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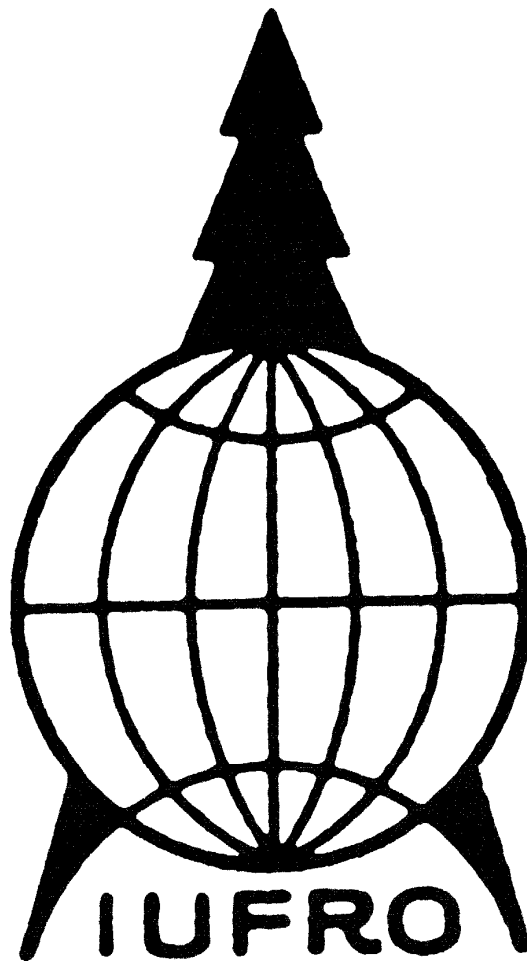
Forest Service

Northeastern Forest
Experiment Station

General Technical
Report NE-130



The Management of Large-Scale Forestry Research Programs and Projects



PREFACE

On April 17-19, 1989, Subject Group S6.06 (The Management of Forestry Research) of the International Union of Forestry Research Organizations (IUFRO) held a meeting at the Forestry Commission's Alice Holt Lodge, Farnham, Surrey, England. The theme of this meeting was, "The Management of Large-scale Forestry Research Programs and Projects". In order to give the papers presented at the meeting the wider audience they deserve, they are being published here as a proceedings of that meeting.

At the meeting, the papers were presented in several different discussion sessions, as shown on the program for the meeting in the Appendix. Here, they are presented sequentially, in the order shown on the program. Due to unforeseen circumstances the authors of three of the papers were unable to attend, although they had prepared papers in advance. Brief summaries of their papers were given at the meeting. They are published in full in these proceedings.

The papers by Oscar Fugalli and George Holmes were prepared by the editor of these proceedings from transcriptions of their taped talks. The editor takes full responsibility for any errors they may contain.

An alphabetical list of those who attended the meeting will be found in the Appendix.

Allen L. Lundgren, Editor
Member, IUFRO Subject Group S6.06

**THE MANAGEMENT OF LARGE-SCALE FORESTRY RESEARCH
PROGRAMS AND PROJECTS**

**PROCEEDINGS OF A MEETING OF
IUFRO SUBJECT GROUP S6.06, MANAGEMENT OF FORESTRY RESEARCH
APRIL 17-19, 1989
ALICE HOLT LODGE, FARNHAM, ENGLAND**

Edited by

Allen L. Lundgren

June 1989

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INTRODUCTION

Denver P. Burns
Leader, IUFRO Subject Group S6.06

The International Union of Forestry Research Organizations (IUFRO) is an international cooperative organization devoted to the advancement of forestry related research to benefit mankind. The internal structure of IUFRO consists of Subject Groups that are focused on specific topics of major interest in the international forestry research community. These Subject Groups are then aggregated into Divisions of which there are six.

Subject Group S6.06 is dedicated to "The Management of Forestry Research." During the past decade the attention of S6.06 members has moved from observing and discussing research activities to formal discussions of the management aspects of forestry research. Coinciding with this shift toward management has been a focusing within IUFRO to initiate and accelerate activities designed to assist developing countries. Representatives of IUFRO member countries and donor agencies are proceeding with full recognition that effective and productive research is critical to provide many of the answers necessary if developing countries are to meet their forestry and natural resource management needs.

The Proceedings of the April 1989 meeting of S6.06, which you have before you, documents the efforts of S6.06 members to learn about and disseminate the issues associated with research management of large and complex international research programs. A key point is that while some of the participating countries have very limited research and research management capability, they are nonetheless partners in some of the most complex research programs ever undertaken in the international forestry community. Given very limited resources, everyone in the forestry research community must take maximum advantage of opportunities to learn from the experiences of others as we strive for a better world. We hope these Proceedings will benefit you.

EXPANDING FORESTRY RESEARCH FOR DEVELOPING COUNTRIES--THE WISTON HOUSE CONFERENCE AND BEYOND; AN INTRODUCTION

Oscar Fugalli

Coordinator, IUFRO Special Program for Developing Countries,
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Before I ask the first speaker on the list to address you, I think that I should give you some background so that you better understand the title of this morning's session, "The Wiston House Conference and Beyond." Later on in the program you will come across the word Bellagio. I wonder whether all of you are fully aware of what the words "Bellagio" and "Wiston House" mean to forestry research. Very briefly, I will say that when the task force of the Tropical Forestry Action Plan completed their task a few years ago they started thinking that there was need for a meeting of world leaders. That idea materialized, and such a meeting took place in July 1987 and was attended by 26 world leaders.

You may ask me why just 26 people took part in the meeting, and not 25 or 30. The reason is very pragmatic. This meeting took place at Bellagio, and there was room for only 26 chairs in the meeting room. Bellagio is a summer resort on the shore of one of the most scenic and large lakes in northern Italy. That has nothing to do with forestry research, of course. But the reason why that meeting took place in Bellagio is due to the fact that there is a house in the locality which is owned by the Rockefeller Foundation, and where the Rockefeller Foundation over the years has organized a series of strategic, high-level meetings on a number of questions. About 20 years ago in that very building a meeting took place which gave birth to the Consultative Group on International Agricultural Research (CGIAR). The CGIAR inherited two or three international agricultural research centers from various foundations, including the Rockefeller and Ford Foundations which had established and financed them for quite a long period of time until their budget requirements became so big that the Foundations were unable to continue to finance these institutions alone. So the CGIAR was initiated in Bellagio about 20 years ago to help finance agricultural research in developing countries around the world. It is now financing 13 associated agricultural research centers. Their current budget is about \$235 million.

Because the public at large has become increasingly aware of and concerned about tropical deforestation, it was thought that it was appropriate to have a meeting of world leaders in such a place as Bellagio to discuss the problems entailed by deforestation in tropical countries. The meeting was held, and received quite a lot of attention. This meeting at Bellagio is now referred to as Bellagio I. Out of this meeting a set of 10 recommendations emerged, one of which dealt with forestry research in the tropics. When the word "tropics" is used in this context, it means really all developing countries, not exclusively the countries which are situated in the tropics.

After the Bellagio meeting, the cosponsors of these meetings, the World Bank, UNDP, the United Nations Development Program, FAO and the Rockefeller Foundation, started thinking about what else was needed in order to make progress. It was realized that progress in implementing all of the ten recommendations made by Bellagio I would be impeded by the lack of relevant information. This meant that priority had to be given to forestry research, if progress were to be achieved in all the other fields.

Early in 1988, the cosponsors established a task force consisting of about a dozen individuals coming from various sectors. It was chaired by George Holmes, who will be addressing

you in a few minutes as to what this task force was able to accomplish. Some time before this decision was made to establish a task force to look into the problems of forestry research in developing countries, IUFRO (the International Union of Forestry Research Organizations) had already embarked on a similar exercise. So, during 1988 two different operations of the same nature were being carried out. While the task force ended its work by presenting their report to what is referred to as the Bellagio II meeting, IUFRO also completed its work mainly thanks to the collaboration of two colleagues of ours who are with us today, Robert Callahan and John Palmer. IUFRO presented its report under the title of INCOFORE, which stands for International Consultative Organization for Forestry Research. It then waited until the Bellagio II meeting was held to discuss the report of the task force, in order to finalize its proposal on the establishment of the consultancy group.

So, there are really two proposals existing nowadays in the world which are very similar. There are points of difference, of course, since the two are the outcome of the work of two separate groups. Nevertheless, the two proposals essentially are similar in nature. Neither of them, so far, has been formally accepted by anybody. You will hear more about this in the course of the discussion this morning.

Now there is one point about which there is some confusion. When you hear the expression Bellagio II and when you hear the expression, as you see on this program, the Wiston House Conference, they are not two different things. The Bellagio II meeting was held at Wiston House in the south of England for practical reasons. I told you about the story of the 26 chairs. In this house owned by the Rockefeller Foundation the meeting room can only accommodate 26 chairs. The reason why the Bellagio II meeting was not held at Bellagio was simply because the interest in the meeting grew so much that there were more people to be accommodated than there could be accommodated by the 26 chairs in that room. Fortunately, the government of the United Kingdom was kind enough to offer hospitality to the meeting at Wiston House near Brighton in the south of England. So, there have not been three meetings, only two, called Bellagio I and Bellagio II, but Bellagio II took place at Wiston House. This is as much as I think I should tell you about the background. You will hear more about the Wiston House Conference from our first speaker, George Holmes.

A REPORT ON THE WISTON HOUSE CONFERENCE

George Holmes

Chairman, Special Task Force on Forestry Research in Developing Countries
Edinburgh, Scotland

Oscar has already given you the background of the Bellagio Task Force and the Wiston House Conference. The report that we eventually produced has the title, "A Global Strategy for Research in Forestry in Support of the Tropical Forest Action Plan." It is an attempt to outline a global strategy focused on two aspects: 1) what research needs to be done and the benefits from the research so identified, and 2) what institutional framework is needed to strengthen research to enable this work to be done. Those are the two essential questions. The Task Force produced a 90 page report, and a large part two report which contains 16 supporting papers that provide considerable detail.

The conclusions of this report were:

- * The forestry related problems in developing countries are very great.
- * The knowledge and information available for their solution is very poor.
- * The research capability in these countries is very weak.

If you add these three things together you have an urgent problem. It is a crises requiring drastic action to put right, with every prospect of an early payoff if investment is made in what we believe to be sensible directions. There are many shopping lists of forestry research needs in the developing world. The Bellagio I conference identified 264 potential projects. We agonized over this and ended up with a strategy based on identification of five priority fields of research:

- 1) forestry's role in sustainable food production and in the management of watersheds and drylands;
- 2) natural forest conservation and its management;
- 3) tree breeding and improvement of trees, with particular emphasis on multipurpose tree species;
- 4) forest products and marketing; and
- 5) policy and socio-economic research.

This latter field is a large diffuse subject, but essentially it focuses on causes of deforestation, incentives for better management, the distribution of benefits from alternative management regimes, and a general desire to illuminate such issues for policymakers and decisionmakers. What we really ended up with is an outline of a strategy based on these five priority research fields. It is not a research program, but a research strategy. The fields are not in any order of priority.

The participants at the Wiston House meeting unanimously accepted this research strategy. They felt this was a sound basis for a move forward. The second question, apart from the research needs, was the question of research capacity, the ability of developing countries to carry out needed research. Generally, the tropical countries by and large are weak in resources, both in amount and quality, and in organization. They lack human resources, such as trained research workers, and physical resources, such as library and information systems. These can be improved by increased financing.

Investment in forestry research has been very low, when you look at the value of the goods and services emerging from forests in these countries. In 1987 research related to the Tropical Forestry Action Plan (TFAP) was about \$250 million worldwide in total. This is less than 10 percent of what is invested in agricultural research. It is less than one-tenth of one percent of the estimated value of forest products in those countries right now. Only \$46 million of external aid is going into forestry research worldwide in the tropics. If you add to that low level of funding the fact that local funding is highly insecure in the majority of cases, it is understandable why it is difficult to get good research work done. Organization and communications are poor. Workers are frequently isolated and lack inspiration, motivation, and good communication. Their status is poor, many would rather be lawyers or accountants or politicians. If you are any good in research you will quickly get out into something that is more remunerative and has a better status. Incentives and motivation are lacking to stay in forestry research in most developing countries. There are obviously exceptions to this. I am painting a deliberately gloomy picture; there are bright lights here and there but they are still few and far between.

The general conclusion of the task force was that there should be urgent action. The emphasis was very much on the urgent need for action, not more talk, which has been going on for so long and which we are still doing. There is a need to expand research in the five priority areas, and to strengthen the capacity to do research, primarily but not exclusively in the developing countries. That is the primary objective on which the Task Force focused. But an important part of this, in the task forces' view, was to deploy the skills in the existing centers of excellence around the world to the problems of the developing world. The scale of the increase in capacity that we had in mind was roughly doubling external aid for forestry research in five years. This means we are no longer talking of \$46 million a year of external aid but something like \$100 million within that five year period. That is quite modest we believe.

None of this will just happen by itself. It requires leadership, it requires organization, and it requires help, both technical and financial. To quote from the Bellagio I conference referred to earlier, we should:

"...try to establish a consultative group for international forestry research with the vision and with the determination of the consultative group for agriculture established 20 years before and in the same place."

The Consultative Group on International Agricultural Research (CGIAR) has achieved great things for agriculture, let's remember that. A similar group focusing on forestry research is needed to provide international leadership and coordination of research. Such a group would help to inspire an awareness of research needs, define objectives, mobilize support for research, establish scientific standards, and insure that research results are put to good use. A first priority of research is to insure that existing information is made available and applied in practice.

A consistent feature of everything we have been talking about is the diversity of problems and conditions that one encounters in the developing world. This, we believe, requires a wide variety of types of funding and institutional arrangements. None of what I have said is new. The International Union of Forestry Research Organizations (IUFRO) has been talking about this for years. Their Special Program for Developing Countries (SPDC), operating on a shoestring, has achieved remarkable progress. Oscar Fugalli, as the SPDC coordinator, has done marvels, I think, in the workshops that have been held. They have established networks, organized workshops, and identified forestry research priorities in the major developing regions of the world. In doing so they have brought people together and

inspired them. And they have, in my opinion, by their vision of leadership and coordination in this field, shown what can be done with quite modest funding. I think it is quite remarkable, and provides something on which we can build and expand and develop for the future. Through IUFRO's SPDC some of the progress has already been made, so we are not starting from scratch.

I would like to turn next to the institutional options available to achieve these things. The Task Force report identified and discussed seven options. The most credible ones were directed to the CGIAR or similar organizational mechanism. Perhaps the CGIAR with a forestry technical advisory committee; possibly a Consultative Group for International Forestry Research, or an independent international research council. The CGIAR route has a great deal to be said for it in theory. It is an excellent organization, it has achieved great things in agriculture; it is vastly experienced in integrating work; and a lot is to be said for bringing forestry research under the CG umbrella.

The Task Force disagreed over that proposal, and came forward with a proposal for an independent institution. We felt that being small, it would have a clear identity. It would maintain the momentum and enthusiasm that exists in this field now; it would be easy to set up; it would evolve from the SPDC as a going concern; it would be flexible; it would be independent; and it would be cost effective. For all of those reasons the Task Force recommended an independent research council. That recommendation was not accepted at the Wiston House Conference. The Wiston House conferees said that they would support all our proposals except that one. They did not want to establish a new institution. If we were going to go forward with the agreed objectives it would have to be done within the framework of the existing institutions. The CGIAR is the obvious institution within which to build a forestry research program, and therefore the CG has been invited to widen its mandate to take in forestry. That is the situation today at the time of this meeting.

What is going to happen post-Wiston? First of all, the CG has been invited to consider, that is the word used, incorporating forestry research into the CG system. Second, the climate is very favorable for this to happen. However, the CG has difficulty in acting quickly because of the many considerations they must take into account in widening their scope to include forestry. Many agricultural institutions that presently are not associated with CGIAR want to get into the system. There is a great deal of discussion as to who is to engage in research on nonrenewable resources. Do you pick up forestry and forget about the others? The CGIAR wants to get this whole thing sorted out. That is not going to be done quickly.

A meeting of donors in Paris discussed a number of important issues. They concluded that agricultural research now has less box office appeal than it had, and that the CG must consider extending its mandate to include forestry. The donors are strongly of that view. There were strong implications in that meeting that more money will be forthcoming for forestry. Encouragingly, a donor consortium has been set up to help the SPDC bridge the gap pending CG agreement on the future to insure that current work doesn't stop.

I attended a meeting of TAC (Technical Advisory Committee of the CGIAR) in Mexico in March of this year. I briefed them on the situation. Although they recognize the need for change, they resist the idea of a separate forestry TAC. I think there are reasons for not creating a separate forestry TAC within an agriculture-dominated organization. Forestry could end up being dominated by agriculture. The CGIAR and the TAC are strongly of the view that they should not be stampeded into a decision. They want to make the right decision, not just make a decision in six months time because they are under pressure. My

appeal to the TAC group was to make sure there is a bridging operation that will enable the SPDC to take work forward while all this talking is going on.

But one thing is quite clear. As a result of the Belliagio initiative, forestry has vaulted into the system. It is being considered up front before any other field of interest at the moment. So all of this preparation and discussion has not been wasted time. What happens within the TAC depends on the outcome of various reports being submitted now. In May the TAC is meeting as a body in Canberra. They call it their half-term meeting. At that meeting they wish to make a decision in principle as to whether to take in forestry. If they do make that decision, then they will take it to the centers week meeting in November. That meeting would discuss details, which are now in the process of being formulated by a committee under Hans Gregersen's chairmanship, and consider the role of forestry research and an expanded CG. They may not make a decision at Canberra in May. But there is a hope that they may decide in November 1990. Politically, the will is there to see more forestry research done, and more money will be forthcoming if you come forward with good project proposals.

I am confident that we are going in the right direction. But there will be delay. Therefore this question of bridging by SPDC is crucial to get action going and extend existing programs. Regardless of what eventually happens with the CGIAR, the role of the SPDC coordinator is vital. There now is a donor consortium in place consisting of the World Bank, the UNDP, US AID and others. Hopefully, they will be able to provide additional funds to enable this bridging operation to proceed. There is a IUFRO paper in draft form, which Bob Buckman and John Palmer wrote, that outlines requirements for a bridging operation in terms of program and financial needs. I think it looks pretty good, although it is perhaps a bit modest. Perhaps the SPDC program could be spun off from IUFRO to serve as an international forestry research center until a decision is reached regarding forestry's role in CGIAR. I think that eventually forestry will be part of the CG system, and will be represented on TAC, the technical advisory committee. If all goes well, forestry could have a higher profile and access to funds and influence that it didn't have before. Thus, forestry could well end up in a much stronger position than it would have as an independent research council.

Our thinking originally was that it was easy to set up a research council, you could do it next week. When it was up and running you could transfer it into the CG system when it is finished talking. I don't think we need to worry about these details. The objectives are clear, the signs are good, and we have to think positively about it.

Finally, IUFRO's SPDC, and IUFRO itself, I believe, is in a pivotal position in this whole matter. You have done more of the work than anybody, and have a better perception of the problems than anybody. I think this subject group on the management of forestry research is particularly relevant to the whole thing. You are in a good position to help develop and take this whole thing forward. And who knows, I don't think it is too optimistic to think that in five years time we will no longer be talking about the CGIAR but we will be talking about the CGIARF.

CHALLENGES AND OPPORTUNITIES FOR
EXPANDING FORESTRY RESEARCH IN AFRICA

by

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SUMMARY

The forest resources of Africa vary from mangrove and moist tropical forests to thorny desert shrubs. Past research has broadly covered management of natural forests and savanna woodlands, tree improvement and plantation forestry. Challenges of current research needs and priorities range from research in specified priority areas to research planning and management, training and acute shortage of resources. These are discussed in detail. Experience of the IUFRO SPDC in Africa is reviewed. Finally opportunities for expanded research are considered to be enormous and this is illustrated with examples.

THE FOREST RESOURCES

Africa has many diversities and its forest resources are no exception. They vary from mangrove and moist tropical forests to thorny desert shrubs. The vegetation broadly corresponds to the climatic zonation from the equator to the tropics of Cancer and Capricorn, but is tempered by the major river basins and mountains in the continent. The broad distribution of the main vegetation types is as follows

- (a) mangroves: coastal strip of West Africa, Mozambique and Tanzania; narrow strip along the Congo river and in Angola
- (b) moist evergreen forests: West Africa; the large Congo basin in Zaire and the Congo
- (c) dry deciduous forests: north of the moist evergreen forests of West Africa; Angola, parts of Botswana, Zambia, Zimbabwe and Malawi
- (d) mountain vegetation: mountain and highlands of Cameroon, Ethiopia, Uganda, Kenya and Tanzania

- (e) grassland and semi-arid vegetation: all countries between the sahara desert and the deciduous forests to the south, parts of Lesotho, Botswana, Malawi, Swaziland, Zimbabwe

The moist evergreen forests, and to a great extent the deciduous forests are rich in long boled timber trees, which include the mahoganies, Chlorophora, Terminalia, Triplochiton and Mansonia species. The forests are complex in composition and genetic diversity. They provide fuelwood, building poles, timber and a variety of foods and medicines. They also protect the environment against the ravages of erosion.

The grasslands or savannas are extensive in the continent. Those with reasonable annual rainfall and 5-7 months of dry season are relatively well wooded with Isobelinia doka, Brachestegia, Khaya senegalensis, Adansonia digitata, Butryospermum parkia, Afzelia africana and some Acacias. These give way to grasslands with Acacias, Balanites, Proposis and Parkia, as the annual rainfall decreases to 500mm or less, and the dry season increases in length and severity. On the boarders of the Sahara and Kalahari deserts, the vegetation consists only of thorny Acacia shrubs and grasses. Like the forests, the savannas provide protection, food, medicines, fuelwood, poles and limited timber.

Tropical forests have provided revenue for national development for countries so endowed, but over-exploitation has resulted in wood shortages. Deforestation has also been accelerated by population pressure for agricultural and urban expansion. The savanna areas are similarly being cleared, but more devastating are the effects of drought, which have increased in frequency and severity during the past 15-20 years. Thus the plant cover in Africa is being reduced, and its genetic composition eroded.

Many countries have established forest plantations for fuelwood, shelterbelts, anti-desertification, pulpwood, poles and industrial timber. The estimated total by 1985 was over 2.4 million hectares and is rising. They are mainly of exotics, Gmelina arborea eucalypts, tropical pines, Azadirachta indica (neem) Tectonia grandis (teak), acacias and some indigenous species such as Terminalia ivorensis, T. superba, and Triplochiton scleroxylon, (obeche).

These natural forests, savanna woodlands, and plantations make up the forestry resource base in Africa, against which forestry research and its expansion can be considered. Productivity of the natural ecosystems is currently below attainable maximum, and more studies are needed on their dynamics and true growth potentials. Also most of the plantations are currently established with genetically unimproved seeds. The scope for upgrading their productivity is therefore enormous.

PAST RESEARCH EFFORTS

Forestry research is old in some African countries but much more recent in others. In the former, it has tended to cover the problems of nursery and plantation, tree improvement, seed technology, management of natural forests, arid and semi-arid savannas, utilization of forest products, and wildlife ecology and management. There has been substantial donor inputs into forestry research in Africa. France, the UK, USA, Denmark, Finland, Holland, Canada, FAO/UNDP, UNESCO, EEC and the World Bank all have on going projects of various sizes in different countries. Results from past research efforts have improved forest productivity and influenced forestry development in many countries. Some examples may be appropriate

- (a) The quality of seedlings has greatly improved and the cost of production substantially reduced.
- (b) Pines, acacias, eucalypts and Casuarina, Gmelina, and teak have been successfully introduced into several countries.
- (c) Provenance selection has significantly increased productivity of pines, eucalypts, Terminalia superba and Triplochiton scleroxylon in Zambia, Zimbabwe, Kenya, Congo, Nigeria, Zambia, Tanzania and Cote - d'Ivoire; while yields of eucalypt plantations in the Congo are now particularly high.
- (d) Seed technology, handling and storage of some species are well known in Zimbabwe, Zambia, Kenya, Burkina Faso, Senegal and Nigeria.
- (e) Many lesser known species are now utilized in Nigeria, Senegal, Liberia, Ghana and Cote - D'Ivoire.
- (f) Agroforestry production system, though old in the continent, is being better understood and used more meaningfully.
- (g) Fuelwood plantations and shelterbelts are now being established with acacias, eucalypts and Casuarina on very difficult environments in the arid zones of Egypt, Sudan and other North African countries.
- (h) management of the moist natural forests has improved in Cote d'Ivoire, Cameroon, Congo and Nigeria, although enormous problems still exist.

However, it is believed that these results fall short of what was possible, given the biological potentials of forest trees, and the growth conditions in much of the continent. In many cases research objectives tended to be too broad and not sufficiently focused to give answers to specific questions. For a long time, research was carried out exclusively by

foresters rather than by multidisciplinary teams with different backgrounds. Consequently, some problems were not covered in depth or avoided entirely. Tree improvement and breeding were not given enough attention, resulting in yields far below potentials, and lost opportunities for utilizing outstanding phenotypes and hybrids.

Serious problems still exist in spite of the laudable achievements of past research. These have caused concerns and gave rise to Bellagio Forestry I and II meetings in 1987 and 1988, and the present initiatives on expanding forestry research in developing countries.

CURRENT CHALLENGES

The challenges in expanding forestry research in Africa are multidimensional. They include research in specified priority areas, research planning and management problems and finally resources for research. These will be discussed under two headings viz, research needs and priorities, and lessons from experience of the IUFRO Special Programme for Developing Countries.

Research needs and priorities

The problems of forestry research in Africa and other developing parts of the world have been reviewed many times recently (Anon, 1988; FAO, 1985; 1987; Iyamabo & El-Lakany, 1988; World Bank/FAO, 1981; World Bank, 1986a; 1986b). This need not be repeated. It is however important to discuss new dimensions, perceptions and trends in forestry, and the research problems they generate. These have bearing on priorities and any planned expansion of forestry research programmes.

In 1988, an International Task Force on Forestry Research in Developing Countries reviewed these problems against the background of the Tropical Forestry Plan (FAO, 1985), and identified five areas as priorities for expanded research (Anon, 1988). These are

- forestry in land use: agroforestry, management of watersheds and degraded lands
- management of natural forest ecosystems and conservation of biological diversity
- tree improvement and breeding
- utilization of wood and non wood forest products
- policy and socio-economic issues in forestry.

Natural forest ecosystems as used above are meant to include arid and semi arid vegetations. However for Africa with vast areas of savannas, these must be listed and treated separately. There are also other priorities which are

important for research and for the African situation viz; institution building, development of human resources and development of data bases. Proposals to expand research in Africa should accord them high priority. The list of five areas above should therefore be expanded to include

- arid and semi arid areas
- institution building
- development of human resources
- development of data bases.

These are treated in some detail below

(a) Forestry and Land Use: agroforestry, management of watersheds and degraded lands

African soils are generally infertile and fragile. Heavy fertilization is needed for sustained high crop yields, but this is expensive. Intergrating trees in production systems enhances and sustained production of crops and livestock. To maximise the contribution of trees to the system, the best possible species and varieties must be used. Research is needed on

- quantification of the contribution of trees to soil fertility and structure
- competition between trees and food crops
- biology of agroforestry trees
- useful characters of these trees for soil improvement, rapid growth and biomass production, competitiveness for soil water and nutrients
- genetic improvement of these characters
- nitrogen fixation and mycorrhizal associations.
- economic trade off between agroforestry systems and other farming systems
- incorporating trees and sustainable farming systems in watersheds as an alternative to expansion agriculture involving clear-felling on steep slopes
- effect of different land uses e.g. of tree cover versus grass cover on watershed hydrology.

(b) Management of natural forest ecosystems, and conservation of biological diversity

The tropical forests of Africa are among the most complex ecosystems in the world. In spite of past research, there are major gaps in knowledge needed to maximise production on a sustainable basis. Productivity is currently 6-8m³/ha/year, and it is believed it can be higher. Research is needed on

- micro climate and plant growth within forest ecosystems
- species composition of the plant associations.
- dynamics of species, growth and its distribution in residual forests after canopy opening or logging

- silviculture for maximum and sustained production.

Current in-situ and ex-situ conservation measures are fraught with security and policy problems. They therefore must be augmented by technologies such as pollen and seed storage, tissue culture and biotechnology. To apply these to tropical trees germplasm, research is needed on their

- phenology, flowering, reproductive biology and seed production
- seed technology, their handling and storage
- seedlings and seedling growth.

For conservation purposes, species identification is only a first though important step. Tree characters and their variation within the tree population must be known as these form the basis for selection for storage. Little of such characterisation has been done. For example only 1% of tropical plants have been screened for useful medicinal qualities, and less than 20% of all tropical plants have been identified and described. The scientific basis for conservation of tropical plants is therefore yet very weak.

(c) Tree improvement and breeding

Trees required in agroforestry, protection, and plantations need to be fast growing, disease resistant and fully adapted to the environments in which they are to be grown. They must therefore be the best possible species, varieties and clones for each purpose.

There is an urgent need for greatly strengthened tree improvement research in Africa. Population pressure is reducing available lands for forestry. Production per unit area therefore needs to be increased. Shifting cultivation, over-grazing and erosion are increasing areas of degraded lands. These must be rehabilitated into agricultural production, and the correct tree species and varieties must be found or developed. The decrease in natural forests and expansion in plantation area increase the risks of pests and diseases. Breeding strategies are the hope for dealing with such problems as they may arise. Research is therefore needed on

- evaluation of tree characters e.g. for rapid growth, gum production, disease resistance and adaptation to particular environments
- reproductive biology of species, flowering and seed production,
- seed physiology, seed handling and seed storage
- maximisation of seed production
- nursery and plantation techniques for important species
- management strategies for maximum production in different environments.

(d) Utilization of wood and non-wood products

Log conversion ratios in most of Africa are only 30-50% instead of a possible 70-80%. Wastage is therefore enormous. There is also a preference for the timbers a few of well known tree species, while all others which are lesser known are not used. A third source of wastage is reliance in some countries on heavy machinery designed for large sized timbers, but are unsuited for the small sized trees in residual and secondary forests, and plantations. The machines suited large trees when these were available, but need to be changed now that they have been exhausted.

Technologies exist in developed countries to

- improve log conversion ratios
- convert small size logs
- use timbers of less known species in panel products, as reconstituted wood etc.

Research needs in this area may not be difficult as it is largely adaptation of existing technologies for use in African conditions.

(e) Policy and socio-economic issues in forestry

No areas of forestry research has been as neglected as policy and socio-economic issues. Yet, these can have the greatest impact on forestry development, attitudes and involvement of people and realisable revenue. Increased knowledge on forest productivity and management can give the resource new values. This is important in Africa where forests are seen only as a resource to be exploited, or be cleared for development. Their values in environmental protection, in conservation of genetic diversity, and for recreation are hardly appreciated.

Research is needed in such areas as:

- Government policies which encourage deforestation in favour of non sustainable land uses
- policies and incentives for involving local communities in forest production and management
- policies to encourage a shift from log export to domestic processing
- policies on timber stumpage fees and taxation
- economic quantification of the value of trees and forests in soil protection, as shelterbelts, and for other environmental purposes.
- economics of tree farming with fast growing species
- economics of small forestry enterprises
- economics of conservation of genetic diversity of trees and natural ecosystems
- economic value of various non-wood products.

(f) Arid zones, desertification and marginal lands

There are about 1.3 billion hectares of semi-arid lands in Africa, South America and Asia. 27 million hectares become desert yearly. Another 160 million hectares of upland watersheds have been degraded and such areas are increasing rapidly. The same applies to lowlands degraded by over-farming, over-grazing, and erosion.

Research aimed at arresting desertification, improving, protecting and rehabilitating degraded or marginal lands for sustained production in harsh environments, constitute a priority package in much of Africa. It is complex, long term and involves

- environmental characterisations
- soil nutrient and water regimes
- plant-soil-moisture relationships including moisture stress
- macro and microclimate
- effect of trees and shrubs on soils, temperature, wind and soil moisture
- plant adaptation to the environment
- establishment techniques and promotion of early growth
- management strategies for maximum production.

It also involves management of the entire resource (crops, forests, grasslands, soil, and water) for sustained production. The forestry component (trees and shrubs) in such systems should be the best possible. This is feasible only by using improved genetic materials and the best production systems.

(g) Institution building

Institution building in this context is taken to cover provision of equipment and vehicles needed for research and extension of research results. Physical office and laboratory space may be included.

Most research institutions in Africa are short of these facilities, a situation which hampers their effectiveness. As a result, technical assistance projects invariably contain provision for them as part of the assistance package. These limitations are naturally not of the same magnitude in all the countries, and the assistance required will therefore vary. It is however important to take account of the problem when considering expansion of forestry research in Africa.

(h) Development of human resources

As for institution building, development of human resources is essential in forestry research expansion schemes. It could cover academic training (under-graduate and post-graduate), technical training, training in particular skills, study tours, attachment training and development through participation in conferences, seminars and workshops.

Training needs will vary with the nature of projects, and from country to country. They should also cover such important areas as research management (research planning, priority setting, evaluation, etc) which may not easily fit into usual technical assistance projects.

(i) Development of data bases

Data bases are essential for research but they are often neglected. Quantified data is difficult to obtain in virtually all countries of Africa. Such data is required for planning, and many other purposes. In a continent of limited resources, duplication of efforts and repetition of research already done must be avoided. Full advantage must be taken of all published and unpublished data, results of work in neighbouring countries and elsewhere.

There is an urgent need to develop national capabilities for data collection, analysis, storage and retrieval. Such facilities and capabilities will greatly enhance institute effectiveness.

Lessons from the IUFRO SPDC experience

The principal objectives of the IUFRO SPDC are solving priority forestry problems of concern to groups of countries, and strengthening of national research capabilities. To achieve these the SPDC has adopted a strategy of

- research networking
- institution building
- development of human resources
- dissemination of information.

(a) Research networking

Within this context the SPDC has organised the following workshops in Africa

- (i) Research Planning Workshop for Africa (1986). This discussed and approved project documents on seven priority problems in the Sahel and North Sudanian zones. The outcome has been published as "Increasing the Productivity of Multipurpose Lands: Sahelian and North Sudanian zones of Africa." (Carlson & Shea, 1986).
- (ii) Follow-up meeting to the 1986 Nairobi workshop (1987). It focused on the two highest priority projects; "Genetic improvement of selected tree species," and "Silvo-pastoral management of savanna woodlands." The outcome has been published as "Tree Improvement and Silvo-pastoral Management in Sahelian and North Sudanian Africa: Problems, Needs and Research Proposals." (Iyamabo, Ed. 1988).

- (iii) Research planning Workshop for East and Southern Africa (1988): on "Genetic improvement of selected tree species" and the "Role of trees and shrubs in the rehabilitation of degraded lands." The proceedings are being processed for publication.

The workshops involved working with national institutions to

- identify priority problems of common interests
- prepare networks which incorporate national projects and regional coordination mechanisms
- contact donors to mobilize funds and implementation strategy
- implement the networks.

It takes effort, tact and understanding to obtain a consensus on priority problems which warrant international network approach. National interests of neighbouring countries may vary or even conflict. Assumptions on national perceptions must therefore be avoided and ideas must be made to originate from the national level.

Care is also needed in formulating national projects in the networks. They are developed with scientists in national institutions and based on what the countries themselves identify as their needs, bearing in mind that they themselves will implement the networks.

Many participants at these workshops have been of the highest calibre, but some have been young and inexperienced. This is understandable given the state of development of many countries, but it underscores the need for tact and understanding of these workshops.

Implementation has been a problem. So far no field research has begun on any of the networks. The sahelian projects were prepared in detail and costed country by country. The proposals have been endorsed with minor amendments by the Forestry Working Group of SPAAR, which comprises the Forestry Advisors of donors. However as most donors operate on bilateral basis, they have requested individual country projects, based on these networks. These are being prepared but it is a slow process. The same will have to be done for the East and Southern Africa networks.

The international research centres within and outside the CGIAR operate many networks in Africa and elsewhere. They backstop, coordinate and finance the networks, subject to controls and auditing measures donors may impose. The IUFRO SPDC is yet far from this stage, and therefore has to work differently. However the present situation adds an expensive, time consuming dimension to the process of developing and implementing research networks.

It should also be mentioned that IUFRO is not yet well known in Africa. Some countries and scientists understand it for what it is, but most look on it as an international body such as the FAO, UNDP and World Bank which directly finance projects. There may be some disappointment when they know IUFRO for what is really is, but it is eventually accepted. However for the good of IUFRO's image in the eyes of these countries, it is advisable that the networks developed in these workshops, are implemented without too much delay, and IUFRO finds a way of being associated with this implementation.

(b) Institution building

The research networks developed so far contain sizeable components of institution building as described earlier. In the tree improvement project in the Sahel for instance, 17% of the total costs for provenance evaluation and conservation, 24% of that for exploration, collection and extraction of seeds, and 42% and 62% of those for seed production and seed centres respectively, were specifically for strengthening institutional facilities. Such costs will vary with the type of problem the project addresses, but the figures above illustrate the priority being accorded this component in IUFRO networks.

(c) Development of human resources

Training is similarly given high priority. This is inevitable in Africa with serious limitations in this area. The IUFRO networks incorporate opportunities for many kinds of training, such as

- exposure to problem identification, project formulation and execution, and to research coordination.
- training in research leadership, programme management and international cooperation. e.g. as coordinators of networks.
- academic training, (degree and post graduate) improvement courses and study tours specific to the projects.

As with institution building, training costs make up significant proportions of project costs as developed by the SPDC. In the Sahelian tree improvement project example, this ranges from 7.7% for training for exploration and seed collection, to 15.8% for training to man seed centres.

The SPDC also organises training programmes per se. In 1987 it ran a 6 weeks IUFRO/Austria "Training Course in Statistical Methods for Forest Research" in Gmunden, Austria for researchers in developing countries including Africa. Arrangements are now advanced for a "Training Workshop on Management of Forest Research in Africa." It is intended for directors, and aimed to improve effectiveness of their institutions and programmes.

(d) Information dissemination

The IUFRO SPDC has established a "IUFRO Information Bulletin for Developing Countries" in collaboration with the Commonwealth Agricultural Bureau (CAB) in London. This consists of reprints of entries selected from the CAB's Forestry and Forest Products Abstracts. It brings the abstracts to the reach scientists in developing countries who do not have access to the CAB abstracts journals. A Newsletter covering activities in Africa was established in 1987.

Dissemination of information presents no problems if funds are available. It does not cost very much either, but it serves a vital purpose. The Bulletin and Newsletter reach a large number of researchers in the continent and are certainly improving scientific awareness of their readers. Each of the proposed networks also has provisions for publication of a newsletter for the benefit of its collaborators.

OPPORTUNITIES

Opportunities for research in Africa are enormous. No problems have yet been researched to the extent that refinements are now the priority. The possibility of obtaining good results from good research are still very high, to the extent that financial investment in such research will yield high dividends. An example is selection and breeding in the Congo, where clonal plantations of eucalypts yield 30 m³/ha/year on infertile sandy soils, unsuitable for agricultural crops. The original natural savanna vegetation produced only 2 m³/ha/year (Delwaulle, 1987). In Nigeria the best of five provenances of E. camaldulensis produced 17.3m³/ha/year while the poorest produced 5.1m³/ha/year (FAO 1979).

There is also a new interesting study. Anderson (1986) quantified economic benefits of shelterbelts in Nigeria and found returns on investment calculated on wood (poles and fuelwood) benefits alone, was only 4.7%, but when calculated on the wood benefits plus the positive impact of the shelterbelt on soil conservation and crop yield, the rate of return was 21.8%.

The provenances of neem, a very successful exotic in much of the savannas of Africa, have not been evaluated. The opportunities for gains in productivity from a selection programme are considered to be very high. Also, provenance evaluation of E. camaldulensis which has proved very rewarding in a wide area, needs to be repeated in other agro-ecological zones of Africa where the species seems to have good potentials.

Many native tree species of Africa for which there is now considerable interest, have not yet been studied for provenance

characterisation and evaluation. The results from such studies will undoubtedly open further possibilities for gains in productivity.

There are only few examples in Africa where tree improvement has gone beyond provenance evaluation. Seed orchards are inadequate and about 80% of seeds used in afforestation are still of genetically unimproved materials. In these areas, expanded research will open opportunities for gains in productivity.

Many eucalypts, and perhaps other tree species as well, naturally exhibit hybrid vigor, but no advantage is taken of this God-sent phenomenon. In agriculture, hybrids are developed at great cost and are then exploited for large scale production. Forestry can take advantage of its natural hybrids.

Tree growth conditions in the tropics also offer excellent opportunities for expanded research. With appropriate silviculture and management, productivity and yields are high even in savanna areas. There are instances of Pinus caribaea attaining 2 meters in height only one year after planting, a provenance of E. camaldulensis attaining 11 meters in height in 18 months (with limited irrigation in the first year), and Khaya senegalensis from unimproved seed stock, attaining 30-40 cm diameter at breast height, and good bole length in 10-15 years. Yields are even much higher in the forest zones with much better rainfall. Rotation can thus be comparatively short and generations of plants in experiments can be obtained in a relatively shorter time than elsewhere.

From the picture shown above, research on forest productivity can yield results relatively quickly. Similarly, though for different reasons, results can be obtained in a short time from forestry related policy and socio-economic research. Such research will be breaking new grounds in much of the continent. Systems research in agroforestry, watershed management, arid zones afforestation, and desertification, though complex will undoubtedly prove exciting for researchers, and valuable to many. The problems of managing natural forests and conservation of their genetic diversity, are similarly complex. Results may not be obtained as quickly as in the other areas discussed so far, but the research is urgent for reasons which do not concern developing countries alone.

Finally any meaningful expansion of forestry research in Africa requires

- increased commitment and support for forestry research by countries in the continent
- substantial expansion in donor assistance, some of which must be to address basic scientific problems on which much of the needed applied research depends
- strengthening of international mechanisms for promoting, coordinating and backstopping research in national institutions, and for tackling problems which are beyond the capabilities of individual countries

- increased cooperation between developed and developing countries' institutions.

Commitment and enthusiasm of researchers in Africa are as high as can be found anywhere else, given their limitations in resources and research environment. They however realise these can never be adequate and they have to content themselves with what is available. It is hoped however that with increasing political awareness of the true values of forests and forestry to people, Government support for research will improve.

There are encouraging signs that donor support for forestry research in developing countries will increase substantially in the near future. Bellagio I and II meetings of 1987 and 1988, and their follow up actions are testimonies of this. Africa anxiously looks forward to the translation of this hope to reality.

IUFRO is in a unique position in all these developments. Its membership contains a body of knowledge not replicated anywhere else. It has been in the fore-front of international efforts to expand forestry research in developing countries, and will no doubt continue to play a leading role as current decisions are translated into action. Forest researchers in Africa are grateful to IUFRO and its members who have been involved in these efforts.

LITERATURE CITED

1. Anderson D. 1987. The Economics of Afforestation: A case study in Africa. Occasional Paper Number I, New Series. John Hopkins University Press, Baltimore, USA.
2. Anon 1988. A Global Strategy for Tropical Forestry: Report of an International Task Force on Forestry Research 88pp. Rockefeller Foundation/UNDP/WB/FAO New York.
3. Carlson Les W and Keith R Shea (Compil) 1986: Increasing Productivity of Multipurpose Lands: Proceedings of the IUFRO Research Planning Workshop for Africa: Sahelian and North Sudanian Zones, Nairobi, Kenya 1986. 333pp.
4. Delwaulle J C 1987. Personnal communication.
5. FAO 1981. Forest Resources of Tropical Africa. Technical Report No. 2. FAO, Rome.

6. FAO 1985. Tropical Forestry Action Plan: Committee on
 Forest Development on the Tropics. FAO Rome.
 159pp.
7. FAO 1987. Review of Developing Countries Research Needs:
 Internal Working Paper FAO, Rome.
8. Iyamabo D E (Ed) 1988. Tree Improvement and Silvo-pastoral
 Management in Sahelian and North Sudanian
 Africa. 196pp. IUFRO, Nairobi, Kenya.
9. ----- and M H El-Lakany 1988. Forestry Research in
 Africa: Problems, Priorities and Needs.
 Report to the Bellagio II International Task
 Force on Forestry Research in Developing
 Countries. 31pp. Nairobi, Kenya.
10. Spears J. 1988. Containing Tropical Deforestation: A review
 of Priority Areas for Technological and Policy
 Research, World Bank Environmental Department
 Working Paper No.10.
11. World Bank/FAO 1981. Forestry Research Needs in Developing
 Countries: Time for reappraisal? 56pp. World
 Bank, Washington DC.
12. World Bank 1986a. West African Agricultural Research Review.
 413pp. World Bank, Washington DC.
13. ---- 1986b. Eastern and Southern Africa Agricultural
 Research Review. 161pp. World Bank,
 Washington DC.

**EXPANDING FORESTRY RESEARCH FOR DEVELOPING COUNTRIES
- THE WISTON HOUSE AND BEYOND**

**CHALLENGES AND OPPORTUNITIES FOR
DEVELOPING COUNTRIES IN ASIA**

**(MEETING OF IUFRO WORKING PARTY S6. 06 --MANAGEMENT OF FORESTRY
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by

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SUMMARY

The developing countries in Asia have diverse political, socio-economic and historical backgrounds. They are very concerned for their own economic and technological advancement and many developing countries utilise their forest resources to provide land for the landless, for national development and to earn foreign exchange through sale of timber. This has led to a high rate of deforestation which has caused concern among the developed countries because of the likelihood of negative long term environmental impacts affecting human welfare. Various international and bilateral agencies, foundation donors have acted to attempt to rectify this problem. One of the action plans involve expanding the forestry research in developing countries by way of financial support and encouragement from developed countries. While this action provides plenty of challenges and opportunities for the advancement of forestry science, for this plan to be effective, the capacity of local research institutions and skills of individual scientists must be upgraded and these same local scientists must as far as possible perform the research.

INTRODUCTION

As a follow-up to the Bellagio I meeting in Italy in 1987 the Bellagio II or Wiston House meeting that took place in the United Kingdom in late 1988 was primarily to work out strategies for further strengthening of forestry research in developing countries (DCs). (IUFRO 1988)

This latter meeting , attended by senior representatives from about 25 multilateral, bilateral and various foundation donors endorsed a recommendation for an expanded programme of forestry research in the DCs to be supported by a very substantial increase of funds by donors and other bodies from the developed countries. The meeting also agreed that the research programme should focus on five priority areas viz. agroforestry and watershed management: natural forest management: tree breeding and tree improvement: forest products utilization and marketing : policy and socio-economics. To coordinate and expedite the entire effort, the meeting also accepted a proposal to form a forestry unit to be attached to the international coordinating body, the Washington D.C.-based Consultative Group for International Agricultural Research (CGIAR) to help donors , national agencies and R & D institutions in identifying research priorities, mobilising support, focusing research and disseminating and exchanging information.

