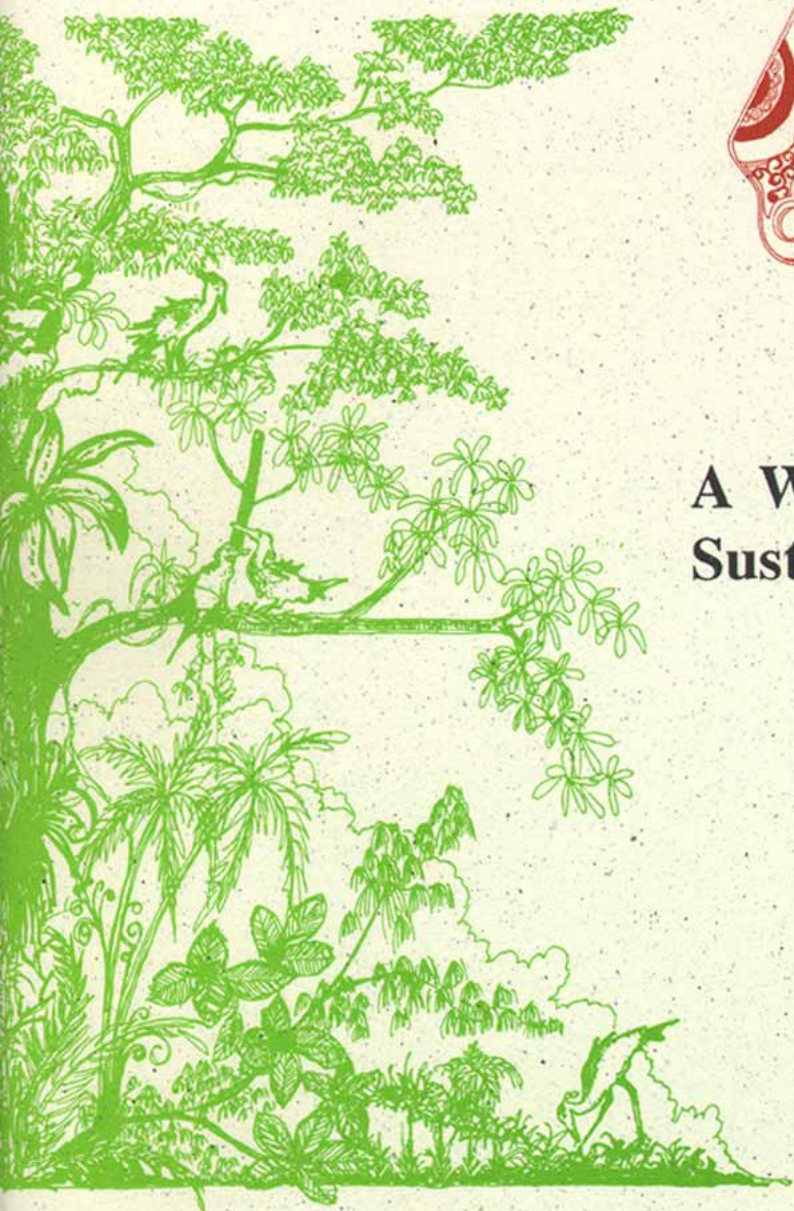


Forest Research



A Way Forward to Sustainable Development



DEPARTEMEN KEHUTANAN



Preface

The need for greatly increased efforts in tropical forest research was recognised in the mid 1970s. The World Forestry Congress in Indonesia in 1978 resolved that more resources should be applied to forestry research. The sponsors of the Tropical Forestry Action Plan (The World Bank, UNDP and the World Resources Institute) identified the lack of research and information as major obstacles to forest development. The TFAP sponsors subsequently orchestrated two "Bellagio-style" meetings in the late 1980s to identify opportunities and build support for forest research. The establishment of CIFOR as part of the CGIAR network of international agriculture research centers has been the only significant response to these concerns.

The Bellagio meetings highlighted the fact that investments in agricultural research had resulted in major improvements in productivity. Investments in forest research are significantly less than those made in agricultural research (for equivalent product value), even valuing just the timber from forests. If the values of environmental services and non-wood products are also included, the figure could be as low as one-tenth of the investment in agricultural research.

Research on forests has not only suffered from a lack of resources. It has been fragmented and highly site-specific. It has never been organised in such a way as to yield a holistic vision of forests. The research effort is distributed in discipline-based or production-sector institutions. A surprisingly large number of forestry research institutions in the world still do not include social scientists amongst their staff.

The UNCED process and the various initiatives leading up to the Commission on Sustainable Development debate on forests scheduled for April 1995 have developed a strong consensus that far-reaching changes are needed in the ways in which the world's forests are used. A new perception ("paradigm") of forest management is rapidly gaining currency - that, in any particular locality, the forest and the people who depend upon it should be considered as a single ecosystem. This means that the ultimate success of

management will have to be judged by the maintenance of the potential of the forest to provide a continuous but changing stream of goods and services. This will require forest policies that are socially acceptable, and policies that provide for steadily improving sustainable livelihoods.

These developments have enormous implications for forestry research. The "new forestry" depends upon a more comprehensive view of the nature of the forest ecosystem, but there is still a critical lack of research on approaches that combine biological, physical, economic and social variables. Even if the ecosystem can be brought under optimal management, how can decisions be made about the inevitable trade-offs among objectives and special interest groups? How can sensible decisions be made about the long-term management of forests against a background of changing societies and economies? All these problems require an unprecedented effort and a new vision of the importance of forestry research.

To address these problems CIFOR and the Government of Indonesia convened a dialogue involving scientists from a variety of disciplines and backgrounds and key persons from the post-Rio processes, NGOs, indigenous people's groups, industry, government and development agencies. The dialogue brought together 60 thoughtful, committed individuals in an environment that was politically neutral and conducive to intense reflection and interaction. Participants were invited in their personal capacity and not as representatives of governments or organisations.

