working Group as part of the Workshop on Natural Resources, jointly organized by LIPI and the U.S. National Academy of Sciences, occurs at a strategically significant time when a conjunction of factors, domestic and international, permits a prudent but promising regeneration of minerals development. Among these factors are:

- a) Indonesia's Second Five Year Development Plan, PELITA II;
- b) national experience;
- c) changing world perception of resources use and supply;
- d) environmental problems;
- e) development goals;
- f) technological changes and improved mining technology, and
- g) the role of international investors in mineral resources development.

2. Preparation is underway for the Second Development Plan covering a five year period crucial in the nation's minerals development. The systematic and coherent expression of a mineral program closely integrated with other resource developments should set

the national course for many years ahead. This is an historic opportunity to draw on actual experience, to respond to world trends and to benefit from the activities of other mineral rich nations.

3. A substantial record of national experience in minerals development has been gained since the introduction of progressive development and foreign investment policies. The record offers an opportunity to capitalize on successes and to rectify observed deficiencies in policy, programming or practice.
4. During the past several years, spurred by preparation for the 1972 Stockholm Conference on the Human Environment, the World Community has become aware of the finite nature of this planet and its store of natural resources. National Governments and their scientists have reviewed their concepts of population impact, economic growth, waste and resources stewardship. While this very process is occurring in Indonesia, full weight should be given to the effect which changing world perception of resources use and supply will have on the country's development plans.
5. Directly related to questions of world supply and conservation is the issue of environment which was also raised by the Stockholm Conference. In this case also domestic environment policy will affect mineral development, while the equal importance world developments in both consuming and producing nations also have an effect. Structural changes in production and trade will have to be taken into account in minerals policy. The probability that environmental stresses in industrial countries will compel geographical reallocation of product enterprises could influence favourably Indonesia's plans for upgrading minerals production, leading eventually to integrated industry of world competitive standard.

6. Indonesia with other developing nations has altered its conception of the development process in a way which bears importantly on minerals productions. To the clear need for economic growth, there has been added concern for pressing social problems: employment, income distribution, urbanization and population dispersal. This trend suggests that new criteria must be applied to all minerals enterprises to ensure their optimum contribution to national development aims and goals.
7. New and promising techniques for minerals surveying have become available in recent years which promised to speed and refine the nations urgent tasks of increasing and classifying its minerals store.

The mounting concern about world minerals supplies, waste and environment is beginning to force improvements in mining processing and beneficiation techniques. The new appreciation of resource values is inducing the mining industry, not noted for technological dynamism, to refine and improve its techniques. This trend should benefit Indonesia and steps should be taken to take maximum advantage of improvements appearing in various parts of the world.

8. Indonesia recognizes its need for capital, management and technology in developing mineral resources. The response from the international investment community has been favourable and it is important to maintain this dynamism of development in the years to come.  
Changes in the perceived role of corporations in both industrialized and developing countries offer the government an opportunity to seek new ways in which the resources of foreign mineral enterprises can be better integrated and deployed in the national development effort. Collaborative consultation on national and local development issues should ensure optimum realization of the development potential of each region.

#### IV. RECOMMENDATIONS

Taking the above mentioned factors into consideration, the Minerals Working Group in the Workshop on Natural Resources formulated its views in the form of suggestions and recommendations regarding the various aspects of mineral inventory, analysis and planning, management of resources policy and the legal aspects of mineral development, as follows:

##### A. On Mineral Inventory

It is recommended that Government agencies assume a more active role in Mineral Resource development..

Specifically this can be accomplished as follows:

1. Geological mapping is the fundamental tool in Mineral Resources Inventory and as such is a primary Government responsibility. Geological maps should be based on all data available, public and private, and the compilation of such maps should be updated on a continuing basis.
2. Acquisition and compilation of data such as Geologic logs, essay results, geochemical analysis, geophysical data, mineral statistics, etc., is also a Government responsibility.
3. Publication and dissemination of the foregoing data is vital to the success of a healthy mineral industry.

To implement the more active role of the respective Government Agencies in assessing the country's mineral resources, an increased budgetary priority should be given to those agencies.