The International Union of Forest Research Organisations (IUFRO) participated actively in both these meetings , more of which have been planned to ensure the speedy implementation of the proposals.

FORESTRY IN THE DEVELOPING COUNTRIES IN ASIA

Since the launching of the Tropical Forestry Action Plan (TFAP), (FAO /WRI /World Bank / UNDP 1985) the issues and problems of forestry in the DCs in tropical countries have been prominently and repeatedly featured in the popular media like **TIME** (1989), and the **Far Eastern Economic Review** (1989). There is now considerable public awareness of the subject in general, particularly on the issues of conservation of forest resources in DCs.

In dealing with the challenges and opportunities for forestry research in the DCs in Asia, it is however appropriate to briefly consider a) the DCs themselves and, b) the role of forestry in the general context of the DCs today.

The Developing Countries

To begin with it is worth stressing once again that these countries, while distinct from the developed countries, are by themselves different in political, socio-economic, ethnic, religious and historical backgrounds. The majority are "young" countries, many having been ruled by European-speaking peoples as colonies for varying periods of time in their respective pasts. They share one common goal though: all are seriously concerned for their own economic and technological advancement in order to attain higher living standards for their citizens. All these factors have an important bearing on the attitude of their policy makers and administrators towards forestry.

Fifteen years ago countries such as Taiwan and South Korea were among the DCs of today. Nowadays a new term "Newly Industrialising Countries (NICs) " has been used to describe these countries because of their extremely rapid economic advancement during this past period. In the market place of international trade, Taiwan, South Korea, Singapore and Hongkong are also called ,rather unflatteringly, the "little Dragons" presumably to differentiate them from Japan the "big Dragon".

From the forestry perspective all these NICs or "little Dragons" have one common feature in that their own native forests resources never played any significant role in contributing to their current economic success . On the contrary , Taiwan and South Korea (together with Japan) utilised and capitalised on supplies of "South-sea logs" from the DCs in the Asean (Association of South East Asian Nations) region to develop their own timber-based industries and to sustain and extend their growth beyond the processing of wood and into industrial manufacturing. Today these countries manufacture and export a growing range of wood processing equipment. The rest of the DCs now aspire to be NICs.

The Forestry Scenario

A vast variety of forest types is found within the DCs in Asia. They range from coniferous forests ,dry and moist deciduous forests to tropical rain forests, including mangroves: each type requires different silvicultural and management systems for proper management. The most complex are the tropical rain forests in which the goals of sustained yield management as practised in temperate forests, have so far been generally unattainable. Indeed the subject of the sustained and wise use of the tropical rain forests has been much more intensely debated by scientists, foresters and environmentalists alike in recent time. (McDermott 1988)

Many DCs in Asia also face socio-economic problems associated with growing populations, unemployment and shortages of fuelwood. According to the TFAP , these problems have contributed to the depletion of their forest lands.

There is also an apparent lack of appreciation by the people in DCs for the forests. In the Asean region where there are still considerable tracts of rain forests, clearing and converting forests for agricultural development has always been accepted since colonial administration days as the appropriate development model. A case in point are the vast plantations of rubber and oil palm in Malaysia today. These are often quoted as very successful development models but seldom is it mentioned that much of these same lands once carried prime and luxuriant lowland rain forests. It is difficult to argue that these forests should not have been developed in the first place, bearing in mind Malaysia's economic backbone is based on these commodities.

This development legacy is still pervasive because of its familiarity and ready economic appeal. In recent years however, doubts have been raised about this approach to development as this has not worked very well in all cases in sites with less favourable topography and soil conditions.

In his study on the misuse of the tropical rain forests, Reppeto (1988), using data from case studies states ".... To a considerable degree, the policy weaknesses identified in this study arose despite well intentioned development objectives. The shortcomings have been the failures of understanding and execution..."(pg. 14)

He advanced a number of reasons for this, amongst which are:- a consistent underevaluation of the benefits of the intact natural forests by both policymakers and the general public ; the overestimation of the net benefits from forest exploitation and conversion and, developmental planning based on reckless clearing of forests to produce commodities of marginal economic value.

The attitude of policy makers "... persistence of the forest custodial perception that a country's forests should be managed by a forestry department for foreign exchange earnings or domestic timber..." (Bengston et al. 1988 : 1) has also been claimed to be a very significant contributing factor for these shortcomings.

Indeed some forest departments still have rather inflexible and unenlightened forest development plans for future domestic timber supplies.

Whatever it is, concerned environmentalists and conservationists in Europe and elsewhere have recently reacted to what they perceive as irresponsible use of the tropical forest resources in these DCs. They now use their growing influence to initiate "Anti tropical timber campaigns". Malaysia is the target of one such campaign.

Forestry Research In DCs

Lately ,the subject of forestry research in DCs and less-developed countries has been fairly thoroughly studied. A successive series of international workshops and seminars have been conducted with support from international and bilateral agencies non-governmental organisations (NGO) and, of course, IUFRO. Priority needs of many national forestry research organisations have been discussed (Lundgren et al. 1986). Fairly detailed analyses of the overall national research capacities of both DCs and developed countries from the IUFRO fraternity have also been done (Bengston and Gregersen 1988).

The overall conclusion is that forestry research in the DCs is inadequate , progress in generating supportive services and new knowledge for better forest management have not been commensurate with present day demands.

In a critical examination of the forestry research capacity of DCs in the Asia -Pacific region it was stressed that strong national forestry research is vital to improved forestry management and practices to deal with the current problems associated with or contributing to forest depletion in many of those countries today (Bengston et al. op cit.).

With respect to the forestry scenario in DCs in general, it would appear that the parties responsible for the Bellagio meetings have succeeded in addressing the appropriate current problems.

CHALLENGES AND OPPORTUNITIES FOR FORESTRY RESEARCH

A discussion on the challenges and opportunities for forestry research must be related to the ultimate objective of the entire research effort. Which is : whether the outputs, on the conclusion of all the research, made any impact towards achieving a more harmonious balance between the economic advancement of poor countries in the shorter term, and sound management and conservation of the tropical rain forests in the longer term. Obviously this subject covers an extremely wide scope and has many dimensions.

For the present it is best that this discussion be confined within the context of the recommendations of the Wiston House meeting and even then, be limited to some of the aspects applicable to the situations of DCs in the Asean region. This is assuming of course, that international funds are made available to support the research.

National Research Capacity

The importance of having strong indigenous research capacities to perform research has been stressed earlier. In real terms this means supporting the expansion of the research capacities of local institutions, upgrading the skills of individual scientists at these institutions and having them be involved in the actual research work. It also means establishing more linkages and networks between forest research institutions within the region to facilitate the performance of research on topics of common interests thus reducing expensive duplication. The network system coordinated and supported by the International Development Research Center, Canada (IDRC) for the rattan and bamboo, and by the United States Agency for International Development (USAID) for the multi-purpose tree species projects are good examples. There is a growing pool of scientific talent within each of the

DCs in the region but without external initiatives from developed countries, opportunities for these scientists to interact, sometimes even among themselves within their own countries, are limited. Such interactions need not be limited to the technical aspects of research topics alone but extend into general research management, an area much neglected by practitioners of forestry research in DCs.

Initiatives to translate research information into the English language, for example the Indonesian Forestry Abstracts (Anon. 1982) are other ways of effecting similar contacts.

Forest policy and socio-economic research. Among the priority research areas, forest policy and socio-economic research appears to be the most challenging. The generation of new knowledge to enlighten and hopefully convince policy makers that logging and clearing of the forests to provide land for the landless, for national development and for earning foreign exchange through sale of timber and timber products are not the best available options for economic development in today's world is urgently needed. This is not easy. There is a general tendency to view this as a problem of the policy makers in DCs alone. As the **Far East Economic Review** (op cit) puts it "... the technical solutions are known: the failures are political, socio-economic and managerial..." (pg. 35) It will be a tremendous challenge to formulate innovative research that not only highlights conservation of the tropical forests as an international responsibility but also suggestions for ways and means for the international community to equitably share in shouldering this responsibility.

New economic arguments for retaining natural forest management in the tropical rain forests in DCs along the lines of **Leslie**(1987) are needed.

The approach adopted by **Repetto** (op cit.) is commendable. On the issue of the underevaluation of the natural forest leading to its misuse, he does not fault the DCs alone but a developed country, USA, is also castigated, albeit over-severely, for consistently undervaluing its timber sales from its National forests and sacrificing potential recreational and wildlife benefits. This balanced approach in presenting and reporting policy findings is more effective and has a better chance of making an impact on readers especially administrators, forestry officials, and laymen in the DCs.

Technology-related research. Technology-related challenges in forestry research are generally less challenging but on the other hand, opportunities for advancement for science and technology in forestry are more. At today's level of science and technology, achieving significant advances for example, in tree breeding and improvement specifically for fuelwood production purposes within a short time is highly probable. In fact we know that technology generated from pulpwood tree improvement research is

now being utilised. *Eucalyptus grandis* planted today in Aracruz, Brazil grows twice as fast, doubling yields of pulpwood in seven years. Improvements to instrumentation coupled with sophistication in computer technology make forest hydrological research less expensive and less time consuming with probably much more precision.

Specific research opportunities vary according to regions and countries. For example, more detailed compilation and analyses of the vast amount of data kept under the Forest reserve compartment history system in Malaysia may reveal knowledge to better understand the stand regeneration dynamics of logged dipterocarp forests. This information is extremely useful for refinement of silviculture systems and field procedures.

An area requiring innovative research is perhaps investigating ways and means to generate income and employment opportunities from development of the tropical forests based on minimum destruction of the uniqueness of the resource itself. In fact it has already been suggested that tropical forest nature tours for example, have good potential to attract regular temperate visitors, given the right conditions and with proper planning and packaging.

No doubt with additional funds and resources directed towards forestry research, more progress will be made.

Public Environmental Awareness

One of the best opportunities for forestry research concerns the current world-wide public awareness and concern for the environment : people now realise environmental problems are real. The nature and dimension of environmental problems today may need international solutions. Thanks to modern communication technology, during the Chernobyl burndown disaster, the USSR could not "cover up " the evidence because remote sensing monitors do not recognise national boundaries. Once the event was admitted as fact however, the containment of Chernobyl generated and involved international cooperation. This is an important demonstration of current international cooperation.

People are also receptive to new facts about the environment. Residents in Kuala Lumpur still recall the weeks of hazy skies during the months of August-September 1982 caused seemingly by the great forest fires in Kalimantan, Indonesia hitherto a scale, in terms of dimension and duration, almost unheard of in tropical rain forests. Foresters have learned and now accept that large-scale forest fires do occur under the right conditions in tropical rain forests. This also serves to illustrate one important benefit of research. Application of new knowledge by way of adoption of preventive actions, including legislation by enlightened administrators, go a long way towards achieving the goals of forest conservation.

Ironically the international community is more in agreement and committed to act to resolve the more recent problem of the production and commercial use of chloroflourocarbons (CFCs). This is simply because the evidence of ozone reduction in the stratosphere and its attendant negative long term environmental impacts with ramifications for continued human welfare and prosperity affecting regions and even continents, are alarmingly clear.

Hopefully it may not be necessary for a similar situation to develop if indeed the long-held theory that fast destruction of the tropical rain forests have the same negative long-term environmental impacts on mankind. Available information so far are not absolutely convincing although they generally appeal to the human intuition for the importance of conserving nature.

CONCLUSION

The forestry research programme for the DCs, and in Asia in particular, must therefore continue to be encouraged and supported by the developed countries. A good start has been made, the momentum must be maintained. In this connection, IUFRO and the other responsible bodies must continue to play key roles.

The test for the success or otherwise of the whole effort will be measured against its impacts. Do the results speedily reach the target groups viz. the users and the custodians of the forest resources in the DCs and in a form they can objectively comprehend? Does the new knowledge reach the ordinary laymen? Will the new knowledge be applied in deciding on forestry development and leading to a voluntary review of forestry policies by local policy makers for the betterment of their own communities, the tropical forests, and the world.

Much patience is needed as this must take time to happen.

LITERATURE CITED

Anon. 1982. Indonesian Forestry Abstracts: Dutch literature up to about 1960. Wageningen: Centre for Agricultural Publishing and Documentation.

Bengston, D N., and Hans M. Gregersen 1988. What influences forestry research in developed and less-developed countries. Journal of Forestry Vol. 86 (2): 41-43.

Bengston, D. M , Hans M. Gregersen , Allen L. Lundgren , and L.S. Hamilton 1988. Forestry research capacity in the Asia-Pacific region. Occasional paper No. 6. 96 pp. Honolulu. Hawaii:

East-West Environment and Policy Institute, East-West Center.

Far Eastern Economic Review 1989. Tropical Forests- Who needs them. The disappearing forests. (12 January) pp 34-41.

IUFRO 1988 IUFRO News. No. 61 (4): 2-3

Leslie, A.J. 1987. A second look at the economics of natural forest management systems in tropical mixed forests . Unasylva 155. Vol. 39. pp 46-58.

Lundgren, L. Allen, Lawrence S. Hamilton, and Napoleon T. Vergara 1986. Strategies for improving the effectiveness of Asia-Pacific forestry research for sustainable development. Workshop Report: Honolulu, Hawaii. East-West environment and Policy Institute.

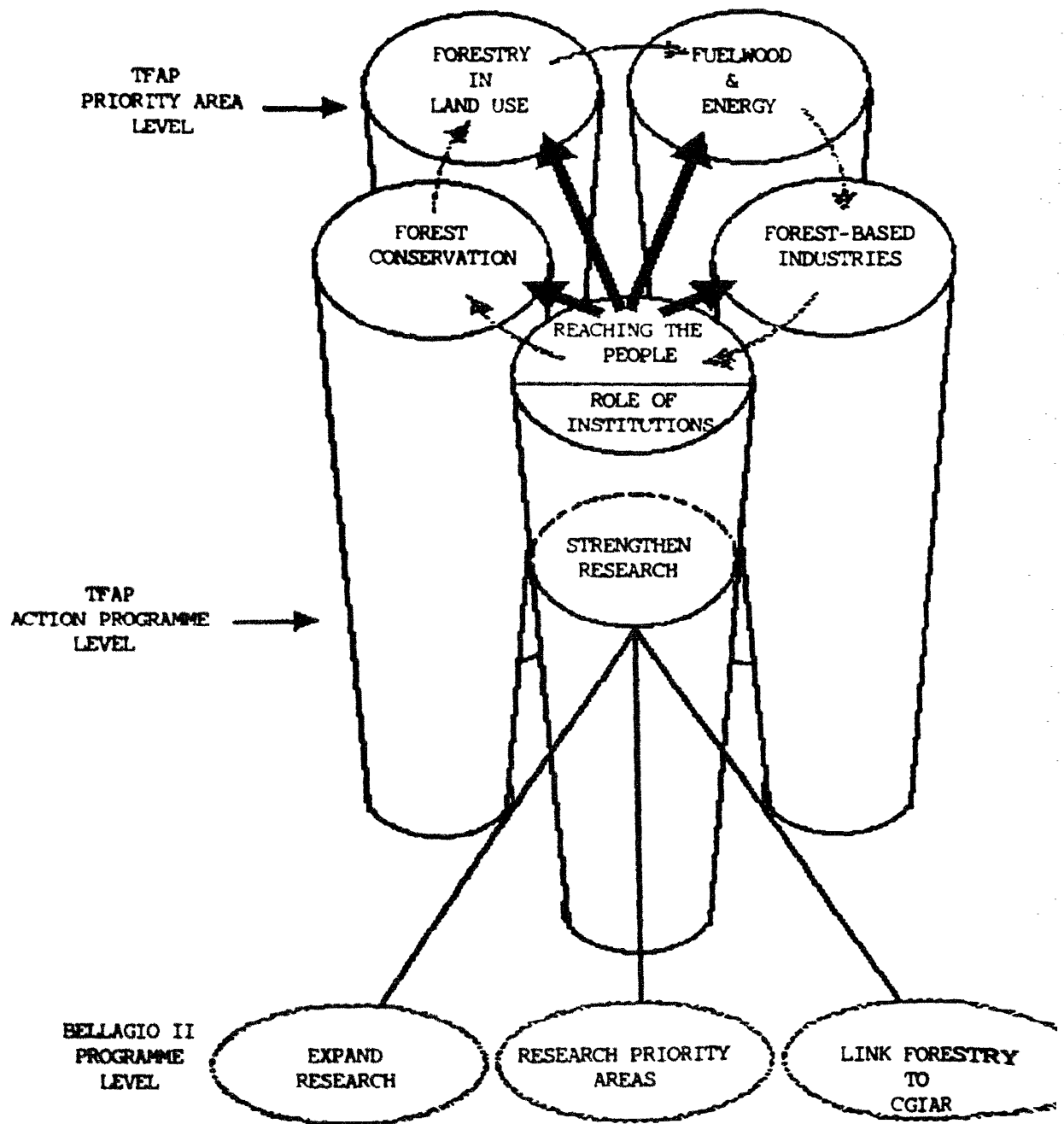
McDermott, Melamie J. 1988 (editor). The future of the tropical rain forest. Proceedings of an International Conference, Oxford Forestry Institute ,Department of Plant Sciences, University of Oxford.

Repetto, R. 1988 The forest for the trees. Government policies and the misuse of forest resources. Washington DC: World Resources Institute.

FAO/ WRI/ WB/ UNDP 1985. The tropical forestry action plan.

TIME 1989. Planet of the year - Endangered earth. (January 2)

FIGURATIVE LINKS: THE TFAP & BELLAGIO II PROGRAMMES



EXPANDING FORESTRY RESEARCH FOR DEVELOPING COUNTRIES
CHANGES AND OPPORTUNITIES FOR LATIN AMERICA

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ORIENTATIONS FOR FORESTRY RESEARCH IN LATIN AMERICA

The Last Formal Efforts to Define Research Priorities

The TFAP related efforts. The TFAP has been a important factor for the forestry community to begin formal efforts for the definition of international, regional and national strategies in research and development to face the challenges imposed by deforestation and poverty.

The Bellagio Meeting on Tropical Forests (Bellagio, 1987), recommended to strengthen forestry research, defining priorities, looking for substantially increased funds and establishing an adequate institutional arrangement to make substantial progress in forestry development in the tropical world.

The created Task Force for Forestry Research, after many consultations, made a proposal of research priorities and institutional arrangements to achieve significant progress in the future (RF, UNDP, FAO, 1988). The composition of the Task Force permitted the integration of global and regional views about forestry research.

The report of the Task Force was presented to the donor community who was very receptive. Now the researchers community and the donors must act in order to transform promises to reality as soon as possible.

The IUFRO efforts. IUFRO has also made strong efforts to change the conception of research. In the past, all the research in the developing world and with few exceptions was approached individually by the countries and the institutions within a country.

IUFRO through the SPDC has organized meetings in Africa, Asia and Latin America that reviewed the research needs on a regional basis. In these meetings, projects were presented, trying to cover a problem at least by ecological zones or groups of countries. The effort has been interesting and useful, although only partial. The emphasis was made in multiple purpose tree species, covering only partially other fields such as silviculture and management of natural forests. Now there is an important basis for beginning wider efforts in each of the regions, but new meetings must be organized to cover a wider collection of priority issues in each region.

The Research Priorities

Summary of research priorities. The research priorities for a global research strategy defined by the Task Force (RF, UNDP, FAO, 1988) were the following: agroforestry and watershed management; natural forest ecology and management; tree selection, improvement and establishment; utilization and market; policy and socioeconomics. The Conference on Forestry Research in Winston House (Winston House, 1988) accepted the priorities, but gave special consideration to three of them: agroforestry and watershed management; policy and socioeconomics and tree selection, improvement and establishment (with a special emphasis in improvement).

The support of the donors group to the priorities is a useful guidance, but further discussions are needed to give more justification for a higher prioritization of natural forest ecology and management. It is very evident that if no financially sound forest management methods are developed, forestry will never be a competing alternative against deforestation.

The Bellagio Forestry Task Force, after many consultations defined regional priorities (Iyamabo, El Lakany, 1988; El Lakany, 1988; Huguet, 1988; Awori, 1988; Salleh Nor, Ahmad, 1988; Khare, 1988). For Latin America the following research fields were considered of greater importance (de Camino, 1988; Solórzano, 1988) (Table 1):

- Management of tropical forests.
- Policy and land use.
- Fast growing species and agroforestry, including the improvement of multiple purpose tree species.
- Improved wood utilization and development of small scale rural industries.

At the same time, special efforts must be done in the development of adequate extension systems (through experimentation) and production of extension materials, as the Task Force recognized that much of the technical problems have a solution that needs to be disseminated.

The Institutional Framework

The existing approach. Today, forestry research in Latin America is made individually by countries and by institutions within a country, without any coordination between the different institutions. The most significant forestry research is done by forestry institutions alone, with few interaction with organizations of other research fields and sectors. Maybe such an approach is usual in the developed countries, but is highly inconvenient in Latin America and possibly also in tropical Africa and Asia.

There are cases of research institutions with agreements with bilateral organizations and research centers of developed countries, but are not predominant. There are also networks organized by FAO, that include institutions working in research, extension, development and other activities without a common research program.

Almost the only case of regional (subregional) organization of research is in CATIE, Costa Rica, where at least three research project networks exist: Multiple Purpose Trees, Watershed Management and Management of Protected Areas. In all the projects the system includes the national institutions and CATIE as a coordinating agency for the regional efforts.

Table 1. Research priorities in Latin America - Short run

RESEARCH			
Line of Action	1. Biological	2. Technical	3. Socioeconomic
1. Forestry and Land use	- Sustainability analysis - Germoplasm production in AFS*	- Analysis and development of sustainable FS - Identification of promising AFS	- Peoples participation in landuse decisions - Dependence of the communities on forests
2. Industrial Development and Forest Resources	- Biotechnology and propagation of improved germplasm - Ecology of primary and secondary forests	- Management of TF - Management techniques for MPT - Networks of seed stands and orchards of MPT	- EA of success cases in TF management - Analysis and design of incentives for TF and and MPT promotion
3. Fuelwood and Energy	- The same do in 2.1 but for semiarid zones and for fuelwood species	- Forest/management techniques for fuelwood production	- Energy policy analysis and incentives for fuelwood production - EA of fuelwood production
4. Conservation of Forests Ecosystems	- Ecological characterization of PA and END.A - Scientific determination of the size of ecosystems in PA	- Systematic identification of products and services of TF - Development of a buffer zones concept and strategy	- EA of conservation - EA of buffer zones
5. Forestry Institutions		- Development of extension material - Development of libraries and documentation centres	- Dynamic sector analysis - Development of methodological tools for policy analysis
AFS = Agroforestry Systems END.SP = Endangered Species EA = Economic Analysis NFT = Nitrogen Fixing Trees FS = Farming Systems SF = Social Forestry TF = Tropical Forests MPT = Multiple Purpose Trees WM = Watershed Management PA = Protected Areas RI = Rural Industries I/O = Input / Output END.A = Endangered Areas NASPA = National Systems of Protected Areas			

Source: de Camino, 1988

The need of a new approach. At least in Latin America, there is a need for a new, more organized, more coordinated effort in forestry research. The Bellagio Task Force, and the Conference at Winston House have defined some elements of this new approach:

- To include forestry research through a specialized TAC in the CGIAR system. This is finally a recognition of the importance on the TFAP and of the contribution of forestry research in alleviating the problems of the planet.
- The definition of a common agenda through establishing priorities for research.
- Building upon existing institutions and strengthening national institutions.

Is important to add some comments to these main elements:

- The inclusion of Forestry in the CGIAR system is an important decision. But it must be not a timid and selfish one. The donors should be aware that the resources needed are many times more than the resources available today. It is incredible that difficulties arrive to get some 100 millions US\$ a year for research needed for the stability of the natural resources and life in the world (developed and developing countries all together), compared with the different and multiple ways in which nations waste money in the destruction of resources and human life. As the Brundtland report says, the chances of OUR COMMON FUTURE are threatened.
- More emphasis is needed in establishing a common research agenda in each region and subregion. The initiative started by IUFRO with regional research projects in multiple purpose trees is a valuable one, but must be completed covering all the priorities for research. Such an exercise can establish a rational framework for the existing institutions.
- Also rationality recommends building over existing organizations and strengthening national institutions. But the examples in Central America show the need of a coordinating institution and the need of a regional or subregional organization in which to base the common efforts. The Task Force Report recommends also that existing research institutions, like IFPRI in policy research and IBPGR in genetic resources, begin to carry out research in forestry related issues. This is a wise recommendation, but if they enter in the field of natural resources they must work together with national or regional research organizations so that one of the objectives is to strengthen the existing research.

MAIN CONSTRAINTS FOR EXPANDING FORESTRY RESEARCH AND POSSIBLE ACTIONS

Available Resources

The Latin American forestry research system has major constraints in resources, including research personnel, infrastructure and funding. Naturally not all research organizations suffer the same constraints and in the same intensity, but nevertheless the above mentioned restrictions are almost general. The dimension of the research system and the main features of it are in tables 2 and 3.

Table 2. Some information about the forestry research system in Latina America

Institution type	Personnel (1)				Research				Research Areas (2)				Library (3)				Cooperation N I(4)	IUFRO Members
	No.	R	T	O	Stations	B	S	T	E	O	S	B	S	B	S	B		
University Forestry Faculty	14	321	51	146	20	4	13	11	10	3	7	7	13	10	7			7
Other Faculty	16	148	97	70	19	-	12	9	2	-	1	4	16	6	1			1
Research Center	5	142	91	240	24	3	2	2	-	-	2	2	4	4	2			2
Government Research Center																		
Forestry	19	431	291	597	84	8	16	10	8	5	14	5	19	16	11			11
Other	11	452	236	650	62	5	10	2	2	-	6	4	10	9	4			4
Forest Service National	14	296	655	3064	38	7	14	5	8	2	13	1	14	13	7			7
Regional	1	10	-	-	5	-	1	1	1	-	1	-	1	-	-			-
Parks	2	13	9	11	16	1	2	-	-	-	1	-	2	-	-			-
Private Research Center General	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-
Forestry	10	91	47	25	38	2	10	3	-	-	8	-	10	9	8			8
TOTAL	92	1904	1477	4803	306	30	80	43	31	10	65	23	89	67	40			

(1) R = Researchers (2) B = Biology (3) S = Small Facilities (4) N = With National Institutions
 T = Technicians S = Silviculture B = Big Facilities I = With International Institutions
 O = Other T = Wood Technology
 E = Economics
 O = Other

Source: World compendium of forestry and forest products research institutions. Forestry Notes #71 FAO. 1987

Table 3. Summary of features of research institutions based on the latin american experience

Significative variables for research success				Gov. research institutions				Forest services			
Universities				Gov. research institutions				Forest services			
1. Capacity				Universities				Forest services			
1. Personnel quantity	Enough	Enough	Few	Enough	Medium-high	Enough	Few	Enough	Medium-high	Enough	Few
2. Personnel quality	Regular	Regular	Low	Regular	Insufficient	Insufficient	Low	Regular	Insufficient	Insufficient	Low
3. Core resources	Insufficient	Insufficient	Highly	Insufficient	Scarce	Scarce	Highly	Insufficient	Scarce	Scarce	Highly
4. Operational resources	Scarce	Scarce	Scarce	Scarce	Scarce to regular	Scarce to regular	Scarce	Scarce	Scarce to regular	Scarce to regular	Scarce
5. Research infrastructure	Regular	Regular	Regular	Regular	Regular to good	Regular to good	Regular	Regular	Regular to good	Regular to good	Regular
2. Transference capacity				Gov. research institutions				Forest services			
1. Motivation of the Researchers	High (institutional type)	High (institutional type)	Very low	High (institutional type)	Regular (institutional type)	Regular (institutional type)	Very low	High (institutional type)	Regular (institutional type)	Regular (institutional type)	Very low
2. Multiplying effect	High (long run)	High (long run)	High	High (long run)	High (long run)	High (long run)	High	High (long run)	High (long run)	High (long run)	High
3. Dissemination capacity	Low	Low	Low	Low	Medium to high	Medium to high	Low	Medium to high	Medium to high	Medium to high	Low
4. Interrelation with other institutions	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
5. Relation to practice	Very low	Very low	Very low	Very low	Regular to high	Regular to high	Very low	Regular to high	Regular to high	Regular to high	Very low
6. Continuity	High	High	High	High	Regular to high	Regular to high	High	Regular to high	Regular to high	Regular to high	High
3. Relevance				Gov. research institutions				Forest services			
1. Planning	Inexisting	Inexisting	Inexisting	Inexisting	Short-run	Short-run	Inexisting	Short-run	Short-run	Short-run	Inexisting
2. Institutional priority	Regular high	Regular high	Regular high	Regular high	Regular to high	Regular to high	Regular	Regular to high	Regular to high	Regular to high	Low
3. Memory type	Personal	Personal	Personal	Personal	Personal-institutional	Personal-institutional	Personal	Personal-institutional	Personal-institutional	Personal-institutional	Inexisting
4. Relevance	Low	Low	Low	Low	Regular	Regular	Regular	Regular	Regular	Regular	Lot to regular
5. Rigorosity	Regular to high	Regular to high	Regular to high	Regular to high	Regular to high	Regular to high	Regular	Regular to high	Regular to high	Regular to high	Very low
6. Feed back capacity	Low	Low	Low	Low	Regular	Regular	Regular	Regular	Regular	Regular	Very low

Source: de Camino, 1988

Research personnel. The institutions do not have enough personnel while the existing personnel are not adequately trained for research. Generally the personnel are not well motivated, the positions are not stable and the salaries are very low. The personnel structure is inefficient with more high level researchers than medium and low level assistants. The personnel must accomplish a heavy load of many other activities, like teaching, administration, and fund raising. The concentration in research activities is a small proportion of total time. Major changes are needed to face the challenge of an intensified forestry research programme for Latin America:

- Well trained personnel are needed in research methodologies and administration. The majority of the programs to train researchers are in English like the one of the Oxford Forestry Institute and of the Forestry Training Programme of FINNIDA. Also the course organized by IUFRO for researchers of the developing countries was in English. There is a need for the researchers of Latin America to have English as a working language, but the same or other sponsors must organize special programmes for Latin America in connection with development countries institutions.

- There are many well trained professionals in Latin America with M.Sc. or Ph.D. degrees from European or North American universities, but they have been prepared for working conditions of developed countries with research studies in subjects that are irrelevant for developing countries. In many cases these people do not go back to his region and remain working in the university of the developed country. One of the reasons for this is the lack of motivation in the organizations at home.

The higher level education in developed countries must continue, but when possible the research for the degree must be agreed with a national institution and should address a priority issue in Latin America. There is also a need to identify, develop and fund, with international support, graduate schools in the region that are oriented to regional problems.

In order to motivate researchers, more stability in the positions and higher salaries are needed. Donors that finance research projects must take in consideration that projects must be long run and also the possibility of including salaries for local people at an attractive level. The donor institutions must recognize the need to develop research modules oriented to priority issues which make research possible and attractive. Each module must have a senior researcher, enough research personnel and resources, in order to improve the structure and to motivate the researchers in a well balanced team that permits the dedication of more time to research.

Research infrastructure. In general, the physical infrastructure in buildings and office rooms is adequate, and only critical in marginal cases. The more urgent need is in laboratories, field facilities and operational equipment like vehicles of different types. Great number of centers have forestry experimental farms, with few research facilities. Besides that, the major constraint is the lack of libraries, documentation centers and data processing units.

The research climate is not only created by the personnel but also by the facilities. It is not motivating to work in a research unit with old buildings, with not enough space, without equipment, vehicles and enough support in up the date libraries, documentations centers and data processing units and banks. The research institutions commonly do not have their own financial support, and after a well funded project is finished, is very difficult for the institution to continue supporting and maintaining the infrastructure in the same level of activity.

Projects financed by the different donors are normally reluctant to finance buildings. They are willing to finance libraries, only with occasional donations while a permanent fund is necessary. The donors also want to have some results in research and is not very attractive for them to finance a documentation center.

Some of these problems need a regional solution, like the support of documentation centers. A network of national centers associated with a regional center could be a good solution. The other infrastructure problems must be faced in a project by project way, or, when the donors are receptive, creating a core budget support that permits to maintain and increase the existing infrastructure.

Funding of forestry research. Forestry and forestry research are not priorities for the government. In the research and education institutions, education has higher priority than research. Many organizations have poor budgets, sufficient only to pay personnel and not to cover operational expenses. Many of the funds are for financing research projects for a limited period. The institutions have no core funds that permit a long run research activity by programmes.

Is very clear that the governments of Latin America are not aware of the serious problems related to natural resources and forestry. On the other hand the cooperators are not prepared to give long term support to forestry research activities to the degree of sustainability. The donors also change priorities and in many cases they change the issue of support, leaving some fields only half-way funded. The actual approach that tries to give a international solution to forestry research funding is the only adequate solution.

Organization of the Forestry Research

There is no real and structured "forestry research system". There are many institutions in each country without coordination and communication. Normally the institutions have no planning, are only a mosaic of disconnected organizations and individuals. At a national level there are no research priorities. Many research subjects are defined by the researcher without considering the problems of the natural resources at a country level.

The national TFAP can provide the opportunities for the countries to contact and coordinate all research institutions. A useful exercise is to prepare a national forestry research strategy and design leading institutions in each of the research fields. Colombia, for example, has done a significative effort to organize forestry research (CONIF, 1987). Costa Rica is trying to formulate a national research program. CATIE, has a regional (subregional) research center has defined a 10 year strategy for research and education (CATIE, 1988). Maybe IUFRO and the new to be created TAC for forestry research should encourage a by country or by subregion formulation of a forestry research strategy.

The system should also be oriented to develop subregional research projects coordinated by one of the participating organizations. The Huaraz workshop on research in multiple purpose trees in Latin America has shown the possibility to organize research subregionally. Many activities need a regional approach, the training of research personnel can be more efficient on a subregional basis, the development of data bases has more sense for a group of countries. The Huaraz workshop and some initiatives of CATIE showed that many cooperation possibilities exists: cooperation in research between Colombia and Venezuela in the highlands of los Andes (Restrepo, Webb, 1987); development of a latinamerican information network on forestry research (Rose,

Ugalde, 1987); supportive research for forestry development programmes in multiple purpose trees in the Andes (Bauer, Jon Llap, 1987); strengthening of silvicultural research in multiple purpose trees in Central America. Mexico and the Caribbean (Salazar, Tschinkel, 1987); genetic improvement of multiple purpose trees in Central América, México and the Caribbean (Boshier, Tschinkel, 1987); research on dryland multiple purpose trees for Central América, México and the Caribbean (Martínez, Hughes, 1987); research on natural forest management for Latin América (Vega, 1987) and Central América (CATIE, 1988); research on the management of protected areas of Central América (CATIE, 1988), research on watershed management in Central America (CATIE, 1989).

The Bellagio Task Force, and the statement of the meeting at Winston House have emphasized the need of strengthening the national institutions. The experience in Central America is a good example that the existence of regional institutions can be the best way to strengthen national institutions on a permanent basis. The results of CATIE's projects can serve as example for studying in more depth the possibility of developing the major centers to fulfill a subregional role in forestry research. It is necessary to insist that in order to make substantial progress in priority forestry research, the funds and activity needed must be substantial, and a regional coordination is necessary.

Dissemination of research results. Forestry research has been very ineffective to reach the farmers and development projects because of a lack of dissemination mechanisms and the absence of data bases that make the existing information available.

Each research project should consider data base and dissemination components. The data base can be regional or subregional, with standardized methodologies to obtain field and experimental information and with a common processing structure (Rose, 1987). The dissemination component must include the production of publications for scientists, and also for field technicians and farmers. It must consider the training of researchers and field technicians through formal education and short courses that include the results of recent research. A major effort should be made to recover and publish in the adequate media, results of research already done and not disseminated.

In Latin America there is a need for a good quality regional of forestry research journal in Spanish, that motivates the researchers of the region and outside to use it as a dissemination channel. A regional system to publish workshop results, textbooks, technical papers, etc is also necessary. Normally a major constraint at the end of a research project is to find the funds and the adequate media to disseminate technologies.

LESSONS FROM A SUBREGIONAL RESEARCH EXPERIENCE THE CASE OF CATIE AND MADELEÑA IN CENTRAL AMERICA

The Agronomical Tropical Center for Research and Education (CATIE)

CATIE is a research and training center in agriculture and natural resources for Central America. It has evolved since 1942 to what it is today situation, and from the very beginning has been one of the few institutions that integrates agriculture and natural resources in research education and training. It is also one of the few subregional institutions

with a wide mandate (not only a crop or crop group); and has as member countries the Central American, Dominican Republic and Panama.

The Center has defined a strategic plan of development oriented to the sustained and rapid development of the regional agriculture (CATIE, 1988).

CATIE is divided in programmes and research areas. Two of the programmes deal with natural resources. Program I is related to improvement of tropical crops. Program II works in sustainable agriculture production and development, and includes an area for Forestry and Agroforestry Production. Program III is dedicated to the integrated management of natural resources. The center has an active Master in Science Program with 4 majors in natural resources: watershed management, wildlands management, silviculture and forest management and economics.

In the area of natural resources CATIE has many research projects like the Regional Tree Crops Production Project (Madeleña), the Regional Watershed Management Project and the Regional Project for the Management of Protected Areas. A proposal for a regional project in Natural Forest Management is now in negotiation.

The Regional Tree Crops Production Project, MADELEÑA

Background of the project. In 1980 a regional project begun in Central America under the name of Fuelwood and Alternative Sources of Energy. The project had two main directions. One oriented to the technology of fuelwood transformation into energy, and other oriented to investigate the most appropriate species for fuelwood production in Central América. This second part of the project was financed by AID/ROCAP and executed by CATIE in collaboration with the national forestry institutions of 6 centroamerican countries (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama). The project ran between 1980 and 1985, and tried about 150 different species for fuelwood production with a life zones approach. Soon after the beginning of the project it was clear that the farmers of the region needed not only fuelwood, but many other products and also agroforestry systems in order to have returns and to have a sustainable agriculture. Considering that, a new project was designed to run between 1986 and 1991, the Tree Crops Production Project or "MADELEÑA" project (CATIE-AID/ROCAP, 1985).

Objectives of the project. The purpose of the project is to improve the conditions and income of small farmers and to stop the deterioration of soils, through the incorporation of multiple use trees in farms.

The purpose should be achieved by strengthening the capabilities of CATIE and national level forestry, agricultural and educational institutions in Central America and Panama; and to develop, access, promote, and disseminate on farm, market-oriented tree cropping technologies.

The final beneficiaries of the project are the small farmers of the region and the counterpart institutions are mainly the forest services of five countries of Central America (in the second part of the project Nicaragua was excluded). The project works also with the universities and with many official extension organizations and private groups in each country.

The most important results. The project has three components: research, dissemination, and training and education. The major achievements of the project will be described by component (Table 4).

Table 4. Results of the Madeleña Project

Results	Number
Field trials	239
Seed stands	51
Demonstration farms	38
Demonstration plots	283
Education for Ph.D	3
Education for M.Sc.	15
Education for technicians	6
Research thesis supported	93
Training courses	60
Publications	
Internal reports	30
Technical	81
Extension	41
Conferences, lectures, and extension meetings	267
Field days	157
CATIE's personnel in headquarters	28
in countries	19
Counterpart institutions personnel	88

a) Research

The principal products reached by the project are the creation of a research capacity in the national institutions, the development of a data base with silvicultural and socioeconomic information, the improvement of the germplasm base for reforestation, the development and improvement of existing incentive programmes, and the identification and preparation of reforestation projects.

i) Silvicultural research

- A regional silvicultural research program was developed for Central America and Panama (CATIE, 1986).
- Species selection: starting with 150 species, 14 more promising species have been selected.
- Trials have been made in species selection, proveniences, nursery techniques, planting techniques, coppicing, pruning, thinnings and yield plots control. Also agroforestry systems are being studied.
- All experiments were installed according to ecological zones and demand priority areas.
- There is now an experiment network of more than 500 experiments throughout the region.
- Yield models for the 14 main species are being developed.
- A network of seed stands of the principal species is under management and producing seeds.
- One of the biggest data bases for trees in the world, the MIRA system has been developed, with information of more than 6000 plots, including seeds, soils, climate, treatments, dendrometry and yield data. Standardized data collection procedures have been developed (Rose, Ugalde, 1989).

ii) Socioeconomic research

- A regional socioeconomic research plan was formulated (CATIE, 1988).
- Economic analyses of reforestation cases and projects are continually being made.
- More than 200 reforestation activities have been controlled for yields and costs.
- Product identification and market studies for forest products in each country are being conducted.
- Attitudes of the farmers to trees and reforestation are being determined.
- Studies of success and failure of social forestry projects in each country are being conducted.
- Demonstrative farms are being controlled and analyzed in all the countries.
- Incentive policies for reforestation have been implemented or are being prepared in all the countries.
- Big social reforestation projects are being prepared to transfer the technologies of the project.

b) Dissemination of the results

In all the countries the species and reforestation techniques of the project are being used by small farmers. In many cases there is an enormous pressure for the project to be transformed from a research and training into a development project.

- A regional dissemination strategy was developed with a central and national elements (CATIE, 1989).
- Field days in demonstration plots and demonstrative farms are being conducted.
- All types of publications for different auditories are published.
- Audiovisuals and training materials for the dissemination of the developed technologies are prepared.
- The national institutions and private sector are contributing to the extension effort.
- Radio and television coverage is available for the project events.

c) Training and education

A critical mass of well trained technicians is now available in the countries to support reforestation programs and projects. Many training activities are transferred to the national institutions. The quantity and quality of research in multiple purpose trees has been increased:

- Master program in CATIE in silviculture and management and economics is running.
- Teaching materials for the courses are prepared.
- Short course program in CATIE and in the countries related to the silviculture and economics of multiple purpose trees were and are being dictated. More than 10.000 man days of training were made.
- Collaboration with the universities to transfer the training activities.

Relations with other projects. MADELEÑA has contacts with projects and institutions at international level like IUFRO, CAMCORE, ICRAF, F/FRED, CARE, and others. It also has strong linkages with many small and big scale projects in the countries. Many activities are conducted in a cooperative manner through exchanging information and experience.

Conclusions for a Research Strategy for Latin America

The MADELEÑA Project includes some elements important for its success that must be taken into account in a research strategy in Latin America:

- The project has clear and relevant objectives, defined together between the national institutions and CATIE.
- The project is well funded in proportion to the objectives, products and activities.

- The donor institution, AID/ROCAP has supported the project activities for 9 years and will support it for three years more. This is one of the principal aspects necessary in a forestry research project.
- Sufficient personnel in quality, level and quantity in the countries and in CATIE headquarters.
- Silviculture and socioeconomic research plans were made for and agreed between collaborators.
- The project has standardized methodologies for all the research activities and has developed a powerful data base. All the information is centralized and available for each country.
- The training and education effort has created a critical mass of well prepared personnel in each of the contributing countries.
- The dissemination of technology has permitted the use of the species and systems in reforestation programs and projects of varying dimensions and will permit the implementation of more project of larger scale.
- Planning, research analysis and administrative meetings between collaborators are frequent.
- The project has reached the decision makers and the beneficiaries and all the levels between. The strategy of the project is the participation of all the counterparts in the countries and to work directly in real conditions, putting experimental and demonstration plots on private farms.
- A regional documentation center gives support to the researchers in CATIE and the countries for bibliographical searches, documentation and edition of papers.
- A well established regional center has been coordinating the effort. All facilities of the Center are available for project purposes.

There are only few examples in the world of a regional project like MADELENA. Naturally there have been problems associated with the implementation and running of the different activities, but very much has been done and the results in this case are much more than the addition of results of countries and components.

In conclusion, it can be said that the regional or subregional project network approach, with a coordinating center, permits to make research with a real impact, and that this type of project should be one of the main elements of a Latin American forestry research strategy to support the tropical forestry action plan in the region.

SUMMARY

The new sources for orientation about research priorities for forestry in Latin America in connection with the second Bellagio meeting are explained. The need to finance research around a common regional research agenda and strengthening the national institutions is emphasized. It is necessary that existing institutions act as coordinating agents at regional and subregional level.

The main constraints of the Latin American forestry research organizations are in personnel, infrastructure, funding, organization and

dissemination of research results. Ways to overcome the constraints are suggested.

Finally, a regional project for research in multiple purpose trees in Central America operating through CATIE is explained. The project is operating as a research project network with very promising results. The research project network approach is proposed as a main component within a strategy for expanding forestry research in the region.

LITERATURE CITED

Awori, Achoka. 1988. Priority issues on forestry research: an african NGO perspective. Bellagio forestry task force. Background paper. Washington.

Bauer, Jan; Jon Llap, R. 1987. Investigación de apoyo a programas de plantación con especies leñosas de uso múltiple en la zona alto-andina. Proyecto presentado al taller IUFRO sobre investigación forestal en América tropical. Huaraz, Perú.

Bellagio. 1987. Statement of the Bellagio meeting on tropical forests. Bellagio. Italy.

Boshier, David; Tschinkel, Henry. 1987. Mejoramiento genético de árboles de uso múltiple para América Central, México y el Caribe. Proyecto presentado al taller IUFRO sobre investigación forestal en América Tropical. Huaraz. Perú.

CONIF. 1987. Memorias. Reunión nacional de silvicultura. CONIF. Serie documentación no.9. Bogotá. Colombia.

CATIE. 1989. Estrategia de disseminación de información. Proyecto MADELENA. Turrialba. Costa Rica.

CATIE. 1988. Plan de investigación socioeconómica 1986-1991. Proyecto MADELENA. Turrialba. Costa Rica.

CATIE. 1988. Facing the challenge. A ten year strategic plan for 1988 to 1997. Turrialba. Costa Rica.

CATIE. 1988. Proyecto regional de manejo de áreas protegidas. Programa de manejo integrado de recursos naturales. Turrialba. Costa Rica.

CATIE. 1988. Silviculture and management of natural forest in Central America and the Caribbean. A project proposal. Turrialba. Costa Rica.

CATIE. 1986. Plan de investigación silvicultural 1986-1991. Proyecto MADELENA. Turrialba. Costa Rica.

CATIE-AID/ROCAP. 1985. Tree Crops Production Project. Project paper. Turrialba. Costa Rica.

de Camino, Ronnie. 1988. Some considerations about tropical forestry research in Latin America. Bellagio forestry task force. Background paper. Washington.

El Lakany, Hosny. 1988. Opportunities for forestry research in North Africa and the Near East. Bellagio forestry task force. Background paper. Washington.