The boat on which the dialogue took place provided efficient access to sites that demonstrate critical issues of tropical forest conservation and management. Participants visited industrial logging areas, lands degraded by fire and shifting agriculture and an area protected for biological diversity.

The primary objective was to review the results of the various international forest initiatives and to determine their implications for future research and information needs. The following statement was adopted by the participants at the dialogue. A more detailed report on the issues that were discussed is being published separately by CIFOR.



Forest Research

Forest Research:

A Way Forward to Sustainable Development

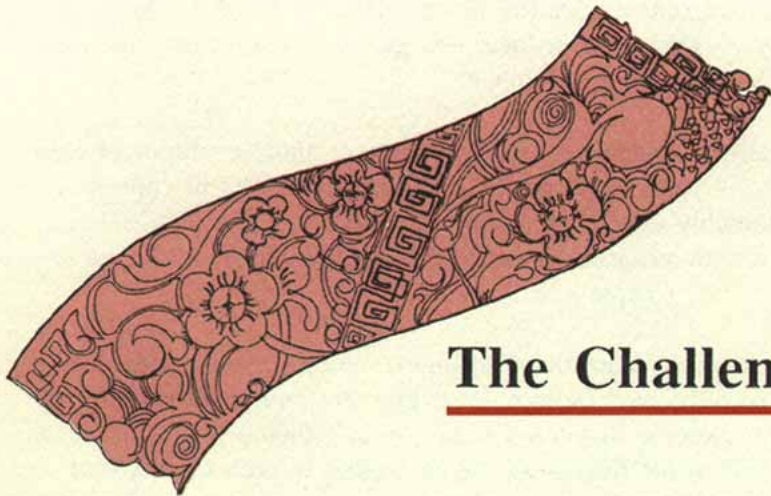
In preparation for the UN Commission on Sustainable Development's review of forest issues at its third session in April 1995, there has been a series of mutually supporting national and international initiatives.

This Policy Dialogue on Science, Forests and Sustainable Development has been hosted by the Government of Indonesia and CIFOR in order to identify and consider the key research needs for the support of sustainable forest management to meet human needs now and in the future.

International Initiatives to Promote Management, Conservation and Sustainable Development of Forests

Since UNCED '92 there have been several initiatives to raise awareness, help develop consensus and to advance towards improving the management, conservation and sustainable development of all types of forest. These initiatives have provided a mutually supporting framework for international action.

- The Bandung Initiative: The Global Forest Conference, held in Bandung, Indonesia, in February 1993, recognised the key role to be played by global partnerships in advancing the forest agenda.
- The Helsinki Process: The Forest Ministers' Conference in Helsinki in 1993 adopted resolutions on sustainable forest management and biological diversity of forests in Europe and launched work on "Criteria and Indicators for Sustainable Management for European Forests".
- The Delhi Declaration: The Forest Forum for Developing Countries met in Delhi in 1993 to develop partnerships and a common understanding of the particular challenges faced by developing countries.
- The Montreal Process: The Conference on Security and Cooperation in Europe convened a Seminar of (Forestry) Experts in Montreal to initiate work on criteria and indicators for the sustainable management of non-European, temperate and boreal forests.
- The Indo-British Workshop held in Delhi in July 1994, agreed on a format for national reports on forests to be submitted to the CSD review.
- The IWGF: The Intergovernmental Working Group on Forests, led by Malaysia and Canada, has achieved a consensus on approaches and options to address several important policy issues, at meetings in April and October 1994.
- The FAO Working Group: FAO is the UN-appointed task manager for forest-related issues and preparation of documentation for the CSD review of forests in April 1995. FAO has participated in all the forest initiatives and intends to host a meeting of Ministers responsible for forests in Rome in March 1995. The results of all the above initiatives will be available for consideration at the FAO meeting and the CSD review.



The Challenge



The Challenge

- Forests play a unique role in meeting human needs at local, national and international levels. They protect local and global environments, and so are essential for sustainable development.
- At the United Nations Conference on Environment and Development held in Rio de Janeiro, in June 1992, world governments agreed to conserve, manage and sustainably develop their forest resources. The UNCED in April 1995 will review progress towards implementation of the Forest Principles and relevant Chapters in Agenda 21.
- Rapid social, economic and technical changes increase global interdependence and uncertainty. Demographic pressure and other human impacts, including patterns of consumption, exert growing demands on the forests. As a result, some forests are being eroded in both quality and area. Smaller areas of forest will need to deliver ever more goods and services, to meet the demands of twice as many people by the middle of the 21st century.
- Without immediate action, this erosion of forest resources, and the environments they protect, will increase. Loss of biodiversity will become more rapid and life support systems will be further damaged. Benefits will be lost or reduced and sustainable development adversely affected.
- It is also the role of forest management to sustain and enhance the potential of forests to provide goods and services to as wide a range of people as possible on an equitable basis.
- There is a consensus on the need to halt and reverse these negative trends. Nationally based strategies and policies must increase productivity, halt forest degradation and deforestation, enhance forest benefits, increase efficiency and provide incentives for the conservation, management and sustainable development of forests.

- However achievement of these objectives will be the product of hundreds of decisions and actions taken at many levels. Individuals, communities, local authorities, private sector interests and non-governmental organisations, as well as government and inter-governmental bodies have a role to play. There will be negotiations and compromises. These decisions and actions will be strongly influenced by: public opinion, legislation, economic and social circumstances; the quality of information available about options, opportunities and approaches; and an understanding of the likely consequences of actions taken, now and in the future.
- The current state of forest science is not adequate to provide reliable and comprehensive information needed for timely decision making. Decisions being made at all levels may be based on incorrect or inadequate information. The effect of such decisions could impair the pursuit of sustainable development. Thus there is an urgent need for forest research to provide the relevant information to guide decisions taken on forest issues at all levels. This must be available in an accessible form and a timely and cost-effective way.