Increased support for universities training earth and mineral - scientists is required, especially with regard to financial means, to meet future needs.

The Government should consider the feasibility of establishing an advisory panel composed of members from public and private sectors to provide counsel on problems pertaining to the mineral industry as they arise from time to time.

### 3. On Analysis and Planning

Minerals analysis and planning should be aimed at achieving three national objectives:

#### 1. Foreign Exchange Earnings

- to attract and encourage the private sector to undertake minerals exploration and development with strict regard for conservation and for environmental impact.
- to facilitate mineral production by providing appropriate incentives such as tax and duty relief, development loans, etc.
- to ensure the viability of such development by taking account of world supply, market and investment conditions.

#### 2. Regional Development

- to recognize that the best minerals prospects exist outside Java and to direct minerals development accordingly.
- to play an active collaborative role with minerals enterprises and local authorities to ensure effective contribution by these enterprises to local development needs as: employment, training and schooling, assistance to and linkages with indigenous industry, transportation, etc.

#### 3. Domestic Industrial Development

- to encourage domestic extractive ventures intended expressly

to provide suitable raw materials to growing domestic industries such as building and construction, etc.

- to collaborate with foreign investors in encouraging an indigenous minerals development capability through entrepreneurship, capital mobilization and management, thereby building an Indonesian tradition in a field of vital national importance.
- to encourage and guide the process of upgrading raw materials as steps towards creation of integrated extraction - to final - product enterprises. To encourage and facilitate the participation by domestic industry in such dynamic additions to national development, employment and export programmes.
- to relate minerals to all other resources development in achieving national aims and objectives.

### C. On Management of Mineral Resources

1. Development of mineral resources is governed by three determined goals and objectives:
  - a. To obtain foreign exchange
  - b. To ensure regional development
  - c. To safeguard raw materials for local use

It is recommended that development of mineral resources should be managed to achieve the three objectives, in a balanced manner.

2. It is recognized that manpower for effective management is in short supply. It is strongly recommended that immediate steps should be taken to make available through training and other methods, adequate manpower in order to manage mineral resources effectively.

3. Managing the resource with respect to conservation involves a balance between avoiding waste and achieving the above goals. No precise rules can be drawn. But at this stage some relaxation of optimum conservation may be necessary to reach these goals. The exact trade off should be determined on a case by case base.
  
4. Similarly, while environmental protection is recognized as an important aim, no uniform national standards are immediately needed since acceptable pollution emissions will vary from region to region.  
No precise rules can be drawn so as to achieve the three goals above with acceptable pollution levels.
  
5. The Government should tap the managerial and technological capabilities of mineral enterprises by establishing a mechanism for continuing, collaborative consultation to obtain optimum contribution to development, local and national, by the enterprises, under conditions that do not impair their profit performance.

D. On Policy and Legal Aspects of Mineral Resources Development

1. Dynamism should be an underlying policy in mining legislation, reviews have to be made on the existing mining law in the future, considering that stability should be assured for maximum efficient rate of production.  
From a national standpoint, one basic law on natural resources would ensure cross sectoral coordination in the development and utilization of natural resources.
  
2. It is recommended that as a policy university education in the mineral resources science and technology be given more attention to ensure manpower and expertise to carry out policy and legal aspects in mineral resources development.

3. Careful research and development should be undertaken on a few selected resources before commitments are made to new products and markets.
4. The establishment of a mapping institute on a national level is recommended to ensure availability of basic data regarding all natural resources.

#### V. CONCLUSION

In conclusion Indonesia is at a historic juncture in its mineral development. Preparations for PELITA II and a series of important developments make a re-assessment and re-generation of minerals policy desirable. These developments in world supply and demand, environmental concern, domestic and global, in changing goals for national development, in improved technology available for surveying and for processing operations and in new possibilities for collaboration with foreign private and domestic investors on development matters, offer a challenge and an opportunity to the Government of Indonesia. If seized and carried out in PELITA II, this country could establish a pattern and a standard of minerals development of significance to the whole world.

## APPENDIX

### WORKSHOP PARTICIPANTS BY WORKING GROUP

#### I. LAND AND SOIL RESOURCES

##### Indonesia

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