Hughes, Louis. 1988. Forestry research in french-speaking tropical Africa: ongoing activities, needs and prospects. Bellagio forestry task force. Background paper. Washington.

Iyamabo, Dominique; El Lakany, Hosny. 1988. Forestry research in Africa: problems, priorities, needs. Bellagio forestry task force. Background paper. Washington.

Khare, Arvind. 1988. Forestry research. An asian NGO perspective. Bellagio forestry task force. Background paper. Washington.

Martínez, Héctor; Hughes, Colin. 1987. Investigaciones sobre especies leñosas de uso múltiple para las zonas secas de América Central, México y el Caribe. Proyecto presentado al taller IUFRO sobre la investigación forestal en América Tropical. Huaraz. Perú.

Restrepo, Guillermo; Webb, Derek. 1987. Estado actual y prioridades de la investigación en las zonas altas de Colombia y Venezuela. Proyecto presentado al taller IUFRO sobre investigación forestal en América Tropical. Huaraz. Perú.

Rockefeller Foundation; United Nations Development Programme, Food and Agriculture Organization of the United Nations. 1988. A global research strategy for tropical forestry. Report of an international task force on forestry research. Washington.

Rose, Dietmar. 1988. Information management for expanded tropical forestry research. Bellagio forestry task force. Background paper. Washington.

Rose, Dietmar; Ugalde, Luis. 1989. Data base management applications in forestry research. An international workshop. Proceedings. CATIE. Turrialba. Costa Rica.

Rose, Dietmar; Ugalde, Luis. 1987. Desarrollo de un sistema de manejo de información para una red latinoamericana de investigación sobre especies de árboles de uso múltiple. Proyecto presentado al taller IUFRO sobre investigación forestal en América Tropical. Huaraz. Perú.

Salazar, Rodolfo; Tschinkel, Henry. 1987. Fortalecimiento de la investigación forestal sobre especies leñosas de uso múltiple para América Latina. Proyecto presentado al taller IUFRO sobre la investigación forestal en América Tropical. Huaraz. Perú.

Salleh, M. Nor; Abdul, M. Ahmad. 1988. Forestry research needs and opportunities in tropical Asia. Bellagio forestry task force. Background paper. Washington.

Solórzano, Raúl. 1988. Perspectives of NGO's on natural resources research in Latin America. Bellagio forestry task force. Background paper. Washington.

Vega, Leonidas. 1987. Silvicultura y manejo de bosques naturales tropicales en América Latina. Proyecto presentado al taller IUFRO sobre investigación forestal en América Tropical.

Winston House. 1988. Statement of the second meeting on tropical forestry. G. Britain.

**MANAGEMENT OF FORESTRY RESEARCH ON THE NATIONAL LEVEL IN
SWITZERLAND: EXPERIENCES FROM CHANGING TIMES 1979-1988**

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1. INTRODUCTION

During the past ten years, forestry and forestry research in Switzerland have been confronted with new problems of national importance requiring rapid and appropriate solutions:

- In the face of the energy crisis of the 70's demands were made for nationwide studies to determine the energy and timber products potential of the Swiss forests.
- The increasing pressure of sale prices on the Swiss timber market through cheap imports from countries where timber production is cheap, increasingly threatened the financial stability of forest enterprises - especially in mountain regions - and more and more restricted the business flexibility of managers.
- The ecological or 'green' movement, with its demands for the conservation of natural or near-to-nature habitats triggered discussions on the goals of forestry in Switzerland in the light of the current revision of the Federal Forest Police Bill of 1902.
- The rapid spread of the new type of forest damage (= 'forest decline') since the early 80's, which affected mountain forests above all, demanded not only a re-orientation in forestry research but also a whole range of immediate measures for the benefit of forestry and environmental protection.

These problems, overlapping in time and topic, led to a phase of upheaval in forestry and forestry research in Switzerland which stood in glaring contrast to the smooth developments of the preceding 100 years (since the first Federal Forestry Bill of 1876). The great number and thematic diversity of the various questions demanded a rapid and drastic adaptation in forestry research. In the first half of 1983, under pressure of time and problematics, a comprehensively designed strategy with proposals concerning science, forestry, environment and information policy was elaborated. In an amazingly short time the government and parliament then passed the bills necessary to establish the legal, financial, and organizational preconditions for the realization of these proposals.

2. AIMS

This discussion summarizes the main findings of a retrospective analysis of developments in forestry research in Switzerland between 1979 and 1988. Particular attention is given to experiences of general importance for research policy and management on the national level.

3. DOCUMENTATION

3.1 Literature

Fortunately, a whole range of literature dealing with questions of research policy and management in forestry was available for the analysis. As some of these documents are nevertheless not easily accessible, the most important ones are listed in Appendix 1, with brief descriptions of their contents.

3.2 Brief Information on Forestry and the Timber Trade in Switzerland

Selected information is given in Appendix 2.

3.3 Information on the Structure of Forestry Research

Information on the structure of forestry research is given in Appendix 3.

4. METHODOLOGICAL APPROACH

Using a retrospective approach, those measures in research policy on the national level and management decisions in the various research institutes which influenced the development of forestry research positively or negatively were analyzed. The aim was first to explore the latitude of freedom in scientific policy of Switzerland, as a small country, and then to elaborate and justify proposals for the optimum utilization of the limited personnel and funds available.

5. FINDINGS

5.1 Capacity of Forestry Research

One of the primary aims of any national research policy is to furnish appropriate, soundly based scientific support for cultural, economic, and political goals. This evident demand in research policy is by no means met, because of the following historical and political reasons:

- For decades the free market approach has taken the line that the training of future scientists and basic research are the responsibility of the state, while R+D for new products lie in the hands of the economy. In Switzerland this principle has proved itself in not only the chemical

These problems, overlapping in time and topic, led to a phase of upheaval in forestry and forestry research in Switzerland which stood in glaring contrast to the smooth developments of the preceding 100 years (since the first Federal Forestry Bill of 1876). The great number and thematic diversity of the various questions demanded a rapid and drastic adaptation in forestry research. In the first half of 1983, under pressure of time and problematics, a comprehensively designed strategy with proposals concerning science, forestry, environment and information policy was elaborated. In an amazingly short time the government and parliament then passed the bills necessary to establish the legal, financial, and organizational preconditions for the realization of these proposals.

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- For decades the free market approach has taken the line that the training of future scientists and basic research are the responsibility of the state, while R+D for new products lie in the hands of the economy. In Switzerland this principle has proved itself in not only the chemical

and pharmaceutical industries but also in the food trade, because these fields are governed by multinational concerns. For the metal and watchmaker's trades, traditionally conducted in one-man enterprises or small firms the picture is quite different. Remarkably little research capacity is allocated to the important fields of tourism and timber management.

- The disparities between the R+D capacities of the various branches have led the state government to establish its own institutions for research on energy, materials, and electronics.
- A further effort to promote applied research is furnished by the National Research Programmes of the Swiss National Research Foundation and the Federal 'Impulse Programme', both of which focus on filling existing gaps within a few years.
- Ever since the 19th century, one of the responsibilities of the state government has been to promote research on agriculture and forestry. Over the past decades, national research has extended to include environmental questions: water supply, conservation of lakes and rivers, and sewage cleaning on the one hand, research on snow and avalanches on the other. Efforts are currently being made to institutionalize national research on environment.
- Since the late 1800's applied research on agriculture and forestry has traditionally been the task of state institutions, which consequently allowed continuous adaptation of research means and programmes to scientific developments and current demands.
- In Switzerland, as in other European countries, research on agriculture is far better supported in terms of personnel and finances than research on forestry. In the past few years, however, the ratio of 6:1 has clearly changed in favour of forestry and may currently lie around 4:1. In comparison with other branches of the economy, forestry research now has considerable capacities in terms of institutes, personnel, and finances at its disposal, particu-

larly considering that further expansion is planned for the coming years.

5.2 Analysis of the Structure of Forestry Research

On the national level the following tasks are allocated to the various branches of research:

- basic research
- applied research and development
- scientific services for the public and the relevant economic sectors
- practical application of scientific findings
- establishment of a scientific basis for political decisions
- public relations.

Taking these general conditions as a basis analysis showed forestry research in Switzerland in 1980 to be very one-sided:

- There was a clear emphasis on research in applied-science; few provisions were made for basic research.
- Little attention was paid to scientific services.
- The conversion of research findings into practical terms was largely left to the training institutes.
- The provision of scientific bases for decisions regarding policies in research and forest policy was admittedly recognized as a need but not put into practice.
- Public relations work was not considered as a task for scientists and was consequently very restricted.

These structural weaknesses distinctly brought to light through various state-of-the-art studies conducted since 1980.

This unsatisfactory situation has since been improved through the two important political decisions described below.

In August 1982 the federal government decreed the setting up of the Swiss National Forest Inventory and allocated funds for the first survey, to be conducted over the period 1983-1985. The Swiss National Forest Inventory is conceived as a sampling survey, the sample areas being permanently marked in the terrain at the intersection points of a one kilometre grid covering the entire country. It provides the basis of an unusually detailed system of information on forests in Switzerland and furnishes a whole range of important bases for decision-making for the forest services and forest policy.

In the autumn of 1983 the federal government decreed the execution of the SANASILVA forest damage programme, which aims at providing both the authorities and the public with information on the development of forest damage on the one hand and supporting the forest services with practice-oriented studies, various services, and increased consultancy. Generous funds were allotted, and the programme permitted, with the appointment of some 50 additional staff members the undertaking of tasks on which little work had previously been done. In the meantime the programme has been extended for a further four years and is to be anchored as a permanent project within the framework of the current revision of the Forestry Bill.

Further measures are as follows:

- During the 80's the two National Research Programmes 'Wood, A Renewable Resource and Energy Source' and 'Forest Damage and Air Pollution in Switzerland' were approved as temporary measures supporting scientific research.

- In the past few years additional funds have been allocated for basic research at the Institute of Forest and Wood Research, FIT Zurich, and the Federal Institute of Forestry Research. The latter has consequently extended its activities with particular reference to the realm of reaching an understanding of the ecosystem 'forest'.
- One structural problem, that has only recently become evident, is the traditional division of tasks between the FIT and the SFIFR. Up to now the major study areas 'Silviculture', 'Forest Policy and Forest Economics'. and 'Forest Engineering' were mainly covered by the FIT through graduate and post-graduate research. Today, however, the capacity of the FIT is so extended that it can no longer cover all the recently arising problems. Efforts are being made to resolve this bottleneck through establishing new research groups at the SFIFR and intensifying collaboration between research institutes.
- One other possibility for promoting forestry research, i.e., joint projects between federal research institutes and universities and private partners, is being explored.

5.3 Scientific Potential

In a small country, the potential number of scientific specialists is naturally limited. A measure of the number of academically trained personnel is given the membership lists of scientific societies, most of which have only a few hundred members. In the past few years between 30 and 50 forest engineers have graduated annually from the FITZ, though only a few have sought a scientific career.

The limited number of scientific specialists considerably restricts the latitude of freedom in the forest policy of a small country, and dictates a policy oriented towards the demands of individual researchers. In forestry research important special fields are covered by only 2-4 academically trained specialists, so that the responsibility for the development of whole research areas of national interest rests on

only a few people. This harsh reality governs all branches of the forest research policy in Switzerland:

- Swiss researchers have to pursue scientific developments over a broad sector and - in international comparison - must therefore be considered as generalists in their fields.
- The very limited number of research posts means that specialization requires additional training abroad, as no suitable opportunities are available at home. About half of the hundred-odd university graduates employed at the SFIFR, for instance, have undergone a second course of study at universities and research institutes in other countries.
- The restricted research potential of a small country forces the individual researchers to pursue developments in their fields through exhaustive studies of specialized literature, participation in conferences at home and abroad, visits to institutes in other countries, contact with visiting specialists, and the use of bibliographic data banks. The appropriate further training of scientific staff utilizing all available possibilities counts as one of the major tasks of the management bodies of forestry research institutes. In this connection, new accents have been placed on bibliographical and documentation services over the past four years.
- The limitation of personnel restricts the latitude of freedom in research policy on yet another level, the importance is not generally recognized. Research scientists choose their fields according to their main interests at the start and can only change with great difficulty. They are subsequently bound to thematically limited topics, which hinders flexibility in changing to new research aims. As it is unusual for specialists to change the direction of their research, any change from one department to another must be examined in the light of whether the previous research areas should be dismissed and replaced by another. One of the major responsibilities of management is to exhaust all possible means for maintaining long-term flexibility in research while duly adapting research priorities to scien-

tific and political developments. In order to achieve this, research can temporarily be strengthened by externally financed projects. Another possibility is to commission universities or private enterprises with research projects. Experiences of the past ten years have shown that credits amounting to 20% of the promised budget funds should be available for such needs.

5.4 Management Capacity for Leadership of Research Institutes

The development of any given research area stands and falls with professional qualifications of the directors to whom the leadership of the institute is entrusted. In Swiss universities the activities of the various, in most cases small, research departments are traditionally directed by the professors in charge. In national research institutes, given the present situation, the directors complement each other in their scientific training and experience in management. In Switzerland there is as yet little understanding for the fact that the optimum utilization of available means for research greatly depends on the experience and professionalism of the director.

It would be advantageous to recruit future managers from those currently working in research, as personal experience in research contributes greatly to an understanding of the particular demands arising in a scientific institute.

As in a small country few researchers are qualified or willing to undertake the directorship of a scientific institute, the recruitment of future directors poses a major problem.

5.5 Allocation of Competence in Decision-Making

One considerable advantage of a small country is the small number of levels on which state decisions on the allocation of public funds are made. Those responsible for forestry research in Switzerland are privileged inasfar as, on 1.1.1989 all forestry research institutes were placed under the Swiss School Board, which internally coordinates the

concerns of the three institutions (IFA, SFIFR, SFISAR) and represents all their interests before the federal administration.

Further, the three institutions possess a great deal of legal freedom in formulating their research activities, so that developments largely depend on the ideals and aims of the directorship.

This high degree of autonomy allows the management of forestry research institutes in Switzerland to be very flexible in adapting research goals, emphases, and internal organization to current developments.

The responsibilities of the directorship, however, extend far beyond the concerns of the individual institutions. The militia system in Switzerland, established in the course of history, is dependent on professional experience at the management level for national decision-making regarding forest policy. Not only collaboration in special task forces and standing committees but also expert consultation on applications for research projects at federal institutes belong to the obvious duties of the directorship. This manifold interweaving of management tasks and activities in national research policy has both advantages and disadvantages. On the one hand, personal and professional contacts within the small network of directors facilitate the flow of information and very often shorten decision-making procedures. On the other, group dynamics often result in the development of research being biased according to personal interests and sometimes drifting into sidelines.

5.6 Selection of Research Fields and Emphases

The restricted means in terms of personnel and funds available in a small country automatically force those in charge to limit research to a few selected fields. Over the past few years, certain criteria for selecting research fields and emphases have become evident.

A certain proportion of the available means must of course remain reserved for those long-term programmes which are sure to retain their importance (e.g., long-term yield studies, afforestation trials in problem areas, hydrological records).

New research topics to be promoted are those of national importance which can only be pursued in Switzerland itself because they concern the special conditions of Swiss forests and forestry.

In the interests of international cooperation, those research fields should be promoted in which Swiss research groups provide internationally recognized contributions.

Research on the development of new methods increasing efficiency should also be promoted (information science, documentation services, satellite transmission).

5.7 Interdisciplinary cooperation

Interdisciplinary cooperation comprises a major prerequisite for promising research on ecosystems. Unfortunately, this view is only slowly achieving recognition in Switzerland, because for one thing research fields continue to fan out in specialized directions as a result of international contacts, and for another the traditional structure of the universities, with strict definitions of study areas is still hampering interdisciplinary cooperation in both teaching and research.

5.8 Importance of Public Relations Work for the Development of Forestry Research in Switzerland

Only recently has the importance of public relations work for the promotion of forestry research been recognized. In Switzerland, the democratic process of establishing public opinion and wishes depends decisively on a long-term information policy providing both the authorities and the public with information appropriately formulated in terms of knowledge, media, and audience. In practice, this can only be

achieved if the researchers acknowledge the importance of public relations, are ready to make themselves available as sources of information, and accept that public relations work forms a part of their professional responsibilities. Today, the research can no longer retreat into his ivory tower. As a beneficiary of state measures for the promotion of science, he must rather render a personal contribution to informing the public.

6. SUMMARY

This paper evaluates experiences in the management of forestry research on the national level in the small country of Switzerland during the period 1979-1988. That was a period of change and upheaval, and in retrospect consequently reveals the problems very clearly.

The following points are discussed:

- the capacity of forestry research compared with that of other research fields in Switzerland;
- an analysis of the existing structures in forestry research and guidelines for the current and future development of forest sciences;
- an analysis of the available research potentials and the consequences for national forest policy and the management of the various research institutes.

APPENDIX 1

Literature

As some of the sources cited are not easily accessible, brief comments are given below.

WULLSCHLEGER, ERWIN; 1985: 100 Jahre Eidg. Anstalt für das forstliche Versuchswesen 1885-1985. EAFV Communications 61, 1+2.

This classic work provides a detailed and excellently documented history of forestry research in Switzerland since 1885 and a survey of future tasks in forestry research.

EIDG.OBERFORSTINSPEKTORAT (BERN); 1975: Gesamtkonzeption für eine schweizerische Wald- und Holzwirtschaftspolitik. Bern. 417 p.

The authors presented, as findings of a state-of-the-art study, guidelines for the future conception of forestry and timber production in Switzerland which have lent new impulses to forestry research.

SWISS NATIONAL RESEARCH FOUNDATION.

- a. Planning of for the National Research Programme 12, 'Wood, a Renewable Resource of Energy and Raw Material' (1981).
- b. Planning of the National Research Programme 14+, 'Forest Damage and Air Pollution in Switzerland' (1983).

In connection with the energy crisis of 1974 and the advent of the new type of forest damage in Switzerland, forestry research was considerably enhanced. Important points regarding forest policy are presented in the basic documents of these two national research programmes.

SCHWARZENBACH, FRITZ HANS; 1985: Zur gegenwärtigen Entwicklung der forstlichen Forschung in der Schweiz. Schweiz.Zeitschrift für Forstwesen 136, 8, 637-655.

This state-of-the-art study on the development of forestry research during the '80s was published in 1985.

SCHLAEPFER, RODOLPHE, SCHWARZENBACH, FRITZ HANS UND SAGER ALFRED; 1988: Anpassung der Führungs- und Organisationsstruktur und Massnahmen zur Rationalisierung des Betriebes. Schlussbericht und Anträge. Eidg.Anstalt für das forstliche Versuchswesen. (Interner Bericht).

In connection with the reorganization of the SFIFR various internal studies on the aims and emphases of research, questions concerning the organization and leadership of this institute, as well as the planning, supervision, and evaluation of research projects are examined.

APPENDIX 2

Brief Information on Forestry and the Timber Trade in Switzerland

Source: Bundesamt für Umwelt, Wald und Landschaft: Vademecum
'Holz und Wald' 14 pp. (1988).

1. Forest area (ha)

Region	Area	Public	Private
Jura	208,761	164,749	44,020
Mittelland	236,763	144,214	94,549
Pre-Alps	197,754	109,030	88,724
Alps	369,592	315,500	54,092
Southern slopes	172,1010	139,973	32,128
Switzerland	1,186,971	873,458	313,513

Total area of Switzerland: 4,129,315 ha.
Proportion covered by forest: 28%

2. Division of area according to land-use

Land-use	Percentage
Forest	28
Meadowland, arable land	28
Pastures	20
Settlements, industry, transport	4
Lakes and rivers	4
High mountains, rock, glaciers	16

3. Division of ownership

Owner	Percentage
Federal government	1
Cantonal governments	5
Political communes	28
Citizens cooperatives	33
Corporate bodies	6
Private forest	26
Others	1

4. Tree species

Conifers	%	Broadleaves	%
Spruce	40	Beech	19
Fir	12	Sycamore	4
Pine	4	Ash	4
Larch	4	Oak	2
Cembra pine	1	Chestnut	2
Others	0.4	Others	8
Total	61		39

5. Personnel (1985)

Public forest	
Permanently employed	4 915
Temporary and casual	1 984
Private forest	2 405
Total	9 304

APPENDIX 3

Organization of Forestry and Research Institutes at the National Level

1. Federal Department of the Interior

Federal Office for Environment,
Forest, and Landscape

Swiss School Board

- Main department 'Forest'

- Federal Institute of
Technology, Zurich (FIT):
Faculty of Forestry

- Main department 'Nature and
Landscape Conservation'

- Swiss Federal
Institute of Forestry
Research (EAFV/SFIRF))

- Swiss Federal
Institute for Snow and
Avalanche Research,
Weissfluhjoch/Davos
(affiliated with EAFV
as from 1.1.1989)

2. Departments of the Swiss Federal Institute of Forestry Research:

Forest sciences:

- Swiss National Forest Inventory
- Forest Management and Forest Development
- Forestry Techniques and Engineering
- Silviculture

Ecology:

- Site Conditions
- Forest and Climate
- Forest Protection and Pollution
- Forest Hydrology

Landscape:

- Landscape

Snow and Avalanches:

- Weather, Snow Cover, Avalanches
- Snow Mechanics and Avalanche Protection Engineering
- Snow Cover and Vegetation
- Snow Physics

FORESTRY RESEARCH IN HONDURAS:

Experiences and Future Expectations

RUBEN GUEVARA-MONCADA*

ABSTRACT

Forestry research in Honduras began in 1926 with the establishment of an arboretum in the north coast where the adaptability of several hundred species from three continents was studied. However, an organized national effort is fairly new, beginning with the creation of two forestry schools in 1969 and the assignment of a special budget in 1977. In 1984, with the creation of the National Applied Forestry Research Center (CENIFA), a consistent research program began, with steadily increasing budgets, publications, and areas of work. Presently most of the research carried out is funded through foreign donations, and grants, and the perspectives in the future are very promising. The human resource, infrastructure, and political conditions are proper to make forestry research a powerful tool for Honduras development in the future.

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FORESTRY RESEARCH IN HONDURAS:

Experiences and Future Expectations

THE RESOURCE

The Republic of Honduras has a land area of 112,088 km². Of this total, because of a mountainous terrain, 82% is classified as suitable for growing forests, and 18% as appropriate for agriculture. Nevertheless, in 1966 only 62% of the country was forested, and in 1986 that figure had been reduced to only 45%.

In 1966 there were a total of 4.07 million ha of tropical, and sub-tropical hardwood forests, while in 1986 that amount had been reduced to only 2.65 million ha., with a total deforestation of 1.42 million ha on an annual average of 71,000 ha. In contrast, in 1966 there were 2.74 million ha of conifer forests (mostly tropical pines) while in 1986 there were 2.40 million ha, for a total deforestation of 0.34 million ha or an annual average of 17,000 ha. Thus, the deforestation rate in the conifer forest is three times lower (on a percentage basis) than that of the hardwood forest (Table 1).

Most of Honduras hardwood, and pine forests have been intervened by lumber producers or by other users. In 1980 there were only 1.86 million ha of dense hardwood forests out of which 0.3 million ha was virgin productive forest, 1.19 million ha had already been intervened by lumber producers, and 0.37 million ha was unproductive forest (1). By now, it is estimated that all of the virgin forest has already been intervened by the industry.

On the average, the Honduran Forestry Development Corporation (COHDEFOR) estimates that there are over 200 species with commercial potential in the hardwood forest, but presently only about 20 species are being utilized by industry particularly Honduras mahogany (*Swietenia macrophylla*), rosewood (*Dalbergia spp.*), laurel (*Cordia spp.*), and Honduran walnut (*Juglans olanchanus*). In the conifer forest, there are seven pine species that make up the most important commercial resource in the country, particularly ocote pine (*Pinus oocarpa*), caribbean pine (*Pinus caribaea*), and pinabete (*Pinus tecunumanii*).

FOREST UTILIZATION

The utilization of Honduras hardwood forest is in the neighborhood of 90,000 m³ per year, in contrast with over 850,000 m³ per year for pine species (2). On the average, only 15 m³ per ha were extracted in the hardwood forest, and 40 m³ per ha in the conifer forest. Over 85% of the volume utilized in the hardwood forest came from only 6 species, of which Honduras mahogany accounted for 48%, and Spanish cedar (*Cedrela odorata*) with 12%.

Table 1. Honduras Forests: 1966 - 1986

Type of Forest	Area (hectares) 1966	Area (Hectares) 1986	Deforestation in 20 years Loss/gain (ha)	Loss/gain (%)
A. PINE FOREST				
1. Commercial Forest	1,936,000	1,004,501	931,499	48.1
2. Young-growth Forest	802,000	1,392,214	(590,214)	(73.6)
Sub - Total	2,738,000	2,396,715	341,285	13.5
B. HARDWOOD FOREST	4,072,000	2,654,273	1,417,727	34.8
TOTAL	6,810,000	5,050,988	1,759,012	25.8

in three continents. Such program has been successful in introducing tropical pines (mostly from Central America) to many countries such as Brasil, Venezuela, Colombia, and Zimbabwe, for commercial purposes. Since the mid 70's ESNACIFOR has cooperated closely with the OFI in stand analysis, tree selection, seed collection, and testing, in the Honduran side of the Program.

In 1974, COHDEFOR was created by the government as a semi-autonomous institution responsible for the management, utilization of all forests in the country, and the marketing of lumber. Part of its responsibilities is to coordinate all forestry research in the country. That same year, ESNACIFOR was absorbed by COHDEFOR, which would prompt the first organized effort in forestry research in 1977, with the beginning of a pine genetic improvement program. In 1978, ESNACIFOR became a member of IUFRO.

In 1984, after special forestry regulations were passed, which stipulated among other provisions - that all forestry research would be planned, and coordinated by ESNACIFOR, forestry research had a big boost. One of the first steps taken was the creation of the National Applied Forestry Research Center (CENIFA). Since that year, full-time scientists are carrying out research in several areas, especially in forest seeds and nurseries, plantations, prescribed burning, stand growth and management, species propagation, entomology, wood properties, and uses, genetic improvement, residue utilization, and social forestry studies in both the conifer and hardwood forests. Presently, there are specialized laboratories dealing with forest entomology, wood properties, seed technology, photointerpretation, species identification, saw doctoring, and bioenergy generation. There is also a new scientific journal called "El Tatascan" where most of the research results are published, and CURLA holds a yearly conference where most forestry research results are presented for the first time.

B. Research Planning

All research carried out at present is applied research. That is why research planning is carried out in consultation with foresters working in the field, loggers, industry, associations, COHDEFOR's executives, related government and private organizations. The priorities in research are identified through this careful multi-way procedure. Then, they are compared with the policies set forth by the Ministry of Planning, and COHDEFOR's General Management as to define common objectives, and needs.

The Ministry of Planning , and COHDEFOR define the policies dealing with research, and technology transfer in the forestry sector, in consultation with CENIFA's executives, which completes a feed-back process that in the end satisfies all urgent needs to be researched. This last link in the planning process is essential to the success of forestry research in both funding from the government as well as from private, and international development organizations, and in carrying out research that will find solutions, and alternatives to problems affecting the forestry sector.

Another procedure involved in establishing research priorities, and thereby planning for research studies, is through surveys, and at workshops, seminars, and conferences. Here, surveys are sent to operations personnel in COHDEFOR, and industry as to outline their needs for researching certain areas or subjects. Then, in workshops, seminars, and conferences such subjects are addressed in more detail as to identify the real needs for researching certain things.

Finally, the recommendations from such organizations as FAO, IUFRO, and ITTO are taken into consideration in the advise given to the Ministry of Planning, and COHDEFOR for establishing policies, and macropriorities in research.

C. Funding of Research

Historical data on funds allocated to forestry research in Honduras are scarce. Nevertheless, a special budget for such activity was set aside by COHDEFOR, through ESNACIFOR since 1977. That year, around U.S.\$ 60,000 were spent in that activity, which accounted for 0.13% of all operating money in COHDEFOR.

Since 1983, funds allocated for research have increased steadily both in total, as well as in a percentage basis. COHDEFOR's operating budget has steadily been reduced in that same period, but due to the effective planning, and lobbying by ESNACIFOR the funds for research have kept increasing to 0.70% of their total operating budget.

On the other hand, funds coming from donations, and grants from international development organizations have increased dramatically since 1983. This increase has been the result of the careful cooperation with the Forestry and Fisheries, Science and Technology, Rural Development, and

International Cooperation Departments in the Ministry of Planning. All international funds are requested, and channeled through such Ministry in accordance with established guidelines set forth for that purpose.

In 1983 funds allocated by COHDEFOR for forestry research amounted to U.S.\$ 81,670, and funds donated or granted by outside sources amounted to U.S.\$ 263,420 for a total of U.S.\$ 345,090. By 1988, COHDEFOR's funding had increased to U.S.\$ 333,000 and other sources of funds to U.S.\$ 1,296,550 for a total of U.S.\$ 1,629,550 (Table 3, and Fig. 1). These totals do not take into consideration money spent outside COHDEFOR such as in CURLA, and other government organizations (which is fairly small).

D. Infrastructure

The facilities that presently exist to carry out forestry research in Honduras have grown considerably since 1977. Presently there are two large, and two small experiment stations with a total of over 27,000 ha of conifer, and hardwood forests, located in three representative areas that cover all forest types but the mangrove forest. In each station there is the basic infrastructure for convenient access by researchers.

As mentioned earlier, there are several laboratories, and shops that cover the most important areas, where research of high quality can be carried out. All in all, there are more than 12,000 m² of building space for these activities, out of a total of 27,000 m² for all of ESNACIFOR.

There is a complete library with over 170 journal or magazine titles, and thousands of books, reports, catalogs, etc. The computing and information management facilities are also adequate, and there is also a modern offset printing shop.

Besides all this infrastructure, there are thousands of ha of forests, numerous COHDEFOR's offices, and camps, and other government facilities that are at the disposal of CENIFA to use them for carrying out research.

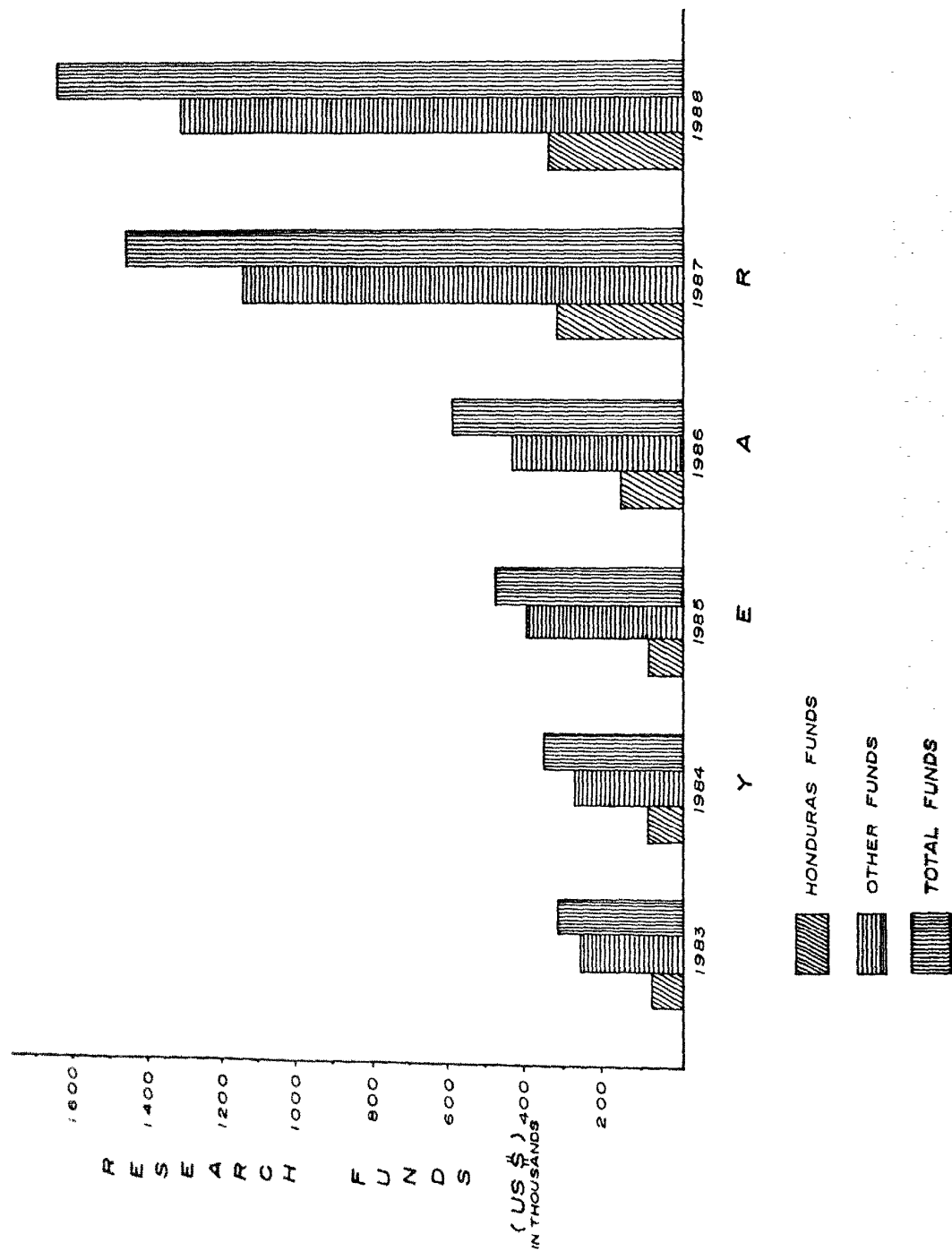
Table 3. Amount of Money Spent on Forestry Research in ESNACIFOR Since 1983*

Year	Funds in U. S. Dollars			Increase (%)
	Honduran Funds	Other Funds*	Total (U.S.\$)	
1983	81,670	263,420	345,090	-
1984	82,550	273,010	355,560	3.04
1985	83,010	391,500	474,510	33.45
1986	159,700	426,280	585,980	23.49
1987	315,920	1,140,828	1,456,748	148.60
1988	333,000	1,296,550	1,629,550	11.86

* Excludes funds spent by one joint project between ESNACIFOR's parent Corporation, and the Tropical Agriculture Center for Research, and Education (CATIE), which was approximately U.S.\$ 250,000 yearly, on average.

* Donations from international organizations.

FIGURE 1
FORESTRY RESEARCH FUNDS IN HONDURAS
1983 - 1988



E. Human Resources

Honduras, unlike most countries in the developing world, is blessed with a comparatively large pool of forestry professionals with various stages of specialization, and graduated from universities in Latin America, the U.S., Europe and in-country. Presently there are close to 600 such professionals, the highest ratio forests-forester in Latin America. (Table 4).

In forestry research the number of professionals is also relatively high. This number has steadily been increased since 1983, and presently accounts for two of the three Ph.D's., and one third of all master's degrees in the country (Table 5). In 1988 there were a total of 44 professionals in forestry research at ESNACIFOR, other COHDEFOR dependencies, CURLA, and the Ministry of Natural Resources. Even though this number is small when compared with european countries, it is fairly large when compared with developing countries.

F. Research Results, and Technology Transfer

As a rule, research results, to be useful, have to be published, transfered, and applied as quickly as possible. However, if finding money, and organizing a research effort is difficult, in developing countries it is even more difficult to get the results of research out of the scientists' labs.

A barometer of research results application, and use is the number of publications published in refereed journals and non-refereed documents, and proceedings. Since 1983 the number of publications in Honduras has increased at a reasonable rate, particularly those refereed, and published in the new "El Tatascán", a scientific journal in Honduras. Publication of the Scientific Series by ESNACIFOR has been also a good source of publications for large documents, and lately the abstracts of the Scientific Week at CURLA, and at other scientific conferences has encreased steadily.

There are also three well established yearly conferences, the one that is organized by CURLA, and two more organized by the National Autonomous Honduras University (UNAH) in the two largest cities in the country. ESNACIFOR organizes workshops, seminar, and other scientific gatherings at the rate of one a month. All this activity is a good sign of a healthy research effort.

Table 4. Professional Human Resources in the Forestry Sector in Honduras, in 1989.

Highest Degree	Total	Specialization Areas	Observations
Ph.D.	3	Wood Tech., Forestry	Includes two foreigners
M.Sc.	49	All areas	Includes 8 foreigners
B.Sc. or equivalent	171	Wood Tech., Forest Mgt., Logging	Includes 4 foreigners
Dasónomo *	374	Fr. Mgt., For. Industries	
TOTAL	597	All areas	Includes 14 foreigners

* Three-year university - backed forestry degree.

Table 5. Number of Scientists in Forestry Research in Honduras, since 1984.

Highest Degree	Y E A R					
	1984	1985	1986	1987	1988	1989
Ph.D.	2	3	3	2	2	2
M.Sc.	7	7	8	10	12	15
B.Sc. or For. Eng.	15	16	18	18	17	18
Dasónomo *	8	10	10	11	13	13
TOTAL	32	36	39	41	44	48

* Three-year university-backed forestry degree.

Table 6. Scientific Publications, Reports, and Technical Presentations dealing with Forestry Research in Honduras Since 1983.

Year	PUBLICATIONS				Totals
	Scientific Journals	Proceedings	Other Publications *		
1983	7	3	14	24	
1984	5	21**	12	38	
1985	6	4	22	32	
1986	15****	18***	28	61	
1987	25****	3	35	63	
1988	30****	5	45	80	

* Includes scientific series, abstracts, scientific reports, thesis and books.

** Mostly in the Forestry Conference Proceedings (Jornadas Forestales).

*** Mostly in the Seminar on Tropical Moist Forest Management Proceedings.

**** Mostly in "El Tatascán", ESNACIFOR's scientific magazine.

Besides, there is a more direct mechanism for transferring results to the end users' through a technical assistance, and extension program, and a training and education program. In technical assistance, ESNACIFOR has a close working relationship with all operations people in COHDEFOR, and other government agencies, as well as with the primary processing industry whereby problems are solved on site usually using the latest research results. This is particularly the case in pest prevention and control, silviculture using prescribed burns and thinnings, residue utilization, multipurpose species propagation, and lumber seasoning and sawmill maintenance.

In the case social forestry system, the main philosophy for rural development in the forestry sector in Honduras, the transfer of knowledge, and new findings from research is performed through the small-scale administration unit in COHDEFOR, the Integrated Management Unit (AMI). There a well-trained forester from ESNACIFOR acts as a development agent, using extension methodologies mostly developed at ESNACIFOR.

More details on science and technology transfer in Honduras forestry sector can be found in a complete report by Hernández, and Guevara-Moncada (3).

PERSPECTIVES FOR THE FUTURE

Present trends in forestry research, and technology transfer in Honduras, as has been mentioned earlier, are very promising. From 1983 to the present, the financial support for forestry research has been increasing, and the outlook for the future is still better.

Presently there are several research projects being carried out, varying in size, and funding from very small to medium. Some of the best known include: a) Conservation, and Genetic Improvement of Honduras Forest Resources, funded by Great Britain's ODA and COHDEFOR, with a minimum duration of a 9 year beginning in 1987, and a budget over U.S.\$ 600,000 per year; b) Forestry and Wood Industries Project with Special Emphasis in the Social Forestry System (CAFIM/SSF) funded by West Germany's BMZ through the GTZ, with a minimum duration of 6 years beginning in 1985, and an annual budget of over U.S.\$ 600,000.

In the near future there will be several projects that will begin, and where research and technology transfer will work closely than before: a) The Center for the Promotion of Wood Products, and Utilization of Wood (CUPROFOR) funded by Great Britain's ODA with total financing of over U.S.\$ 1.9 million beginning in June, 1989; b) Center for the Development of Appropriate Forestry Technology (CENTA), funded by Italy's IRI (Bonifica) with a total financing of U.S.\$ 7.2 million and a duration of 5 years. There are also strong possibilities of funding smaller projects by the E.E.C. through joint execution between a European and a Honduran Research Center, as well as from sources in Canada, Japan, the U.S., and ITTO. The UNAH, CURLA, and a few other institutions are also starting a strong effort to carry out more forestry research. The presence of the Tropical Agriculture Center for Educa-

tion and Research (CATIE) in Central America is definitely bringing good research into Honduras, which has the potential of growing in the future.

All in all, the expectations for forestry research in Honduras are high, and the leaders of this sector will be the decisive factor in this growth.

CONCLUSIONS

After this brief analysis of Honduras forestry research, the obvious conclusion is that it is a small but consistent effort that is gaining approval within and outside the country, and that promises to grow as to convert itself in an essential, and important factor in Honduras development. The research presently carried out at COHDEFOR through ESNACIFOR, at CURLA, and at other institutions is of good quality, and is readily used by users both in government and in the private sector. This ability to transfer such results rapidly, the close interaction between researchers, and operations people, and the multi-way approach to planning with the participation of people at all levels in the forestry sector, and in the specialized planning agency are the key to this success, to date.

Based on actual trends, and the knowledge of future projects already secured in research and technology transfer in Honduras, the expectations for the future are high. This is perhaps a good example for other developing countries where there is urgent need of forestry research and where initial efforts to organize a good research program have not been welcome. The key to success in forestry research in Honduras is a combination of salesmanship, good technical work, and a pragmatic approach where the national priorities are those first tackled, and where results are always there to solve the main problems in the countries' forestry sector.

LITERATURE CITED

1. COHDEFOR, 1982. Honduran Tropical Hardwood Forests: An Evaluation. Canadian International Development Agency (CIDA), and COHDEFOR, Tegucigalpa, Honduras. 600 p.
2. GUEVARA MONCADA, R. 1989. The Tropical Hardwood-based Industry in Honduras. Working document at the Roundtable on Opportunities, and Constraints to the Development of the Tropical Hardwood-based Industry in Latin America, organized by ITTO, and Brasil's Institute for Forestry Development (IBDF), held from 20 - 23 February, 1989, in Brasilia, Brasil. 12 p.
3. HERNANDEZ, M. , and GUEVARA MONCADA, R. 1988. Technology Transfer in Honduras Forestry Sector , Presented at the VI Scientific Week of the National Autonomous Honduras University (UNAH) from 24 - 27 October, 1988, in Tegucigalpa, Honduras. 7 p.

TRAINING AND EDUCATION FOR MANAGEMENT OF RD&A ACTIVITIES

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WHY TRAIN OR EDUCATE FOR MANAGEMENT?

Research, development, and applications (RD&A) to solve forestry-related problems have grown substantially around the world and are expected to expand rapidly in developing countries. To achieve desired goals and objectives, managers of these RD&A activities must be effective, and the effectiveness of management depends upon the capabilities and experience of the managers. The usual situation of RD&A managers, regardless of the technical field or the state of economic development in a country, is that they are promoted from the ranks of scientists into managerial positions. Most scientists are neither specially trained nor educated for their managerial assignments. Usually they have learned management on the job by suffering through difficult situations, by emulating successful superiors, and by coaching received from superiors or peers. In developed and developing countries alike, training and education too often are nonexistent, meager, or unavailable to scientists moving upward as managers.

People responsible for RD&A programs related to forestry have recognized and responded to this need for managerial training and education of leaders. In developed countries such training and education have been underway for 25 years. In developing countries it started in 1984. The expectation is that RD&A institutions led by trained managers will become more effective and efficient and will be able to build and retain high quality staffs.

Training and education to improve managerial capabilities are available and should be utilized to meet the expanding needs of RD&A leaders around the world. International training activities to improve management of agricultural RD&A activities have been underway for more than a decade. Managerial training programs have been utilized since the 1960s by some forestry-related RD&A institutions in developed countries. Five training courses for managers of forestry research activities have been provided in Southeast Asia and Africa during the past five years. A workshop for Africa on training for management of forestry research is being organized by the International Union of Forestry Research Organizations (IUFRO) at Nairobi, Kenya, June 21-30, 1989. These courses in Southeast Asia and Africa were designed to provide a first exposure to what is known about management. They have reached only 10 to 15 percent of the forestry-related RD&A managers needing training.

Global Expressions of Need

Calls for expansion of forestry-related RD&A activities in developing countries, particularly those countries having tropical forests, have been published repeatedly during the past decade. These calls came from the VIIIth World Forestry Congress (Wyatt-Smith, 1978), the XVIIth World Congress of IUFRO (World Bank & FAO, 1981),

the Food and Agricultural Organization of the United Nations in its *Tropical Forestry Action Plan* (TFAP) (FAO, 1985), and two recent conferences of world leaders at Bellagio, Italy (World Bank, 1987; World Resources Institute, 1987) and at Wiston House, near Brighton, United Kingdom (Fugalli, 1988). These meetings and associated reports called for strengthening the infrastructure of existing RD&A programs and building effective teams to manage new and expanding programs. Bengston and Gregerson (1988a, 1988b) documented indirectly many managerial problems that hinder research capacity in developing countries. Reports from missions to developing regions and countries, organized by the multilateral and bilateral TFAP Advisors (1986, 1987), repeatedly recommend strengthening existing RD&A programs and adding urgently needed new RD&A programs. IUFRO, through its Special Programme for Developing Countries and the proposed transformation of that program into INCOFORE (IUFRO, 1989), has pointed to the need in developing countries for training leaders of forestry-related RD&A institutions in the science and art of management.

Reasons for Training and Educating Managers

Managers who are adequately prepared for their jobs can improve the efficiency and effectiveness of their institutions and create desirable conditions for work. Benefits result not only to the clients and sponsors of the institutions, but also to the staffs of the institutions, and to the managers personally. Good managers increase outputs. The result is satisfaction to producers internal to the institutions, to external clients or users in need of new or improved technologies, and to those who finance productive enterprises. Leaders should understand and relate to the factors influencing behavior and motivation of their staffs. By so doing, they can strengthen morale, esprit, and cohesiveness within their institutions. Perhaps most important, competent managers can improve their personal situations by reducing or eliminating stress and anxiety for themselves, their subordinates, and their superiors.

Managers and Management of RD&A

Before delving into the training and education of managers it might be helpful, particularly to readers whose first language is not English, to define meanings of some terms. Being an American, I seek definitions by Webster, but those in the Oxford English Dictionary are substantially the same. According to Webster,

- **management** is "the act, art, or, manner of managing, or handling,, controlling, directing, etc. . . . skillful managing; careful, tactful treatment." A **manager** is "a person who manages affairs or expenditures . . . skillfully and carefully."
- **to train** is "to instruct so as to make proficient or qualified; . . . ". A synonym is to teach, but Webster distinguishes that training "implies the development of a particular faculty or skill, or instruction toward a particular occupation, as by methodical discipline, exercise, etc."
- **to educate** is "to give knowledge or training to; train or develop the knowledge, skill, mind, or character of, especially by formal schooling or study; teach; instruct. . . . **educate** stresses the development of latent faculties and powers by formal, systematic teaching, especially in institutions of higher learning."