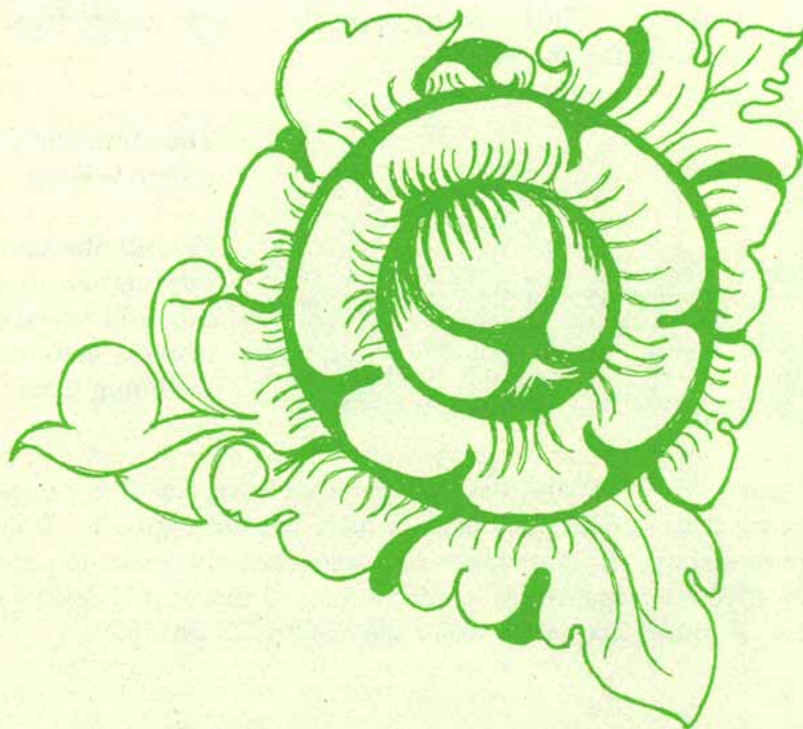
Therefore the Challenge for forest research is to:

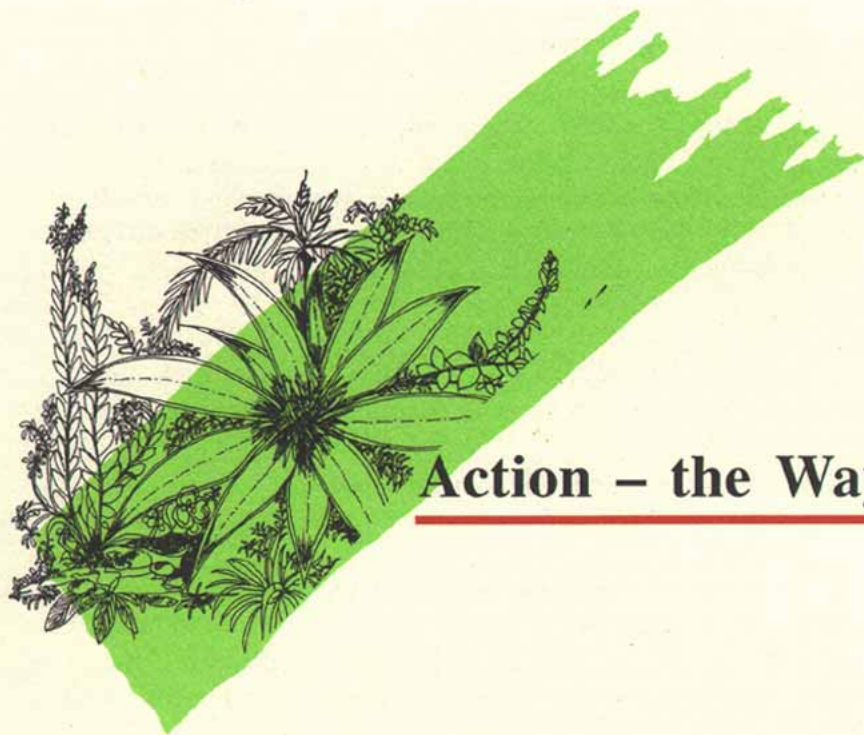
Provide the knowledge and information to assist decision making that will sustain and enhance the benefits of forests to all people, including future generations.

In accepting this Challenge, the Dialogue concluded that forest research must broaden its horizons and adopt a more holistic approach. It must attempt to address all forest functions, values and potentials, in order to achieve effective management, conservation and sustainable development in all types of forests and for as many stakeholders as possible.

Research priorities identified by the IWGF (Malaysia-Canada Initiative)

- management, conservation, and sustainable development, and enhancement of all types of forests to meet human needs
- criteria and indicators for sustainable forest management
- trade and management issues
- approaches to mobilising financial resources and environmentally sound technologies
- institutional linkages
- participation and transparency in forest management, and
- cross-sectoral linkages and integration.





Action – the Way Forward



Action – The Way Forward

The complexity of issues in the management, conservation and sustainable development of forests requires better research tools, diverse sources of information and flexibility in how problems are identified and solved. Further research is needed to provide a firm scientific basis for sustainable forest management and for discussion of environmental issues with global impacts.

The Dialogue identified an urgent need to improve research tools and understanding, and a longer-term need for improved research methodology.

It identified the following urgent research priorities.