These definitions point to some of the purposes and functions of management and managers. They contrast training, which is usually informal and associated with a particular job or kind of work, with education, which usually is formal and theoretical and gained through courses in a college or university.

TRAINING AND EDUCATION FOR MANAGEMENT

To both expand on the definitions of management and identify some topical needs for training and education, we can examine the goals, objectives, and activities of managers. We will follow the managerial steps starting with first-line supervisors and progressing to middle-level managers and executives. At each step, the managerial functions directed at the four resources of every institution—people, funds, facilities, and information—will be listed.

First-line Supervisors

Most individuals become managers for the first time when they accept responsibilities to supervise subordinate employees in the field, laboratory, or office. They anchor a line of supervisors that extends upward through a second-line supervisor to the head of the institution. The introduction to management of financial resources typically occurs when an individual is given limited delegations of authority and responsibility for obligating and expending funds. Individuals who are made responsible for individual laboratories, field stations, or specialized equipment or property thereby become managers of physical resources. Involvement in managing informational resources begins for scientists and others when they produce their first report or publication or become involved in an institution's internal or external communication systems.

Supervision. Having responsibilities for subordinates introduces a first-line supervisor to new duties and responsibilities toward people. When fulfilling these responsibilities, each new supervisor must rely on his or her experiences in life and as a subordinate worker and on coaching by his or her peers and supervisor. The strains experienced by beginning supervisors during management of human resources can be eased through training on the job, but an external short course on elements of supervision can be helpful and is especially recommended. Such training should cover:

- understanding human behavior and motivation
- recruiting new employees, including the art of conducting an interview.
- orienting new employees to the organization and place of work
- delegating authority and responsibility for work
- describing work to be done both verbally and in a written position description
- training to accomplish assigned work and fulfill delegations
- coaching to warn of lagging performance and to improve performance
- explaining and using standards for measuring performance
- appraising and discussing performance
- using incentives to improve performance
- handling less-than-satisfactory performance and related problems
- rewarding superior performance through awards and promotion

- displaying propriety, tactfulness, and empathy toward subordinates
- distinguishing between symptoms and causes of problems
- reporting about subordinates to superiors and outsiders

Management of other resources. On-the-job experiences and internal short courses usually are adequate for beginning managers to learn about an institution's financial, physical, and informational resources. Limited authority for purchasing usually is the scientist's introduction to management of financial resources. Training on the job is the usual procedure for learning about an institution's internal procedures for obligating funds, paying bills, and handling accounts. Explanations of and tutoring in construction and use of budgets usually is best done by the second-line supervisor. Similarly the second-line supervisor and an institution's property-management specialist are in the best position to train new managers on procedures for discharging responsibilities for physical resources. Each institution should formalize its processes to train new managers and should not leave such training to chance or to the new manager's individual initiative, which unfortunately is the usual case.

Management of RD&A programs. Each RD&A institution should have formal policies and procedures for managing work to fulfill its mission. First-line supervisors, being at the bottom rung of the managerial ladder, need to have a basic understanding of these policies and procedures. In-house training is essential to enable each first-line supervisor to communicate and interpret these policies and procedures accurately and clearly to subordinates. Basic training should cover:

- organizational structure showing the place of each unit and individual
- planning of RD&A programs including identification and priorities of problems
- monitoring and evaluating progress of work and accomplishments
- communicating and reporting both internally and externally

Middle-level Managers

Mid-level managers characteristically are in charge of one or more organizational units including projects, branches, or centers. By definition, they are in the middle of the line (chain) of command. Characteristically each middle manager is responsible for several first-line supervisors and reports to someone at the executive level. As managers, their substantial delegated authorities and responsibilities often include:

- recruiting to fill approved positions
- budgeting for the unit and overseeing its obligations and expenditures
- planning and approving all technical work to realize the goals of the unit
- monitoring and evaluating progress of all work within the unit
- authority for further delegations to accomplish work of the unit
- recommending to executives on decisions affecting the unit and the institution

Mid-level managers usually are involved full-time in managing human, financial, physical and informational resources. For the most part they learn how to do their jobs by having observed superiors, who were middle managers, and through coaching by their peers and superiors. Leaders at this level are positioned to benefit greatly from the world's knowledge about management. Their experience is such

that they can relate to almost all of these topics for managerial training and education:

- dealing with human frailties, including insubordination, abuse of drugs and alcohol, civil rights, abuse of time and attendance, irregularities involving funds or facilities, and unethical behavior
- leading and motivating subordinates
- understanding and fostering creativity
- planning RD&A programs
- organizing for work, including span of control, organizational effectiveness, matrix organizations, and networking
- controlling and monitoring programs of work
- evaluating organizational units and accomplishments
- managing complex delegations of authority and responsibility
- cooperation versus competition in dealing with other units and institutions
- decision-making skills
- problem-solving skills
- communication skills, such as briefing superiors, writing effective letters, dictation, and both writing and speaking to the public
- managing within budgetary constraints
- justifying changes of plans and budgets
- using time effectively
- holding effective meetings
- performing staff work for executives

Executives

Every significant RD&A institution has at its upper organizational level one or more executives who are, or certainly should be, accomplished managers. Executives usually are at the top of each line (chain) of command. Some executives may serve in staff positions, outside of the line, where they typically have special responsibilities for external relations, planning, auditing, or other topics having great importance to the institution. Reporting to an institution's chief executive officer (CEO) would be the other executives and perhaps some or all of the middle managers. The CEO usually reports to a superior executive in a sponsoring institution.

Executives usually receive their managerial training from on-the-job experiences as they climb the ladder of success. However, in some developing countries such ladders may be short with the result that individuals in executive positions may benefit greatly from training in the topics listed above for middle managers.

Executives, being at the top of the management team, are occupied less with routine aspects of management and more with assuring survival and growth of the entire institution. Their training and education should include these important topics and subtopics:

- dynamics of the work-force
 - planning for changes in the composition of the work-force
 - building satisfying career paths for scientists who are not managers
 - recruiting and retaining managers and specialized employees
 - meeting institutional needs by training and educating employees
 - providing incentives to improve performance and morale

- dealing with organized labor
- managing budgets and funds
 - building alternative budgetary scenarios for the future
 - allocating funds to subordinates using alternative strategies
 - improving the timeliness and utility of periodic reports
 - providing accounting services useful to middle and first-line mgrs.
 - improving audits and other financial controls
- obtaining additional funds
 - identifying sources of funds
 - constructing attractive justifications and proposals
 - lobbying for increased funding
 - gaining support by influential people
 - recognizing and dealing with competition for funding
- managing when funds are cut
 - planning for contingencies
 - eliminating weakness or unresolvable problems
 - suffering through versus aggressively reducing staff or programs
- relating to other institutions
 - building bridges
 - cooperating
 - competing
- understanding global, regional, and national strategies
 - economic development
 - role of RD&A institutions
- getting forestry research on the national political agenda
 - increasing priorities for forestry research
 - explaining how forestry research contributes to attainment of national goals
- *Management by Objectives (MBO)*
 - identifying and agreeing on objectives for work
 - measuring progress toward objectives
 - evaluating results of work
- evaluating RD&A programs and activities
 - estimating costs of projects and programs
 - itemizing and evaluating accomplishments
 - assessing benefits to society
 - relating benefits from accomplishments to costs of RD&A
- disseminating information to the public and to clients
 - Linking research with training and educational programs
 - demonstrating applicability of findings from R&D
 - assessing effectiveness of different communication media and publications
 - structuring a public relations program
- using advisory bodies and consultants
 - standing versus *ad hoc* bodies
 - creating and using technical teams
 - avoiding biases of individual consultants

- enhancing creativity
 - understanding the creative intellect
 - measuring an individual's potential for creativity
 - providing working conditions that foster creativity
- improving communications
 - building and using a system of formal directives
 - relating to the web of informal communications
 - providing training in public speaking
 - providing training in technical writing
 - providing training in letter writing
- understanding group dynamics
 - recognizing differences among and within groups
 - expressions of formal and informal leadership in groups
 - building participation in a group's activities
- leading and motivating institutions
 - understanding concepts of leadership
 - dynamics of change within organizations
 - managing conflict and change
- planning methods
 - strategic planning
 - *Goal-Oriented Project Planning (GOPP)*
 - *Program Evaluation Review Techniques (PERT)*
 - *Critical Path Method (CPM)*
- meeting technical needs of scientists and specialists
 - providing consultation on statistics and experimental design
 - providing adequate computing services
 - providing editing, writing, and publishing services
 - providing adequate scientific and technical informationservices

EXPERIENCE IN TRAINING AND EDUCATING MANAGERS

The above listings of topics and subtopics related to management demonstrate the dimensions and complexity for training and educating managers of RD&A institutions. Obviously on-the-job training can only begin the process of learning about management. To become proficient, managers must participate in training and educational programs that provide broad and deep experiences. In developed countries use of such programs has been underway for 20 or more years. In a few developing countries, notably India and the Philippines, the needs for and benefits from such programs have been recognized, and managerial training programs have long been in use. In most developing countries training and education for management have not been emphasized or available, but that situation is changing.

Training for Management of RD&A in Developing Countries

Experience in the Asia-Pacific region. The need for managerial training in developing countries was vividly brought to my attention in August, 1982. The occasion was the first Asia-Pacific Regional Workshop for Forest Research Directors.

The Environment and Policy Institute of the East-West Center had gathered these executives at the University of Hawaii to ponder the needs and priorities for forestry-related RD&A programs. To everyone's surprise, they gave highest priority to solving managerial problems in RD&A institutions and programs. They urged the multilateral and bilateral sponsors attending the conference to provide managerial training for themselves and their staffs.

Accepting that challenge, the International Development Research Centre (IDRC) of Canada organized the world's first international training course for managers of forestry-related RD&A institutions. The three-week course was delivered 22 October—8 November 1984 by the Human Resource Management Unit in the School of Management at the National University of Singapore. Attending were 29 managers from 11 countries in Asia and Southeast Asia. A few were first-line supervisors, most were middle managers, and a few were executives.

The success of the first course led to a second course, 22-28 September 1985, organized by the same institution. The United States Agency for International Development (US-AID), sponsored that abbreviated, one-week course. Being trained were 15 managers of the international watershed research project from four ASEAN countries.

Having benefited from these training courses, the Director-General of the Forest Research Institute of Malaysia (FRIM), Dr. Salleh Mohd. Nor, decided to provide similar training for all managers at his institute. Using financial support from the German Association for Technical Cooperation (GTZ), he organized in February, 1987 the first training course to serve the entire management team at a single institution. This was the first such course in a developing country and perhaps in the entire world. The excellent facilities and staff of the Malaysian National Institute for Public Administration (INTAN), located at Bukit Kiara, near Kuala Lumpur, were utilized for the course. The three-week course for 22 participants was modeled on the first course delivered at Singapore, but the experiential training focused on generating team spirit and on solving some of FRIM's recognized managerial problems. Both the training and the recommendations that resulted from teamwork during the training have significantly affected management at FRIM.

As the Vice President of the International Union of Forestry Research Organizations and an enthusiastic supporter of managerial training, Dr. Salleh decided to organize a third international training course for managers of forestry-related RD&A institutions in Asia and Southeast Asia. He once again involved INTAN in cooperation with FRIM to organize and deliver the course. Again both US-AID and IDRC sponsored participants. Training was given during three weeks, 18 July—5 August 1988. Attending were 23 trainees from 19 forestry RD&A institutions in 8 countries. Trainees at the close of the course enthusiastically endorsed the training received and recommended that it be offered again so more of their countrymen could be trained.

Dr. Salleh's goal is to gain support for a continuing program of international managerial training for forestry-related RD&A institutions in the Asia-Pacific region. Most developing countries in that region lack access to such training courses. An estimated 40 to 50 executives and 150 to 200 middle-managers from 15 countries need training in the theory and practices of management. Dr. Salleh seeks financing during 5 years at the level of US\$55,000 per year to support two annual training courses. The funds, to be obtained from one or more multilateral or bilateral donors, would be used annually by FRIM and INTAN to organize and deliver two

courses—one lasting five to seven days for 8 to 12 executives, and another lasting three weeks for approximately 25 middle-managers (see Appendix A).

Here are some of the lessons learned from the four managerial training courses given in Singapore and Malaysia.

- Hundreds of managers in the Asia-Pacific region need training.
- First-line supervisors, middle managers, and executives should be trained separately.
- Duration of training courses should be about two weeks for first-line supervisors; three to four weeks for middle managers; and one to two weeks for executives.
- The optimum number of trainees per course varies—for first-line supervisors and middle managers, 18-24; for executives, 6-10.
- Governmental training facilities have advantages over academic settings.
- International training will not occur unless some institution accepts responsibility for organizing successive courses to meet regional needs.
- Training should be institutionalized at one place where an investment should be made to build a cadre of qualified and experienced trainers.
- After trainers are qualified and experienced, they can be called to an RD&A institution to provide needed training.
- Experiential training is preferred, and lecturing should be minimized.
- If time is limited, then the number of topics should be reduced but not the depth of coverage of each topic.
- Training curricula and methods should be modified in recognition of variation in national and regional cultures.
- Simultaneous training for all members of the management team at one institute has significant advantages—economy, building managerial teamwork, and identifying solutions for managerial problems.

Experience in Africa. Managerial training for leaders of forestry-related RD&A institutions in Africa started at Nairobi, Kenya, 13-29 October 1986. Having heard of the successes with managerial training at Singapore, leaders in the Finnish International Development Agency (FINNAIDA) decided to provide similar training for Africans. The Forestry Training Program of the National Board of Vocational Education of Finland with assistance from the Finnish Forestry Research Institute organized a *Training Course on Forest Research Management for English-Speaking Africa*. It was attended by African leaders of forestry-related RD&A institutions from 8 countries. That course was organized as a seminar with papers being delivered and discussed and ultimately published as a proceedings (Temu *et al.*, 1987). This seminar format differed substantially from the experiential training methods and limited lecturing used in Singapore and Malaysia.

A second meeting on training for management of forestry research institutions in Africa has just been announced. IUFRO's Special Programme for Developing Countries, using financial support from The World Bank, is organizing a bi-lingual workshop in Nairobi, Kenya, June 21-30, 1989. Approximately 20 executives from forestry research institutions in Africa will be addressed by 10 international experts on management of RD&A institutions. The workshop will provide a seminar-style training experience for the African participants. The organizers hope the workshop will identify needs for managerial training at forestry-related RD&A institutions in Africa and will generate recommendations on strategies for providing managerial training in Africa.

Experience in Latin America. To date no interest has been expressed in managerial training for the forestry-related RD&A institutions in Latin America. I have no doubt that considerable interest could be generated if a course in Spanish or Portuguese were to be offered by a multilateral or bilateral sponsor. Perhaps IDRC, GTZ, or US-AID, having successfully sponsored managerial training in the Asia-Pacific region, would be willing to offer such training in Latin America. A champion is needed. Someone, who wants such training in Latin America and is willing to work hard to achieve it, should explore possibilities with potential sponsors.

Training for Management of RD&A in Developed Countries

For many managers of RD&A institutions in developed countries the situation is not much different from that in developing countries. It is customary for managers of RD&A activities at academic institutions to have had only on-the-job training and not to have taken advantage of available opportunities for managerial training and education. Standing in sharp contrast are many RD&A managers, particularly those employed by governmental agencies or industry, who have had extensive training or educational preparation for management of RD&A institutions.

Having served for 25 years as a manager of R&D for the Forest Service in the U.S. Department of Agriculture (USDA), I can report, as an example, on the managerial training undertaken by that agency. Before or immediately upon becoming a supervisor for the first time, supervisory training for 80 hours (two weeks) is required. This requirement can not be met by on-the-job training but only by attendance at a course given by a qualified trainer.

A general rule requires that each federal employee be in training for at least one week every year. For rising managers, a variety of one- and two-week courses are available from the Forest Service, USDA, other federal agencies, and the private sector. These courses cover all of the topics listed above for middle managers and executives.

All project leaders, as middle managers, are expected to attend a two-week course in Washington, D.C. There they learn how research in the Forest Service manages its programs, funding, reporting systems, and external relations with other federal agencies and the Congress of the United States.

Executives in Forest Service research are expected each year to spend one or two weeks at courses offered by the Federal Executive Institute and other sources. Before advancement to the level of senior executive, managers are assigned (detailed) to work outside of the agency for several months. The purpose is for them to learn about management of other RD&A organizations or to attend special programs given by universities.

One key element in this training program is each manager's 3- to 5-year training plan. The plan is negotiated by the manager with his or her immediate supervisor and is concurred to by the second-line supervisor. The plan specifies attainable objectives and lists the training needed to achieve each objective. The plan thereby becomes the basis for the manager to request approval for needed training or for his or her supervisor to present a training opportunity.

WAYS TO TRAIN AND EDUCATE MANAGERS

The preceding section points out that learning can be accomplished in diverse ways. The science and art of management can be learned from job-related experiences, by details to work elsewhere, by self-study, by coaching or tutoring, and by attending short-courses or academic courses. These options will be examined in greater detail in the following sections.

On-the-Job

It is often said that “experience is the best teacher”, and so it is with experience gained on the job. Each person’s learning from experience starts in the home where the parents manage the child and where siblings and other relatives have managerial responsibilities. Learning management from experience continues during many years of schooling and after entry to the world of work. Each person’s accumulation of experiences conditions his or her perceptions and reactions to being managed by others and, in turn, on being the manager of other people. From our own lives we recognize that these experiences are both good and bad and thereby can positively or negatively influence our perception, our behavior, and our managerial style.

Learning management on the job has several advantages. The learning situations are real and not theoretical or contrived. Learning occurs at a relatively slow pace and is easily assimilated. What is learned is usually practical and workable. The tangible costs of learning are low.

However, the intangible costs and losses from experiential learning can be substantial. Learning on the job has several other disadvantages. Foremost is that one can not expand his or her learning beyond the job-related circumstances. Growth in learning is relatively slow, unless one moves relatively quickly through a succession of jobs, each different from and more difficult than the last. A danger in learning on the job is that what is learned may not be the best or even a correct way of managing. Learning on the job rarely requires the manager to consider all alternatives for action and to analyze all positive and negative consequences of a managerial decision or action. Learning on the job also suffers from a lack of oversight by a skilled manager as occurs by a coach, tutor, or course instructor.

Special Assignments

The pace of learning on the job can be accelerated by exposing a manager to a variety of work situations. Assignments (details) to work for relatively short periods of time in unfamiliar positions or at different locations provide diverse and enriching experiences. Such assignments accelerate the learning process. New people, changed conditions, and different circumstances—all require quick assessments, appraisals, decisions, and actions.

Details, besides being used to accomplish a special task, help the person(s) involved to grow. A detail to work that differs substantially from the manager’s current job will provide broadening experiences that may be useful in future managerial positions. A detail to work that is closely aligned with the manager’s current job may provide learning that will be directly useful upon return to that job.

Special assignments have associated costs that must be weighed against the expected benefits. The absence of the person sent on detail may result in problems or difficulties with the work that he or she was managing. Assignment to another task, even for a brief time, has debilitating distractions. The detailee, before absents him- or herself, must think about disassociating from the current job, undertaking new tasks, and what may be difficult personal changes. Then upon returning from the detail, the manager experiences further difficulty in dissociating from the engaging work done on the detail. Generally these costs are substantially outweighed by the organizational and personal benefits that result from special assignments.

Self-Study

Learning about management from reading, listening to tapes, and watching movies or videos can be rewarding, pleasurable and relatively inexpensive. Books and magazines dealing with management can be borrowed from most libraries. Each RD&A institution should subscribe to periodicals on management and route them past the managerial team. To subscribe to *Research Management* and similar journals for managers is just as important as to subscribe to scientific and technical periodicals for the RD&A staff. Each institution also should build and maintain a managerial bookshelf where managers can borrow documents to read on the job or at their leisure. For personal development and growth, every manager should commit significant time to self-study on the job, when traveling, and at home.

Although it can be more difficult to borrow tapes, movies, and videos, they are available. For example, the American Management Association has an extensive catalog of multimedia training materials related to many aspects of management. Sometimes the comparatively high costs of these materials can be shared by several users.

A primary advantage to self-study is that you decide the direction and pace of learning. You may specialize or skim. You decide when and where to study and how long to spend at it. Another advantage is that it costs relatively little, particularly if you can borrow from libraries or other students. If materials for self-study are costly, then the employer may be willing to pay the costs, or other managers may be willing to share the costs.

Self-study requires the student to display initiative in setting personal goals and objectives, in obtaining materials for study, and in relating what is learned to his or her managerial situation. Anyone who has taken a correspondence course knows that a major difficulty in self-study is disciplining oneself to commit the required time and energy.

Coaching and Tutoring

Everyone has learned from a wiser or more experienced person. Each manager's supervisor should provide instruction, guidance, and advice, and otherwise serve as a coach or tutor. Coaching also may come from one or more managerial peers or from a hired consultant. Sharing of experiences helps colleagues to understand managerial problems, solutions, and alternatives for proceeding in difficult situations.

Lucky is the manager who has a mentor—a loyal friend, who serves as a wise advisor, teacher and guardian. Mentors not only help and give good counsel, but they protect from adversities and difficulties. Mentor-relationships often occur spontaneously, but they also can be arranged. A junior manager may personally seek such a relationship, or a mentor may be assigned to a junior manager.

Coaching, tutoring, and mentoring all facilitate two-way communication. They speed the flow of advice and counsel from more experienced to less experienced managers. They provide someone to turn to when the junior manager is troubled or confused. They are inexpensive yet highly effective aids to learning.

Difficulties with this approach to learning can occur. Coaches, tutors, or mentors may not be available. Those who are available may lack requisite wisdom or experience. Interpersonal difficulties or problems in communications may block the essential two-way flow of information. A manager faced with such difficulties definitely needs to go elsewhere to learn about management.

Short-courses and Academic courses

Short training courses and formal academic study provide desirable venues for learning about management. Specialized courses may last from a few days to a few weeks. Managers usually can be absent from their work for training purposes during such short periods of time. Short-courses usually are tailored to the practical needs and circumstances of specific individuals. The result is that most of what is learned is closely related to the specialized duties and responsibilities of the trainees.

Educational courses at universities or colleges tend to cover topics broadly. They focus more on theories and principles than on procedures and practices. Rarely do academic courses cover the peculiar and special problems encountered in the management of an RD&A institution. Academic courses usually require attendance for a relatively long period of time.

A single course at an academic institution usually must be attended one or more times a week for three to five months. To learn about all aspects of management, most students spend one to two years in full-time attendance at a college or university. Someone wanting to study only one or a few managerial topics might enroll on a part-time basis for one to two years and take a sequence of related courses.

Coursework, whether delivered in a shorter or longer time, has numerous advantages. Courses instill a discipline to the learning process. They concisely present a great deal of information. Presentation usually is by one or more teachers or trainers whose expertise has been established. Because the manager usually is required to leave his or her place of work and job-related responsibilities, the job interferes little with the learning process. But if a course is taken at the manager's place of work, then potentials are great for conflict between the job and the learning process.

However, being gone from the job creates a vacancy and may result in substantial costs. When a vacancy can not be tolerated, then someone must be reassigned to act for or even to replace the absent trainee. If the trainee is not replaced, his or her undone work may result in losses or problems.

The direct costs of taking courses also can be a deterrent to the learning process. Costs of travel, enrollment, and living away from home often are prohibitive. Particularly troublesome in most developing countries are constraints on obtaining foreign currencies for training and educational purposes. In this regard multilateral and bilateral sponsors can help by supporting the travel, enrollment, and living costs of trainees who would otherwise be unable to participate in courses.

RESPONSIBILITIES FOR TRAINING AND EDUCATING MANAGERS

The growth in learning, capability, and capacity of members of the management team depends upon the executives of an institution. Their responsibilities are to establish and utilize both policies and procedures for training and educating members of the management team.

- First, executives should assure that the institution has a clearly written policy on training and education for managers.
- Second, they should utilize annual appraisals of performance to identify each manager's needs for training and education.
- Third, they should encourage each manager to display initiative by learning more about management through self-study, by requesting to attend courses on management, and by suggesting short-term details.
- Fourth, they should require each supervisor of a manager, including themselves, to pursue training and education of their subordinate managers through a variety of means.

The performance of every manager should be evaluated annually. The performance rating and its discussion with the subordinate manager should be the occasion for agreement on training or education to improve or enhance current performance or to prepare for future assignments. Every manager should have a 3- to 5-year training plan that is updated at each annual performance appraisal.

Implementation of each manager's training plan should be the joint responsibility of the manager and his or her supervisor. The manager has the responsibility to search for appropriate courses and to request permission to attend them. The supervisor has the responsibility to tell the subordinate about opportunities for learning more about management. Included would be documents for reading and beneficial courses. The supervisor has the added responsibility to seek out, yes, even to create, opportunities for special assignments that will enrich the manager's experiences and contribute to his or her growth.

IDENTIFYING PERSONAL NEEDS FOR TRAINING OR EDUCATION

The foregoing sections have repeatedly called for every manager to have a 3- to 5-year training plan. Every manager should have the responsibility for drafting such a plan, but the manager's supervisor should have an equal responsibility to review and improve upon the draft. The plan resulting from their joint work should be sent to the second-line supervisor who should have the delegated responsibility to accept it for the institution.

Outlined here are some of the factors to consider when constructing a multiyear managerial training plan:

- assess your strengths and weaknesses as a manager
 - what do you do well or easily?
 - what situations or problems cause you difficulty?
 - involve your superiors, peers and selected subordinates in answering these questions
- identify managerial topics about which you want to learn more
 - scan a few basic books or periodicals on management
 - talk with managers whom you admire
- build your managerial training plan
 - involve your superior and peers
 - start with your identified needs
 - write some specific objectives for improving your knowledge, skills, and abilities that you can attain in three years
 - identify intramural and extramural opportunities for attaining your objectives
 - propose a schedule of self-study, attendance at short-courses, special assignments, etc.
 - put this information into a draft training plan
 - seek the time and resources to attain your objectives
 - negotiate amendments to the draft plan with your supervisor
 - produce your revised training plan
- have your plan approved by management
 - present your revised plan to your second-line supervisor
 - learn what elements of the plan are and are not acceptable
 - produce the final plan that is acceptable to the institution

RECOMMENDATIONS FOR TRAINING AND EDUCATING MANAGERS

At this point it seems appropriate to review what has been written above and to draw from it a series of recommendations. The forthcoming recommendations fall naturally into three categories: those directed to individual managers; those directed to heads of RD&A institutions; and those directed to representatives of multilateral and bilateral sponsors of forestry-related RD&A activities. Although some recommendations repeat what has been written above, together here they create what I regard as an agenda for action.

To Individual Managers

- identify your needs as a manager
 - identify your specific strengths and weaknesses
 - involve your superiors and peers
 - involve selected subordinates
- specify achievable objectives for improving your managerial knowledge, skills, and abilities
- propose appropriate actions to attain your objectives
- include your objectives and proposed actions in your managerial training plan
- gain management's acceptance of and commitment to your plan
- pursue your objectives aggressively
- fulfill your responsibilities for the training of subordinates as managers

To RD&A Institutions

- create an atmosphere that accepts and encourages improvements in management
 - establish improvement of management as a specific goal of the institution
 - specify objectives to be attained in the improvement of management
 - seek from all employees suggestions on how management can be improved
 - urge managers to improve their knowledge, skills, and abilities
 - provide time and resources for managers to improve themselves
- identify needs of specific groups of managers
- identify and use extramural opportunities to provide needed training
- provide intramural training opportunities
 - build a bookshelf on management for self-study by managers
 - subscribe to and route copies of periodicals on management
 - clip and disseminate copies of articles on management
 - organize regular short-courses or workshops on management
 - create competitive managerial training positions
- provide incentives and rewards to individuals who improve their managerial skills

To Multilateral and Bilateral Sponsors

- recognize importance of improving management of RD&A institutions
- provide opportunities for managers to improve their knowledge, skills, and abilities
 - organize short courses on management
 - sponsor managers to attend short-courses and schools of business management
- sponsor consultants on management to assist RD&A institutions
- sponsor production and dissemination of managerial training materials

SUMMARY

A global problem is that managers of forestry-related research, development, and application programs typically lack education or training to fulfill their roles and responsibilities as managers. This problem is increasing in severity as the pace of forestry-related RD&A activities accelerates in developing countries with financing from multilateral and bilateral sponsors. Institutions lead by inadequately prepared managers suffer from inefficiencies and ineffectiveness. They experience difficulties in building and retaining competent staffs and in fulfilling their mandates. A proven way to help solve these problems is to train and educate the leaders of these RD&A institutions in the theory and practice of management.

The needs for training and education of managers of RD&A institutions become obvious upon examination of the topics of concern to first-line supervisors, middle managers, and executives. These topics cover the four resources that must be managed—people, funds, facilities, and information—and the principle functions of managers—supervision, planning, organizing, controlling, evaluating, communicating, leadership, making decisions, and solving problems. Some unique features of RD&A programs—creativity, experimental design, statistical analysis, publications, technical information systems, and networking—require special attention.

That these topics can be taught with good effects to forestry-related RD&A managers has been demonstrated via five short-courses held in Southeast Asia and Africa. These courses have introduced managers in developing countries to the training that is being used in developed countries. These courses, leading to understanding of the theories basic to management and to improved managerial skills, have been enthusiastically received around the world.

But short-courses are only one means of expanding the knowledge, skills and abilities of managers. The science and art of management also can be learned through experience gained on the job, special work assignments, self-study, coaching and tutoring, and attendance at academic courses. Each of these ways of learning has associated advantages and disadvantages.

Executives in each RD&A institution have responsibilities to establish and use policies and procedures for managerial training. Evaluations of the performance of managers should be the occasion for identifying needs for managerial training or education. Each manager should be helped by his or her supervisor to prepare a 3-to 5-year training plan that is endorsed by an executive. The manager and his or her supervisor should share the responsibility for implementation of the training plan.

Recommendations are given for training and educating managers of forestry-related RD&A institutions. The recommendations provide agendas for action by individual managers, by RD&A institutions, and by multilateral and bilateral sponsors of forestry-related RD&A activities.

LITERATURE CITED

- Bengston, D. N.; Gregerson, H. N. 1988a. What influences forestry research capacity in developed and less-developed countries? *Jour. Forestry* 86(2):41-43.
- Bengston, D. N.; Gregerson, H. N. 1988b. Forestry research capacity in developing countries: A review of issues and findings. St. Paul, Minnesota; University of Minnesota, Center for Natural Resource Policy and Management Studies, Working Paper 4. 38p.
- FAO. 1985. Tropical forestry action plan. Rome, Italy; Food and Agriculture Organization of the United Nations, Committee on Forest Development in the Tropics. 159p.
- Fugalli, Oscar. 1988. Highlights from Bellagio II. Vienna, Austria; International Union of Forestry Research Organizations, IUFRO News No.61 (4/1988).
- IUFRO. 1989. INCOFORE: a research and extension system for tropical forestry. Vienna, Austria; International Union of Forestry Research Organizations. 35p.
- Temu, A. B., and nine others (editors). 1987. Forestry research management. Proceedings of the IUFRO training course on forest research management for anglophone Africa, Nairobi, Kenya, 13-29 October 1986. Helsinki, Finland; National Board of Vocational Education, Forestry Training Programme (FTP).166p.
- TFAP Forestry Advisers. 1986. Summary report on the third meeting of Forestry Advisers on harmonizing international forestry development cooperation, Berlin, Fed. Rep. of Germany, 4-6 November 1986. Utrecht, Netherlands; Statsbosbeheer, Forestry Development Cooperation. 21p.

TFAP Forestry Advisers. 1987. Summary report on the fifth meeting of Forestry Advisers on harmonizing international forestry development cooperation, Brussels, Belgium, 1-3 December 1987. Utrecht, Netherlands; Statsbosbeheer, Forestry Development Cooperation. 143p.

World Bank & FAO. 1981. Forestry research needs in developing countries—time for a reappraisal? Special paper for the 17th IUFRO World Congress, Kyoto, Japan. Washington, D.C.; World Bank, and Rome, Italy; Food and Agriculture Organization of the United Nations. 56p.

World Bank. 1987. Incorporating economic and other policy reforms into development strategies for containing tropical deforestation. Contribution to keynote paper, Rockefeller Foundation Tropical Forestry Conference, Bellagio, Italy, 1-2 July 1987. Washington, D.C.; World Bank, Agriculture and Rural Development Department. 37p.

World Resources Institute. 1987. Statements and background documents from the Bellagio Strategy Meeting on Tropical Forests. Washington, D.C.

APPENDIX A. TOPICS COVERED DURING A THREE-WEEK MANAGERIAL TRAINING COURSE IN MALAYSIA

- Overview of forestry-related research, development, and applications (RD&A) of technology in the region and globally*
- Philosophy of forestry-related RD&A*
- Internal and external environment of an RD&A institution*
- Framework and functions of managing an RD&A institution*
- Planning*
- Organizing*
- Controlling*
- Evaluating*
- Leadership*, motivation*, and supervising subordinates
- Dynamics in groups
- Effective meetings
- Learning styles of individuals
- Communication systems and techniques*
- Cooperation versus competition
- Decision-making*
- Problem-solving
- Delegating authority and responsibility*
- Creativity*
- Managing conflict and change*
- Technology transfer (putting knowledge to use; applications of available technology)
- Personnel (performance evaluation, incentive systems, promotion, staffing)
- Finances (budgets, accounting, audits, obtaining funds, managing under reductions)
- Costs and effectiveness of RD&A institutions*
- Visits to analyze and learn from nearby RD&A institutions
- Opportunities for each individual to improve as a manager
- Commitment and plan to improve one or more managerial situations at home*

* Indicates topics to be covered during a 5- to 7-day training course for executives

RESEARCH NEEDS, ASSESSMENT, AND EVALUATION:
IDENTIFYING EMERGING ISSUES AS A KEY TO
FORESTRY RESEARCH PLANNING

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INTRODUCTION

It seems at times that planning is something everyone talks about but no one does. But studies have found that research managers spend a significant portion of their administrative time planning research programs. A survey of IUFRO research managers found that they spend one-third of their time on planning projects and programs (Gregersen, 1984). USDA Forest Service research managers spend a similar proportion of their administrative time on developing research programs (Jakes, 1988).

Despite the effort that goes into planning research programs, there is little literature on how public research organizations decide which research projects or programs they will undertake. Forest Service research managers rated the desire to solve problems and the need to respond to requests from users as the most important factors in determining the direction or content of their research programs (Jakes, 1988). The desire to solve problems is the critical factor for selecting research projects in both developed and less developed countries (Gregersen, 1984).

The question for research managers and for researchers is, How are these problems identified? Or from another point of view, How do users ensure that their research needs are heard and considered? During the life of a Forest Service research work unit users are contacted several times for input to the research program. The Forest Service's National Forest System, a principal client of Forest Service Research, identifies its research needs when it writes a forest plan, outlining planned management activities for a National Forest. However, a recent evaluation of the competitiveness of Forest Service Research shows a need to reexamine the adequacy of the Forest Service Research effort to identify research needs and their relative priority among its clientele (Chapman and Milliken, 1988). The report further found that Forest Service Research needs to improve its methods for soliciting the advice and assistance of outside experts in identifying priority research areas. This finding should come as no surprise to research

managers. In recent studies, research managers in developed and less developed countries have indicated a need for better techniques or methods for selecting research studies (Gregersen, 1984; Jakes, 1988).

We conducted a study to develop a tool for identifying emerging forestry issues (Gregersen *et al.* in press). Notice we did not say forestry **research** issues. Other studies have outlined similar methods for identifying and prioritizing research needs (Milne, 1989; Phillips *et al.*, 1986). The difference between these approaches and ours is that we asked clients and researchers to list the most important emerging forestry issues. We did not directly ask respondents to identify research issues or needs. We were concerned that when individuals are asked to identify research needs, they are likely to respond with technical research topics dealing with genetics, forest management, forest utilization, *etc.* Because we were ultimately trying to identify the role of research in addressing emerging issues, we wanted to break away from the traditional responses. Once issues were identified, we asked clients and researchers to identify barriers to addressing the issues. Once barriers are identified, actions (including research) to resolve issues can be planned.

METHOD

A modified Delphi Exercise was used to identify emerging forestry issues from National Forest managers, National Forest users, and forest economics researchers. The Delphi has been characterized as a method of structured communication that allows a group of individuals to deal with a complex problem (Linstone and Turoff, 1975). There are generally three steps in a Delphi Exercise:

(1) Design a questionnaire. Our first questionnaire consisted of one open-ended question:

From your point of view, what are the most important emerging forestry issues that national forest managers and national forest users will face over the next 10-15 years?

(2) Develop a second summary questionnaire to focus results. The first questionnaire was returned and the results were summarized. Using these results, we designed a new questionnaire. On the second questionnaire, respondents to the first questionnaire were asked to consider the results, to change or reevaluate their first response, and to provide further input to help focus the results. For our second questionnaire, we presented participants with 11 issues summarizing their responses to the first questionnaire and asked them to rate the relative importance of the issues and to indicate any critical issues we missed in our synthesis.

(3) Use additional rounds of questionnaires until some desired level of consensus is achieved or it becomes evident that no further consensus is possible. We used a third questionnaire to determine the key barriers to addressing the 11 issues. We asked respondents to indicate the importance of four barriers—inadequate knowledge, inadequate resources, inadequate incentives, and inadequate institutional support—in resolving the issues.

Because we had decided to focus on U.S. National Forest management and use, we surveyed the line officers responsible for managing the National Forests—all Forest Service regional foresters and forest supervisors, and a random sample of district rangers (at least one per forest). We also identified 60 organizations and corporations that use National Forest outputs and included them in our Delphi Exercise. Because our ultimate goal in identifying emerging issues is to develop timely research programs, we also sent the Delphi to a group of researchers. Due to budget and time constraints, we limited our researchers to Forest Service and academic forestry economics researchers. The number of persons participating in each stage of the Delphi Exercise for each respondent group is shown in Table 1. Our response rate from Regional Foresters and National Forest users was not adequate for statistical testing. We combined the two groups of researchers to have a sufficient number of respondents.

Phases of the Delphi Exercise	Regional forester	Forest supervisor	District ranger	Clients	Researchers
Original mailing	9	120	120	60	140
Respondents to:					
First questionnaire	6	63	62	14	60
Second questionnaire	5	55	58	9	55
Third questionnaire	5	34	28	7	37

Table 1.—Number of respondents in each phase of the Delphi Exercise by respondent group

FINDINGS

Participants responded to the first questionnaire with phrases, sentences, and paragraphs. From the hundreds of pages of text, 11 issues surfaced that summarized most of the concerns raised (Table 2). In the second questionnaire respondents rated the relative importance of each

Rank	Issue
1	Increased use of legal and political processes to challenge decisions and forest plans. [Legal and political challenges to decisions] ¹ Range = 19-186 Mean = 102 Standard deviation = 31
2	Increasing conflicts and polarization among various user groups (recreationists, hunters, loggers, etc.) of uses of the National Forests. [Conflicts among user groups] Range = 0 Mean = 100 Standard deviation = 0 ²
3	Increasing conflicts between local and national interests and priorities. [Conflicts between local and national interests] Range = 25-200 Mean = 97 Standard deviation = 28
4	Inconsistencies between priorities established in the planning process and those in the budgeting/appropriations process. [Inconsistencies in priorities established during the planning and budgeting processes] Range = 19-200 Mean = 93 Standard deviation = 34
5	Increasing constraints on planning and management activities due to environmental/conservation concerns expressed in laws or regulations (e.g., threatened and endangered species, herbicides). [Constraints imposed by laws or regulations] Range = 25-178 Mean = 92 Standard deviation = 28
6	Declining budgets to manage the National Forests. [Declining budgets] Range 13-175 Mean = 91 Standard deviation = 35
7	Effectiveness and cost of forest planning process. [Forest planning process] Range = 8-188 Mean = 84 Standard deviation = 35
8	Making user fees commensurate with costs (e.g., below cost timber sales, recreation). [User fees commensurate with costs] Range = 0-185 Mean = 82 Standard deviation = 33
9	Increasing role of the National Forests in watershed and water management. [Watershed and water management] Range = 6-150 Mean = 78 Standard deviation = 33
10	Increasing problems associated with the wildland/residential/urban interface. [Wildland/residential/urban interface] Range = 0-154 Mean = 74 Standard deviation = 32
11	Increasing adverse impacts on the National Forests due to certain uses (e.g. off-road vehicles, marijuana growing). [Adverse impacts due to certain uses] Range = 5-161 Mean = 72 Standard deviation = 27

¹ Phrases in brackets indicate how issues are referenced in the text.

² Because all the values were normalized around the value assigned to "conflicts among user groups," there is no standard deviation or range for that issue.

Table 2.—Emerging issues in the management and use of National Forests in the United States

issue, and to indicate any critical issues we missed in our synthesis. Very few new issues were mentioned on the second questionnaire, and no new issue was mentioned by more than two respondents. Thus, we felt fairly certain we had captured the major concerns in our 11 summary issues.

Two points stand out with regard to the ranking. First, there was remarkable agreement among the three respondent groups on the importance of the 11 issues—the mean importance values for issues do not vary widely. Because the issues in the second questionnaire were developed from participant responses to the first questionnaire, it is not surprising that all 11 issues were considered important.

Second, the range in values for each issue is large, with standard deviations near 30 for almost all issues. Opinions differed about the relative importance of any one issue, even though the average or mean opinions are fairly close. We found a significant difference between rankings given by Forest Service managers (forest supervisors and district rangers) and those given by researchers to several issues. Researchers felt that the issue "User fees commensurate with costs" was much more important than National Forest managers did, while National Forest managers ranked the issue "Legal and political challenges to decisions" as more important than researchers did.

Regarding barriers to resolving issues, for all issues and all respondents, inadequate institutional support was considered to be the most important barrier to resolving emerging issues. Inadequate knowledge was considered the least important barrier.

DISCUSSION

We can draw some general conclusions from this study.

First, a Delphi Exercise can be used to identify emerging forestry issues, the relative importance of issues, and barriers to resolving the issues. Once issues and barriers have been identified, it becomes the task of forestry policy and decision makers to develop programs to address the issues. But it should be the task of researchers and research managers to develop specific research projects that offer the greatest potential for resolving the issue.

Second, the agreement of National Forest managers on the importance of the 11 issues was striking. Eighty-one percent of the forest supervisors and 86 percent of the district rangers gave the top ranking to the same five issues (the first 5 issues shown in Table 2). It's interesting to note that 4 out of 5 of these most important issues deal with conflict resolution. There is a need to evaluate the significant body of literature dealing with conflict management in other fields, and to explore possibilities for establishing a

natural resources research program in conflict management. There was also close agreement on the importance of the four barriers in resolving issues.

Third, we were able to demonstrate that researchers and national forest managers do not always agree on the importance of issues, nor on the barriers to resolving issues. However these differences are important only if they hinder research programs in solving important resource problems.

Finally, the research required to resolve the issues is primarily social science research. But natural resource managers seldom identify social science research as a priority when asked to identify research needs. The traditional response to requests for research needs focuses on technical management information. Although research in these fields is essential to efficient production and management of natural resources, this technical information does little to resolve day-to-day issues faced by managers.

The method and issues developed in this study should aid in the management of research and natural resources in the Forest Service. With continued research on research, we can help ensure that the forestry problems addressed are not only interesting problems, but also important.

LITERATURE CITED

Chapman, R.; Milliken, G. 1988. Forest Service research: dealing with the issues underlying concerns of competitiveness and system responsiveness. Consultants report to the Forest Service. Littleton, CO: Milliken Chapman Research Group, Inc. 28 p. plus appendices.

Gregersen, H. 1984. Forestry research planning and evaluation: an international comparison. In: Policy Analysis for Forestry Development, Volume I of the proceedings of the IUFRO International Conference, August 27-31, 1984, Thessaloniki, Greece: 1-15.

Gregersen, H.; Current, D. 1985. Forestry research planning and evaluation: a comparative study of U.S. institutions. Unpublished manuscript, College of Forestry, University of Minnesota, St. Paul.

Gregersen, H.; Lundgren, A.; Jakes, P. in press. Identifying emerging issues in forestry: A case study of national forest management and use. General Technical Report, NC- , North Central Forest Experiment Station, U.S. Department of Agriculture, Forest Service, St. Paul, MN.

Jakes, P. 1988. Research evaluation in the U.S. Forest Service: opinions of research managers. *Research Policy* (17): 283-292.

Linstone, H.; Turoff, M. 1975. Introduction. In: H.A. Linstone and M. Turoff (eds.) *The Delphi Method: Techniques and Applications*. Reading, MA: Addison-Wesley Publishing Co: 1-10.

Milne, G. 1988. Strategic forest sector issues in Newfoundland and potential CFS program initiatives. Information Report N-X-267, Newfoundland Forestry Centre, Forestry Canada, St. John's, Newfoundland, Canada. 22 p.

Phillips, W.; Beck, J.; Lamble, G. 1986. Forest economics research needs for west-central Canada. Information Report NOR-X-281, Northern Forestry Centre, Government of Canada, Canadian Forestry Service, Edmonton, Alberta.

MANAGING LARGE RESEARCH PROJECTS IN DEVELOPING COUNTRIES

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INTRODUCTION

Research is the orderly procedure by which humans increase their knowledge, and is contrasted to accidental discovery because it follows a series of steps designed precisely for the purpose of developing information (Andrew and Hildebrand, 1982). Management is defined as the science/art of optimizing the achievement of defined objectives. Management of a research project is therefore concerned with planning, organizing and conducting all operations that are needed to fulfil the objectives of the sponsor(s) and the executer(s) of the project.

Management of research projects differs from that of commercial enterprises or other undertakings because research is seldom profit-oriented. Accordingly, traditional management procedures may not be applicable to research projects. While general research management principals may be common to both developed and developing countries, the latter suffer from certain constraints that may not exist in the former. This paper describes the constraints to managing large research projects in developing countries and suggests approaches to overcome some of the more serious problems.

CONSTRAINTS TO MANAGING RESEARCH PROJECTS IN DEVELOPING COUNTRIES

The most common factors impeding research in developing countries are the lack of well developed research policies, especially for the long term, and the multitude of governmental bodies and institutions undertaking research. While in many countries, it may not be too difficult to formulate national research policies in broad terms, planning specific research and setting priorities are much more tedious. This may be due to the fact that in developing countries the bodies responsible for drawing research policies often do not communicate or coordinate with research institutions. Researchers and administrators tend to overlook the fact that the prime objective of research in a given country is to serve its own science policy. For example, it is not unusual to find that in some forest-poor countries, research on wood properties and industrial utilization is more common than

research on afforestation and reforestation, which has been identified as the main thrust of forestry in developing countries (World Bank/FAO, 1981).

Research policies in many developing countries, if they exist, are influenced by the political atmosphere prevailing in the country, which is seldom stable. Needless to say, drastic changes in the attitudes of politicians towards science have undesirable effects on research planning, disturb researchers and may upset funding agencies.

Plans for scientific research should deal with general and specific objectives, resources (inputs), constraints and interactions. The resources available to research programs in developing countries are in fact their constraints, as shown below. Resource availability has an important impact on the nature of the research product derived as well as the level of precision achieved and in turn the level of confidence which can be placed on the results. The resources which limit research in developing countries may include the following:

Information

Information is the foundation upon which research is based; hence, one of the major tasks of the researchers is collection of information for use in the research process. Information in general and data specifically are as critical to the problem identification phase of the research project as they are to the analysis of the results. Their availability profoundly affects both the quantity and quality of research which can be produced within a given period of time. In general, published information provides the basis for problem formulation while published data and/or data generated in the research process may be the source of information for analysis. Although voluminous amounts of information have been documented in the literature, researchers in developing countries have limited access to it. Many of the relevant books, periodicals and reports are not issued free, and commonly a forestry or an agriculture department orders only one copy, which then remains in the headquarters and does not circulate to the field staff. International organizations, such as IUFRO and FAO, are urged to compile relevant information and make it available, similarly to what has been done for agricultural research.

Human Resources

Like most resources, the human element must be considered from the points of view of quantity and quality. Mere availability is not sufficient for most research undertakings; the training and capabilities of local personnel must be considered when planning the research project. Except in rare instances, the time factor in applied research projects prohibits the training of

professional personnel though there may be time to train some non-professionals such as technical assistants.

It is quite common in many developing countries that scientific research is managed by civil servants or by scientists with limited management training. Some research projects, especially those funded by international agencies, have expatriates as managers. Adaptation to local cultural and environmental conditions may not be easy. Alternatively, some developing countries insist on appointing inexperienced junior local staff to be in charge of research projects, which is not the best solution.

Physical Resources

Nontechnical physical resources include transportation facilities, land and office space, and other items of a similar nature, while technical physical resources include machinery, scientific instruments, calculators, computers, etc. Certain types of instruments may be indispensable for particular aspects of the project; some phases of the research may need to be eliminated if the proper instrument is not available or is too costly to justify its use. Like all other resources, their availability must be considered when planning the research project. On the other hand, some research managers tend to demand and acquire modern equipment which may not be needed for the research executed.

Finance

Funds are required for almost all research projects and their availability is an important consideration in research planning and management. Contrary to a general belief, many developing countries receive funds beyond their absorptive capacities. Most funds available for forestry research in developing countries, for example, are secured through multi- and bi-lateral agreements and seldom locally. Unlike developed countries, scientific research in developing countries, if locally funded, would be through governmental bodies and seldom by private organizations and companies. In many developing countries, external funds are received and administered by governmental authorities, with inherent bureaucracy that often create problems for the managers of research projects. Further problems are caused by unstable rates of exchange for local currency.

In certain instances, foreign money allocated for specific research projects were diverted to other, more pressing, uses without even consulting the manager of the project. One can easily cite examples of equipment and cars meant to be used by the research personnel, that were held in customs because of sudden changes in importation laws. Such circumstances make planning and implementation of research projects a difficult, if

not an impossible, task.

A general feature of salary structure in many developing countries is that forestry researchers receive lower salaries than other comparable professionals in the same country (Bengston et al, 1988). Also the lack of monetary and non-monetary incentives for attracting and retaining skilled researchers is a major obstacle to improving research in developing countries. On the other extreme, managers and senior professionals in research projects sometimes receive substantial incentives and enjoy privileges not available to their subordinates. This obviously creates many problems.

Institutions

In many developing countries, weak research institutions constitute a major obstacle to development. Besides the constraints mentioned above, other weaknesses include a vulnerability to arbitrary changes and tendency to duplicate research completed or in progress elsewhere. Significant improvement in national research capabilities cannot be achieved without securing a strong central government commitment to research programs and a clear perception of the role of science in the economic development of the country as a whole.

A popular subject for debate in many developing countries is foreign vs. indigenous research. Such arguments are not justified because well conceived national research is likely to be more enduring than imported research. This, of course, does not exclude the adoption of appropriate technologies by developing countries.

Forestry research facilities and capabilities of many developing countries were examined by a group of consultants to the World Bank and F.A.O. in the late 1970's. At least 90 institutions were identified; the majority of which were weak and severely constrained by lack of staff and funding, (World Bank / F.A.O., 1981). It was recommended that first priority should be given to the strengthening of national institutions in these countries. Building up of national expertise may be very costly and take a long time. In the meantime, technical assistance may be sought from foreign bilateral and multilateral aid agencies. A second conclusion which emerged from this analysis is that regional forestry research institutions supported by governments of countries in a particular ecological or geographic zone have not, so far, proved to be very successful. Generally, such institutions face obstacles that impede their efficiency, particularly the need for political compatibility among participating countries, the security of finance needed for long term forestry research programs and the difficulties of agreeing on research priorities and staffing policies.

Institutional constraints and weaknesses in the existing research

capacity of developing countries were recently reexamined by the International Task Force on Forestry Research (1988). The report prepared by the Task Force states that:

"While the potential for substantial gains from research exists, it is recognized that an expanded research effort will not make progress unless there is the capacity to manage it and implement it, however well-chosen the objectives and priorities. The Task Force concludes that the current state of national research systems in developing countries will be a major constraint unless significant effort is made to expand capacity."

IMPROVING THE MANAGEMENT OF RESEARCH PROJECTS

Research projects in developing countries cannot achieve success unless the constraints listed above are tackled. Solving of the problems may be beyond the capabilities of the project leader, yet he should possess certain qualities necessary for proper project management.

Most of the present scientific research in developing countries is problem - oriented, i.e. applied research aiming essentially at solving specific problems, such as shortage of fuelwood and other forest products, erosion control, preventing soil degradation, improving watershed, systems of agroforestry, etc. The complexity of most of such problems makes it imperative to conduct multidisciplinary research (El-Lakany, 1985). Besides looking at the problem from many angles, multidisciplinary research is a means of conserving scarce research resources. Too often a researcher in one discipline minimizes the effects of those factors commonly included by others, so that in the absence of cooperation, the results are of limited value to other researchers. Of course it is not always possible to obtain answers for more than one discipline without increasing the size and complexity of the experiment beyond manageability and available resources. But it is precisely in those cases where resources are most scarce that it is important to consider the advantages of multidisciplinary research, (Kiehl, 1957).

The managers of research projects in developing countries must therefore be qualified to lead multidisciplinary teams of researchers and technicians and to cope with associated problems. In addition to coordinating between scientists of different backgrounds, and sometimes of different nationalities, the manager should be familiar with all aspects of the project. It takes a devoted person and a good scholar to be in charge of a diversified group of scientists. Meanwhile, the manager should be known and well-respected by the policy makers of the government as well as by the representatives of funding agencies and international organizations.

In addition to having managerial abilities in scientific, technical, and administrative aspects about the research project, the manager must have a good working knowledge of preparing research proposals, budgeting, accounting, and report preparation. While it is customary in developed countries to assign specific tasks to certain persons with clear terms of reference requiring minimal interference by the manager, the situation is quite different in developing countries, where the manager usually oversees all aspects of the project. It is advisable, and often mandatory, that the manager relinquish certain responsibilities and delegate authority to his subordinates. This may be easily implemented if the manager is able to choose his staff, which is not the case in many developing countries.

Reporting research results may exert a strain on the managers of large-scale projects in developing countries. Individual reports prepared by different scientists are usually of different styles, and sometimes even written in different languages. Another problem, which may not be peculiar to developing countries, is that reports are seldom prepared and submitted in time. It is the responsibility of the project leader to compile individual reports in a form acceptable to the sponsor(s).

The real skill of a research manager comes into play after the collection of the data has been completed. Experience and imagination pay-off in the analysis and the interpretation of the data and can make a difference between a useful project and one which ends up in a file drawer. The researcher must draw conclusions from the analysis and at the end make recommendations to the user to help in resolving the original problem of the project.

It is as essential that the user comprehends what the researcher has to tell him as it is for the researcher to understand the meaning of the data. The researcher is a scientist whose job is to understand complicated analysis and confusing data, the user has other interests and ordinarily does not have the same training. Therefore, the manager must rewrite the findings in a language that the user will understand. In this case, it is most useful to prepare additional research reports which present only the specific recommendations and the nature of the effect or response which can be expected if the recommendations are followed.

Sometimes it is better to present results in a form directed toward extension specialists and agents and then work with them to prepare a non-technical publication for use in extension programs. Leaflet - type publications which present the recommendations in simplified form, in the local language, can also be prepared if the research is applicable to a wider audience.

As a practical matter, a great deal of experimentation is carried

out with an orientation that is only partly research centered. An important example in forestry are the demonstration trials usually conducted by, or in cooperation with, the extension service. One of the purposes of this type of research is to demonstrate the results of research under real conditions, i.e. under conditions which will be applied by the user toward whom it is focused. For this reason, rather poor experimental control is to be expected, and accordingly, the experimental design is usually quite simple. A fairly successful demonstration trial may be the best means of illustrating some of the more important aspects to be considered when initiating a research project. It is rather unfortunate that most of the professionals lack appropriate training in extension methods. There is also marked reluctance among them to work in remote areas. A regrettable, but common feature of developing countries, is that professionals prefer to work in the capital city offices rather than in the field.

Finally, in developed countries, dissemination of information and extension services may not be the responsibility of managers of research projects. Specialized agencies are in charge. In developing countries, managers of multidisciplinary research projects are often involved in such activities, which adds to their responsibilities.

SUMMARY

Between developed and developing countries, planning and managing large research projects does not differ in principals but rather in practice. The complex nature of large research projects necessitates the undertaking of integrated, multidisciplinary research as well as the adoption of a systems approach to research. In planning research, it is essential to state clearly the objectives and to identify the resources or inputs. The managers of research projects in developing countries are often faced with the peculiar problem that the resources available are in fact the constraints to implementing the project.

This paper elaborates on the informational, human, financial, physical and institutional constraints impeding the management of large research projects in developing countries. Approaches toward overcoming such problems and improving the managerial abilities of the project leaders or principal investigator are also described.

LITERATURE CITES

Andrew, C.O. and Hildedrand, P.E. 1982. Planning and conducting applied agricultural research. Westview Press Inc. Boulder. Col. 94 pp.

Bengston, D.N., Xu.Z. and Gregerson, H. 1988. Key factors in strengthening Forestry research capacity in developing countries. A working paper from the Center for Natural Resources Policy and Management Studies, Univ. of Minnesota, St. Paul, MN 55/08, 27 pp.

El-Lakany, M.H. 1985. The role of forestry research, demonstration, extension and dissemination in combating desertification. Paper presented at the "FAO Expert Consultation on the Role of Forestry in Combating Desertification. Saltillo, Mexico, 18 pp.

International Task Force on Forestry Research. 1988. A Global Research Strategy for Tropical Forestry. Report published by UNDP, New York, 88 pp.

Kiehl, E.R. 1957. Integration of science for effective research. J. Farm Econ. 39: 1230-1231.

World Bank/FAO 1981. Forestry research needs in developing countries; Time for reappraisal. Paper prepared for the 17th IUFRO Congress, Kyoto, Japan. 54 pp.

MANAGING MULTINATIONAL RESEARCH PROJECTS
TO SOLVE PROBLEMS IN DEVELOPING COUNTRIES

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INTRODUCTION

Developing countries usually face common problems and constraints in their efforts towards development and conservation of their natural resources and training of their personnel. They are confronted at the same time with corresponding research and development needs and the lack of resources and inadequate strength of their institutions. Hence, the rationale of trying to work together and join forces to achieve anything durable. This assumption leads international or regional institutions, one time or another, to devise multinational research projects to solve problems, develop workable technologies and train badly needed staff for relatively young institutions. The creation, the management of these research projects and the efforts to disseminate any result obtained are constrained by many difficulties, some of which are reviewed in the present document. These difficulties may concern assessment of real needs, achievement of preliminary prerequisites for cooperation, determining research subjects that may reasonably attract interest of participants, the implementation of the projects, and the sharing and transfer of results.

The views expressed in this document draws essentially from the writer's experience as a user of research results and from that of the FAO Forestry Department in its efforts to help developing countries evolve action-oriented research activities and promote networking in selected subject areas.

I. NEEDS FOR A REGIONAL APPROACH AND NEEDS OF INDIVIDUAL COUNTRIES

The regional approach may be very appealing when its many advantages are considered; but it also has many constraints; overemphasizing advantages and neglecting constraints lead to imagining projects that will face many difficulties and may be very rapidly bogged down by difficulties of a very practical nature affecting project management.

1.2 Reasons for a Regional Approach

The reasons that lead programme or project managers to decide for a regional approach span from geographic and ecological similarities to strategic considerations, especially those relating to resource availability; these are the factors that rationalize the choice and are examined below.

1.2.1 Geographic and ecological similarities

The most evident reasons are of course those forced by physical conditions which render natural resources and processes similar if not common. Countries sharing the same climatic conditions face the same problems relating to flood or drought for instance; these natural phenomena force them to look at similar strategies and parries. Also, countries sharing the same geophysical units or the same natural systems (river basins, large watersheds, large vegetation groups, ...) may naturally look at obvious similarities and address common problems jointly. The large latitudinal organization of vegetation types in Africa, the massive guineo-congolese tropical forest in the same continent, the humid and dry Andes on one hand and the Amazonian forest on the other hand in Southern America, all these are examples of natural regions calling for common regional approach. IUFRO itself owes its origin to strongly similar problems in Western and Central Europe forest communities. Within geographic entities more pressing ecological constraints may create natural regrouping of countries so as to devise more likely operational bases on which to build regional projects. The IUFRO regional or subregional meetings organized by the Special Programme for developing countries helped identify such groupings. For Africa in the meetings organized in the framework of the IUFRO Special Programme for developing countries (Nairobi, January 1986 - February 1987 and Lilongwe, October 1988) many homogeneous subgroups were identified within northern Sudanian and Sahelian countries on one hand, and Eastern/southern African countries on the other hand; these subgroups of about 6 to 8 countries would make regional cooperation in forest research matters more feasible.

1.2.2 Historical and institutional similarities

Countries which have shared the same history or the same institutions may want to use the relevant common frameworks to tackle common research problems in common regional or subregional projects and programmes. To take some examples in Africa, it was only natural that in the sixties and early seventies, the countries of East Africa try and resolve their common research problems through common projects or even institutions; the East African Agriculture and Forestry Research Organization was a way in using not only common natural framework but also a largely shared common history and institutions during colonial times. In West Africa, the success of some common regional approaches in the CILSS ^{1/}countries is partially due to their common history and strong similarities in their institutions. One could however realize in examining these and other experiences that geographical and historical and institutional similarities alone are not sufficiently strong to support a lasting common regional approach translated in operational projects.

1.2.3 Political background

This is one of the factors that may play positively or negatively to support or empty the natural framework and substance of regional approach based on geographical, ecological, historical and institutional similarities. The creation of partly political entities such as the CILSS,

^{1/} Inter-State Committee to Combat Drought in the Sahel including Burkina Faso, Cape Verde, Chad, Gambia, Guinea Bissau, Mali, Mauritania, Niger and Senegal.

the IGADD ^{1/} and the SADCC ^{2/} organizations has offered excellent support to regional projects; this was taken advantage of through regional forestry research or research related projects especially those relating to natural forest management in dry areas, sand dune stabilization and genetic resources and seeds in recent common efforts of the countries concerned with the assistance of FAO, IUFRO and many bilateral organizations. In reverse, the excellent promises in East Africa were somewhat blurred or eliminated by political differences in the subregion; also examples from Northern Africa and the Maghreb subregion did not foster development of excellent regional project ideas interesting the countries of the region sharing the same Northern African forest and steppe formations; however new prospects, indeed very promising, are being translated into new cooperative research projects relating to forest resource degradation and desertification control, forest seed and genetic resources, species focussed research programmes (e.g. Pinus pinea, Cedrus spp., etc), especially in the framework of Silva Mediterranea (Committee on Mediterranean Forestry questions).

Political problems in a single country may also cause serious management problems of common projects or programmes and the conception of regional projects should consider this risk in devising ways and models of responsibility sharing.

1.2.4 Better use of limited resources and synergy effects

In developing as well as developed countries, *mutatis mutandis*, resources allocated to forestry research are scarce; this only translates the situation of the whole forestry sector. Researchers as well as people engaged in development are very much concerned by human resources, funding and institutional strength; these are not only fundamental to individual performances of national research organizations but to their relevant participation to any regional or subregional cooperative activities.

Human resources are a basic factor. They affect the ability of participation in many ways that need to be looked into more closely.

Level of training of researchers: this comes first in many studies, aiming at assessing needs of forest research institutions and forest researchers. In programs conducted by FAO in some developing countries, even with weak institutions, one single dedicated participant or correspondent may positively affect the development of a regional program.

Stability of personnel: one of the most serious difficulties that is often affecting cooperation between or with countries is the stability of interlocutors. In developing countries the turn-over is very rapid and this may entail instability and discontinuity in program implementation. This instability associated with the insufficient training of the staff as referred to earlier shows the risks encountered in any cooperative project. However there is an optimum situation to be reached; too much stability leads to the creation of a club syndrome for instance in

^{1/} Intergovernmental Agency for Drought and Development including Djibouti, Ethiopia, Kenya, Somalia, Sudan and Uganda.
^{2/} Southern Africa Development and Cooperation Conference including Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, Zimbabwe.

networking activities. A country representative may concentrate information at his level and does not activate the circulation of this information within the country. This difficulty has been encountered even in developed countries. At Avignon, in March 1988, some participants to the FAO/IUFRO/Silva Mediterranea workshop engaged in forest fire related research showed evident enthusiasm to actively participate in the forest fire management network while deploring the fact that adequate and timely information did not trickle down to them as it should. Hence stability of personnel, a team spirit and an active endeavour to share information are strong prerequisites for international, regional or subregional research projects.

Financial resources: national institutions are always underfunded in developing countries; in developed countries, it is assumed that the total money available for research is more efficiently used if overlapping is avoided and complementarity enhanced; the rationale of international research projects lies there. The Silva Conference held in Paris in February 1986 recommended common approaches in developing countries as well as in developed countries to better use restricted financial resources; joint projects were supposed to increase efficiency in domains such as the use of the mediterranean ecosystems biomass, finding solutions to the woodfuels problems, forests and acid rains, etc.

In international research (or development) projects, national funding may not be the most important factor. However too little national funding is not likely to produce a good national response to international research projects. The following conditions must be filled:

- minimum national funding to prepare national institutions to participate in international projects and later to continue on their own after the end of the project;
- stability of national funding whatever its level;
- existence of the international funding for a reasonable duration to achieve meaningful results; mobilizing resources in international or regional mechanisms for less than 5 years is not very productive and 10 years should be a reasonable target.

The FAO/IBPGR/UNEP international project on Genetic Resources of Arid and Semi-Arid Arboreal Species for the Improvement of Rural Living is an example in which it was realized that financial support to international research activities needs to be extended on an adequate time frame. This project which is discussed in more details in section 4.1 clearly demonstrated that sufficient time frame and continuity in funding are among the major factors that influence success of such a project.

Considering the sources of funds, it is not always evident that the donor's interest or strategy coincide with the preoccupations of the local institutions; however, it is a fact that funding institutions tend to build their strategy and establish their centres of interest. Research institutions may participate in programmes that may be financially supported while being not the first priorities they would consider if they had command of the funds. In that sense, the IUFRO regional workshops for forestry and research planning held at Kandy, Nairobi, Huaraz, Lilongwe, etc. are a good approach to identifying genuine interests of participating countries. In November 1984, in Addis Ababa (Ethiopia), FAO organized a meeting to identify priorities relating to woodfuel research and development in Africa. The Netherlands and other donors then offered to fund regional projects that would aim to respond to those priorities. This kind of approach succeeds in defining priorities first and funding at a second step and helps establish priorities not unduly tied to specific preconceived orientations.

1.3 Assessment of Needs and Priority setting

Regional projects should reflect the genuine needs of participating institutions and countries. There is no major difficulty in reaching consensus when countries and institutions involved are more or less on the same footing as concerns their manpower, equipment and experience. Usually, the situation is quite different when countries have different capabilities and when a leading cooperating or aid institution has to take initiative. In these cases priority setting may be done along two lines:

- a normally time consuming one involving national surveys and programming meetings;
- a more or less top down one involving desk study and project formulation that is assumed to take into consideration practical constraints and information gathered in a way or another.

Whatever the model used, the major difficulties relate to the following:

. How to select domains for multinational projects: the reasons used to justify multinational cooperation must serve also as guidelines for selecting the domains for multinational projects: multinational projects should address large problem areas which have significance for most of the participating countries; they should not in their activities overlap or smother individual national activities but support them. In that connection they should include the essential components that would help build up national capabilities, especially training.

. Criteria for priority setting: Setting priorities is not always safe of personal and subjective bias and in the special conditions known in some developing countries concerning turn-over of personnel, this may raise many difficulties. When participating countries spontaneously meet to discuss and set their priorities in the framework of a politically backed

institution, the process may be long and difficult but once decisions are taken, they are respected. In the case of programming meetings or desk studies supported by a single donor, or by a group of agencies, as was the case in the IUFRO Special programme for developing countries, people may change opinion or attitude from a meeting to the following and a painfully built consensus may be challenged. Further, at the implementation level, priorities may also be challenged when new institutions are involved or when implementation has to be coordinated with additional regional organizations not represented as such in the planning meetings. In many cases, when the following criteria have been respected, consensus has been confirmed or reestablished:

- . the subject should interest the majority of countries in an homogeneous region;
- . the resolution of the research objectives should be meaningful for the largest number of the people in the countries concerned;
- . the subject should be significant to development or help resolve development related problems;
- . the project should give opportunity to each national institution to contribute;
- . the project should take due account of the regional/subregional institutions and their programmes.

The projects being developed by FAO or other institutions and related to genetic resources, woodfuel resources development, natural forest management in arid zones of Africa have gone through time consuming discussions and meetings but after these meetings, development has been smooth and cooperation positive, especially as concerns the Subregional Cooperative Programme for the Improvement of Genetic Resources of Multipurpose Woody Species (FAO Project GCP/RAF/234/FRA) implemented by FAO and funded through a French trust fund; this project is working in a collaborative way with Sahelian Countries and their common institutions (IGADD and CILSS).

In cases where many countries are engaged in similar actions in which they face common difficulties for which they express need for support, setting priorities may be easy. The meetings of the statutory bodies of some international organizations (e.g. FAO regional forestry commissions, Committee on Forest Development in the Tropics, Committee on Forestry, ...) or regional organizations meetings may come up with special requests for support in selected areas or subjects. Most of the multinational research or networking programmes stem from needs expressed through such meetings.

II. PREREQUISITES

Discussing details of projects, contribution of participating countries and institutions and division of labour is a very important prerequisite before any project is implemented; an important work of information dissemination is also needed before implementation to have all cooperating institutions aware of all developments. The prerequisites discussed below are to be given due consideration in order not to seriously hinder project development.

Project formulated should be allowed full circulation and participants observations taken into account; all observations should be replied to and the largest consensus obtained from the cooperating institutions. It may be useful to issue an information note summarizing the content of the project (background, objectives, substance and structure, institutional arrangements, inputs and cost, ...).

Designation of implementing institutions and division of labour should be clarified and agreed upon; failure to do so at an early stage implies a long delay in implementation and opens doors for criticism and challenges even in a very advanced stage of project implementation.

Preparatory meetings are useful though they may be costly. Economy in travel costs may be reduced when project preparation facility arrangements are provided for, i.e. when a preliminary funding is allowed to meet all the preproject conditions and undertake all necessary negotiations. A project coordinator may constitute a link between participating agencies but this cannot replace direct contacts and discussions between future protagonists, right from the planning and preparation stages. In project involving national institutions information is to be circulated often at the highest level (ministerial cabinets for instance) which means long delays at times; but it is the only way to secure the institutional support needed.

III. IMPLEMENTATION

It is very likely that institutions, potentially involved in the implementation of a multinational project will not have the same level of experience and efficiency and this should be taken into account in the distribution of work and in the training, networking and twinning components of the project. Major difficulties that are often met at all stages of implementation relate to a range of issues: differences between institutions as regards experience, personnel and equipment, the mechanisms set forth for implementation, the coordination of activities, continuity for action and follow-up.

3.1 Facing Differences between institutions

This normally constitutes a positive factor of stimulation provided this difference is not too important. It is translated into the designation of a lead institution and facilitates distribution of responsibilities. In the various implementation stages (preparation, evaluation, publication)

the exchange of visits, contacts between officers may facilitate integration and more easily lead to networking arrangements. Generally the difficulties include the following:

- individuality and competition may hinder the acceptance of any leadership;
- reluctance to accept some types of activities not always of a research nature but necessary to the implementation of multinational projects: project management, preparation and submission of reports, discussion of one's own methodologies and respect of common guidelines, training, etc.

3.2 Mechanisms for Implementation

Methods and hence results obtained in a multinational project should of course be comparable. In developing countries, tradition may not be so strongly established that they cannot be changed or adapted to follow common guidelines and methods; however one has to be always very careful that these agreed upon, are strictly respected. The implementing mechanism should address this very important aspect; it includes at least:

- . a coordinating unit;
- . planning/evaluation meetings;
- . assistance and backstopping in the framework of which twinning arrangements should be developed with institutes in developed countries.

In the example of the project GCP/RAF/234/FRA, though the implementation of substantive research activities has not yet been reached, the preparatory activities include effective coordinating functions implemented by the project coordinator as regards the FAO input on one hand, the subregional organization on the other hand; a planning meeting was organized by CILSS and assistance and backstopping may be organized through joint efforts from the donors involved in the project and even from the subregions. This set up will be certainly maintained for further implementation. As concerns twinning arrangements, the potential does already exist and will certainly be developed in the second phase of the programme, when national seed centers become operational.

3.3 Evaluation of Results and Publications

It is absolutely indispensable that evaluation of results and publications be made in a way that give due credit to efforts developed by different participants. The coordinating unit will have to do it; the results will most likely be presented as the outputs of a project; it should however single out the contributions of the various institutions.

IV. PRACTICAL EXAMPLES FROM PROJECTS AT DIFFERENT STAGES OF IMPLEMENTATION

The following examples illustrate some aspects which have been exposed in this document; they concern 3 projects in the African region:

4.1 FAO/IBPGR/UNEP Project on Genetic Resources of Arid and Semi-Arid Zone Arboreal Species for the Improvement of Rural living

The objective of this project was "to act as a catalyst for gathering genetic materials and information on arid and semi-arid zone woody species and to help countries in the practical application of any results which may become available from it". It included 8 participating countries (Chile, India, Mexico, Pakistan, Peru, PDR Yemen, Senegal and Sudan) from the arid and semi arid zones of Africa, Asia and Latin America. Duration of the project was 6 years (1979, 1985), including one year preparatory phase; it covered the following activities: seed collection and distribution for evaluation, in and ex situ conservation, technical support and cooperation from FAO. The project, which also benefitted from the cooperation of CSIRO Australia, CTFT France, Oxford Forestry Institute U.K., and DANIDA Forest Seed Center, Danemark, was essentially geared to solve problems related to activity development in more countries than those directly participating and corresponded very much to the nature of project covered in this note. Difficulties that may be noted are, among others:

- large and scattered geographic coverage and difficulty of direct contacts between participants; lack of funds for regular, on the spot contacts between the coordinating/backstopping agency (FAO) and the participating countries;
- difficulty of direct contacts between participants from institutions of developing countries not directly involved in the implementation of the project;
- lack of full time coordinator;
- substantive funding should have lasted longer.

The general results of the project were nonetheless judged very satisfactory due to the quality and dedication of participating and cooperating institutions.

4.2 Sub-regional Programme for the Improvement of Genetic Resources of Multipurpose Woody Species in Africa (FAO-GCP/RAF/234/FRA)

This project was drawn up following two technical workshops organized by IUFRO in cooperation with FAO in 1986 and 1987 in Nairobi, within the framework of the IUFRO Special Program for Developing Countries. Objectives were: a) strengthening or creation of national seed centers or services; b) identification and conservation of genetic material and resources, improvement of genetic materials for tree planting; c) training. Out of the seventeen countries of the Sahelian and North Sudanian zones which participate in the project (9 countries from CILSS, 5 countries from IGADD, Nigeria, Cameroun and Tanzania), 12 countries have to date signed the project document and are actively participating. The project has met with very favorable conditions as a regional project: the needs for high quality seeds for rapidly growing planting programmes, a large homogeneous region with very similar ecological conditions, existence of economic/political groupings based on common problems most of them climatically

induced and previous planning exercises. At the same time, numerous initiatives had been taken in the same matter in the region. In spite of all these conditions implementation was not without initial difficulties; they related to the following:

- continuity of dialogue and change in staffing between planning meetings and implementation;
- coordination of and cooperation with various initiatives on the same field in the region;
- cooperation with subregional/regional institutions and due respect to and cooperation with their individual programme;
- existence of young institutions at national level at a very different level of experience.

Today these difficulties have been reasonably resolved and many countries, the regional institutions and other donors involved in the region are working together smoothly in the different aspects of the project implementation.

4.3 Planning of a Regional Project on Management of the Plant Natural cover in Sahelian countries

This project is mentioned to illustrate difficulties met at the planning stage for a multinational project not only at participating country level, but also at donors level; the project idea was developed in cooperation with IUFRO, FAO and potential participating countries at the IUFRO SPDC planning meeting at Nairobi in 1986. Later a proposal was drawn up especially for Sahelian countries, aiming at launching research and development activity in the area of arid zone forest resources management in Africa South of the Sahara. Most of the conditions relating to needs and interest from countries, geographic and ecological homogeneity, were met; but preparedness of countries, full support of regional institutions, agreement between cooperating agencies have delayed progress of this project; difficulties were mainly due to the following:

- strong interest from countries meant difficulty in choosing the experimental units that would implement the field work of the project;
- involvement of the most interested subregional institution had to be carefully worked out;
- long discussions between cooperating agencies concerning the scope and dimension of the project, details for implementation took also much time;
- institutions involved are located in distant cities, which make communications, reviews, transmission of observations very slow.

Very often, in areas in which participants are many, these kinds of difficulties are likely to be met and it is always necessary to devote the time needed to obtain consensus - hopefully not at cost of the project quality - among participants and cooperating and funding agencies.

CONCLUSIONS

Multinational projects may have many advantages and are anyway indispensable in solving major common problems when resources are scarce and experience limited. Their planning and management are delicate because they must take into account a range of needs from participating countries who usually have very limited financial resources and staff. Continuity is often interrupted either due to institutional changes or to financial difficulties when local funding is inadequate. The above leads to the conclusions that multinational projects, to be effective, should among other have the following characteristics if difficulties are to be minimized:

- relatively long planning period, as it takes time to reach a consensus;
- large involvement of national and regional institutions; in developing countries individuals must be strongly backed by their institutions to ensure continuity;
- strong training component; the only future guarantee for continuity and enthusiastic participation is the existence of a competent staff;
- joint approach or sufficient coordination/cooperation between cooperating agencies, to heighten impact and advantages expected from multinational projects;
- a large timeframe, permitting progressive withdrawal of external support at the end of the project period and subsequent self-sufficiency building of local institutions.

BIBLIOGRAPHY

- C. Palmberg, 1988 Research Needs in Forest Tree Breeding and Improvement in Developing Countries.
- D.N. Bengston et al. Forestry Research Capability in the Asia and Pacific Region.
- FAO - 1988 Forest Genetic Resources Information Bulletin no. 16.
- FAO - 1987 Forestry Research in Developing Countries (Secretariat note to 1987 session of the Committee on Forest Development in the Tropics).
- IUFRO - 1986 Increasing Productivity of Multipurpose Lands (IUFRO Research Planning Workshop for Africa Sahelian and North Sudanian Zones).
- J. Burley, 1987 International Forestry Research Networks objectives, Problems and Management (Unasylva, 157/158, Vol. 39, 1987/3-4).

RESEARCHER INCENTIVES IN PUBLIC FORESTRY INSTITUTIONS

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INTRODUCTION

The array of incentives and rewards for scientists has frequently been identified as a critical factor influencing the productivity and effectiveness of research institutions. Scientists are the most important resource in research, and a strong system of incentives is essential for the development of this resource. The incentive system serves at least two key functions. First, it is central to an institution's ability to attract and retain highly qualified scientists. Inadequate rewards and ineffective incentive systems lead to a high turnover of scientists and seriously reduce the productive capacity of research institutions. Second, an appropriate incentive system will guide scientists to work for the goals of the research organization. The nature of incentives and rewards will have a profound effect on the type of research that scientists carry out. For example, rewarding scientists for the number of scientific publications produced will encourage more basic research; rewarding scientists for contacts with users and actual adoption of research findings will encourage more applied research (Elz 1984, Dada 1984).

But problems with incentive plans and systems of recognition and reward for scientists have been identified in public research institutions, particularly in less developed countries (LDC's). Low salaries for researchers relative to other professions have often created serious personnel problems (Nicholls and Cheosakul 1969, Pastore 1978, Callahan and Buckman 1982, Kim 1984). Researchers who remain in an institution with low salaries often accept major consultancies or second positions in order to adequately support themselves, thus limiting their ability to carry out a meaningful research effort. In addition, some observers claim that public research institutions in LDC's often fail to provide a challenging environment for research, with opportunities for professional advancement and freedom for creativity (Kim 1984). In a survey to determine the major causes of resignations at three agricultural research institutes in Latin America, Ardila et al. (1981) found that various factors unrelated to salaries — such as facilities, managerial style, and opportunity for professional advancement — were rated among the top 10 causes for resignation by scientists.

The consequences of inadequate rewards and inappropriate incentives may be devastating for a research institution. High turnover rates for research personnel have been widely reported. Because they have greater opportunities for employment elsewhere, the most highly trained and experienced scientists are most likely to leave; turnover rates for Ph.D. level scientists are often substantially higher than for M.S. and B.S. scientists (e.g., Ardila et al. 1981). To quote one observer: "Staff instability hampers sustained effort and results in incomplete projects or badly conducted research. Organizations with a long history of staff instability are unlikely to make the desired research breakthroughs" (Idachaba 1980: 27). Improving researcher incentive systems is therefore likely to be a key to strengthening research institutions in LDC's. A logical first step in improving an institution's incentive system is to attempt to evaluate the adequacy of the existing system. The purpose of this paper is to shed some light on how one might approach this task.

One caveat is in order before proceeding. An effective incentive and reward system for scientists is only one aspect of a system for managing human resources in research. Other

interrelated components or subsystems include a human resource planning system, a performance appraisal system, and a career management system (Badawy 1988). Although none of these components can be neglected, the incentive and reward system is vital for productive research organizations: "The biggest cause of relatively low-performance among potentially productive scientists is the confining work environment they face as professional scientists... Sociological research shows that *motivation* seems to count at least as much as native ability or training in producing good scientific research. The fundamental problem is to create a work environment in which the practising scientists show a high level of motivation and job involvement," (Vijh 1987: 10-11).

INCENTIVE INDICATORS

To be effective, an incentive system must be consistent with what motivates scientists. Nobel laureate Paul Samuelson has commented on the motivation of scientists as follows:

Scientists are as avaricious and competitive as Smithian businessmen. The coin they seek is not apples, nuts and yachts; nor is it coin itself, or power as that term is ordinarily used. Scholars seek fame. The fame they seek... is fame with their peers. (Samuelson 1986, p. 2F).

Samuelson is not alone in this view. Hans Selye, the father of the concept of stress, wrote that scientists are motivated by fame, not fortune (Saffran 1988). Scientists want recognition from other members of the "invisible college" of research in which they work. But various other motivators stem from personality traits common to productive scientists. We can classify these motivating factors as either extrinsic or intrinsic. Extrinsic or external rewards arise outside the actual doing of scientific research and are unrelated to the technical content. Examples include a good salary and various types of awards. Intrinsic or internal rewards are associated with a scientist's inner satisfaction in his or her work, including the satisfaction that comes from the freedom to pursue one's own ideas, the challenge of working on difficult problems, the opportunity to use specialized knowledge and skills, and so on. Intrinsic rewards are related to what has been called the 'joy of science' (Sinderman 1985). Although the most productive and creative scientists are likely motivated primarily by intrinsic rewards, that does not mean that the extrinsic rewards can be ignored. In their classic work, Pelz and Andrews (1966) show that adequate extrinsic rewards are necessary but not sufficient for a healthy incentive environment.

In this paper, I present a method for evaluating researcher incentives in an institution. The method is based on a set of five indicators of a healthy incentive environment: the first two correspond to various extrinsic rewards, and the last three relate to the kind of institutional environment that facilitates the attainment of various intrinsic rewards:

- (1) a measure of the adequacy of salaries,
- (2) an index of other extrinsic rewards, which includes six individual components,
- (3) a measure of the decision making power of scientists,
- (4) a measure of the adequacy of technical support for scientists, and
- (5) a measure of the degree of "bureaucratization" of a research organization, or the administrative burden placed on scientists.

This is obviously not a complete list of potential indicators, but these five do cover many of the most salient features of the incentive environment. With comparative data from a sample of research institutions, these indicators can be used to evaluate the relative strengths and weaknesses in an institution's incentive system. Data obtained from two mail surveys covering 91 public forestry research institutions worldwide — 46 from LDC's and 45 from developed countries (DC's) — were used in this study (Gregersen 1984, Bengston 1986). Respondents

were research administrators, usually the top administrator in an organization. Significant differences in incentive systems between DC's and LDC's and between government research institutes and universities are analyzed. The following sections examine each of the five incentive indicators in turn.

1. Relative Salary of Scientists

The salary of researchers is an extrinsic reward that has often been identified as a particularly important aspect of a reward system. Inadequate salaries have been found in some studies to be the single most important cause of resignations from LDC research institutions. Monetary rewards are not the main motivator for highly productive scientists, but scientists are more likely to quit when their pay is not commensurate with their level of achievement (e.g., Pelz and Andrews 1966: 110-111).

"Relative salary" was measured by rating the salaries of researchers in a particular institution relative to the salaries of comparable professionals *in the same country*. Survey respondents were asked to rate the relative salaries of researchers in increments of 10 percent, ranging from "Researchers earn about 40 percent less than comparable professionals," to "Researchers earn about 40 percent more than comparable professionals."

As shown in Figure 1(a), responses from both DC's and LDC's ranged from -40 to +20 percent. In general, the pattern of responses is similar in DC's and LDC's. The Chi square test is unable to distinguish between the two distributions. But a higher percentage of LDC institutions was found at the extreme low end of the scale. About 16 percent of LDC respondents reported the salaries of their scientists as 40 percent below that of comparable professionals in the same country, compared to only about 2 percent of DC respondents. In these low-end institutions, salaries are clearly inadequate and are likely to be a source of institutional instability and high researcher turnover.

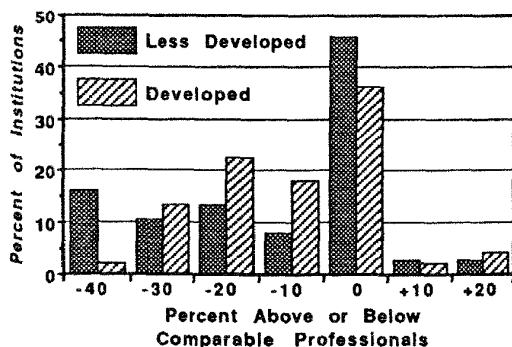


Figure 1(a). Salary of forestry scientists relative to comparable professionals in the same country in institutions from less developed countries (Less Developed) and developed countries (Developed).

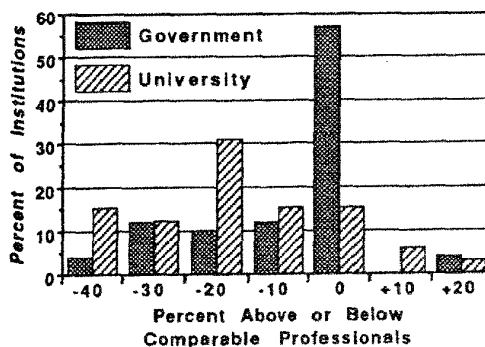


Figure 1(b). Salary of forestry scientists relative to comparable professionals in the same country in government research institutes (Government) and university departments (University).

More striking than the difference between DC's and LDC's was the contrast between government forestry research institutions and university forestry departments with respect to this indicator (Figure 1b). This difference was highly significant statistically, using the Chi square test. The modal value for salaries in universities was 20 percent below that of comparable professionals in the same country, compared to a modal value of 0 in government institutions

(scientists earning about the same as comparable professionals). Lower university salaries are offset at least in part by greater opportunities for university scientists to augment their salaries through consulting activities.

2. Other Extrinsic Rewards

In addition to direct salary, a variety of other extrinsic rewards and incentives for scientists may be important. Six categories of rewards are considered here:

- financial awards for outstanding productivity, quality, etc.,
- nonfinancial awards and recognition,
- additional research funding,
- other benefits such as housing or transportation,
- international travel, and
- career advancement in research.

Rewards such as these are likely to be important in encouraging scientists to work for the goals of their research organization. For example, award programs may be set up to recognize outstanding contributions to technology transfer, interdisciplinary research, or other organizational goals. Souder has shown that there is no one ideal type of award program: "Each program must be carefully tailored to the needs and the culture of the host organization," (1985: 18). This is especially important in international comparisons of research award programs, where cultural and other differences may be marked. The prospect of additional research funding may also induce scientists to work in areas of high priority to the organization. Housing, transportation, and other benefits may be essential incentives for researchers in remote locations in LDC's. International travel and career advancement in research may give scientists fame within the scientific community mentioned by Samuelson.

Survey respondents were asked to rate the frequency of use of the above six items in their research organization (1 = never, 2 = occasional, 3 = frequent, 4 = always), and their perception of the effectiveness of each reward in stimulating researcher productivity (1 = none, 2 = slight, 3 = moderate, 4 = great). The mean frequency of use of these six rewards in LDC institutions was "occasional," although averaging the responses obviously hides the variability between institutions (Fig. 2). A statistically significant difference was found between DC's and LDC's in their ratings of frequency of use for two of the six rewards (only the LDC ratings are shown in Figure 2). "Other Benefits" were used significantly more in LDC institutions. This may be due to the use of housing, transportation, and other special benefits to induce scientists to work in remote locations. In contrast, "career advancement in research" was used significantly more in DC institutions. This may indicate lack of a career ladder in research in some LDC institutions. In extreme cases, assignment of personnel to a public research institute with no possibility of career advancement has been used as punishment for poor performance elsewhere in government service (cf., Mathu 1983).

The perceived effectiveness of each reward in stimulating researcher productivity does not closely match frequency of use (Fig. 2). For example, "nonfinancial awards" were used most frequently on average, but were perceived to be least effective, relative to the other five rewards. "Financial awards" were used least often, but received a high rating of perceived effectiveness.

A composite index was constructed to provide an overall indicator of the adequacy of the incentive environment relative to these extrinsic rewards (the composite index of extrinsic rewards is used in the incentive profiles in the following section). For each institution, the frequency of use of each reward was weighted by the rating of perceived effectiveness. The six components were then summed to form a composite index — a single number that summarizes this aspect of

the health of the incentive environment for each institution. A wide dispersion of this index around the modal index value was found. The distribution was quite similar between DC and LDC institutions, except that about three times more LDC institutions were found at the bottom of the distribution than DC institutions.

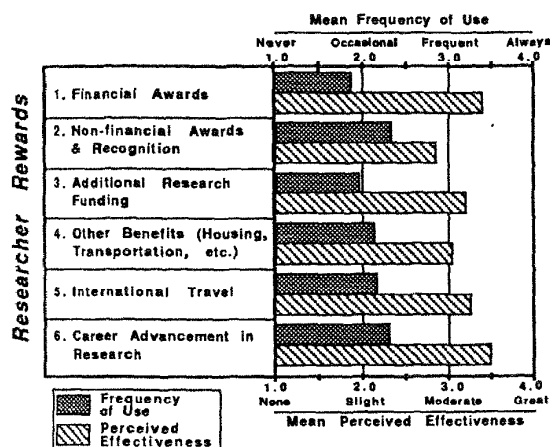


Figure 2. Mean frequency of use and perceived effectiveness in stimulating researcher productivity of six rewards for researchers in developing countries.

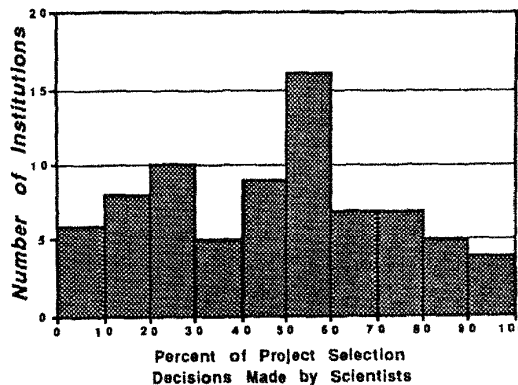


Figure 3. Distribution of the mean percent of project selection decisions made by forestry researchers in less developed and developed countries.

3. Decision Making Power of Scientists

A third indicator of the research incentive environment is a measure of the amount of freedom that scientists have in their research. Scientific freedom is clearly an intrinsic reward, and it is an important one for most scientists. Being independent and curious by nature, scientists naturally prefer to have as much autonomy as possible in their work. There may be a tradeoff, however, between scientific freedom and the ability of administrators to direct scientists toward work that will accomplish organizational objectives. Pelz and Andrews (1966) examined the tradeoff between "freedom and coordination" in research and found that "some combination of both is not only feasible, but helpful for the scientist himself, that is, when he involves several other people in shaping his assignments, but keeps substantial influence over the decision process" (p.32). A scientist's performance tended to be higher when various people were involved to some extent in decision making. Pelz and Andrews also found that performance was low where the chief alone determined the scientist's assignments.

The percent of project selection decisions made by scientists was used as a proxy for research freedom. Survey respondents were asked to estimate the percent of project selection decisions made by scientists in their organization, by administrators in their organization, and by administrators in other organizations. Figure 3 shows the distribution of this indicator for DC's and LDC's. The influence of scientists on project selection decisions differs greatly among institutions. There is some degree of central tendency around the modal value of 50 to 60 percent. Institutions falling on the low end of this scale are likely to have some difficulties with motivation because scientists in them lack decision making power, and those at the extreme high end may have problems coordinating or directing their research programs. No statistically significant differences were found between DC and LDC institutions. As might be expected, some evidence was found of greater decision making power of scientists in universities than in government research institutes, although this relationship was not very strong.