- *Criteria and indicators*
Criteria and indicators for the assessment and prediction of impacts of management, conservation and sustainable development in all types of forests are urgently needed. The scientific basis for these, and their ease of use, should be improved and tested in large-scale demonstration sites.
- *Linkage to global environment*
The increasing number of environmental conventions and agreements on climate change, biodiversity, desertification, etc. requires a better understanding of the linkages between trees and forest ecosystems (at national and global levels) and the general health of the environment, including the impact of human activities.
- *Assessment systems*
Periodic measurement and assessment of the state of forests is needed, at local and national levels, including their biodiversity and other environmental services and values. Exchange of information through cooperation at national and international levels should be enhanced. This will require the creation of standardised techniques and methodologies and appropriate means to share the information gathered. Predictive models would greatly facilitate assessment and future action.

- *Forest valuation*

Reliable methodologies and appropriate mechanisms need to be further developed, to assess the contribution of forests to sustainable national development. These should include ecological, environmental, economic, social and cultural aspects. They should take into account the services provided and all values of forests, including the effects of other sectors such as agriculture, energy, mining and urbanisation.

The costs of management, conservation and sustainable development of all types of forests should be fully reflected in market mechanisms. All impacts of forest industries on the provision of other forest goods and services should be incorporated in forest valuation and land-use planning.

- *Community participation*

Traditional knowledge and management of trees and forest ecosystems by local communities, who may play an important role in the maintenance of healthy forests, should be documented. Local communities and other forest managers and stakeholders should be included in forest research as appropriate. Means to better achieve this must be developed.

- *Forest Conservation*

There is a need for more research on, and a better understanding of, the impact of forest management on biological diversity. Conservation values of forests are of prime importance, and should be a subject of future research.

The Dialogue identified the following as necessary elements of research methodologies to provide a more comprehensive approach to the understanding of the basic science of trees and forest ecosystems, deforestation, and degradation, in their social and economic contexts.

- *Integrated socio-economic and biophysical studies, at a network of landscape-scale sites, to understand the relationship of human development to forests.*

This should include consideration of: inter-sectoral interactions; the causes of deforestation and degradation; the impact of all stakeholders, and ways of ensuring their participation; and the role of forests in the socio-economic development process.

- *Periodic assessment of all types of trees and forest ecosystems, and of forest management, at national levels; and exchange of information at national and international levels.*

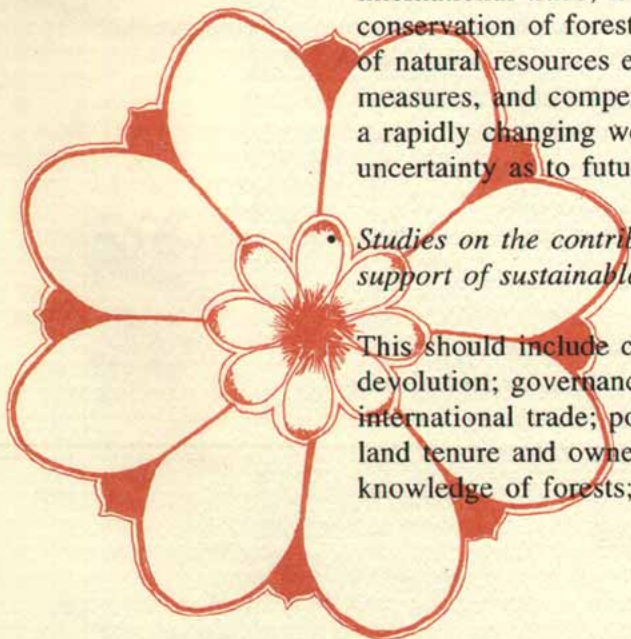
This would include: methodological development of criteria and indicators for assessment systems; implementation of these systems; information exchange; and international cooperation networks.

- *Examination of trends of supply and demand in forest goods and services and their relationship to forest area and health; the development of strategies to optimise the balance between them, in pursuit of sustainable development.*

This should include consideration of: causes, patterns, and rates of change; patterns of production and consumption; improvement of productivity; international trade; natural resource accounting; efficient use and conservation of forest resources and products; inter-generational allocation of natural resources endowment; incentives; technological gaps; fiscal measures, and compensation mechanisms and subsidies. In the context of a rapidly changing world, these analyses must explicitly consider uncertainty as to future conditions.

- *Studies on the contribution of political and institutional arrangements in support of sustainable development.*

This should include consideration of: management issues; participation and devolution; governance and decision making; conflict resolution; international trade; policy and institutional design; cross-sectoral linkages; land tenure and ownership; community forest management and traditional knowledge of forests; and legal and customary rights.





**Guiding Principles for the
Conduct of Forest Research**

Guiding Principles for the Conduct of Forest Research

The research agenda described above is forward-looking, and represents a marked shift from the present orientation of forest research. A widespread transformation in attitudes will be needed to establish a new research culture. It will require changes in the management of science, maintenance of organisational and financial stability, improvement in the status of scientists and other incentives, and revised patterns of assistance for research in developing countries. Implementing the new research agenda will require major revisions in the way research is conducted.

- *Scales*
Research should be conducted at the global, national, regional (eco-regional or political regions) and local levels; in recognition of the differing scope of the emerging issues.
- *Cross-sectoral*
The research outputs should be comprehensive and consider forest-related problems within a cross-sectoral and inter-disciplinary context.
- *Problem-oriented*
The research should focus on problem identification, solution and prevention. Research on developing new methodologies appropriate for each type of problem, at each scale, may be required.
- *Stakeholders*
Involvement of all the appropriate stakeholders in the design and conduct of research, at each level, can achieve both better research results and their more effective implementation. Thus, wherever possible, formulation of research should be guided by the priorities identified by local people and others who depend on forests for their livelihoods.

- *Networking and Participation*

Networking and linkages between institutions, researchers and clients is essential. Existing networks must be strengthened, and new ones developed as necessary. At the local level, NGOs, local government agencies, extension workers, forest managers, industry, local people and researchers should network and communicate, ensuring that there is close collaboration between researchers and the users of the research outputs including collective decisions on the research agenda and priorities.