4. Technical Support

A fourth indicator of the incentive environment is the adequacy of technical support for scientists. The extent to which scientists are adequately supported by technicians and other support personnel is associated with a scientist's ability to achieve the intrinsic rewards of a scientific career. The analogy has been drawn between the importance of technical support personnel to scientists and ancillary medical professionals to a medical doctor: "A highly trained agricultural scientist with hardly any competent backstopping is comparable to a doctor with no nurses, laboratory staff, or paramedics," (Oram 1978: 8). Scientists without adequate technical support will be frustrated and severely handicapped in carrying out a program of research, in using their specialized knowledge and skills, and so on. Without adequate support, scientists will spend too much time on unrewarding busy-work. Inadequate provision of research support personnel has often been observed in LDC's (cf., Jones 1971, Radhakrishna 1979, Odera 1983, Kim 1984).

The adequacy of technical support for researchers was measured simply as the ratio of technicians to scientists in an institution. This is obviously an imperfect measure of technical support. Some fields of research require more field and lab assistants than others, and this measure glosses over these differences. But the overall number of technicians per scientist does provide a measure of the relative adequacy of technical support in an entire institution, and should separate out institutions with glaring deficiencies in this area.

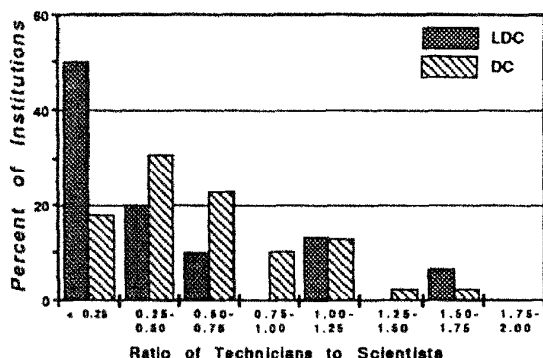


Figure 4. Ratio of technicians to scientists in forestry research institutions in less developed and developed countries.

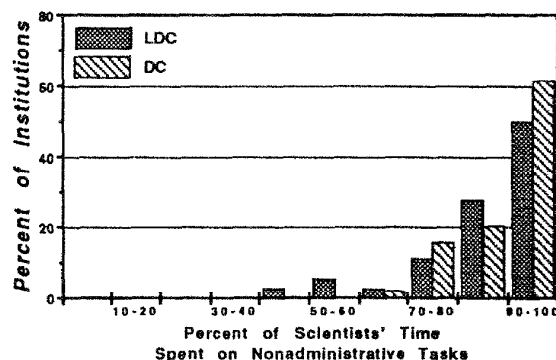


Figure 5. Percent of scientists' time spent on nonadministrative tasks in forestry research institutions in less developed and developed countries.

As shown in Figure 4, the distribution of this indicator is skewed to the right (the right-hand tail of the distribution is stretched out). A higher percentage of LDC institutions is found at the extreme low end of the scale, although the statistical evidence is not conclusive on this difference. Fifty percent of the LDC institutions sampled have less than one technician for every four scientists, compared to less than 17 percent of the DC institutions. Much more striking, however, is the strong statistically significant difference between government institutes and universities in technical support — 60 percent of universities sampled have less than one technician for every four scientists, compared to about 10 percent of government research institutions.

5. Bureaucratization

If research freedom is an important aspect of the incentive environment for scientists, then a related factor may be freedom from an excessive administrative burden that diverts scientists from research activities. Noble laureate T.W. Schultz has commented that "Organization is

necessary... But there is the ever present danger of over-organization... of requiring working scientists to devote ever more time to preparing reports to 'justify' the work they are doing, and to treat research as if it were some routine activity befitting a high-class clerk." (Schultz 1978: 102). Unfortunately, many research institutions are organized so that scientists must spend much of their time and energy on administrative tasks that keep them away from their research. An excessive administrative burden on researchers in developing countries has often been observed (cf., Dessau 1969, Iyamabo 1975, Menon 1980, Brunig 1982). In a review of agricultural research systems in Asia, Ruttan states: "I am concerned about excessive administrative burden that stifles both routine investigation and research entrepreneurship" (1981: 12).

The degree of "bureaucratization" in a research institution was measured as the percent of time that researchers spend on nonadministrative tasks, so that low values of this indicator relate to a heavy administrative load on researchers. Survey respondents were asked to indicate the approximate percent of time that researchers in their organization allocate to:

- research,
- technology transfer,
- teaching, and
- various administrative tasks.

As shown in Figure 5, the distribution of this indicator is skewed to the left for both DC and LDC institutions (the left-hand tail is elongated). In general, 50 to 60 percent of DC and LDC respondents reported that 90 percent or more of their researchers' time was devoted to nonadministrative duties. However, a few LDC institutions report that about half of their researchers' time is spent on administrative tasks, a heavy load that could be a strong disincentive for scientists. The hypothesis of no difference in this indicator between DC and LDC institutions would be rejected at a significance level of .09 using the Chi-square test, so there is some evidence of greater administrative burden in developing countries. Government research institutions reported a significantly heavier administrative load on scientists than universities, as might be expected.

INCENTIVE PROFILES

To be useful in efforts to strengthen research institutions, the set of incentive indicators must be presented in a way that facilitates evaluation and comparison between institutions and within an institution. A convenient way of summarizing the information about all five indicators is to con-

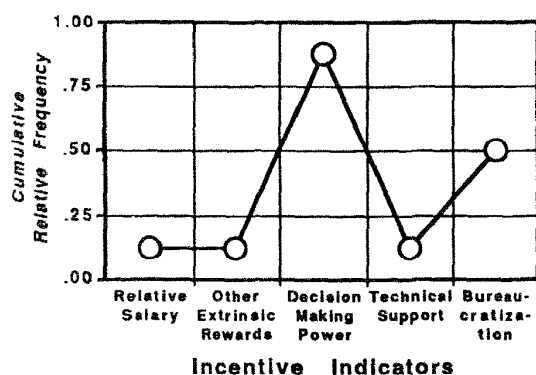


Figure 6(a). Researcher incentive profile for a university forestry department in an African country.

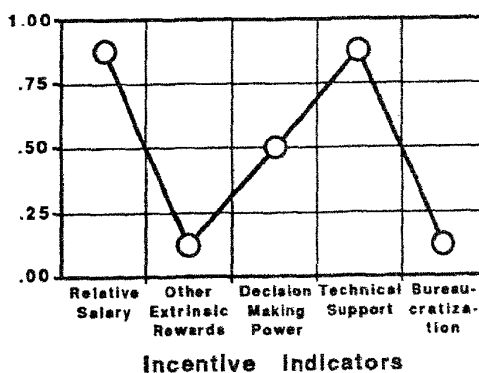


Figure 6(a). Researcher incentive profile for a government forestry research institution in a Latin American country.

struct a profile for individual research institutions. Figures 6(a) and 6(b) show how an institution ranks relative to all other institutions in the sample with respect to the five indicators. These profiles divide the distribution for each indicator into quartiles, so that the dividing points are the first quartile, the median, and the third quartile. For a finer breakdown, distributions could be broken into deciles or percentiles. The research institution represented in Figure 6(a) — a university forestry department in an African country — has a fairly typical incentive profile for a university. The institution ranks in the bottom quarter of all LDC institutions sampled in terms of the “relative salary” of scientists and “other extrinsic rewards.” It ranks in the top quarter in “decision making power” of scientists, but in the bottom quarter in the ratio of technicians to scientists, both characteristic of universities. Finally, it is right on the median in terms of “bureaucratization” or administrative burden. The potential value of an incentive profile is its ability to highlight the strengths and weaknesses of an institution relative to other institutions. Figure 6(a) shows the potential bottlenecks of “relative salary,” “other extrinsic rewards,” and “technical support,” to focus on in efforts to strengthen the incentive environment of this particular institution.

The institutional profile in Figure 6(b) was chosen to illustrate that profiles may be unique. This profile represents the incentive environment in a government forestry research institution in a Latin American country, and it is fairly typical of government research institutions. “Relative salary” of scientists falls in the upper quarter of the sample, but “other extrinsic rewards” ranks very low. This indicates an opportunity for improving extrinsic rewards. “Decision making power” of scientists falls in the middle of the distribution and, typical of government institutions, “technical support” ranks high. The level of “bureaucratization” falls in the lower quarter of the distribution, indicating a high level of administrative burden on scientists. This last indicator and “other extrinsic rewards” are two areas that would warrant further investigation in this institution.

CONCLUDING REMARKS

Future research on incentive systems should include several refinements. First, a more comprehensive set of indicators would be valuable, especially with respect to the nonsalary extrinsic rewards and incentives. These may be key to creating a productive research environment and motivating scientists to work for the goals of the organization. Second, developing multiple indicators of each aspect of the incentive environment would also be useful to test the validity of the incentive indicators. The validity of an indicator is the extent to which it measures what it is intended to measure. With only a single indicator for each characteristic, validity may be suspect. If we can make a reasonable and convincing argument that each of several indicators produces a valid measure of the characteristic in question and there is agreement between the multiple indicators, then the claim of validity is greatly strengthened.

Finally, research examining the link between the use of various incentives and rewards and the actual productivity of a research organization or the retention of scientists would be extremely useful. The approach for evaluating researcher incentive systems outlined in this paper measures the strengths and weaknesses of an institution’s incentive system relative to norms established by other forestry research institutions, rather than measuring the actual effectiveness of various incentives and rewards. These norms will represent a meaningful evaluation yardstick only if a wide range of incentive systems — from outstanding to lackluster — is represented in the sample. The wide range of responses for each of the five indicators tends to confirm what others have observed about the range of institutional capacities in forestry research: “Some countries can tap into high-quality research institutions while others have very limited local institutional capacities,” (USAID 1984, p. 26). Forestry research in four Asian LDC’s ranges from “exemplary to moribund” according to Callaham and Buckman (1982, p. v. See also: FAO 1978, Menon 1980). Comparisons between a sufficient number of research institutions are therefore likely to

define a meaningful evaluation yardstick capable of distinguishing high and low quality researcher incentive systems.

The incentive indicators and profiles discussed in this paper can help research administrators and others readily single out, study, and correct potential bottlenecks in an institution to strengthen its research capacity. Comparison of the two illustrative profiles in Figures 6(a) and 6(b) suggests that institutions may have a unique mix of strengths and weaknesses in the area of researcher incentives. Cost-effective strategies for strengthening incentive systems and research capacity in LDC's would involve targeting high priority areas and removing these bottlenecks. The importance of strong researcher incentive systems is indicated by the fact that the ideas, talents, and skills of scientists are a research institution's most valuable resource and its most expensive investment. Creating a work environment that nurtures the creativity and productivity of scientists is perhaps the most important function of research management.

LITERATURE CITED

- Ardila, Jorge; Trigo, Eduardo; Pifheiro, Martín. 1981. Human resources in agricultural research: Three cases in Latin America. pp. 151-164 in: *Resource Allocation to Agricultural Research*, Douglas Daniels and Barry Nestel (eds.) Proceedings of a Workshop held in Singapore, June 8-10, 1981. IDRC-182e. Ottawa, Ontario: International Development Research Centre. 170 p.
- Badawy, Michael K. 1988. Managing human resources. *Research • Technology Management* 31(5):19-35.
- Bengston, David N. 1986. Research capacity in developing countries: An evaluation of public forestry research institutions. Ph.D. thesis, University of Minnesota, St. Paul, MN. 205 p.
- Brunig, E.F. 1982. Summary Report on the Asia-Pacific Regional Workshop for Forest Research Directors at the Environment and Policy Institute, East-West Center, Honolulu, HI. Aug. 22-29, 1982. 33 p.
- Callahan, R.Z.; Buckman, R.E. 1982. Some perspectives of forestry in the Philippines, Indonesia, Malaysia, and Thailand. Final Report, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, unnumbered bulletin, Dec. 74 p. (Reproduced by National Technical Information Service, PB82-201591).
- Dada, G.O.B. 1984. The Extension and Research Liaison Unit: The new organization machinery for transfer of forestry research results in Nigeria. pp. 24-30 in: *Technology Transfer in Forestry*, G.H. Moeller and D.T. Seal (eds.). Forestry Commission Bulletin No. 61. London: Her Majesty's Stationery Office. 113 p.
- Dessau, Jan. 1969. Social factors affecting science and technology in Asia. *Impact of Science on Society* 19(1): 13-23.
- Elz, Dieter (ed.) 1984. *The Planning and Management of Agricultural Research*. Proceedings of a World Bank and ISNAR Symposium. Washington, D.C.: The World Bank. 141 p.
- FAO. 1978. Needs for forestry research in the tropics and what international action can do to meet them. Discussion Paper, Eighth World Forestry Congress, Jakarta, Oct. 16-28, 1978. 20 p.
- Gregersen, Hans M. 1984. Forestry research planning and evaluation: An international comparison. pp. 157-171 in: *Policy Analysis for Forestry Development, Vol. I*. Proceedings of an International Conference held in Thessaloniki, Greece, Aug. 27-31, 1984. International Union of Forestry Research Organizations. 520 p.
- Idachaba, Francis S. 1980. Agricultural research policy in Nigeria. Research Report 17, International Food Policy

- Research Institute. Washington, D.C. 70 p.
- Iyamabo, Dominic E. 1975. Managing forest research in developing countries. pp. 57-66 in: *Managing Forestry Research for Results*. Proceedings of the First Meeting of Subject Group S6.06, Management of Forestry Research, Paris, France. Sept. 1975. International Union of Forestry Research Organizations. 146 p.
- Jones, Graham. 1971. *The Role of Science and Technology in Developing Countries*. London: Oxford University Press. 174 p.
- Kim, Hyung-Ki. 1984. Building scientific and technological infrastructure in developing countries. Washington, D.C.: The World Bank. 89 p.
- Mathu, Winston. 1983. Major characteristics of forestry research in Kenya. pp. 158-163 in: *Proceedings of the National Workshop on Strengthening Forestry Research in Kenya*. Government of Kenya and U.S. Agency for International Development. 294 p. + appendices.
- Menon, K.D. 1980. Research and development: Identification of priorities for international action on forest management and reforestation. UNCTAD Paper TD/B/IPC/TIMBER/29. Geneva, Switzerland. 23 p.
- Nicholls, Frank G.; Cheosakul, Pradisth. 1969. Harnessing science to development in Thailand. *Impact of Science on Society* 19(1): 75-84.
- Odera, J.A. 1983. Some major opportunities for strengthening forestry research in Kenya. pp. 184-211 in: *Proceedings of the National Workshop on Strengthening Forestry Research in Kenya*. Government of Kenya and U.S. Agency for International Development. 294 p. + appendices.
- Oram, Peter A. 1978. Current and projected agricultural research expenditures in developing countries. Working Paper No. 30, International Food Policy Research Institute. Washington, D.C. 34 p.
- Pastore, Jose. 1978. Science and technology in Brazilian development. pp. 233-287 in: *Science, Technology, and Economic Development: A Historical and Comparative Study*, W. Beranek and G. Ranis (eds.) New York: Praeger. 347 p.
- Pelz, Donald C.; Andrews, Frank M. 1966. *Scientists in Organizations: Productive Climates for Research and Development*. New York: John Wiley and Sons. 318 p.
- Radhakrishna, S. (ed.). 1979. *Science, Technology and Global Problems: Views from the Developing World*. New York: Pergamon Press. 240 p.
- Ruttan, Vernon W. 1981. The Asia Bureau agricultural research review. Bulletin No. 81-2, Economic Development Center, University of Minnesota. 26 p.
- Saffran, Murray. 1988. Why do scientists travel? For applause, of course. *The Scientist* 2(14):14. July 25.
- Samuelson, Paul A. 1986. Quoted in: Lives of the Laureates: Seven Nobel Economists. New York Times, October 12, 1986. p.2F.
- Schultz, T.W. 1978. What are we doing to research entrepreneurship? pp. 96-105 in: *Transforming Knowledge Into Food in a Worldwide Context*, William F. Hueg, Jr. and Craig A. Gannon (eds.) Miller Publishing in conjunction with the Institute of Agriculture, Forestry and Home Economics, University of Minnesota, St. Paul, MN. 202 p.
- Sinderman, Carl J. 1985. *The Joy of Science: Excellence and its Rewards*. New York: Plenum Press. 259 p.

Souder, William E. 1985. Award programs for R&D personnel. *Research Management* 28(6):13-18.

Vijh, Ashok K. 1987. Spectrum of creative output of scientists: Some psycho-social factors. *Physics in Canada* 43(1):9-13.

USAID. 1984. Asia / forestry / fuelwood research and development planning conference, Bangkok, Thailand, April 16-19, 1984. Draft Final Report. 65 p.

PROGRAM REVIEW AND STRATEGIC PLANNING FOR
THE NEWFOUNDLAND FORESTRY CENTRE,*
FORESTRY CANADA

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INTRODUCTION

The Newfoundland Forestry Centre (NeFC) of Forestry Canada (ForCan), is the principal federal agency in the forest sector of Newfoundland and Labrador. The NeFC is one of six regional establishments of ForCan which span the country and mainly address regional priorities. ForCan also operates two national institutes in central Canada, one dealing primarily with forest pest research, and the other addressing key research at the national level in areas such as genetics, biotechnology, and remote sensing.

The activities of the NeFC are conducted within Newfoundland and Labrador, one of ten Canadian provinces. The area of the province is approximately 360 000 km² and comprises the island of Newfoundland, off Canada's east coast (one third of the area), and Labrador on the mainland (two thirds of the area). Forty two percent of the province's inventoried land area is productive forest. Approximately 92 percent of these forests are softwood species. The forest industry is almost exclusively located on the Island and consists of three large pulp and paper mills, 1400 small sawmills, and approximately 80 small converted wood product plants. The provincial government has the constitutional authority over resource ownership, management, and administration.

The role of ForCan, including the NeFC has gradually evolved from forestry research to include a very important regional development responsibility. The NeFC's staff complement of 70 person years is grouped into management (8%), professional (33%), technical (36%), and administrative (23%) categories. Programs at the NeFC are delivered through an organizational structure of six business units:

1. Forest resources research and technical services
2. Forest protection research and technical services
3. Forestry development
4. Information and technology transfer services
5. Policy, planning and economics
6. Finance and administration

* Since this paper was written, the Centre has been renamed Forestry Canada, Newfoundland and Labrador Region.

Total expenditures in 1988/89 were \$13.1 million, of which \$4.0 million were for regular programming (A-Base), and \$9.1 million in contributions to regional development through a cost shared federal-provincial forestry agreement. For the A-Base budget, the combined research units account for 60 percent of expenditures.

The NeFC is uniquely positioned as the only agency in the region presently conducting a comprehensive program of forest research and development. This situation imparts a responsibility to ensure programs address the most critical issues, especially in view of constrained A-Base person year and financial resources throughout ForCan. Over the past two years, a thorough review of planning and management was undertaken, and corrective measures initiated. This paper outlines the review process at the NeFC and describes steps taken to develop a strategic plan.

REVIEW OF PLANNING AND MANAGEMENT AT THE NEFC

Background

In early 1987, this author was requested by the Director General of the NeFC to design and implement an improved planning system for the Centre. A prudent policy for any organization is to periodically review the current planning process, the extent to which management and staff understand and apply planning principles, and whether the appropriate level and mix of planning exists. At the insistence of this author, the review was expanded to include an assessment of management at the NeFC. Planning is a primary component of the management process and should not be studied in isolation. Also, planning involves a human element, both in managers and staff. Therefore, any review of planning must include a critique of broader management practices.

The timing of this initiative was appropriate for three reasons. First, this author had just returned to the NeFC after an extended education leave and could objectively evaluate the present situation. Second, several senior management positions at the Centre had been filled with new players who felt planning and management could be improved. Third, a general trend was emerging within ForCan to improve planning at the corporate level.

Approach

Several steps were involved in the review of planning and management. First, all managers and professional staff were notified of the study by the Director General and asked for their cooperation. Second, the general planning system in the federal government was reviewed to learn of the process by which ForCan receives its annual budget allotment. The historical development of the headquarters planning system was studied (objectives, information requirements, scheduling, and regional input) to understand the impact of national ForCan planning upon the NeFC, in particular the demands placed upon regional staff in supplying information.

The third step was to review regional planning activities by studying files and other related documents such as the annual program plan. The main objective of

this step was to become conversant with the general planning process at the NeFC and any formal planning documentation. The fourth and most important step was to interview all managers and most professional staff (the latter representing a cross-section of age, experience, and area of expertise). The objectives of the interviews were to:

1. determine the level of knowledge, understanding, and use of management principles among staff, including planning, organization and control;
2. determine the level of knowledge and understanding among staff of both corporate ForCan and regional NeFC planning systems;
3. solicit input for improving planning at the Centre;
4. gain an understanding of concerns among staff about general management practices at the Centre relating to programs, financial, and human resources;
5. solicit input for improving management at the Centre.

A series of questions were prepared and used for all interviews to ensure the necessary information was collected in a consistent form. The interviews were conducted during the summer of 1987.

The fifth step in the review process was to collate the responses (approximately 20 interviews) and prepare a comprehensive report. The report evaluated the current situation and provided 23 recommendations for improvements to national planning, regional planning, and regional management. The report was completed by early November, 1987.

The sixth step was to obtain feedback from managers and professional staff at the Centre. Initially, the report was circulated to management for review and comment. After a two week period, this author met with managers and received feedback. Following minor revisions, the report was circulated to all professional staff for their review. Written comments were received from several staff. In December, 1987 a meeting of all managers and professional staff was held to discuss the report and the recommendations. A further meeting was held between this author and managers to discuss feedback received from professional staff and consider implementation of the recommendations.

Key Results of the Review

Regarding the broad national ForCan planning system, managers felt improved communication was necessary between headquarters and the region. This conclusion reflected an inadequate regional understanding of the evolving corporate planning approach and led to concerns over national ForCan planning objectives, regional application, and impact on local programs. This situation was amplified for professional staff at the NeFC. Most scientists had little awareness of the corporate ForCan planning system and the number of plans being produced.

At the regional level, the report identified a strong need for a strategic plan to provide a clear sense of direction for the Centre over a time horizon of at least five years and thus form a strong foundation for lower level planning. An operational planning system was also required to provide a linkage between the

longer term strategic plan and the existing annual program planning process. The operational planning system had to be comprehensive and address programs, financial, and human resources. This type of operational plan would also address concerns by managers and professional staff over the need for improved human resource planning at the Centre. With the existing annual plan itself, the main recommendation was to add a section comparing output in the previous year for projects and studies, with the objectives actually stated. This gap hindered tracking of work progress and therefore the performance of staff in meeting specific objectives. For planning in general, greater communication between the NeFC and regional clients was felt necessary to ensure programs in research, regional development, information services, etc. were properly targeted.

In terms of management at the Centre, both managers and professional staff felt positive changes could occur in a number of areas. First, professional staff wanted more input and control over the operating budget relating to their projects and studies. A related point was the need for greater communication between management and staff over developments in headquarters which could impact on resource levels at the Centre, particularly the A-base budget.

Another area of potential change was the improvement of internal communication between managers, in particular, strengthening of linkages between the two research programs. One other key recommendation was the need to explore and perhaps establish an internal merit award program to acknowledge outstanding achievements in research and support activities. Other areas where management could be modified were identified, however these were of less importance than the previous points.

The report was generally well received by both managers and professional staff. Obviously, any move to change existing and familiar practices can be difficult for some people. The fact that most of report was viewed favourably reflected the need for change and a positive attitude to change by managers and professional staff. Twenty-one of the 23 recommendations were accepted by management. Since January, 1988 a number of recommendations have been implemented. Although not directly due to the NeFC review, the general approach to planning at headquarters has improved, especially in the area of regional communication. Within the NeFC, a strategic plan has been developed which incorporates substantial external input. A fully computerized operational planning system has been developed by a committee comprising this author and two research scientists, with considerable assistance from the Centre's computer programmers. This system should be functional by June, 1989 and will replace the existing annual program planning approach. Several changes have occurred in the management of financial resources. Professional staff have been given increased budget responsibility which has alleviated a number of concerns with financial planning and control. A human resource plan will be developed during 1989 to provide managers with better information for decision-making in areas such as staffing, training, and longer term educational or management development. Communications among management and staff have been improved, particularly in terms of keeping staff informed of key developments in headquarters, for example new policies, programs, and organizational changes.

The importance of continued dialogue and involvement with the Centre's professional staff during the review process must be emphasized. This fundamental principle ensured that the report represented the views of professional staff as well as managers. This point is critical when considering changes in planning

and management in a research facility. Managers and scientists often have different ideals and values relating to career progression and success. Managers often conform to norms internal to the organization. Success and thus promotion is usually measured by results compared to the organization's objectives, normally represented financially. Scientists tend to conform to external norms. The quest for knowledge, being able to share this knowledge with other scientists, and having autonomy in problem selection and research approach are important. Success for the scientist is measured by establishing a reputation for excellence in research among peers outside the organization. Overlaps do occur, however this difference in management and scientist subcultures is real and exists in most research organizations. The study at the NeFC clearly confirmed this fact.

The review and resulting report were a positive step. The external environment is constantly changing as are the people in any research organization. The success of this type of review depends not only upon staff involvement, but also a strong commitment by management to undertake the review, acknowledge concerns, and accept recommendations for improvements. One possible weakness in the approach used at the Centre was the omission of technical staff from the interview and feedback process. The rationale for exclusion was that most technical staff were not directly involved in planning and, outside of supervising students, did not have any management responsibility. Nonetheless, their input would have been useful in assessing management of technicians by professional staff.

STRATEGIC PLANNING AT THE NEFC

Background

A key recommendation of the report on planning and management at the Centre was the need to develop a regional strategic plan. ForCan had formulated a national strategic plan and a strategic plan for research which indicated broad national forest sector issues and priorities. However, Canada is a large country with specific regional issues, a fact that ForCan recognizes by operating six regional establishments. The national strategic plans were not designed to account for regional characteristics. Therefore, a decision was made early in 1988 (following the review of planning and management), to develop a regionally oriented strategic plan. This plan would clearly identify the long term direction of the Centre and provide a framework for improved operational planning of programs, financial and human resources.

The Strategic Planning Approach

The specific approach for strategic planning can vary depending upon the nature of the organization. In many large corporations, strategic planning is often undertaken by planning departments as a staff function to senior management. External input may be limited to published data. The resulting strategic plan is usually restricted to senior management to prevent competitors from learning of future business strategies. The NeFC is a public and non-profit organization. Therefore, a completely different approach was selected. The strategic planning process was directed by this author, acting as an advisor and facilitator, primarily to managers at the Centre. Strategic planning should be a

function of management and is most effective when conducted largely by line managers rather than an isolated staff planning department. A decision was also made to conduct the planning in an open atmosphere, incorporating substantial input from professional staff at the Centre and clients outside the organization (including headquarters). Finally, the plan was to be published and circulated to all staff at the NeFC as well as clients in the region. Any other interested parties would be able to obtain a copy of the plan. A five year outlook was deemed appropriate, given that regional development agreements and many research projects rarely exceed that period of time. Too many uncertainties were associated with a longer planning horizon.

The plan consists of seven sections and was derived using a number of sequential steps. The seven sections of the plan are:

1. Introduction
2. The Forest Sector of Newfoundland and Labrador
3. Forestry Canada in Newfoundland and Labrador
4. Strategic Forest Sector Issues
5. Strategic Planning Assumptions
6. Strategic Issues, NeFC Objectives and Expected Achievements, 1989-1993
7. NeFC Management Strategies

Sections 1 and 2.

The sections of the plan were developed in order, from 1 to 7, over a 15 month time period. Sections 1 and 2 were drafted by this author to provide background information to management during subsequent steps, and as general information in the final planning document. Section 1 explains the rationale for the plan, while section 2 describes the forest resource base, the multiple outputs and forest functions in the region, and the general importance of forestry.

Section 3.

Section 3 presents information on the broad national ForCan mission and mandate, provides a mission statement for the NeFC, and describes current NeFC programs, resources, and operating relationships. This section required considerable input from managers. An initial step was to construct a business unit matrix (Figure 1). The matrix consists of a table with the six NeFC business units on the vertical axis and in this case, six criteria on the horizontal axis. These criteria are:

1. Regional boundaries: where does the unit operate and have an impact (provincial, national, global)?
2. Client Population: who are the unit's main clients?
3. Prime Function: what does the unit really do?
4. Unique products/services: what does the unit produce or provide?
5. Impact of work: what is the significance of the unit's work both presently, and potentially in the future?
6. Relationships: what are the unit's relationships, both formal and informal, with other groups such as client agencies?

Figure 1.

BUSINESS UNIT MATRIX - NeFC

	Regional Boundaries	Client Population	Prime Function	Unique Products or Services	Impact of Work	Relationships with Other Groups
Forest Resources Research and Tech. Serv.	Province-wide with National and International implications	Provincial government and related industries, scientific community and educational institutes	Provision of scientific Technological Knowledge Technology Transfer	Scientific and technical publications and services	Significant on scientific community, low immediate impact on local agencies, but strong potential impact	Provincial & federal agencies & committees, some with universities (Formal and informal links)
Forest Protection Research and Tech. Serv.	Same	Same, plus non-government organizations and public	Same	Same	Significant immediate impact, strong potential impact	Same
Forestry Development	Provincial, with some Atlantic and National implication	Provincial, federal and private forest - related agencies	Develop and enhance the forest sector	Agreements, employment development programs, expertise in technology transfer	Significant impact on quantity, lesser impact on quality of For. Man. Low impact on Research, moderate future impact	Same
Information and Technology Transfer	Provincial - 70% National - 25% International - 5%	Same as the above three business units plus NeFC staff and media agencies	Coordinate and facilitate communication program	Information to forest sector public, media relations, advisory services, audio-visual services	Significant impact with clients	Formal and informal relationships with all client agencies and the public
Policy, Planning and Economics	Regional and national	Provincial and federal agencies, industry, scientific community and educational institutes	Research (economics) & advice in policy, planning and economics	Economics research policy and planning documents, advisory services	Significant current impact on NeFC prog., significant future impact on client agencies	Same
Finance and Administration	Regional, national and same international contacts	ForCan regionally, nationally, plus other clients in public and private sector	Provision of financial and administration services regionally and nationally	Finance & administration reports and services, eg. computer work plans, financial statements, etc.	Significant impact on ForCan regionally and at national level	Same

The matrix was completed in a one day meeting. One business unit at a time was discussed in terms of the six criteria. The manager responsible for a particular business unit would add his or her remarks following all other managers. This approach prevented the manager from biasing the responses of other managers in relation to his or her business unit. The method worked well and indicated that an individual manager often overestimated the function and importance of their own business unit relative to the perceptions of the other managers.

The information from the matrix was used to develop a mission statement for the Centre. The corporate ForCan mission statement was viewed as too general and not fully reflective of the regional perspective. The resulting NeFC mission statement (Figure 2) defines what we do, who our clients are, and the impact of our programs.

The NeFC of ForCan is the lead federal agency in Newfoundland and Labrador responsible for:

- conducting forestry research to produce scientific and technical knowledge,
- managing forestry development agreements and related programs,
- disseminating scientific and technical information, and
- providing forest policy advisory services,

to enhance the economic, environmental and social benefits from the forest resources in the region. The principal clients are the provincial, federal, and private forestry related agencies, the scientific community, educational institutions, and the general public. The programs of the NeFC are designed to have a significant impact on the forest sector, primarily in the region, and contribute to national and international knowledge in forestry.

Figure 2. NeFC mission statement, 1989

A full day meeting was required to complete a first draft of the mission statement. The statement was reviewed by managers and then modified at another meeting where the remaining components of section 3 were drafted. These components describe current financial and human resource allocation at the Centre, research program structure, and expand upon the NeFC's position as the only major forest research agency in the region.

Sections 4, 5 and 6.

Section 4 identifies the key strategic forest sector issues in the region both presently, and over the five year planning horizon. Section 5 presents information on planning assumptions which could impact on the forest sector over a five year period. Section 6 lists expected five year achievements by NeFC programs in relation to the strategic forest sector issues. Section 5 was drafted by this author and examines economic, environmental, social, and

political factors which influence forest resources and resource use. In addition, the effects of these factors on the NeFC, for example political changes, were addressed.

At a management meeting in early 1988, a decision was made to collect information for sections 4 and 6 from a wide diversity of forestry opinion in the region. This decision acknowledged the fact that managers and staff at the Centre had a limited perspective of forest sector issues. Forest resources are complex and touch upon a range of interests and disciplines. Clearly, to obtain a broader picture of key issues and how best the NeFC could address these issues, input from external sources was deemed necessary. A Delphi survey of two sequential questionnaires plus a follow up workshop were used to collect the required information (Milne, 1988). The Delphi process is a technique to collect and pool individual judgments into a consensus. One main advantage of this approach is that participants remain anonymous in providing their input, free from group or peer pressure.

Managers at the Centre identified 38 individuals to participate in the survey and workshop. While the nominee's position was a factor in the selection process, more important criteria were a good knowledge of forestry (both fiber and non-fiber aspects if possible) and interest in research and development. The 38 nominees included NeFC managers and project leaders; representatives from the Provincial departments of Forestry, Parks, Environment; Federal departments of Parks, Environment, Agriculture, Wildlife, Fisheries and Oceans; Memorial University; the local media; and the Newfoundland Wilderness Society. A representative from ForCan in headquarters was also included. The nominees represented a diversity of opinion and a good balance between fiber and non-fiber interests. The NeFC nominees accounted for about one-third of the total. All nominees were contacted in March, 1989, informed of the survey and asked for their cooperation. All nominees agreed to participate in the survey, at least in terms of receiving the first questionnaire.

During April and May of 1988, the questionnaire survey was conducted. The first questionnaire asked respondents to identify key strategic forest sector issues, either presently existing or expected to emerge over the next five years. Any number of issues could be listed. Information was also collected regarding criteria for ranking the various issues in the next questionnaire. Three criteria were presented (potential economic, social, or environmental impact) which respondents then scored from 1 to 5, with 1 being low importance and 5 high importance. The respondents were also requested to list potential NeFC initiatives to address each issue. The response rate for the first questionnaire was 92 percent. More than 200 issues were recorded, each with a number of NeFC initiatives. The 200 issues were gradually distilled into 13 separate issues. These 13 issues, while viewed as distinct for the purpose of the survey, had many interrelationships. Each issue was assigned appropriate NeFC initiatives. Finally, two criteria for ranking the issues, potential economic and environmental impact, were selected based on scores received.

The second questionnaire presented the 13 strategic forest sector issues along with the two criteria of potential economic and environmental impact. Respondents were asked to rate each issue by assigning a score for both criteria on a scale of 1 to 5 (with 1 being very low impact and 5 very high impact). The second part of the questionnaire again presented the 13 issues, however each was followed by a list of associated NeFC initiatives. Respondents were asked to

rate each initiative using the criteria of urgency and importance on a five point scale. The response rate for the second questionnaire was 71 percent. The decline in response rate from the first questionnaire is not unusual in Delphi surveys. The results from the second survey produced an ordered ranking both for the 13 strategic forest sector issues as well as the potential NeFC initiatives under each issue.

The follow up workshop took place over a two day period in late June, 1988. The objectives of the workshop were to provide closure of the study by presenting aggregate survey results of individual judgments, discuss the findings, derive group ratings of issues and initiatives, and develop a consensus between survey and group judgments. To aid in achieving these objectives, a professional facilitator with a strong background in strategic planning was hired from the Faculty of Business Administration, Memorial University of Newfoundland. Twenty-three survey participants and five substitutes attended the workshop. Because of group dynamics and the time allotted to the workshop, only the six top ranking issues (and corresponding initiatives) were addressed in detail. The consensus ranking among those six issues was:

1. The effect of forestry practices (harvesting, processing, and management) on the environment.
2. Loss of forests from fire, insects and disease.
3. Uncertain situation of future wood supply versus demand, including pulpwood, sawlogs and fuelwood.
4. Forest land alienation due to poor comprehensive land-use planning and a reliance on single-use rather than multiple-use management.
5. Inadequate understanding of intensive forest management practices, for example site preparation, planting, seeding, thinning, prescribed burning, etc.
6. Need to improve and further develop forest legislation and policy relating to a number of issues such as land tenure, private woodlots, control over domestic cutting, and government funding in forestry.

Each of these issues had several potential NeFC program initiatives listed encompassing research, regional development, advisory services, and information/-technology transfer. These initiatives were discussed and reworked several times at the workshop. The remaining seven issues from the original list of 13 were not addressed in detail:

7. Inadequate adoption of new technology in forestry harvesting and processing in Newfoundland.
8. Effect of climate and acid rain on the forest.
9. Inadequate species diversity in commercial forests and insufficient use of genetically improved stock.

10. Inadequate information on the forest land base and forest resource inventory.
11. Poor diversity in forest products and markets in Newfoundland.
12. Inadequate communication and education within the forestry sector, and between the forestry sector and the general public.
13. Lack of development of the Labrador forest.

The workshop revealed a strong polarity of opinion regarding the ranking of issues. Individuals with a strong orientation towards industrial forest use tended to favour the economic aspects of forestry while individuals oriented to non-fiber uses favoured environmental aspects. This observation was confirmed by survey results and suggested that some participants had difficulty linking economic and environmental aspects for some issues. The workshop was fairly successful in increasing the group awareness of both forestry attributes. At the end of the workshop, participants were given a form to evaluate the sessions and provide constructive feedback. One main criticism was that the workshop should have been longer, perhaps spanning four or five days. The longer time period would have allowed more in-depth assessment of the last seven issues and their corresponding NeFC initiatives.

The survey and workshop results were not perceived by NeFC management as cast in stone, nor was the process viewed as an abrogation of decision making over programming. Instead, the results were regarded as information from a wide body of opinion upon which more effective decisions could be made in setting long term directions for the NeFC. During the period of August, 1988 to January, 1989 the list of issues and potential NeFC initiatives were reviewed and refined by managers and professional staff. The strategic issues were grouped into primary issues (which could be significantly addressed by the NeFC) and secondary issues (which the Centre can play a supportive role). For each issue, managers developed a broad objective for the Centre. The primary issues (Figure 3) were to be allocated approximately 80 percent of available resources, while the secondary issues (Figure 4) would receive the remainder.

For each issue, a sub-list of expected NeFC achievements was compiled using the survey/workshop results plus input from all managers and professional staff. These expected five year achievements were reviewed and refined several times. At this point, section 6 provided a clear sense of direction for the Centre over a five year planning period. However, one missing component was an indication of how this issue oriented programming was different from the present situation. In other words, what general shifts in program direction would occur over the next five years? To address this gap, managers of each business unit reviewed their current programs in comparison with the directions established in the plan. In some units, few changes were required while in others, the need to gradually shift direction was evident. One example was the small research effort currently addressing environmental questions in comparison to the importance of the issue based on survey and workshop results. To accommodate increased activity in this area, other fields of research which are not addressing key issues will have to be scaled down and the personnel gradually redirected.

-
- Issue 1. The effect of forestry practices on the environment
- Objective: To identify forestry practices detrimental to the environment and develop guidelines to minimize the effects of such practices.
- Issue 2. Loss of forests from fire, insects, disease, and pollutants
- Objective: To develop integrated management systems to reduce forest losses to an economically acceptable level.
- Issue 3. The uncertainty of wood supply
- Objective: To assist forest management agencies in their efforts to quantify and ameliorate wood supply deficits.
- Issue 4. Inadequate knowledge of intensive forest management practices and ecological processes
- Objective: To develop prescriptions and guidelines for silvicultural practices.
- Issue 5. Inadequate public information and technology transfer
- Objective: To enhance public awareness to forestry and fulfill the needs of clients through technology transfer of program outputs.
-

Figure 3. Primary issues and NeFC objectives

Section 7.

The final section of the plan outlines management strategies to assist the Centre in fulfilling its mission and achieving the five year objectives. Considerable time was spent in discussing several initiatives managers could undertake. The report on planning and management at the Centre was a valuable source of input in addition to the strategic plan itself. A number of initiatives were identified such as reviewing the organizational structure, continuing progress to establish an integrated computer system at the Centre, exploring external sources of funding for research, and reviewing communications between clients and the NeFC. These management activities and others were planned to be implemented over a full five year period.

Issue 6. Forest land alienation to other uses

Objective: To develop decision-making tools for land use planning.

Issue 7. The need to improve forest legislation and policy

Objective: To support appropriate government agencies in the development of policy and legislation affecting forest lands.

Issue 8. Inadequate use of new technology in forest harvesting and processing

Objective: To promote advanced technology in wood harvesting and processing.

Issue 9. Limited diversity in forest products and insufficient information on market potential

Objective: To provide information on the feasibility of forest product diversification and potential markets.

Issue 10. Lack of development of the Labrador forest

Objective: To provide information on the Labrador forest in support of anticipated socioeconomic development.

Figure 4. Secondary issues and NeFC objectives

DISCUSSION

The strategic plan is presently being reviewed by members of the Newfoundland Forest Research Advisory Committee (FRAC) and will be reviewed by senior headquarters staff. Following comments from these groups, the plan will be revised and published. The time period for the initial review and subsequent strategic planning covered approximately two years. At least five additional years will likely be required to implement the many management strategies and improvements to operational planning at the Centre. The completion of the strategic plan is

therefore only the end of one phase in an ongoing process. The plan will be reviewed annually by managers and another planning year added. In this way, a five year outlook will always exist from which to base lower level plans and management strategies for programs, financial, and human resources. This annual evaluation will promote the concepts of flexibility in strategic planning and proactive management. The review will also be linked with the headquarters planning cycle to ensure that regional activities continue to mesh with broader national priorities.

At the end of the initial five year planning cycle (1993), a more detailed review of NeFC activities is anticipated. This review would compare progress made in management and planning over the preceding five years with targets established in the strategic plan. Broad external input could again be solicited through a survey and/or workshop.

The critical question to ask is "what has the review and planning process done for the NeFC"? A number of benefits have occurred. First, the review of planning and management greatly improved the dialogue between managers and professional staff at the Centre. Problem areas were identified and corrective steps taken, however the most important impact has been that professional staff have had real input into progressive change and in charting long term program direction.

The survey and workshop to identify and rank forest sector issues and potential NeFC initiatives was also important. This process marked the first time that such a broad spectrum of agencies had been asked for input regarding NeFC program direction. In addition, this input has created a sense of stability in NeFC programming, especially in research. Previously, the priorities of several client agencies appeared to change yearly; consequently, some research tended to be overly reactive. The constantly changing priorities were disruptive to scientists and contributed to the feeling that the Centre lacked a strong sense of direction. The workshop was valuable in allowing the NeFC and other forest related agencies to reach a general consensus on priority issues. Involving these agencies in program direction should reduce the tendency for sudden and reactive shifts in research priorities. This workshop also exposed different agencies to the wide variety of opinions which exist about forest sector issues and research priorities in the region. The open dialogue also promoted the idea of cooperative research through the pooling of expertise from various agencies to address specific issues.

SUMMARY

The process of reviewing planning and management at the NeFC, and the development of an initial strategic plan has potentially wider applications. Research resources are limited, especially in developing countries. Efficient allocation of these resources is predicated on effective long term planning and management. The recent experience at the NeFC can provide useful lessons to other research agencies. Reviewing how effectively research and development are conducted is an appropriate exercise in any research establishment. This type of self-review is healthy and encourages improved management of programs, financial, and human

resources. The various steps involved in developing the strategic plan can also be applied to other research establishments. On a broader scale, the Delphi survey and workshop could be used at the national level for identifying strategic forest sector issues and setting research priorities. For cooperative international research programs, this type of consensus building could be exercised to improve the focus of programs.

LITERATURE CITED

- Milne, G.R. 1988. Strategic forest sector issues in Newfoundland and potential CFS program initiatives. ForCan, Nfld. and Labrador Region. Inf. Rep. N-X-267. St. John's.

CORPORATE PLANNING IN A USER-PAYS ENVIRONMENT
AT THE FOREST RESEARCH INSTITUTE, NEW ZEALAND

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SUMMARY

The Forest Research Institute, which is part of the Ministry of Forestry of New Zealand, is operating in a fast-changing environment. Since 1986, it has changed from being a fully Government-funded research organisation to an institute which has to provide research and consultancy services to a wide range of local and overseas clients at commercial rates to earn about one quarter of its total income.

To support management in this commercial environment, a comprehensive process of corporate and operating planning has been developed. It comprises the development of a hierarchy of plans, from a corporate plan for the whole of the Ministry, through operating plans for each research division, to work plans for each individual staff member. The FRI has a participative style of management, and the planning process provides opportunities for each staff member to contribute to this set of plans.

The corporate planning process is expensive in the time commitment it requires, but it has many benefits in terms of clarity of goals, unity of objectives, development of organisation culture, team building, internal communication, and participative management style.

BACKGROUND

The Forest Research Institute (FRI) is part of the New Zealand Ministry of Forestry (MOF). It has four research divisions, and an administration and servicing division. Its research programme covers all aspects of production and protection forestry, and wood technology. About 320 of the total staff of 400 are located in Rotorua, in the centre of

the North Island, which is one of the main production forestry areas. The Christchurch division, in the South Island, concentrates on protection and environmental forestry research. The organisation structure and an indication of the scope of the research programme are given in Figure 1.

Until 1986, the FRI was almost totally Government-funded. Research directors concentrated their planning and management effort on personnel management, on developing and implementing 4-year research programmes, and on technology transfer. Each of the research divisions had a Research Advisory Committee, comprising people from client groups and other research organisations. These committees assisted with the identification of research needs, evaluation of progress, setting of priorities, and also served as research communication mechanisms. The draft 4-year research programmes were widely circulated for comment, to obtain input from user groups. Some projects teams had industry working groups which provided further research evaluation and direction.

Since 1986, all Government research budgets in New Zealand have been progressively cut. The research organisations were given the choice of reducing their research programmes and staffing, and thereby cutting costs; or undertaking contract research and consulting services to earn revenue and thereby maintaining their size; or a combination of these two strategies. The FRI decided to use both strategies. The extent of the budget cuts is indicated in Figure 2.

At about the same time, a number of Government Departments were being restructured to make the State sector more market-oriented and more accountable. The Forest Service, which owned and managed more than half of the nation's production forests and much of its native forests, was replaced by a much smaller Ministry of Forestry (to provide policy advice, research and quarantine services), and the Forestry Corporation (to manage the State's production forests along fully commercial lines as a State owned enterprise). Management of the native forests was transferred to the new Department of Conservation.

The FRI was transferred as a unit from the Forest Service to the Ministry of Forestry, with no staff losses. Within the Ministry of Forestry, the various groups are funded at different levels by Government: Policy Division is fully Government-funded, while the regional offices and the FRI have to earn growing portions of their funding by selling services.

FIGURE 1
 ORGANISATION OF THE FOREST RESEARCH INSTITUTE
 SECRETARY, MINISTRY OF FORESTRY
 (Wellington)
 ASSISTANT SECRETARY (RESEARCH), MINISTRY OF FORESTRY
 (Wellington)

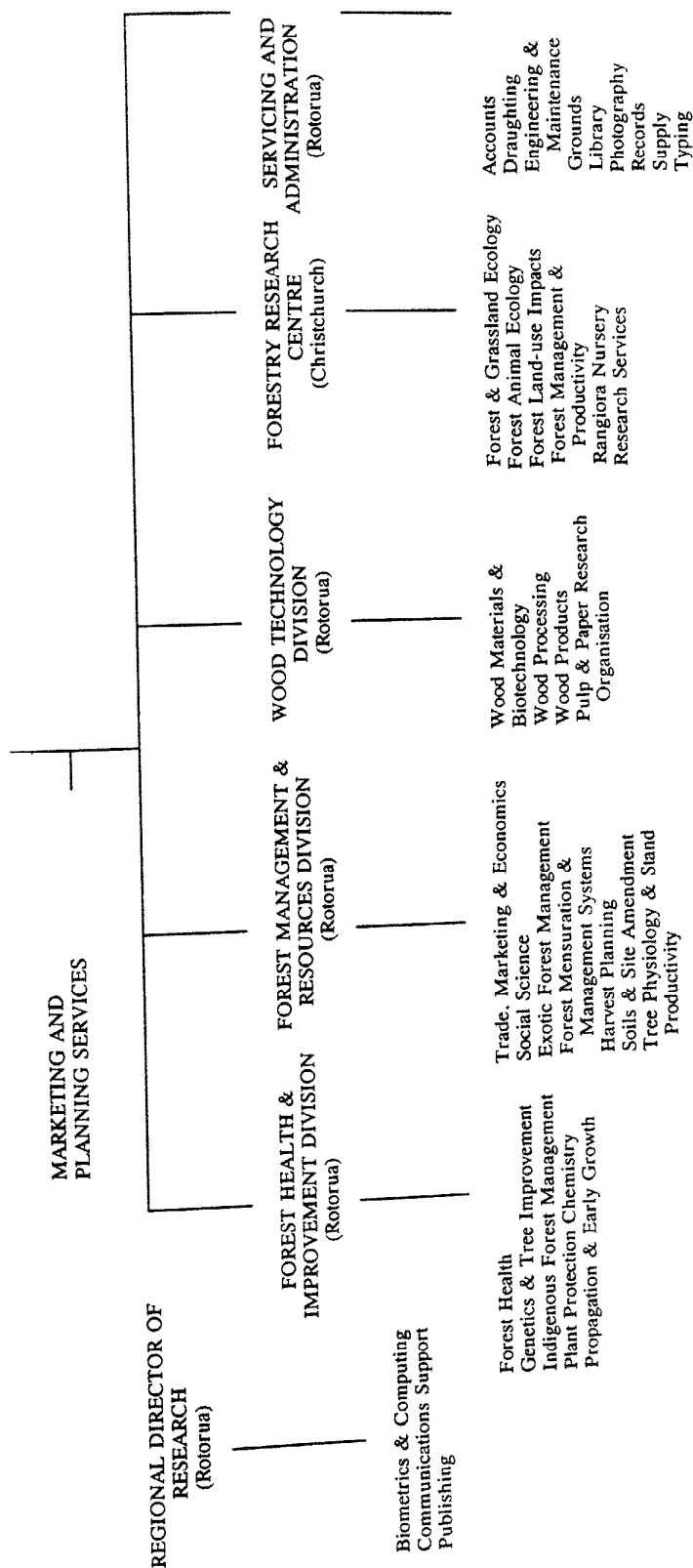
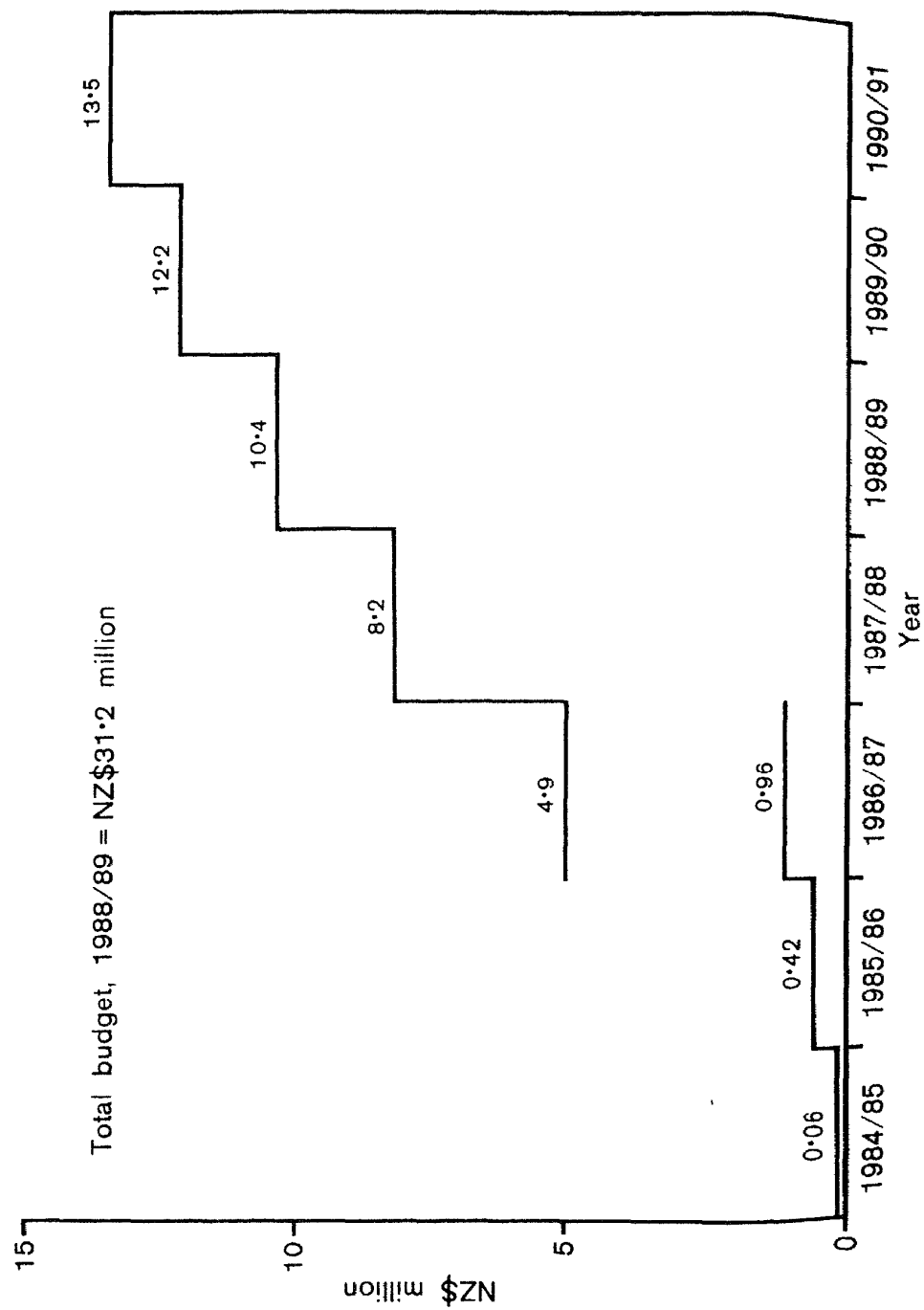


Figure 2
Forest Research Institute Cost Recovery Targets
(Revenue earnings plus cost savings)



FRI'S RESPONSE TO COMMERCIALISATION

The FRI was faced with the task of changing, virtually overnight, from a traditional, internationally respected research organisation to a much more commercially oriented research and consulting business. Half-way through a financial year, Government funding was cut by about NZ\$4 million, and within three years income from commercial contracts had to grow from NZ\$0.5 million to NZ\$7 million. The whole style of management had to change. Users of research results, used to getting all FRI's services for free, had to be persuaded that they should now be paying about NZ\$80 per hour for a scientist's time. Free exchange of information was replaced with confidentiality and legal agreements. Results obtained from State funded research were no longer regarded as belonging to the public; it became the Government's equity, a product to be sold in future years. Scientists, who have always regarded their number of publications as an important measure of their success, were no longer free to publish, or even talk about the results of some of their work. Science managers were asked to be marketers, promotion managers, financial forecasters, cost controllers, production planners, consultants, and resource managers. Job security disappeared; recognition and reward systems became outdated; and there was an urgent need for training in management and business skills.

To support the directors and staff in responding to all these changes, Marketing and Planning Services staff were appointed. The group of four comprised: a Technology Marketing Manager, who helped scientists to develop marketing plans and who undertook negotiations on some of the larger contracts; a Software Manager who ensured that this important type of FRI product was properly marketed; a Research Cooperative Manager who set up and administered cooperatives jointly funded and managed by FRI and groups of industry clients; and a Planning Manager who was responsible for implementing a corporate and operating planning system for the FRI and its divisions.

CORPORATE PLANNING TERMS DEFINED

It was necessary to develop a set of definitions for the planning process, so that there would be a common understanding of planning terms such as goals and objectives amongst all staff members. There was initial resentment of these jargon words amongst the scientists in particular, but the terminology is now accepted almost without comment at planning meetings.

Some of the definitions used, are:

Mission is the broad statement of purpose for which an organisation exists. A mission statement defines the boundaries of the territory; it answers the question: "Why are we here?" The mission of MOF is: "To promote the national interest through forestry, including the wood-based industries." The mission of FRI is: "To promote the national interest through research and technical innovation in forestry, wood products and wildlands."

Goals are statements of the intended outcomes of each programme or major activity in broad terms. Goals are relatively intangible. As outcomes, they are the impacts on, or the consequences for, the community of the outputs or activities of government; they answer the question: "What do we want to achieve in the next few years?" An example of a goal for the Ministry, to which FRI contributes, is: "To assist the forestry sector to penetrate and become more competitive in overseas markets."

Objectives are statements of the key results which the organisation seeks to achieve in the next financial year. Each goal is supported by at least one objective. Objectives are outputs, and they are measurable in time, quantity and cost. Objectives should be in the form: "How much? By when?" Under the goal of: "To become an established international forestry industry consultant", one of FRI's objectives in 1988/89 was: "To earn \$650 000 from overseas sources by providing research services."

Critical success factors are things that the organisation simply have to get right if it is to succeed in the following year. Some examples have been: organisation structure to deal with the new environment; marketing training for staff; and developing export marketing plans.

FRI'S CORPORATE PLANNING PROCESS

The FRI's corporate planning process is integrated with that of the Ministry of Forestry. The entire process runs over a period of about 6 months, and is characterised by a series of distinct stages.

STAGE I: Input From All FRI Staff

For a financial year that runs from 1 July to 30 June, FRI's planning process starts with a series of five all-day, all-staff planning meetings in November of the previous year. One meeting is held for each of the divisions. All 60 to 80 staff members are invited, and urged by their directors to attend. A typical timetable for these meetings would include:

- * a review by the director of the progress that is being made by the division in meeting the objectives set in the plans for the current year;
- * a general review of the progress of the whole of FRI and the Ministry of Forestry;
- * an analysis of the internal and external environments by the staff, working in small discussion groups. They update and edit the analysis of strengths and weaknesses of the organisation, and opportunities and threats in the external environment, produced at the previous year's meeting;
- * a discussion of the goals of the FRI and the division;
- * a first attempt at setting objectives for the next financial year;
- * a discussion of some of the key issues affecting the division, and developing strategies to deal with the issues; and
- * identifying the critical success factors for the division for the next year.

The purpose of these all-staff planning meetings is to provide everybody with the opportunity to contribute to the corporate plan of the Ministry, and to the operating plans of their own division. The discussion of the day is summarised, and circulated to all participating staff for comments and corrections. These summaries are then taken by the five directors to the next phase in the planning process: the Ministry of Forestry's corporate planning meeting, which is held in March.

The directors also take a strategic, longer-term outlook for their divisions to the MOF planning meeting.

STAGE II: Ministry of Forestry Corporate Plan

The MOF planning meeting takes two full working days, with an evening session. It is attended by a planning committee of 25, comprising the top management team of the Ministry, including the seven members of the FRI's Board of Management. The topics discussed are similar to those at the all-staff planning meetings, but the purpose of the meeting is quite different. Instead of recording a range of ideas contributed by the participants, the planning facilitator has to integrate the views of the whole team, and ensure that at the end of the meeting, a draft corporate plan for the next financial year has been produced.

STAGE III: Forest Research Institute Plan

In April, the FRI's top and middle managers - a team of about 30 - meet for 2 days to consider the implications of the Ministry's plan on the Institute, and to decide how research will contribute to the relevant MOF goals. They also identify issues which are of particular importance to research, and develop a plan for the FRI for the next financial year. This will contain much more detail than the MOF plan; for example, revenue targets will be broken down by research division and by type of client, and strategies for dealing with the critical success factors will be developed further.

STAGE IV: Divisional Operating Plans

Once the FRI's plan has been drafted, each director is able to develop, with the help of his project leaders and senior researchers, an operating plan for his division. This plan is again more detailed than the previous one, and a standard format is used for all the divisional plans. Typically it includes revenue targets by main client and by project team, the key government-funded research targets, a list of equipment to be purchased, a calendar of conferences, an overseas travel schedule, overseas visitors expected, and an allocation of responsibility for each of the objectives and strategies. Much of this information is, of course, commercially sensitive, and the divisional operating plans therefore have a very restricted circulation.

STAGE V: Staff Work Achievement Budgets

Each FRI researcher has a Staff Work Achievement Budget for each year. These form the last link in the planning process. In these budgets, researchers indicate the projects that they will be working on, the progress that they hope to make, the publications and other forms of research communication they will use, and their other commitments, such as teaching at the Forestry Training Centre, organising conferences, or serving on the publications refereeing committee.

STAGE VI: Reporting Back To All Staff

Once the directors have written their operating plans, most of them hold another all-staff planning meeting, at which they report back on the outcome of the whole planning process. They go over the planning input that staff had provided at the all-staff planning meetings in the previous November, and indicate which ideas had been taken up somewhere in the whole set of plans, and why some ideas were not used.

ROLE OF THE PLANNING MANAGER

As Planning Manager of FRI, I am responsible for the process of planning, but not for the content of the plans. The directors, middle managers and staff of each division are the people who will be held accountable for achieving the objectives set in the plans, and for making the strategies work. It is therefore vital that they should develop a sense of ownership for the plans; this is only possible if they take responsibility for the content of the plan. This distinction between process and content is emphasised at each planning meeting. The deal I make with the participants is that I will not interfere in what goes into the plans, and that they will not interfere with the process. They will accept the definitions of planning terms that I provide; and they will keep to the timetable that I have developed for the meeting.

Outside of the planning meetings, I assist in various other ways with corporate planning, and with the implementation of strategies developed at planning meetings. Examples are:

- * developing 5-year financial scenarios for FRI, which have been used in resource planning and in making the decisions on staff redundancies which followed further cuts in Government funding in 1988;
- * coordinating the management training programme for researchers, and developing, with the Graduate Business School of the University of Auckland, an intensive course "Business skills for Science Managers";
- * acting as relationship manager for a consultancy on developing a new recognition and reward system for FRI;
- * analysing the FRI's whole research effort in terms of the sector of the forestry industry at which the research is aimed, such as growing trees for wood production; harvesting; processing; marketing; and managing wildlands. This analysis is used for decisions on broad shifts in the FRI's research programme;
- * keeping abreast of developments in national science policy in New Zealand; of corporate planning in other Government research organisations; and of planning demands placed on Departments by the controlling agencies such as the Treasury, State Services Commission, and the Audit Office.

Over the past three years, the planning process has become more and more accepted by managers and staff. Top management were the first to accept the value of planning, and without their commitment, it would have been impossible to implement a planning process to which all staff contribute. At the first planning meetings, the planning facilitator had three tasks:

- * to convince the sceptical staff of the value of this new approach to planning, and to persuade them to participate. Especially for an audience of scientists, it is not sufficient to say that we are doing corporate planning because it is a Government requirement that all Departments must have corporate plans; they must be convince that it is a useful way to spend their valuable time.
- * to teach the participants the process of planning, and all the new terminology involved;
- * to develop a draft plan.

Now the task is much simpler. Everybody knows the process and the jargon, most are willing to accept the need for planning, and I can get on with guiding them through the process that will result in a draft plan.

BENEFITS AND COSTS OF THE PLANNING PROCESS

The integrated, participative planning process of the Ministry of Forestry and the FRI is not cheap but management considers it an essential expenditure at a time of cost cutting and science budget restrictions. However, despite management's commitment, it is important to be continually asking what tangible benefits have accrued to FRI from the planning process. Was it really necessary to develop such a large set of plans; could management not simply have continued with the systems that worked well before the budget cuts and commercialisation occurred?

It will never be possible to say that any particular objective would not have been set, or any strategy not followed, without corporate planning. However, directors agree that they needed new systems and more support in the new, very complex environment. Corporate planning has gone a long way in addressing this need.

Some of the benefits of corporate planning have been:

- * setting up a Board of Management to manage the FRI as a team, in a much more coordinated, integrated way. Before commercialisation, each director managed his own division, and coordination was done in an ad hoc

way. Commercialisation, and the requirement for coordinated policies on marketing, asset management, staffing, and confidentiality, and, in particular, for the development of an adaptive, integrated budgeting system, created the need for joint management. This was the major outcome of the FRI's first corporate planning meeting;

- * setting up a Research Policy Advisory Group to replace the divisional research advisory committees. This group is concerned with strategic research planning, and does not concern itself with research programme details. The members are senior executives of the major forestry companies and the Department of Conservation, a marketing consultant, and a professor of agricultural economics;
- * improved internal communication mechanisms. In the uncertain environment, the all-staff planning meetings put great emphasis on the need for speedy, accurate internal communication. Weekly staff newsletters were improved; management set specific objectives for staff seminars and for "management by walking about"; meetings were arranged between research management and the leaders of the support and administration groups; more inter-divisional research projects were set up; and one particular person was given responsibility for improved internal communication;
- * developing the ability to respond much better and faster to changes in the external environment. During the planning process, many "What if...?" questions are asked and answered, thus preparing management for immediate action when it is required;
- * developing export marketing strategies. To survive in its present form, FRI needs to earn revenue from overseas. This can create a conflict of interest with the New Zealand forestry industry, if FRI sells technology to countries who are competitors in export markets for forest products. After a planning meeting, a task group was set up to develop strategies to cope with this issue. Training courses were offered in pricing policy and negotiation;
- * staff training in personnel management and business skills. Planning meetings gave high priority to training for all staff with significant personnel management responsibility. Each division now includes a training programme for the year in its operating plan. Each staff member indicates their personal training needs on their annual staff work achievement budget;

THE NEW FOREST SERVICE INTERNATIONAL FOREST PRODUCTS PROGRAM: EXPERIENCE TO DATE

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INTRODUCTION

This paper describes the new Forest Service International Forest Products Program, which was initiated in 1988. As background to the program, I will first describe the role of its parent organization, the USDA Forest Service Forest Products Laboratory (FPL).

The FPL was established in 1910 as a national laboratory of the USDA Forest Service to conduct research leading to improved utilization of wood. The Laboratory was created at a time of concern about dwindling timber supplies, and improved utilization of the resource was seen as a logical means of extending supplies. The mission of FPL reads "to improve the use of wood through research that leads to improved management and use of the timber resource, thus meeting the needs of the United States and contributing to the international community." In pursuit of this mission, FPL has attained international recognition and stature. For example, its research wood collection or xylarium has 100,000 specimens and is the largest such collection in the world. We regularly receive requests for exchange of specimens. Our collection of wood-rotting fungi is certainly among the largest in the world, if not the largest.

The present staff of FPL consists of about 300 persons, nearly 100 of whom are classified as scientists. The total budget is approximately \$16 million, about 90 percent of which is appropriated. Table 1 lists the types of research that are addressed at the Laboratory.

Although the primary focus of the FPL research program is on U.S. needs, the program has an international dimension as well, as noted by its mission statement. Requests for information and advice come from all over the globe, but primarily from the industrialized nations (Ingram et al., 1987). In 1988, we answered 26,500 requests for information and sent over 100,000 documents. We also entertained over 200 foreign visitors. The involvement of FPL in international co-operation dates back to its inception and the development of similar research institutes overseas. In its first decade, the FPL hosted visitors from 8 foreign countries (Youngs, 1987). Within the next 10 years, researchers from nearly 20 countries studied at FPL for periods up to a year. In many cases, the visiting scientists were from developing countries and went on to become leaders of their home institutes.

¹ The Forest Products Laboratory is maintained in cooperation with the University of Wisconsin. This article was written and prepared by U.S. Government employees on official time, and it is therefore in the public domain and not subject to copyright.

TABLE 1. ORGANIZATIONAL STRUCTURE OF RESEARCH
AT FOREST PRODUCTS LABORATORY

Special Programs	Research Work Units		
	Protection & Market	Wood Products	Pulp, Paper, & Composites
Energy From Wood	Forest mycology	Engineering properties	Improved adhesives
International Forest Products	Wood biodeterioration	Engineering design	Performance-designed
Institute for Microbial	Wood anatomy	Engineered products	composites
& Biochemical Technology	Wood surface chemistry & protection	& structures	Fiber product design
	Economics; utilization of national timber & wood products	Fire safety	Chemistry & pulping
		Process optimization	Fiber processes
		Wood drying & moisture management	& products
		Engineering mechanics	Analytical models

International collaboration also involves the participation of FPL staff in foreign activities. For example, a former director of the Laboratory, George M. Hunt, was a co-director of the Philippine Forest Products Laboratory (now the Forest Products Research and Development Institute) for 5 years, along with a Filipino counterpart. In this role, Mr. Hunt was instrumental in establishing the Philippine institute as well as a program for sending young scientists to FPL as research associates and to the University of Wisconsin for advanced coursework.

In the 1970's, with the support of the U.S. Agency for International Development (USAID), FPL showed how tropical hardwoods could be used to manufacture a variety of products. This culminated with a major international conference, "Improved Utilization of Tropical Forests," which took place in Madison in May 1978. In 1986, the international involvement of FPL was given new life through the Forest Service program for tropical forestry in Latin America and the Caribbean under what is commonly called the Caribbean Initiative. This led to the establishment of a Tropical Forestry Team to further cooperative research, technology transfer, and training in Latin American countries. Finally, the international involvement of FPL was strengthened and broadened in 1988 with the establishment of the International Forest Products research, development, and application program. The remainder of this presentation is devoted to an evaluation of this unique program.

INTERNATIONAL FOREST PRODUCTS PROGRAM

The International Forest Products (IFP) program was established with the mission to "Facilitate forest products research through an international program of research, development, and application between FPL and other Forest Service units, universities, and related institutions throughout the world." The key word is facilitate. In pursuing this mission, IFP has defined four objectives: (1) to coordinate forest products research in the United States with that in other countries, (2) to identify foreign technologies that could be applied in the United States, (3) to support research institutes in developing countries, and (4) to exchange visiting scientists with other nations.

Coordinating U.S. and International Research

The IFP was established at FPL to facilitate and coordinate our forest products research with that of similar institutes around the world. This is a logical role for FPL because it is the largest laboratory of its type in the world. The bulk of Forest Service research that is related to wood products is housed at FPL.

Although IFP can play a unique role in coordinating products research, it complements the coordinating role played by the International Forestry staff of the Forest Service. A strong sense of cooperation has developed between the two offices, and they do not compete. In addition, cooperative efforts between IFP and other Forest Service units and selected universities have been initiated, though they are still in the formative stages.

Although coordinated efforts are the key to reaching out to new opportunities in the products field, a shortage of funds prevents forestry research institutes from taking advantage of existing opportunities. The Bellagio II conference recognized this when it endorsed utilization and market research as one of five areas requiring additional support (Rockefeller Foundation et al., 1988).

Identifying Applicable Foreign Technologies

There is a growing concern in the United States that our technological leadership is waning and that steps must be taken to improve our competitive position. For example, expenditures for national research and development (R&D) are now equal in West Germany, Japan, and the United States when related to the size of the economy. However, when defense-related R&D expenditures are removed, the nondefense expenditures as a percentage of gross national product are much higher in West Germany and Japan. In 1985, these percentages were 2.5, 2.8, and 1.9 for West Germany, Japan, and the United States (National Science Foundation, 1987).

The Council on Competitiveness cites a number of other indicators of declining U.S. technological leadership (Council on Competitiveness, 1988). Some of these indicators are as follows:

- America registered its first high technology trade deficit in 1986
- American students have averaged lower scores on international math and science tests
- Foreign inventors captured 46.6 percent of U.S. patents in 1987, up from 35 percent in 1975
- Only approximately 10 percent of Federal R&D is relevant to the technical needs of industry

Gregersen et al. (1989) conclude that these trends apply to forestry as well. These authors recommend increased efforts to tap foreign sources of information related to forestry research.

Close working relationships between government and industry are common overseas, particularly in Europe. In the United States, however, problems in the transfer of Federal R&D to the domestic industry have long been recognized (Morone and Ivins, 1982). They relate primarily to the limitations that previously governed the types of arrangements possible between Federal laboratories and industry. Without the ability to protect and exploit information developed jointly with a Federal laboratory, individual firms have been hesitant about joint ventures.

Over time, this impediment to our respective competitiveness should change because of the Federal Technology Act of 1986 (PL 99-502). This Act permits, indeed encourages, Federal laboratories to enter into cooperative R&D agreements with the private sector. It further permits the negotiation of licensing agreements on the commercial application of the resulting technology.

Youngs (1989) urges the domestic industry to take advantage of the opportunities offered under the Act and presents several strategies for cooperation.

In addition to strengthening our own R&D and its application, we are increasingly aware that we can no longer rely almost exclusively on domestic sources for innovations. We need to try to seek out foreign technology that might be applied here in the United States.

The first step in internationalizing innovation is to scan or monitor the activities of foreign laboratories and firms (Ronstadt and Kramer, 1982). We have begun this process, and we are presently attempting to build a database of information on the organization and research programs underway at foreign institutes. We intend to share this information with U.S. scientists to help them plan their research and any foreign travel. In return, we ask these scientists to be our "eyes and ears" during their foreign travel and to bring back additional information for the database. Eventually, as we continue to gather more information, we intend to be much more specific in our requests for information from foreign travelers. We must learn how to target our efforts.

Although the concept of scanning may seem straightforward and simple, some countries are taking it very seriously. For example, Japan has been preparing itself for the global economy for nearly three decades. The Information Center of Science and Technology, which is governed by the Prime Minister's office, has been gathering, summarizing, and translating foreign research and technical information into Japanese and distributing it widely within Japan (Satoh, 1988).

The second step in internationalizing innovation is to establish connections between domestic and foreign laboratories (Ronstadt and Kramer, 1982). This can be fairly formal, such as a memorandum of understanding. More commonly, the connections are established at a scientist-to-scientist level.

Hopefully, the steps to internationalize innovation will eventually lead to tangible cooperative research projects between domestic and foreign institutions. Such projects should facilitate the adoption of resulting innovations. In addition, cooperative projects facilitate the research itself by broadening the skills and resources available, reducing expenses, and sharing the risk (Ronstadt and Kramer, 1982). One good example is a current research program between FPL and the Federal Research Centre for Forestry and Forest Products in Hamburg. This work is focused on producing composite boards bonded with inorganic binders. Another example is the research on acetylation that is being conducted jointly between FPL and several foreign laboratories.

Supporting Institutes in Developing Countries

As discussed earlier, FPL has historically offered extensive support for similar laboratories in developing countries. This support has waned somewhat in recent years, primarily because of our own budgetary problems. Creation of the IFP is a reaffirmation of our commitment to foreign research institutes. One aspect of the IFP is to work with sponsoring agencies to support cooperative R&D.

The pressing need for support for research institutes in developing countries is well recognized. Furthermore, major international organizations have recognized that we should strive to make more effective use of the research capability that already exists in many centers; well-planned national research is likely to be much more effective than imported research (World Bank, Food and Agriculture Organization, 1981).

Institutes in developing countries can be aided in a variety of ways. Initially, the World Bank and the Food and Agriculture Organization (1981) advocated the development of "twinning"

arrangements. In this type of agreement, one institute strengthens its partner **by contributing** staff, training, equipment and materials, or financial aid. Most commonly, **such an arrangement** would occur between an institute in a developed country and one in a **developing country**. The concept of twinning can be extended to include informal or formal **arrangements between institutes** with similar situations and problems to pool their resources and **attack common problems** that would be insurmountable individually. This "networking" is seen **as an efficient way of** strengthening institutional capability and research application (Burley, 1987). **The goal of FPL is** to tie into existing networks or develop networks among similar institutes **to attack** mutual problems and optimize resources. For example, most institutes have research **underway** to evaluate different wood preservatives and preservation systems. This usually involves **field tests** to simulate actual use. An exchange of field test results would enable each member **of the network** to have a much better understanding of how different species, treatments, and **preservatives** perform under a variety of conditions.

Presently, we are canvassing major donor agencies for support for including **research training in networking arrangements**. The level of training of the researchers is **considered** the most important factor that affects research capabilities of institutes in lesser **developed countries** (Bengston and Gregersen, 1988). Our experience to date has been fairly **limited**. During the last year, the International Tropical Timber Organization (ITTO) supported **two FPL preproject proposals**: drying mixed tropical species and sawing difficult woods. The **preproposal on drying** has advanced to a proposal for a major multiyear project. Support for this project **will be considered** at the ITTO semiannual meeting in May in the Ivory Coast.

Exchanging Visiting Scientists

As mentioned earlier, FPL has had extensive interactions with visiting **scientists**. Generally, these interchanges have been positive and beneficial to both parties. The **exchange** has often involved formal training at the University of Wisconsin or elsewhere. **Creation of the IFP** reflects the notion that we should be more proactive in seeking out opportunities for **exchanging** visiting scientists. If the presence of visiting scientists makes sense and is **mutually beneficial** to the scientists and our Laboratory, then let us seek out these individuals rather **than waiting** until we are approached. We are also looking for opportunities to bring visiting **scientists to other Forest Service units** and to our university colleagues. For example, a researcher **from the Swiss Federal Laboratories for Material Research** recently visited FPL for 4 months. This **visitor** is now at the University of California for 4 months, after which he will return to FPL **to complete** his stay in the United States.

At present, 17 visiting scientists are working at FPL, including 9 foreign **nationals**. The foreign countries represented are Yugoslavia, Indonesia, Republic of China, **Poland, Brazil**, Republic of Korea, Sri Lanka, Venezuela, and Finland. These visitors have their own **financial support** and are presently engaged in on-the-job training with our scientists.

Although the primary focus to date has been to bring visiting scientists **to the United States**, eventually we hope to create opportunities for our scientists to venture **abroad for training**. Direct participation by our scientists in overseas R&D will speed U.S. access **to the resulting technology** (Alic, 1988).

CONCLUSIONS

The IFP is a modest effort since it involves only two full-time employees **and operating dollars** are at a minimum. However, this program is real and it is unique.

Certainly, the announcement of the program raised many expectations. We received messages of encouragement and support from around the world. We also received numerous messages from institutes in the developing world about the implications of the new program with respect to support for their fledgling research programs. Despite the enthusiasm expressed for IFP, some clouds have appeared on the horizon. American business has been described as unprepared for the global era and unable or even disinclined to benefit from foreign technology (Sato, 1988). Furthermore, because domestic industry is often disenchanted with our own technologies, it is often commercialized by foreign firms. The FPL research in such areas as press drying of paper or fiber acetylation has been met with keen interest abroad, but little interest at home.

Some signs also indicate that research institutes are being forced to modify their programs to reflect modern budgetary realities. As more and more research institutes become "privatized," the trend towards short-term problem-solving research at the expense of longer term basic research seems inevitable. Of even more concern is the possible negative effect of privatization on the free flow of information. This is illustrated by a statement from the latest annual report of a respected international forestry research institute. The statement reads as follows: "In the past (name) has operated in the same way as any internationally known research organisation and freely communicated its knowledge internationally by way of publications, attendance at conferences, and exchange of visits with like organisations overseas." Although the statement does not elaborate, the clear implication is that the institute does not intend to operate that way in the future. I think that a free flow of information is absolutely vital to scientific progress.

Despite the storm clouds, other signs point toward a cooperative approach to meeting research needs. The delegates to the Bellagio II conference recognized the need for such an approach when they called for increased cooperative efforts to strengthen forestry research worldwide. Towards this end, the Forest Products Laboratory will continue its leadership role in the international forest products research community.

LITERATURE CITED

- Alic, John A. 1988. Japanese R&D and U.S. technology policy. *Research-Technology Management*. September-October: 6-7.
- Bengston, David N.; Gregersen, Hans M. 1988. What influences forestry research capacity in developed and less developed countries? *J. Forestry*. February: 41-43.
- Burley, J. 1987. International forestry research networks: objectives, problems, and management. *Unasylva*. 39(3,4): 67-73.
- Council on Competitiveness. 1988. Signs of declining U.S. technological leadership. *Research-Technology Management*. November-December: 3.
- Gregersen, H.; Haygreen, J.; Sindelar, S.; Jakes, P. 1989. U.S. gains from foreign forestry research. *J. Forestry*. February: 21-26.
- Ingram, C. Denise; Loarman, Jan G.; Contezac, Michel C. 1987. International technology transfer: the Forest Products Laboratory. *Forest Prod. J.* July-August: 15-16.
- Morone, Joseph; Ivins, Richard. 1982. Problems and opportunities in technology transfer from the national laboratories to industry. *Research Management*. May: 35-44.

National Science Foundation. 1987. International Science and Technology Data Update. 1987. 73 pp.

Rockefeller Foundation; United Nations Development Programme; World Bank; Food and Agriculture Organization of United Nations. 1988. Report of an International Task Force on Forestry Research. 88 p.

Ronstadt, Robert; Kramer, Robert J. 1982. Getting the most out of innovation abroad. Harvard Business Review. March-April: 94-99.

Satoh, Tomoyuki. 1988. Getting ready to access Japanese technical information. In: U.S. Dept. of Commerce, National Technical Information Service. NTIS Directory of Japanese Technical Resources in the United States. pp. 3-6.

World Bank; Food and Agriculture Organization. 1981. Forestry Research Needs in Developing Countries: Time for a Reappraisal? Prepared for 17th IUFRO Congress, Kyoto, Japan, 6-17 September, 1981. 56 p.

Youngs, Robert L. 1987. The Forest Products Laboratory: Highlighting its advances in the international wood research community. J. Forestry. December: 33-37.

Youngs, Robert L. 1989. Using research to gain the competitive edge. Forest Industries. January: 28-31.

OBJECTIVES OF NETWORKS

Networking is a concept accepted by most development agencies and developing countries as a cost-effective mechanism for strengthening institutional capability and causing rapid change in the application of research findings. Although statisticians, mathematicians, transport experts, economists and neurobiologists have their own specialized concepts and analyses of networks, for forestry and agroforestry a network may be considered a formal or informal arrangement of cooperation between institutions with similar conditions and problems but without individual resources to find the answers to these problems. Most frequently they concentrate on developmental and applied research but they may be supported by institutions able to carry out basic research and occasionally they include networks related to the extension and field application of results. Networks are therefore an extension of twinning and multiple twinning between institutions. (The advantages and problems of twinning as a mechanism for technology transfer and institution building were reviewed by Cooper, 1984.)

The generalized aims of networks are to minimize duplication of efforts, reduce costs, increase efficiency and lead toward national self-sufficiency in research capability and research management. Networks are therefore of most benefit to countries with limited funds and scientific manpower.

Specific aims of networks identified by Oram (1988) include the following:-

- (i) Facilitate the identification of common problems
- (ii) Facilitate communication and scientific bonds
- (iii) Increase individual and national research competence
- (iv) Speed research and application
- (v) Accelerate transfer of materials and experience, and verify their local application
- (vi) Provide "critical" mass of research effort but not all concentrated in one place
- (vii) Economize in fixed capital costs and overhead administrative charges associated with large institutions.

The principles for success of networks, as reviewed by Plucknett and Smith (1984) with additions by Burley (1985), can be summarized as follows:-

- (i) The problem must be clearly defined and a research agenda agreed
- (ii) The problem should be common to several participants
- (iii) Strong self-interest must exist in each collaborator who must be willing to commit some resources
- (iv) Outside funding should exist at least for the birth and initial functioning of the network
- (v) Staff must be sufficiently trained and expert to make significant contributions
- (vi) Strong leadership is required, having the confidence of all the participants in a network
- (vii) Information should be shared among all collaborators through a range of media
- (viii) Participators should develop mechanisms for the extension of research results to the eventual user
- (ix) Networks should not be considered permanent institutions but should show flexibility to cope with the range of skills and requirements of the participants
- (x) Local institutional continuity and commitment are needed.

PROBLEMS OF NETWORKS

The major groups of problems that have been experienced in the existing forestry research networks were detailed by Burley (1985 and 1987) and are summarized below:-

- (i) Choosing topic or species
- (ii) Competition for leadership
- (iii) Identifying participants
- (iv) Inadequate activity and resources
- (v) Poor communications and feedback
- (vi) International controls and lack of facilities for exchanging plant material
- (vii) Insufficient amounts of test material
- (viii) Reaching agreement on appropriate experimental design
- (ix) Reaching agreement on comparable assessments and appropriate analyses
- (x) Lack of continued national Government commitment
- (xi) Identifying and preparing adequate documentation for donors, particularly if multiple donors are involved
- (xii) Difficulties of obtaining finance for coordination and supporting activities.

THE ORGANIZATION OF RESEARCH

Research networks are not the answer to all forestry research problems within developing or developed countries. They must be seen in the light of the continuum from research to application and particularly with the recognition of the clients or users of the research results (Table 1); these may include politicians and administrators, professional foresters in either Government or industrial forest departments, rural community workers, individual farmers, and peer scientists.

The continuum of research itself has four major but overlapping steps (Table 2); some of these fall more easily than others into the concept of networking:-

- (i) fundamental (basic) research seeks new understanding of processes at the individual or population level and is commonly carried out at a well endowed institution. For many problems of forestry networks in developing countries such institutions may be remote from the network itself and not necessarily be the leader of the network or a field participant or beneficiary; it may be more cost-effective to pay for basic research to be conducted in an existing international or remote national laboratory than to finance the creation of major new institutions (with all the problems of national brain drain, competition between countries as potential hosts, expenses of bricks and mortar and hardware, etc.).

Table 1. Relationship of beneficiaries of tree planting to policy,
management and research

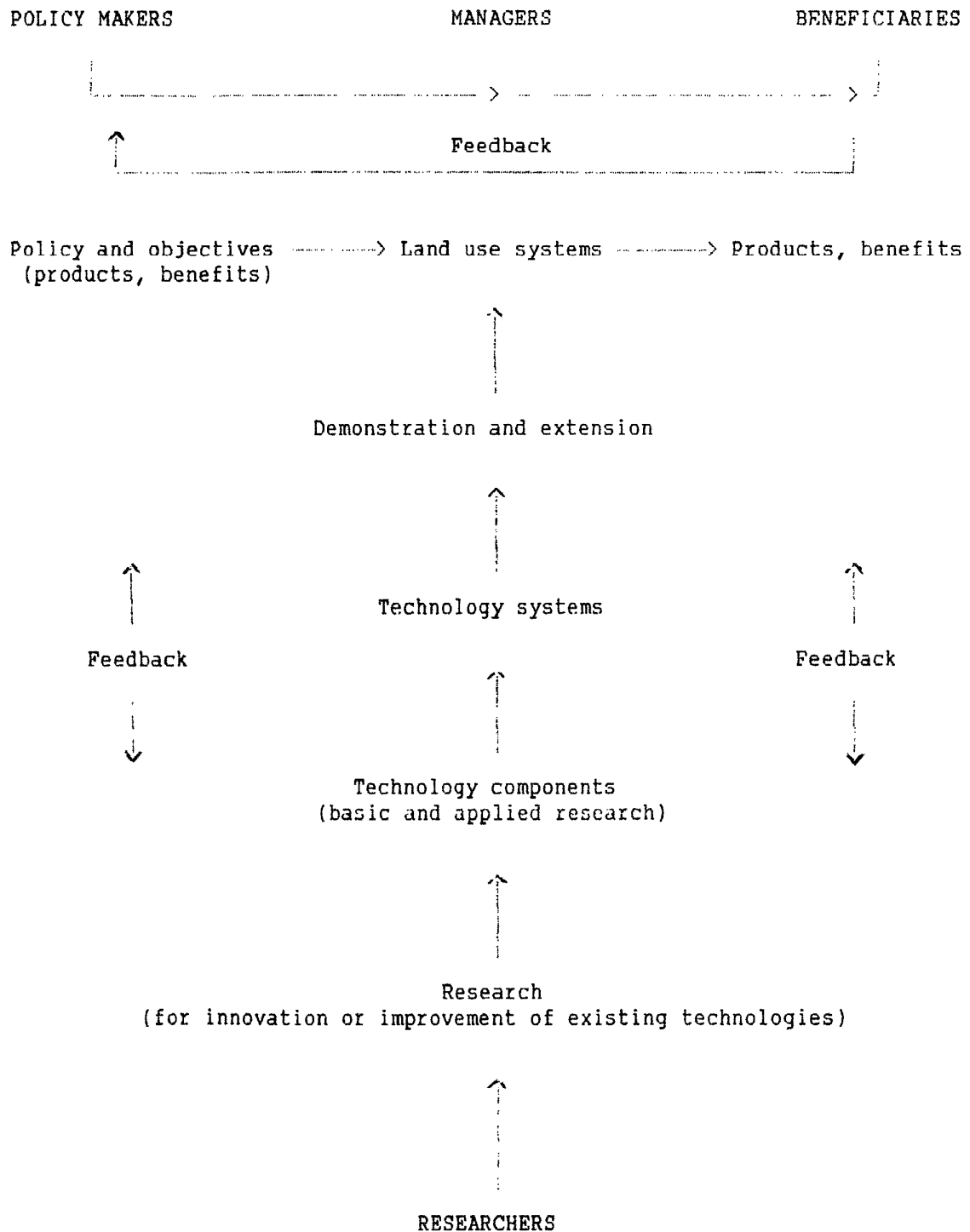


Table 2. The research/development/application continuum;
stages, locations and cooperation in research

(Modified from policy statement of
the International Rice Research Institute.
NARS = National Agricultural Research Service.)

Dominant Research Phase	Dominant Research Mode	Primary Research Location	Primary Research Cooperation
<u>RESEARCH</u>			
BASIC	New understanding	In laboratories of advanced research institutions	Collaboration with with advanced research laboratories
STRATEGIC	Technology generation	Mainly at research stations; technical feasibility	Advanced laboratories with NARS at key research sites representative of major constraints or environments
<u>DEVELOPMENT</u>			
APPLIED	Technology refinement	At research stations and on-farm, mainly researcher-managed; technical, managerial and economic evaluation	Advanced laboratories in collaboration with many NARS at national sites; research linkages facilitated through networks
ADAPTIVE	Technology synthesis and evaluation in target environments	On-farm with farmer involvement and broader socioeconomic and impact analysis	In many countries and at many sites, with major initiative taken by NARS; supported by international networks

APPLICATION

Extension training, information, financial and material support

- (ii) strategic research is concerned with the generation of technology. It is commonly conducted on research stations and, in the case of research for rural forestry and agroforestry, it should follow the process of rapid rural appraisal (farm systems analysis or the Diagnosis and Design system of ICRAF). It may be conducted on advanced research stations such as those of the International Agricultural Research Centres (IARCs) or at major national centres that are located on sites representative of major agroecological zones. It is intended to determine the technical feasibility and sustainability of specific land use interventions.
- (iii) applied research refers to the refinement of technologies and may, in fact, be a starting point for a research network - for example the marginal or incremental improvement of existing agroforestry systems used by local farmers. It is conducted on research stations and on farms or in forests and plantations that are mainly managed by researchers; it is intended to determine managerial and economic feasibility.
- (iv) adaptive research involves the technical synthesis of technology components and their evaluation in specific representative environments. It is commonly conducted on farms or in forests with involvement of farmers or line forest managers and with broad socioeconomic and environmental impact analyses.

Research can therefore be located at three types of facility:-

- (i) centrally; basic research or facilitating research is done at one location for the benefit of all participants, e.g. the determination of optimum seed storage and germination conditions or the analysis of soil properties, fodder or wood quality
- (ii) regionally; strategic and some applied research can be conducted at a regional centre representative of a wide-ranging set of ecological conditions, e.g. a major trials of species, provenances, improved genotypes, fertilizers, silvicultural spacings or agroforestry mixtures and cultural treatments.
- (iii) locally; some applied and all adaptive research should be conducted in the local environmental and social conditions.

ALTERNATIVE APPROACHES TO NETWORKING

Top-down vs. Bottom-up

Within forestry research there already exist a number of international collaborative networks and for convenience these may be classified into bottom-up or top-down approaches.

The original model was the informal bottom-up approach of traditional IUFRO activities in which groups of scientists shared problems, information on research activities to solve these problems, and the results of this research by means of correspondence, occasional meetings and individual publications. No specific network activities occurred and the gains came from shared ideas and the careful extrapolation of site-specific results. Participation in such activities came through hearsay and voluntary, personal application to join.

Before and after the second world war IUFRO began the process of what is now recognized as networking research and may be considered the top-down method. Collections were organized of seed of provenances of conifers important as plantation species in Europe, North America and Japan; replicated experiments were designed to be carried out in full or in part in each collaborating country, and proposals for assessments were made by the coordinators. Originally data from such experiments were still published as individual trial results but more recently attempts have been made to combine data and publish the results of trials over several sites (e.g. the IUFRO international Norway and Sitka spruce trials).

For the initial trials seed collections were made virtually "by correspondence" with collections being made by local foresters wherever the species was indigenous; they were forwarded to the coordinator who shared them with the participants for field trials (with or without specific guidelines on the conduct of trials). This was also the approach taken by the Food and Agricultural Organization of the United Nations (FAO) in its international trials of dry zone species supported by the International Board for Plant Genetic Resources (IBPGR).

Genetic research at the level of species and provenance trials clearly lends itself well to collaborative research since one coordinator can collect or arrange for the collection of seed from a number of indigenous seed sources, often where it would be difficult, impractical or repetitious and costly for foresters in each planting country to make their own collections throughout the natural range of a single species. Recently several funding and research agencies have recognized this and provided the resources for such collection, dissemination and, in some cases, combined analysis. Examples include the Australian and Danish Tree Seed Centres, the Centre Technique Forestier Tropical of France, FAO, the Nitrogen Fixing Tree Association of USA, and the Oxford Forestry Institute, all of whom have provided seed of species and provenances of mutually agreed allocations of species that have widespread potential in developing countries.