- *Exchange and Use of Information*

Coordination mechanisms will be necessary to ensure networking at the international level. New assessment methodologies are required for the provision of transparent, comprehensive and timely national databases, as well as for international comparisons of databases. Spatial predictive models can be developed as aids to decision making.

There is a need to seize opportunities presented by modern communications technologies (e.g. Internet) to improve accessibility to, and diffusion of, forest-related information through both informal and formal networks.

Access to existing sources of forest-related information should be facilitated. Inventories of databases, including libraries, will enable more efficient use of existing knowledge.

The issue of intellectual property rights needs to be resolved in a way that is equitable to all parties concerned, including traditional users of forests, national governments and the international community at large.

- *Partnerships*

South-South research cooperation between countries should be encouraged and facilitated by new and existing mechanisms. In this way affordable and appropriate technologies can be directly transferred, between scientists and between nations.

There is a need to promote joint working arrangements between scientists from developed and developing countries, in institutions located in developing countries.

The private sector should be encouraged to conduct in-house research and to support external research, whenever possible.

- *Capacity building*

Training in research for scientists from developing countries should involve up-to-date concepts, methods and techniques; as well as, where appropriate, research administration (e.g. through internship programs).

New educational approaches are needed to promote true inter-disciplinary understanding and research, and for inter-disciplinary programs of post-graduate study.

Strengthening of local institutions will also frequently require suitable research facilities.

Support for NGOs will enable them to facilitate local participation in research.

- *Dissemination of research results*

A “user-friendly” means of communicating forest research results to decision makers needs to be promoted. Efforts should be strengthened to make information available in national languages and accessible media.

- *Coordination of Research*

Improved collaboration and coordination of research activities by funding agencies would considerably enhance research effectiveness and efficient use of resources.

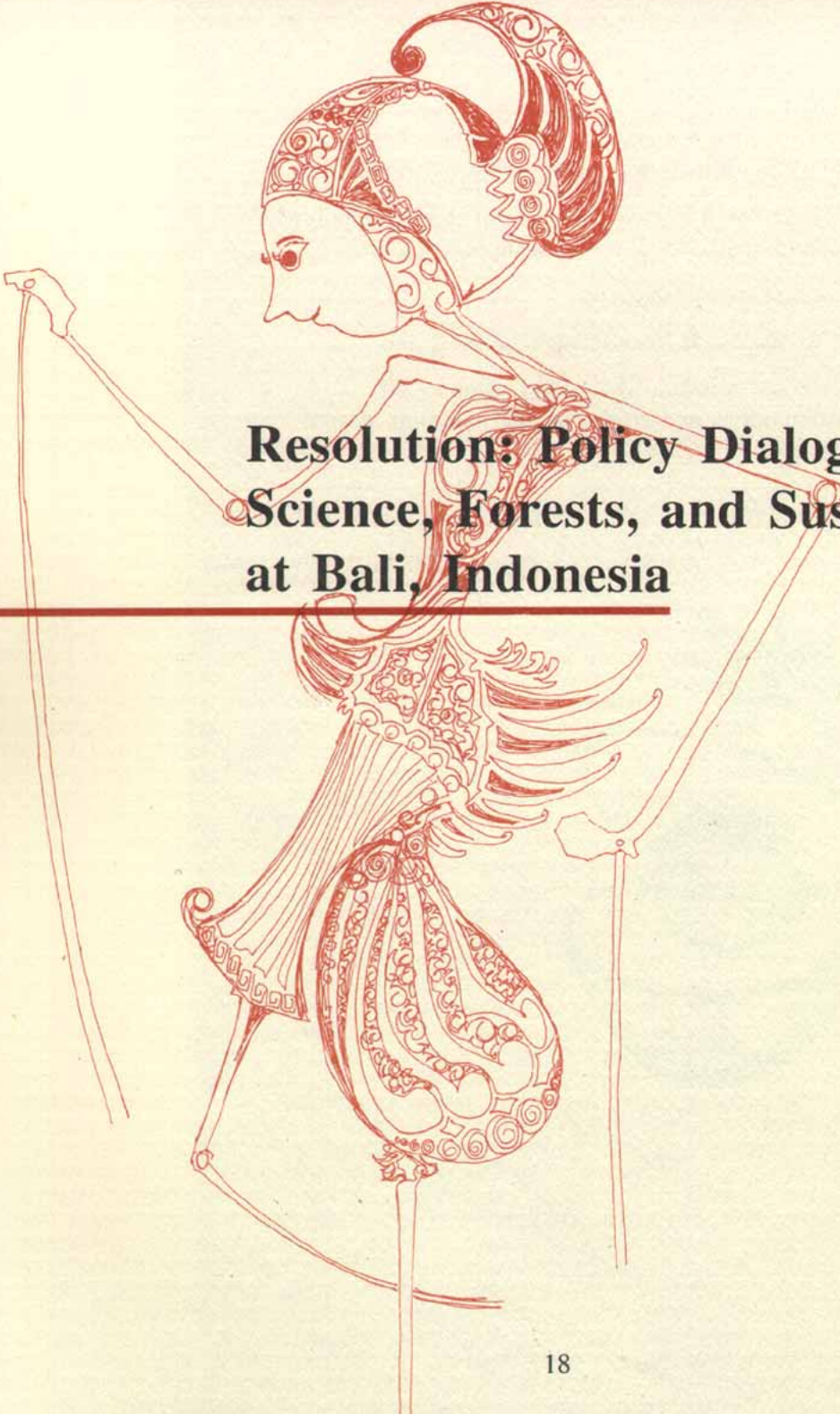
- *Funding*

New forest research activities can be supported by refocusing existing research, and by innovative reallocation of existing funding, as well as a net increase in research expenditures.

In the context of the above guiding principles, urgent attention is required:

- to develop and strengthen the research capacities of nations through a political commitment at the national and international levels to support research;
- to develop true global partnerships in research;
- to make concerted efforts to share and transfer technologies; and
- to encourage where possible and relevant, the participation of all stakeholders, including communities and NGOs, in the planning, design and conduct of forest research.



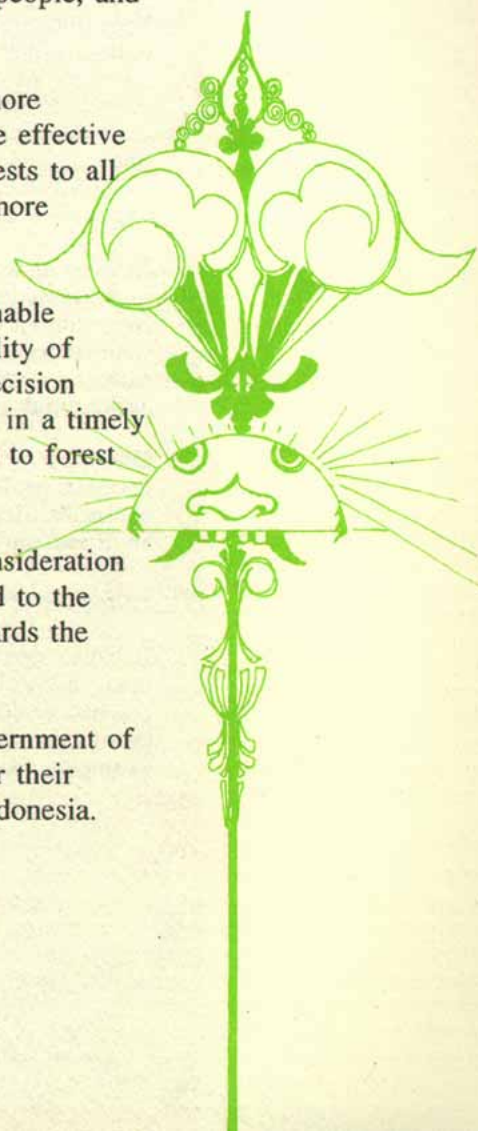


**Resolution: Policy Dialogue on
Science, Forests, and Sustainability
at Bali, Indonesia**

Resolution: Policy Dialogue on Science, Forests, and Sustainability at Bali, Indonesia

The participants at the Policy Dialogue on Science, Forests, and Sustainability meeting in Bali, Indonesia, from 10-15 December, 1994

- expressed their concern at the state of forest resources and the environments they protect, and the loss of biodiversity which could further damage life-support systems, reduce the flow of benefits to all people, and adversely affect sustainable development;
- recognised that forest science should be reoriented to provide more complete information necessary to assist decision makers to take effective decisions and actions to sustain and enhance the benefits of forests to all people and conserve the forests for future generations through more complete knowledge;
- adopted a report on Forest Research: A Way Forward to Sustainable Development, which is a call for action to improve the availability of information and scientific knowledge needed to support good decision making on forest issues at all levels, in an accessible form, and in a timely and cost-effective way, through a more comprehensive approach to forest research;
- request the Dialogue hosts to forward the report to FAO for consideration at the meeting of Forest Ministers in Rome, in March 1995, and to the Commission on Sustainable Development as a contribution towards the review of forests in 1995; and
- finally, expressed their deep appreciation and thanks to the Government of Indonesia and CIFOR for having organised the Dialogue and for their warm and generous hospitality and support received while in Indonesia.



Annex I

Assessment of the Impact of Research

Methods

Forestry research is no different from agricultural research in that it forms part of the continuum: problem - research - development - application. Unlike agriculture, forestry is by nature a long-term enterprise and research on many forest-related topics requires considerable time for completion.

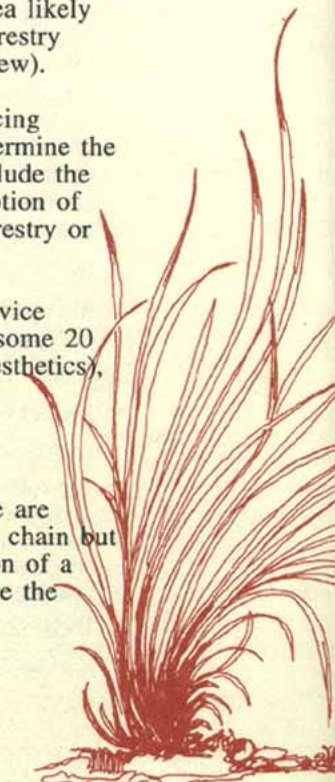
Nevertheless, forestry research, like other activities, should be appraised in terms of costs and benefits (social, environmental, financial and political). Techniques for appraisal *ex ante* and *ex post* do exist; the former are typically used by funding sources to compare different research proposals and include peer review, scoring and mathematically derived gradings. However, they also include assessment of direct impacts such as the number of people, the number of cattle, or the land area likely to be affected by the solution to a particular problem (see OFI Tropical Forestry Paper on the World Bank's Sub-Saharan Africa Agricultural Research Review).

Ex post analysis of research investments has rarely been done by the financing institutions but has commonly been used by the research institutions to determine the continuation or cessation of particular lines of enquiry. These analyses include the same criteria of people or areas affected, but also the adoptability and adoption of research results by the users (recognizing that users may be government forestry or agricultural departments, industry, local communities and individuals).

One type of *ex post* appraisal is the hindsight analysis of 81 US Forest Service research projects (Callaham, 1982) in which each project was assessed for some 20 characteristics including social effects (job creation, income, tourism and aesthetics), environmental effects (soil, water and climate impacts), and production.

Examples of Successful Research

Because research ranges from pure through strategic to applied stages, there are many examples of successful research projects that have formed part of the chain but not had direct impact themselves. The ultimate criterion is the total solution of a problem or the creation and dissemination of an improved technology. Here the examples are fewer but more striking in their impact.



An Example of impact assessment of a successful research program

Species and provenance selection for industrial tropical pines

One example of *ex post* evaluation, albeit with some assumptions about rate of uptake of the research results, was that conducted by the Oxford Forestry Institute in 1985 to establish the impact of nearly twenty years' work on the exploration, evaluation and improvement of Central American tropical pines that were widely used as exotics for timber and pulp plantations in many tropical countries.

The main assumption was that the countries would continue to plant at the same rate but with the correct species and provenances identified by the research. The analysis showed that the improved yields expected within one 20-25 year rotation would approximate one billion sterling pounds (£1 billion) from an initial investment of one million pounds (£1 million) over the preceding twenty years (at then current pricing).

Subsequent partial evaluation in some countries suggests that this will be an under-estimate of the industrial economic benefit because the original analysis concerned only volume production and did not include value for the improved wood quality.

An Example of collaborative research and development

Biological control of forest pests, diseases and weeds

To reduce timber losses, costs of chemical controls, and environmental hazards of those controls, the Canadian Forest Service undertook intensive studies over twenty years that resulted in the development of application technologies for:

1. The control of forest defoliators such as spruce budworm by the bacterium *Bacillus thuringiensis*
2. The control of gypsy moth by viruses (in collaboration with the US Forest Service)
3. The control and monitoring of various insects by pheromone and light traps

All of these studies required the coordinated research of CFS scientists and managers together with commissioned university scientists; collectively they covered topics in the taxonomy, biochemistry, physiology, genetics, ecology and management of trees, insects, bacteria and viruses. In addition the research involved engineers and environmental toxicologists.

An interesting feature of the gypsy moth research was the resultant cooperation of an American scientist (W. Wallner) with Russian specialists who introduced him to the life cycles of European and Asian gypsy moths and gave him the awareness of the threat they would pose to North American forests if accidentally introduced. This has resulted in intense screening of all imported material.

Example of research on trees in support of agriculture

Shelterbelts in north-west China

A major shelterbelt system has been constructed in north-west China with financial support from the World Bank; a total of 11 million hectares of farmland have been protected. The equivalent of 13 million hectares have been planted and some 600,000 hectares were aeriaily seeded.

The success of the plantings resulted from a series of research activities from 1978 to 1985. These included site classification, recognition of regional differences, selection of tree and grass species, determination of planting patterns, inventory of the growth by ground and remotely sensed data. Plantings are monitored ecologically and environmentally in long-term inventory and monitoring plots. A major data bank has been established to support future decisions.

Example of research on wildlife and human needs

The Campfire Programme of Zimbabwe

Increasing human populations and their demands for agricultural land in the drier districts of Zimbabwe led the people to hunt or drive away elephants that damaged crops. Following social, anthropological and wildlife biology research, the Zimbabwe Wildlife Service supported by the Zimbabwe Forestry Commission developed systems of integrated use of both land and elephant resources. The animals are shot by fee-paying tourist hunters and the carcasses are processed totally by the local inhabitants who benefit from the meat, hides, and other goods that can be made from the animal. As a result the local human population accepts some elephant damage to crops, gains some direct benefit from the elephant, and provides sustainable control of the elephant population.

Example of research on catchments

The US Forest Service Coweeta Hydrological Research Laboratory

For nearly forty years the Laboratory in North Carolina has studied the topography, soils, water and vegetation of catchment areas under different management systems. This has provided an extremely good understanding of the relationships between land use and hydrology, soil erosion and plant physiology and growth. It has resulted in improved land use planning and management systems including the identification of problem areas and the location of optimal road layouts.

Example of integrated research to develop a product

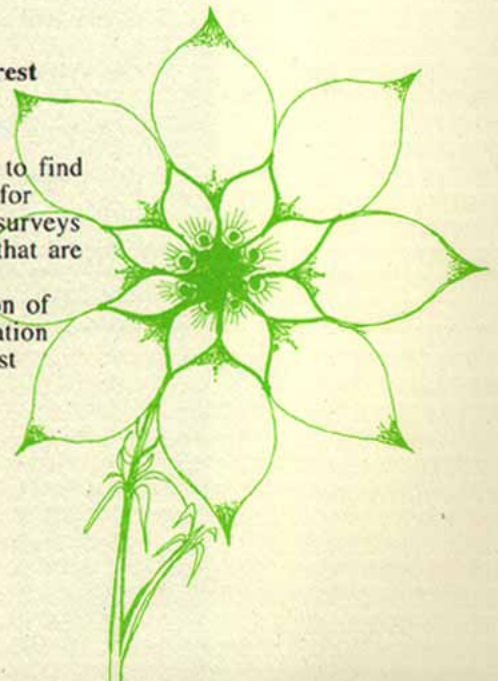
The development of rubber wood processing in Malaysia

Malaysia is famed for its rubber production but an unexpected by-product of the industry was the rubber tree's wood. For nearly a century it was considered unusable. Approaching 127 million over-mature trees required disposal. Following prolonged and coordinated research at the Forest Research Institute of Malaysia in cooperation with various wood-using industries, there is now a major furniture industry which supplies strong local and export markets.

Example of Research by NGOs in support of conservation, management and sustainable development.

IUCN survey of conserved areas and IIED survey of the status of forest management

One of the fundamental pieces of research needed in many disciplines is to find out what the resource is. Throughout the 1980s the International Union for Conservation of Nature and Natural Resources (IUCN) undertook major surveys of the extent and location of tropical forests and those portions of them that are conserved (e.g. the reports by J and K MacKinnon and three regional conservation atlases). These provide a basic resource in the determination of rates of change of tropical forests and the location and needs of conservation areas. These studies had a major impact on political thinking about forest resources in the tropics.



The survey of tropical forest management by the International Institute for Environment and development (IIED) led directly to the ITTO Guidelines for tropical forest management, to criteria and indicators, and finally to Target 2000.

Example of research for the development of non-wood products

Rattan in Malaysia and Indonesia

Inter-disciplinary research at the Malaysian and Indonesian Forest Research Institutes involved studies of the taxonomy, breeding systems, ecology, inventory, planting, management, harvesting and utilization of rattan species (and some other palms and bamboos). These resulted in major increases in investment in the planting of rattans to support the growing local and national furniture industries for local use and export.

Example of research on sustainable forest management systems

Selection systems in Malaysia, Ghana and Australia

Research on selective silviculture of various forest types in Malaysia over a period of many decades progressed through the Malayan Uniform System to the Selective Management System that now forms the basis of recurrent harvesting schedules. These are now accepted by Government and the public as sustainable and environmentally benign.

The system has been adapted for Ghanaian conditions through progressive research by the Ghana Forest Department and various collaborating and supporting agencies.

In a totally different forest type the Queensland Forest Service developed a sustainable system of management for the rain forests through dedicated and integrated research involving ecologists, botanists, forest managers, and specialists in harvesting, wildlife and environmental impacts. However, the forest type has now been declared a World Heritage Area and management for wood production has ceased.

Example of breeding for disease resistance

Sandalwood in India

The sandalwood industry in India was decimated by the mycoplasma "Sandal spike disease". Research on chemical and biological control had failed to resolve the problem. The identification of individual trees that appeared to be unaffected by the disease resulted in a program of resistance breeding that has now apparently solved the problem, allowed new planting and revitalised the industry.

Example of non-wood product development and improvement

Pine resin from Himalayan forests

Pine resin is a major product of the Indian Himalayan forests; some 30,000 tons are produced annually at a rate approaching 3 kg per tree, thus requiring 30 million trees to be tapped. The standard (French) method of tapping requires deep scoring of the bark and wood. The damage to the wood causes trees to snap at the base and ruins the basal log. Relatively simple research on the "rill" method of scraping only the bark and cambium, followed by application of dilute acid, resulted in less damage, wind blow, and wood deterioration while maintaining resin yield.



Science, Forests and Sustainability - A Policy Dialogue



N 1:1M coastline and BRUs

Water bodies

Mangrove

Degraded mangrove

Inland swamp

Degraded inland swamp

Montane rain forest

Lowland rain forest

Sub-montane rain forest

Degraded rain forest

Montane monsoon forest

Lowland monsoon forest

Degraded monsoon forest

Dry forest

Pine forest

Cloud cover

Non tropical moist forest

No data

Protected areas: IUCN categories I-V

Protected areas: IUCN categories I-V

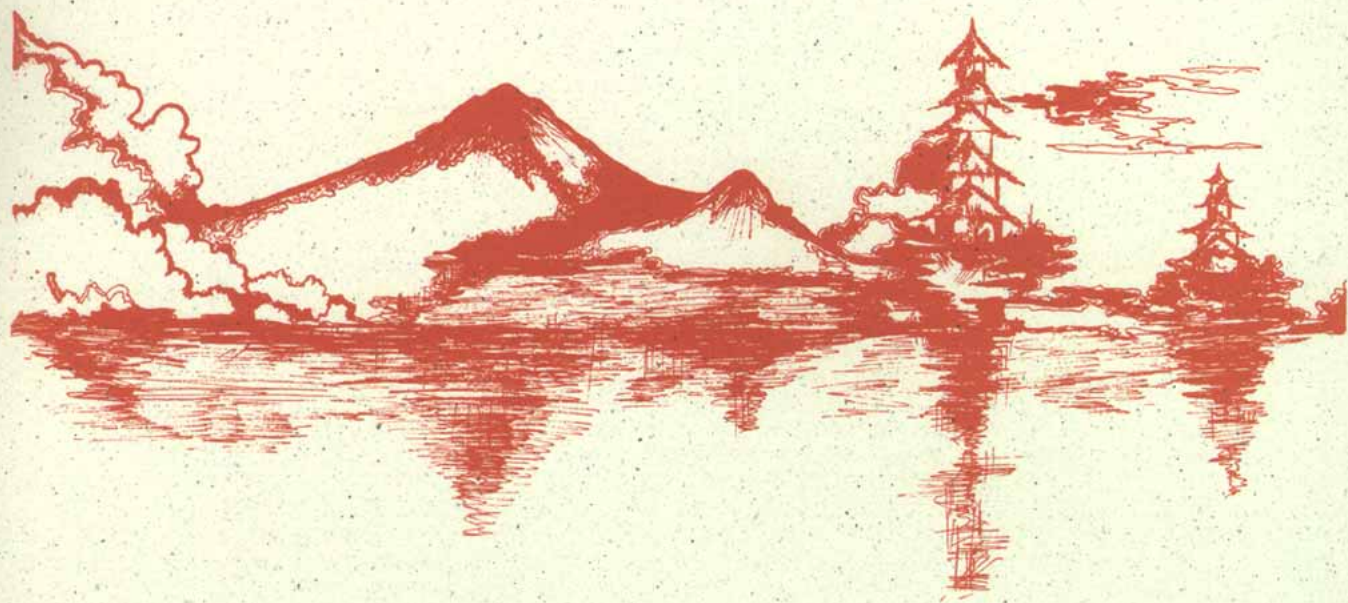
Rivers

Source: WCMC Biodiversity Map Library



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