For most of these trials, some of which originated in the 1960s, seed was allocated to all enquirers with no selection by the coordinators and usually with no financial support to the collaborators to manage the field trials and only with the implication of technical capability and government commitment to continued support. This is strictly a mixture of bottom-up and top-down operation since participation is individual and voluntary while leadership is, in a sense, imposed. The OFI through its long experience of research institutions in developing countries was able to identify organizations that were likely to be able to complete a given trial and contribute to the pooled experience and, as an example, in the international pine provenance trials some 20000 seedlots were distributed, 1000 field trials were nominally established in some 60 countries, but only a possible 100 trials are yielding results that can be analyzed meaningfully and used. Presumably the same proportions may be expected in the other OFI series of trials (see Table 3) and almost certainly from the large numbers of trials that have been established by other international institutions.

One of the principal reasons for this relatively poor return from the original investment in seed collection and distribution lies undoubtedly in the failure of the coordinator or sponsor of networks to provide financial support to the collaborators. Recently the USAID has addressed this issue directly and provided substantial support for the Forestry/Fuelwood Research and Development Project (F/FRED) in several Asian countries (a networked project that arose from the first IUFRO Regional Planning Workshop). Hopefully other sponsors such as the Australian and British aid programmes will be able to follow this example, although for the latter it is difficult to coordinate the allocation of funds by individual geographic desks, each of which depend on requests from national Governments. The exact cost of field trials clearly varies with country and the complexity of the experiment but a marginal addition of some \$5000 appears on average to be a realistic target for inducement and completion.

Table 3. Historical sequence of OFI forest genetic resources programme

SPECIES GROUP	1963	1970	1975	1980	1985	1988
PINES	REVIEW	- EXPLORE	-- EVALUATE	--- IMPROVE	---- CONSERVE	
FINE HARDWOODS			REVIEW	-- EXPLORE	---- EVALUATE	
DRY ZONE HARDWOODS				REVIEW	--- EXPLORE	--- EVALUATE
GLIRICIDIA				REVIEW	----- EXPLORE	
ACACIA species					REVIEW	- EXPLORE

In addition to the provision of genetic material for these trials there is frequently a requirement for centralized basic research in support of the whole network. Examples of this include taxonomic and biochemical analysis of genetic variation within the natural range of a species, the evaluation of wood quality, or the development of appropriate strains of nitrogen-fixing associates or mycorrhiza. Such services are provided at the centre as required for collaborators in the trials organized by OFI and NFTA (see, for example, Table 4).

Although the provision of genetic material is the prime requirement for many forestry and agroforestry research networks, perhaps supported by the specialized analyses mentioned above, other major benefits from networking include the combined analysis of data to examine genotype-environment interaction effects and the stability or plasticity of genotypes, the publication and dissemination of results, and the training of research staff. The costs of these elements are increasingly being recognized and included in network plans such as those identified for tree improvement networks in the recent IUFRO Regional Planning Workshop for Eastern and Southern Africa.

Although the bulk of this paper has used genetic trials as examples, other research networks are possible in forestry and agroforestry. In the latter the best example is the Agroforestry Research Network for Africa organized by the International Council for Research in Agroforestry (ICRAF) in which participating countries in four zonal networks conduct regional and local research on tree species and agroforestry systems, including genetic trials per se but also tests of intercropping and tree manipulation.

Operational systems

Planning and operation of forestry networks have taken four major forms.

1. Collegiate voluntary type.

This is the *modus operandi* of the traditional IUFRO arrangements in which enthusiastic leaders have created Working Parties to pool their talents on particular problems (and more latterly on particular species), arranged or conducted seed collections themselves, in some cases held a planning meeting to discuss designs and analyses, and occasionally held meetings to present results. A good example of this type of operation is the IUFRO Working Party S2.02-12, Sitka spruce provenances and breeding. (My predecessor as Coordinator of Division 2, Dr. R.Z. Callahan, referred to this as giving a "hunting licence" to the leader and it does allow the participation of those seriously interested in the objects of the work; however, it did not provide funding.)

Table 4. Activities in OFI forest genetic resources programme

EXPLORATION			EVALUATION		UTILIZATION			
<u>Geography</u>	<u>Ecology</u>	<u>Phenotypic Variation</u>	<u>First Seed collection</u>	<u>Species/ provenance tests</u>	<u>Second seed collection</u>	<u>Provenance/ family tests</u>	<u>International breeding pool</u>	<u>National breeding populations</u>
Latitude	Soil	Morphology	Species Populations	Morphology	Select populations	Genetic parameters	Propagation	Composition
Longitude	Climate	Anatomy		Chemistry	Select individuals	Individual selections	Bulking	Trial designs
Altitude	History of site	Chemistry		Isozymes			Distribution	Management
				Wood properties			Recommend strategies	Orchard designs
				Genetic parameters including GEI				
Maps		Maps Taxonomies						
					CONSERVATION			
					<u>IN SITU</u>		<u>EX SITU</u>	
					Natural stands		Conservation stands	
							Trial areas	
							OFI populations	

2. Invitational type with little financial support.

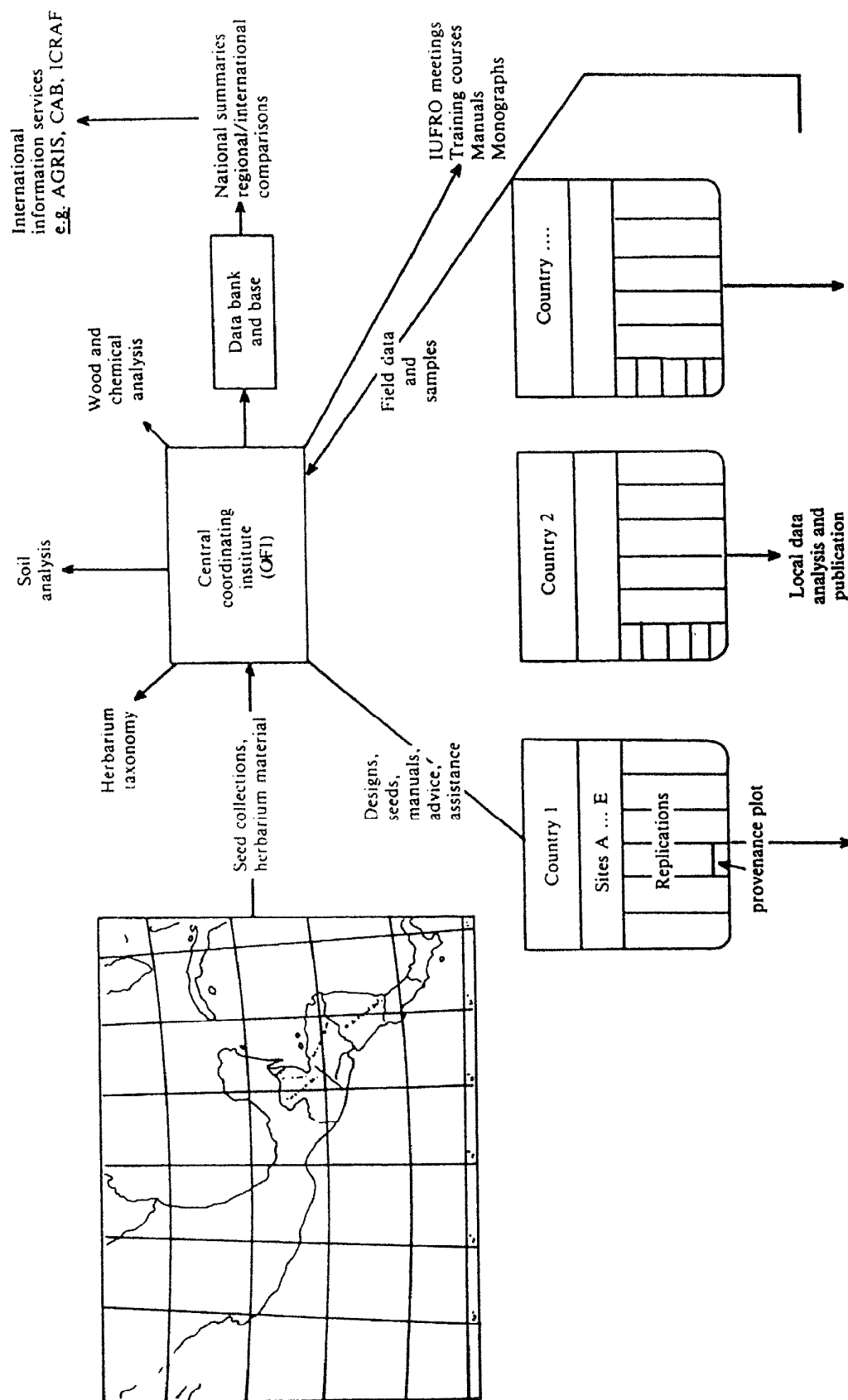
A second form is that of the OFI (see Figure 1) in which UK Government Overseas Development Administration funds are used by the Institute to collect, distribute and assess material for trials of species that are recognized as having high potential value throughout the tropics by OFI staff, by Commonwealth Forestry Conferences and by FAO's Panel of Experts on Forest Genetic Resources; the Institute provides supporting analytical services (taxonomy, biochemistry, wood and pulp quality analysis), organizes workshops (in conjunction with IUFRO Working Party S2.02-08, Tropical species provenances and breeding), and publishes proceedings, combined analyses and species monographs. Every year specialized research training courses are offered that use material from the network trials and train local staff involved with them as well as others. Developing country institutions are invited to share fully in all activities.

A similar approach is taken by the Australian CSIRO Seed Centre for its international provision of seed of Australian *Acacia*, *Casuarina* and *Eucalyptus* species, by the Danisy Forest Tree Seed Centre for its provenance trials of several Asian industrial species, and by the Hawaii-based Nitrogen Fixing Tree Association for its networks of *Leucaena* and other nitrogen-fixing trees; in this latter case although the degree of comparability and combined analysis is not as high as that of the OFI trials with industrial pines, fine hardwoods and dry zone hardwoods, the Association does publish regular issues of two journals (Nitrogen Fixing Tree Reports and *Leucaena* Research Reports) that include articles in short, uniform style from all the participating institutions. (See also the paper by Brewbaker in these proceedings.)

3. Institutional type with considerable financial support.

A third form is that of ICRAF for its regional agroforestry networks (AFRENA). In this case research needs are identified through a process of rural appraisal (Diagnosis and Design) and research plans are drawn up by multi-disciplinary teams representing both ICRAF itself and research institutions from agriculture and forestry in each host country. Funds are provided by ICRAF's donors to each participant. Professional staff from ICRAF are located in the regions and coordinate the activities of local staff, assist them to establish the experiments and collect data, encourage and assist them to analyze and publish results; at the same time headquarters staff of ICRAF (Nairobi) arrange combined analyses of data, joint presentations at workshops, training courses, provision of seed and experimental designs. This procedure is similar to that of the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE) for six central American countries, especially in its externally supported Proyecto Madelena.

Figure 1. Example of functioning international forestry research network:
the OFI tropical pine programme



4. Catalytic type.

The fourth most recent form is that of IUFRO's donor-funded Special Programme for Developing Countries (SPDC). Here IUFRO acts as the catalyst for establishing networks but has no direct research activity; Regional Planning Workshops have been held in the main tropical regions attended by research leaders from the national institutions. They discuss proposals made by consultants from within and outside the region on topics identified initially by the Special Coordinator of the SPDC advised informally by various specialists. Detailed proposals are prepared by the Workshops, refined by the Coordinator or his Deputy, and submitted to various donor agencies for consideration. Hopefully the entire suite of individual national component projects within a regional network are accepted by one donor who provides additional network support and administration. The best examples of this are the F/FRED network supported by USAID and the bamboo and rattan networks supported by IDRC (Canada) throughout southeast Asia. The French Government's support for the initial preparation of national project documents in the Sub-Saharan network is channelled through FAO as the operating agency. In all these cases there is provision for training and workshops.

The costs and benefits of these different approaches are difficult to obtain and compare but a summary attempt is made in Table 5. As one example of a generalized cost-benefit analysis, the OFI estimates that its 25-year programme of exploration, evaluation, conservation and improvement of the genetic resources of industrial tropical pines has cost approximately \$2 million; if the planting countries continue to plant at the same rate but use the proven superior provenances instead of the currently used commercially available material the standing value of plantations could be enhanced by \$1 billion by the end of the century. This does not include the value of improvements made in the current selective breeding projects. It will be much more difficult to estimate the benefits derived from research with multipurpose trees for rural development but it may be assumed that the speed of obtaining socioeconomic and environmental benefits from the optimum seed source and management system for these species will be enhanced by the benefits derived from collaborative networks.

Table 5. Summary comparison of advantages and disadvantages of different networking methods (1 = low; 5 = high)

	Collegiate	Invitational	Institutional	Catalytic
Problem ident.	1	4	4	5
Leader ident.	4	5	5	5
Particip. ident.	1	1	5	5
Staff training	1	5	5	5
Information				
Design	2	5	4	5
Data collection	1	5	4	3
Data analysis	3	5	3	4
Publication	2	5	5	5
Meetings	3	4	5	5
Plant material				
Exchange	2	5	2	3
Amounts	3	3	2	3
Extension	1	2	5	4
Internal funds				
Current	1	2	5	5
Continued	1	1	3	3
External funds				
Initial	1	2	5	5
Continued	1	2	5	5

SUMMARY

IUFRO, the second oldest international institution after the Red Cross, has for 100 years practised research networking. Originally activities were informal and led by enthusiastic individuals with little financial support other than that from their own employer. Recently IUFRO has established a Special Programme for Developing Countries to bring the benefits of collaborative research and some financial support to tropical countries lacking sufficient resources of skills and finances. Individual and collective donor agencies support various types of networks de novo and resulting from IUFRO's Special Programme.

The paper summarizes the specific aims of networks, the principles for success, and the problems in establishing and operating networks. It describes four major operational systems for forestry networks and attempts to tabulate their relative advantages. Networks are not the immediate panacea for all ills but should be considered in the light of the continuum from research through development to application. Similarly research activities may be located centrally, regionally or locally in a network and conducted by different organizations for the benefit of all participants; while the economic evaluation of forestry research networks is difficult, especially for multipurpose trees in rural development systems, it is assumed that networking will speed the achievement and application of results and the strengthening of national research capability.

LITERATURE CITED

- Burley, J. 1985. Forestry research networks. In: Increasing productivity of multipurpose species (Burley, J. and Stewart, J.L., eds.). Proc. IUFRO Plan.Wksp. for Asia on For.Res. and Technol.Transfer, Kandy, Sri Lanka. IUFRO, Vienna, Austria, 27-36.
- Burley, J. 1987. International forestry research networks - objectives, problems and management. *Unasylva* 39 (3/4): 67 - 73.
- Burley, J. et al. 1989. Forestry research in eastern and southern Africa. Trop.For.Pap.19, Oxford Forestry Institute, Oxford, UK, 58p. and 200p. annexes.
- Cooper, L. 1984. The twinning of institutions; its use as a technical assistance delivery system. World Bank Technical Paper 23, World Bank, Washington, DC, USA, 46p.
- Oram, P.A. 1988. Networks as a research modality. Background Paper, Task Force on Tropical Forestry Research ("Bellagio II"), Wiston House, Brighton, UK, 11p. (Available from International Food Policy Research Institute, Washington, DC, USA.)
- Plucknett, D.L.; Smith, N.J.H. 1984. Networking in international agricultural research. *Science* 225: 989 - 993.
- World Bank; FAO. 1981. Forestry research needs in developing countries - time for a reappraisal? Special Paper, 17th IUFRO Congress, Kyoto, Japan, 56p.

Managing MPTS Research Networks in Asia

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INTRODUCTION

Networking has become a fashionable phrase among international agriculture and forestry researchers during 1980's, with institutions of all sizes and shapes participating and coordinating research networks. Yet researchers and research administrators rarely understand the complex dynamics of cooperative research within and through networks. The process of network coordination and management is related to the management of other types of organizational structures, but does require sensitive guidance of diverse groups of researchers united primarily by common research interests rather than by a rigid bureaucratic structure. Management of research networks in which researchers and institutions participate voluntarily includes unique challenges which may not be as critical in programs in which the manager has more direct control.

This paper describes some of the management problems and lessons learned from experience gained during the first three years of a ten-year research networking project on multipurpose tree species.

Networks Defined:

The often cited concept of networking is in reality a series of ideas which date from the beginnings of institutionalized science. Communication between researchers, the sharing of hypothesis, research methods, professional society meetings and cooperative research projects are common elements of "networking" which have existed in some form for centuries. The concept of networking forms the basis of the International Union of Forest Research Organizations (IUFRO) and underpins its successes of the past century.

Burley (1987) defines agriculture and forestry research networks as:

informal or formal arrangements of cooperation between institutions with similar conditions and problems but without the immediate resources for finding solutions to these problems individually.

Several common concepts of what constitutes a research network exist among forestry and agriculture researchers in Asia (MacDicken et al., 1986; MacDicken and Lantican, 1988):

1. Networks may be loosely grouped associations of researchers who divide research problems into work assignments, either formally or informally. An example of informal division of topics is the Northern Thailand Natural Resources Management Network (NORMNET), an advisory group of agency officers and researchers, whose members jointly identify and help allocate funds for research projects of relevance to the participating development agencies. The formal division of topics is found in the approach adopted by an IUFRO working group meeting on multipurpose tree species (MPTS) research organized in Kandy, Sri Lanka, in 1984 which identified lead institutions to conduct and coordinate research on tree species or genera (Shea and Carlson, undated).
2. Networks may also be composed of participants who conduct a set of identical or similar experiments to solve specific research problems. This approach concentrates greater resources on a well-defined problem, and is often used by international agricultural research centers to test food crop varieties (Plucknett and Smith, 1984). Rice variety trials coordinated by the International Rice Research Institute and network experiments on multipurpose tree species supported by the Forestry/Fuelwood Research and Development Project are examples of this type of network.
3. Other networks are primarily communications-oriented and are comprised of groups of people who communicate regularly in areas of common interest. Organizations which produce research publications and newsletters such as the Nitrogen Fixing Tree Association (NFTA) exemplify this type of network.
4. Some networks provide a wide range of services and support among network participants. This type of "integrated network" combines aspects of all three of the above concepts. It facilitates the training and development of network participants and includes publications and research components. An example of this type of network is the Multipurpose Tree Species Research Network which is supported by the U.S.A.I.D.-funded Forestry/Fuelwood Research and Development (F/FRED) Project.

Description of the F/FRED Project and the MPTS Research Network

The F/FRED Project is a ten-year effort designed to help scientists cooperatively address the needs of small-scale farmers for fuelwood and other tree products. The project has helped to

initiate and support the establishment of the Multipurpose Tree Species Research Network which has some 25 participating institutions in 12 countries in Asia. Mechanisms for network development include scientific and organizational meetings, cooperative research projects, training, travel grants, publications and small research grants.

The MPTS Research Network is regional, covering most of the non-Communist countries in Asia. However, it is built upon informal, national-level networks which are being established through a series of National MPTS Research Meetings held annually in most of the participating countries. A primary objective in encouraging these meetings is to provide an open forum for discussion of MPTS research issues and to provide national-level links to the regional research network.

The field operations of the F/FRED project have been largely successful in establishing the MPTS Research Network (Butterfield et al., 1988). Activities have increasingly been initiated and managed by network participants with support from F/FRED. Formal and informal leadership of these activities by participants are crucial to long-term network success.

During the first three years of network establishment most network activities have been managed by the F/FRED Coordinating Unit housed at the Kasetsart University Faculty of Forestry in Bangkok, Thailand. However, several important sub-projects such as a national-level network of researchers working on Azadirachta indica and Melia azedarach and a regional research program on the leucaena psyllid have been initiated, coordinated and managed by network participants.

MANAGEMENT OF THE MPTS RESEARCH NETWORK

The management of the MPTS Research Network has necessarily changed through its formative years in response to changes in the level of active participation. Network development can be classified into three stages which require different management strategies (MacDicken and Lantican, 1988). Table 1 outlines some of the general characteristics of networks at each stage and the types of resources required. While these stages are useful in providing a description of the process, in reality network development is best described as a continuum in which the transitions are less distinct.

Organizational stage

The organizational stage of the MPTS Research Network began with two major events: the IUFRO Research Planning Workshop for

The operational stage of network development requires an effective secretariat and staff from participating institutions with sufficient training to make a significant contribution. The secretariat must be able to secure external financial and conceptual support, and must be led by effective leaders who have recognized skills which are relevant to the topical focus of the network.

CRITICAL MANAGEMENT FACTORS

During the process of network establishment several lessons have been learned. Critical management factors have included:

- o an active core of participants
- o management of conflicts of interest
- o flexibility of project support
- o neutral institutional base
- o sustained, long-term support
- o strong scientific and professional interest
- o cooperative research
- o optimization of compromise
- o appropriate grant levels
- o effective coordinating staff
- o donor cooperation and coordination

Active group of "core" participants

A nucleus of unselfish network cooperators/participants who are keenly interested in learning, sharing information and working with other researchers is essential to successful network development. While this core may be less than ten percent of the total number of network members, it provides critical leadership, both formal and informal, and technical expertise which strongly influences network programs.

The group assists other network participants, and provides the essential "critical mass" for the operational stage of network development. A key management role of the Coordinating Unit has been in seeking out and encouraging the participation of active, interested and qualified individuals to form this critical mass.

Managing conflicts of interest

Networks such as the MPTS Research Network involve very diverse participants or clients including researchers, research administrators, donor agency administrators and end-users of research. In principle, each of these groups are working toward

common goals, yet in practice there often exist differences in perspective and strategy which lead to disagreement and in some cases interests which conflict with each other. A critical role of network administration is the management of these often conflicting interests.

Plucknett and Smith (1984) recognized the need for self-interest in research networks. Participants obviously join networks for a variety of reasons, including the facility to exchange ideas, to identify and obtain funding and to take part in training courses. However, since competition for scarce resources almost always exists in networks, self-interest can evolve into conflicts among clients - i.e. researchers, research administrators, donor agency administrators and end-users of research. While none of this potential conflict has emerged openly in MPTS Research Network activities, competition for limited funds has the potential for alienation of network participants who feel strongly about priority uses of funds.

Perhaps the most important lesson to be stressed is the need for administrative procedures which are fair, practical and generally understood and agreed to by active network participants. These procedures must also provide sufficient flexibility to promote creativity and innovation.

Flexibility

While networks are generally based upon topics of common interest, they can only function and grow when provided with enough institutional and managerial flexibility to allow some redirection in research focus and allocation of funds. A prime example has been in the project's response to the jumping plant lice which has seriously damaged Leucaena leucocephala production in much of Asia and the Pacific.

Within three months after the long-term field team arrived in Bangkok, the first of several regional workshops on the psyllid infestation was held with F/FRED support. This ultimately resulted in the development of a cooperative regional plan for leucaena psyllid research and substantial coordination of research efforts between national institutions in some 7 countries, IDRC and F/FRED. The psyllid problem was not foreseen in the original planning documents for F/FRED, but the design allowed such a response and the project management was responsive to the need for a regional approach to a serious regional problem. F/FRED helped to provide a unique service - timely facilitation of regional coordination of national research programs by national program coordinators. Flexibility in both program direction and funds were critical in providing such a response.

Neutral institution

There is clearly a need for a host institution to provide an impartial, neutral venue which is beneficial to both the host and other network participants. The MPTS Research Network has been most fortunate to be headquartered at the Kasetsart University, Faculty of Forestry. The Faculty has provided logistically well-suited facilities and has also recognized the regional nature of the F/FRED Project and the MPTS Research Network. The Faculty has actively participated as one of some 25 institutions in 12 countries which are involved in network activities.

Sustained long-term support

The development of the MPTS Research Network has been a direct result of the long-term commitment of the U.S. Agency for International Development to some of the concepts developed at the IUFRO meeting in Kandy in 1984. While it is far too early to determine whether the MPTS Research Network will survive, the long-term funding commitment helps to increase the probability of future success. A ten year funding commitment is probably a reasonable minimum period for a network to grow from the organizational to the sustainable operations stage.

Strong scientific and professional interest

Finding important problem areas which are of broad regional interest is not difficult, but agreeing on methods of cooperation or coordination can be. Cooperation is easily encouraged on "crisis" topics that are current and important. For example, the leucaena psyllid is a significant problem facing at least eight countries in Asia and the Pacific. The infestation was rapid and severe enough to stimulate national research programs in each of these countries. It has provided a very strong focus for cooperative research and coordination of research efforts (Banpot et al., 1987).

Organization and administration of research on other topics which are not of a "crisis" nature has often required more initiative and staff work by the Coordinating Unit. Some of these topics may be of greater long-term significance than the "crises" which motivate expedient cooperative action.

Legitimacy through regional effort

The MPTS Research Network can provide very significant incentives for national researchers to become involved in

innovative research which may not attract the attention of national research administrators. Research on multipurpose tree species or social aspects of farm forestry have not generally received much attention from national funding sources, and has often been considered out of the main stream.

Funding from F/FRED has sometimes helped researchers to prove the legitimacy of the topics they are interested in by providing financial and conceptual support which allows the research to be conducted. It is hoped that this support will ultimately help attract additional attention from national sources. While the F/FRED project has been able to assist several researchers and institutions with this type of support, it is often difficult to recognize these situations and assist in appropriate ways.

Cooperative research

Another management lesson has been the importance of standardization of research methods and cooperative research projects. Scientists at planning meetings have exercised professional cooperation in developing plans for network field trials, agreeing on both treatment designs and common methods. The standardization process has included consideration of characteristics of MPTS that are important to small farmers and reliable assessment methodologies for biological research. It has not always meant agreement, and in some cases has resulted in agreements to disagree, yet it has provided excellent opportunities to discuss and in most cases resolve important research issues.

Standardized methods and cooperative research are also resulting in the generation of very valuable data from multi-location experiments on a wide range of sites, and also provided a tool to foster cooperation. It is hoped that this cooperation will help provide the foundation of the long-term professional relationships which are the core of a functioning network.

Optimization of compromise

Cooperative effort among researchers inevitably means compromise. Compromise means that concessions must be made and that few researchers end up with everything they would have had they been in complete control. However, the compromise can be managed in a way that there is significant net benefit.

For example, cooperators discussed and agreed to an experimental design for an International Provenance Trial for Acacia auriculiformis. Debate focused on the use of a balanced,

incomplete block design which offers greater precision, but is more difficult to layout than a randomized complete block design with which most researchers are familiar. In the end, cooperators who were more interested in the design of greater precision agreed to a less precise design to allow greater participation in the trials - a compromise which resulted in net benefit for the network by allowing the inclusion of a larger number of well laid out experiment sites, although it reduced the direct benefits to several participating researchers. These compromises in procedure have not reduced the value or general quality of data to be collected through the network experiments.

Appropriate grant levels

MPTS research in Asia attracts a wide range of funding levels from a variety of sources. Small projects from national programs are often less than US\$1,000 while donor research projects may be up to US\$200,000. F/FRED has been largely successful in providing modest funding levels which cover operational costs for small-scale research projects. This has allowed the Project to increase the number of scientists involved with the limited research funds available. It has also encouraged co-financing of research from national sources, adding to the likelihood that such investigations will receive future attention from national programs. Great potential exists for helping researchers improve research objectives, methods, analysis and reporting. However, monitoring and follow up of small research grants is very time consuming and should not be underestimated. The Coordinating Unit has been unable to take full advantage of the opportunities for working closely with researchers on methodologies, implementation and communication of results.

Effective coordinating staff

Adequately trained and well-motivated staff are critical to the success of any research effort. Network development and management requires staff who have recognizable skills in the subject area focus of the network. It also takes staff who are able to deal with a wide diversity of researchers and administrators with both self and network interests.

It has been very useful for the F/FRED Coordinating Unit staff to be from several different disciplines, which allows access to a wide range of in-house expertise. It also provides an opportunity for multi-disciplinary cooperation in research design, implementation and analysis.

Donor cooperation

Donor coordination is also important. Each donor agency has strengths and weaknesses which determine the limits of its effectiveness. For example, in the area of psyllid research support, the IDRC has granted substantial funds psyllid research, yet has been generally unable to encourage and support regional coordination of psyllid researchers. The F/FRED project, on the other hand, has little money for research grants, but has effectively used travel and workshop funds to support the development of a coordinated regional plan for psyllid research. Both agencies have recognized these niches and worked together to maximize their efforts.

Donors need to understand the strengths and weaknesses of their research support programs, and work together to bridge as many research "gaps" as possible.

CONCLUSIONS

The F/FRED Project has been able to organize and encourage the establishment of the Multipurpose Tree Species Research Network in Asia. In the process, several lessons have been learned about the management of the wide variety of network activities and the process of network establishment. These lessons have been more often learned through problem solving and trial and error than through adherence to a well-defined methodology.

The management of these interests has begun to develop from that of centralized project management of activities to management of activities by network participants. This reflects the need for adjustment of management strategies as the project and the network develop and participants take on greater responsibility for network activities.

LITERATURE CITED

- Burley, J. 1987. International forestry research networks - objectives, problems and management. *Unasylva* 157/158, Vol. 39.
- Butterfield, S., F.Ng, C. Hatch, A. Manzardo, D. Osburn, J. Palmer. 1988. Forestry/Fuelwood Research and Development (F/FRED) Project Evaluation Report. Tropical Research and Development, Inc. Gainesville, Florida. 170pp.
- IUFRO. 1984. Proc. IUFRO Research Planning Workshop for Asia at Kandy, Sri Lanka.
- MacDicken, K.G., M.R. Dove, J.L. Brewbaker and W.F. Hyde. 1986. Multipurpose Tree Species Networks for the Forestry/Fuelwood Research and Development Project. Winrock International Institute for Agricultural Development. Arlington, Virginia. 120pp.
- MacDicken, K.G. and C.B. Lantican. 1988. Resource development for professional education and training in agroforestry. Paper presented at the International Workshop on Agroforestry Education and Training. Gainesville, Florida. Dec. 5-8, 1988.
- Napompeth, B., K.G. MacDicken, M.W. McFadden and I.N. Oka. 1987. Regional Research Plan for the *Leucaena* Psyllid. Report No. 2. Winrock International. Arlington, VA.
- Plucknett, D.L. and N.J.H. Smith. 1984. Networking international agricultural research. *Sci.*, 225: 989-93.
- Shea, K.R. and L.W. Carlson. Undated. Increasing Productivity of Multipurpose Tree Species: a Blueprint for Action. IUFRO Planning Workshop for Asia, Kandy, Sri Lanka, July 16-28, 1984. USDA Forest Service. Washington, D.C. 100pp.

Table 1 Resources required for successful network establishment

Stage of network development	Critical elements	Personnel requirements	Other resource requirements
Organizational	1. The focus of the network is a topic or problem that is clearly defined and is common to many countries 2. Sufficient interest exists in network topic to warrant further development	Subject matter specialists actively consult with network participants in designing network structure and activities. This initial commitment is most likely to come from an institution with strong commitment, but without assurances of future funding.	Adequate funds for initial infrastructure development and travel for organizational purposes. This may be limited to office space and facilities for the organizer until funding sources can be identified for the establishment stage.
Establishment	1. Adequate funding is allocated for a minimum start-up period of five years 2. Participants are willing to share both research results and training materials. 3. Participants are willing to commit resources for future network operations.	Subject matter and training specialists, publications and administrative staff are required. Coordinating staff provide leadership in organizing and implementing in the early years of this stage. This evolves to a "facilitation role" which supports leadership of network participants.	Funds for network meetings, publications and research are required. Donor support is critical to long-term success since the greatest financial inputs are required during this phase.

Research on the genus Leucaena was initiated at the U. Hawaii soon after its founding in 1907. Studies of other woody legumes prior to 1950 included Acacia koa, a premier hardwood in Hawaii, Prosopis pallida, a premier charcoal source, and Cajanus cajan, a significant fodder, food and green manure plant. Our breeding work with legume trees started in 1961 with L. leucocephala ("koa haole" in Hawaii, named as a white-flowered version of A. koa), following extensive early agronomic studies.

Fast-growing trees of the tropics require trials that are more similar to food crop experiments than they are to trials with premier timbers of temperate forests (Brewbaker 1987). Tropical trees often produce a harvestable product in 1 to 4 years and can be bred on 2-5 year cycles. They are often grown at high population densities on agriculturally prepared soils, and can be evaluated in small plots with emphasis on short-term productivity. The 46 Statewide Energy Tree Trials of the University of Hawaii average less than 0.2 hectare in size, yet all are replicated and coefficients of variability for yield rarely exceed 20%.

Phase 1: Leucaena varietal trials of U. Hawaii

"Giant" or arboreal leucaenas were identified in observational trials started in 1963, and a formal release of germplasm was made in 1968 when the variety K8 was named ("K" for koa haole). Species hybridization began in the early 60's and led to broad taxonomic and interspecific hybridization studies that dominate present research (Brewbaker 1987). Several varieties of comparable woody biomass yields--K28, K29, K67, K72 and K132--were seed-increased in the mid-60's and tested primarily as fodder-plants in Hawaii. Collaborative research was then initiated at Kasetsart U. (Thailand) in 1967 and U. Philippines (Los Banos) in 1970. This led to wide-scale testing of these varieties in S. E. Asia, where they soon gained prominence. The U.S. National Academy of Science gave added stature to the leucaenas in a discerning publication (NRC 1984) from our workshop in the Philippines in 1975.

International varietal trials of the leucaenas have been assisted informally by the U. Hawaii since 1968, with an average of over 200 seedlots annually. Seed costs were borne under research grants at the U. Hawaii, but were minimal since L. leucocephala is a self-pollinated species with abundant seeds that are easily collected, stored and germinated. The giant varieties released from Hawaii and Australia showed consistent superiority over the "common" Mexican leucaenas, that naturalized throughout the tropics after 1600. The versatility and ease of production of leucaena simplified its dispersal and evaluation, and both the research and literature on this species exploded in the mid-70s (Oakes 1983-5).

Phase 2. Informal Network Trials of NFTA

The Nitrogen Fixing Tree Association (NFTA) was established in 1981 as a non-governmental agency dedicated to motivating research, development and communication about N-fixing trees. The international leucaena trials were then transferred from U. Hawaii to NFTA and linkages forged to network NFTA associates in these trials. An informal guide to establishment was provided, more varieties added, seed documentation formalized, and a journal established ("Leucaena Research Reports" or LRR) for publication of results. Now in its 10th year, LRR carried 54 articles from 17 countries in 1988, many from collaborators in these informal networks.

NFTA has thus become a communicating body for exchange of information among tropical scientists, and for guidance of extension specialists and growers. Over 1400 scientists in 105 countries currently associate with NFTA and share their results with fellow scientists in LRR and its companion journal, NFTRR (Nitrogen Fixing Tree Research Reports) established in 1983. These journals serve to assist scientists, especially in developing countries, to keep current with advances in breeding and silviculture with these versatile fast-growing trees, and are a bargain at \$5/year (developing country rate, with foundation subsidy).

NFTA drew attention to 44 significant N-fixing trees at an early workshop in Rockefeller Foundation's Bellagio Center (MacDicken and Brewbaker 1984). Most of these species are now growing in NFTA arboreta in Hawaii, and many are included in Hawaii's Statewide Energy Tree trials. Seeds of superior provenances were then collected and made available by NFTA for international trials, together with appropriate rhizobia from UH-based and USAID-financed NifTAL (P. O. Box O, Paia, Maui, Hawaii). These species are subject of an expanding data-base (DBaseIII), and of provenance collections from leading investigators where available. NFTA began to offer assistance primarily in the form of seeds and counsel on growth and management of these species. International workshops with attendant proceedings and guides to production were produced on leucaena (IDRC 1982), gliricidia (NFTA, in press), and sesbanias (NFTA, in preparation), and planned for casuarinas (in 1990) and other important groups. Short "HIGHLIGHTS" were published on all species, outlining some of their advantages and shortcomings.

Phase 3. NFTA's Cooperative Planting Program (CPP)

NFTA's associates urged greater formalization of assistance in research trial planning and reporting. NFTA staff members Ken MacDicken and Nancy Glover initiated this process in 1984, and it is currently assisted by Robert Wheeler, William Macklin and Jim Chamberlain of NFTA. The program is entitled CPP (Cooperative Planting Program) to stress that NFTA's role is in cooperative

assistance rather than in direction. However, this assistance has been formalized much as it is in other international programs where specific trials of specific provenances are prepared. Two important differences occur. NFTA does not finance the trials, except in provision of seeds and counsel. Secondly, NFTA encourages great flexibility in trial design and in entries or treatments used, and stresses that trials not be excessively large, lengthy or costly.

The utility of Federer's "Augmented" designs (ARCB) has been exploited, as these designs provide flexibility while offering opportunity for combined ANOV (Brewbaker 1986, Federer and Raghavarao 1975). Augmented designs have a core of entries or treatments that is fixed at all locations, allowing combined analysis and calculation of genotype by environment interactions. The designs also provide the flexibility to include lesser-known entries or treatments not in the core group, e.g. entries of special interest to local investigators. A simplified analysis involves only the calculation of appropriate standard errors for comparisons of the core entries vs. the augmented entries.

NFTA trials are normally of the randomized complete block design. A common configuration would involve 6 core species or provenances in 3 reps of small plots and 6 augmented species or provenances, each in only one rep (total, 24 plots). Federer's versatile augmented design seems to awe too many investigators, who prefer the familiarity of complete replication and complete factorials, both of which can be notoriously wasteful of time and money. NFTA requires minimal data sets on each trial site and on its soil and environment. Mensuration guides are given, but normally specified only for height and breast-height diameters in tree trials, or wet and dry weights of foliage for fodder trials.

The CPP trials totalled 268 at the end of 1988, and were in 60 different countries. They involved seeds of provenances or cultivars from 65 species, all previously evaluated in Hawaii (Table 1). These represented about 10% of the known N-fixing tree species (Halliday 1984), which in turn is about 10% of those suspected to fix. The trials were of the following three types:

A. Site-adaptability trials (SATs). SATs are designed for species screening where land and labor are major constraints. Typical collaborators in SATs are church and other volunteer organizations, growers and seedsmen, local government officers and grass-roots organizations. The trials are of the Completely Randomized Design, with large, unreplicated plots. Species selection is guided by the experience in Hawaiian trials and by traditional published resources (e.g., von Carlowitz 1986; Webb et al. 1980). Counsel is given on seed and nursery practices, tree spacing, plot size, border rows and silviculture. Data are expected to be few and empirical in nature, with little emphasis on statistical significance.

B. International Yield Trials (IYT). IYTs are designed for species screening where statistical data are important, and where

land and labor are not constraints. Expected collaborators in IYTs include universities and national and international research agencies. Species and provenance selection is made carefully with reference to site description, in collaboration with the cooperator. IYTs in similar ecological zones have similar core germplasm and treatments, and are designed to permit combination of data over sites. Recommendations are made of replication, spacing, plot size (commonly 7x7 or 9x9 trees), border rows, layout and mensuration.

C. Provenance Trials (PTs). PTs are designed to quantify performance of diverse seed sources of a selected NFTree (original provenance, derived seed source, selected cultivar). PTs are established when the preferred species has already been identified as suitable to ecosystem and local use, e.g., through SATs or IYTs. Expected collaborators are private voluntary organizations, local governmental and non-governmental agencies, and research institutions. NFTA assists with provenance trials for species of Gliricidia, Leucaena and Sesbania, and provides counsel on trials that are available for other NFTrees (e.g., CSIRO, FAO, F/FRED, OFI). All data from IYT and PT experiments are recognized as privileged to the lead institution, but NFTA encourages that such data be shared through publication, and offers assistance in compiling data for GxE analyses.

Phase 4. Leucaena Network Trials

Formalization of leucaena network trials by NFTA and the U. developed after a threat from a newly widespread insect pest, the psyllid Heteropsylla cubana. At the USAID-supported 1986 Leucaena psyllid workshop (NFTA 1987), plans were laid for the LPT network (Leucaena Psyllid Trial). LPT trials are conducted to identify levels of resistance to the psyllid and involve regular coppicing, to create optimal conditions for the psyllid attack. Three reps of 10 sq.m. plots (minimized due to self-fertility of most leucaenas) are planted with about 15 entries, including species hybrids of the 13 leucaena species. Results from 19 trials in 10 countries fully justify the care in networking, and allow regional recommendations for outstanding varieties under a wide variety of ecological conditions, e.g., involving different psyllid predators (Glover 1987).

The ILT network (International Leucaena Trial) is being established in 1989, with coordination by scientists in Nigeria, India, Taiwan, Thailand and Hawaii. The network involves separate trials for fodder production and for wood production at lowland and at highland sites. A fourth area of concern--acid soils--awaits release of germplasm with verified tolerance. Three different levels of inquiry are planned; introductory trials similar to the SAT trials, species and varietal evaluations akin to the PT trials, and variety x environment or variety x management interaction trials. Formal designs and worksheets, detailed site descriptions, and combined statistical analyses are planned for the latter two types of trials. Preformatted Lotus 1-2-3 spreadsheets are available on disk to investigators with

computer capability for summaries and ANOVs. NFTA is establishing field offices abroad, and seeking to fund a full-time scientist to monitor these trials and aid in data compilation and analysis. Few NFTrees are at leucaena's advanced stage of germplasm collection (>2000 accessions, including all species) and breeding (>50 viable species hybrids) to warrant this type of network.

The informal approach taken by NFTA and the University of Hawaii to NFTree trials has obviously led to many rather informal experiments but few published data and no combined analyses. This approach successfully blends scholarship with motivation, and does not involve major investment by NFTA or its collaborators. However, it is much less successful in data reporting and analysis, steps that clearly require staff for on-site visits, and perhaps the added motivation of fiscal support to the conduct of trials.

Developing countries are often adequately staffed with foresters and agricultural scientists who, given financial support, could conduct excellent NFTree trials. What can informal scientist-to-scientist networks like those of NFTA best provide? Among the options are the ready access to superior germplasm, guides to seed handling and appropriate silviculture, databases on species and provenances, published information often not readily obtained and communication channels with fellow researchers.

At what time is further formalization of trials essential? We would argue that for most NFTrees there is no urgency, despite the current insistence on the elegance of computer modeling and of genotype by environment interactions. Our base of knowledge with most tropical trees--including taxonomy, germplasm collections, chromosome numbers, breeding systems and basic botany--is often far too naive to justify elaborate and expensive network trials. Major progress can be made with simple evaluations for adaptability and performance at many sites under diverse methods of management (Huxley 1984). This does not reduce the urgency of germplasm collection, for a major defect in present networks is the pathetically narrow gene base for our evaluations (Burley and von Carlowitz 1984).

References Cited

- Brewbaker, J. L. 1986. Multi-purpose tree species and provenance trials. In "Forestry Networks", ed. N. Adams and R. K. Dixon. Proc. of Conference by Winrock International, Petit Jean, Arkansas; pp. 15-24.
- Brewbaker, J. L. 1987. Leucaena: a multipurpose tree genus for tropical agroforestry. In "Agroforestry: a decade of development", ed. H. A. Steppeler and P. K. R. Nair. ICRAF, Nairobi, Kenya.
- Burley, J. and P. von Carlowitz. 1984. Multipurpose Tree Germplasm. ICRAF. Nairobi, Kenya.
- Carlowitz, P. von. 1986. Multipurpose Tree & Shrub Seed

- Directory. ICRAF. Nairobi, Kenya.
- FAO and NFTA. 1987. Nitrogen Fixing Trees: A Training Guide. FAO/RAPA Publication: 1987/15. FAO, Bangkok, Thailand.
- Federer, W.T. and D. Raghavarao. 1975. On augmented designs. Biometrics 31: 29-35.
- Glover, N. 1987. Evaluation of *Leucaena* species for psyllid resistance. *Leucaena Research Reports* 8:15-18.
- Halliday, J. 1984. Register of nodulation reports for leguminous trees and other arboreal genera with nitrogen fixing members. *Nitrogen Fixing Tree Res. Rept.* 2:38-45.
- Huxley, P. (Ed.). 1984. Source materials and guidelines for research methodology for the exploration and assessment of multipurpose trees. (in 27 parts). ICRAF. Nairobi, Kenya.
- IDRC. 1982. *Leucaena* research in the Asia-Pacific region. Proc. of Workshop, IDRC and NFTA, Singapore, Nov. 1982.
- MacDicken, K. G. and J. L. Brewbaker. 1984. Descriptive summaries of economically important nitrogen fixing trees. *Nitrogen Fixing Tree Res. Rept.* 2:46-54.
- NFTA. 1987. Proceedings of a Workshop on the biological and genetic control strategies for the *leucaena* psyllid. *Leucaena Research Reports* 7(2), 109 pp.
- NRC. 1984. *Leucaena*: Promising forage and tree crop for the tropics. 2nd ed. U.S. Natl. Acad. Sciences, Washington, D.C.
- Oakes, A. J. 1983-5. *Leucaena* bibliography. 3 vols. Germplasm Resources Lab., USDA, Beltsville, MD.
- Webb, D.B., P.J. Wood and J. Smith. 1980. A guide to species selection for tropical and sub-tropical plantations. Tropical Forestry Paper No. 15. Oxford Forestry Institute. Oxford,

Table 1. Nitrogen fixing tree species in the NFTA network trials, classified for preferred ecosystems; provenance trials are available from NFTA for species marked (P).

Species	(Synonyms)	Ecosystem*
<i>Acacia acuminata</i> Benth.		AL,AH
<i>A. aneura</i> F. Muell. ex Benth.		AL,AH
<i>A. angustissima</i> (Miller) Kuntze		ML,MH
<i>A. auriculiformis</i> A. Cunn. ex Benth.		ML
<i>A. crassicarpa</i> A. Cunn. ex Benth.		ML
<i>A. holosericea</i> A. Cunn. ex G. Don		AL
<i>A. mangium</i> Willd.		ML
<i>A. mearnsii</i> Willd.		MH
<i>A. melanoxylon</i> R. Br.		MH
<i>A. nilotica</i> (L.) Willd. ex Del.		AL
<i>A. polyacantha</i> (A. catechu)		AL
<i>A. tortilis</i> (Forsk.) Hayne		AL
<i>Acrocarpus fraxinifolius</i>		ML,MH
<i>Albizia lebbek</i> (L.) Benth.		AL,AH
<i>A. procera</i> (Roxb.) Benth.		AL
<i>A. saman</i> (Samanea saman)		AL,ML
<i>Alnus acuminata</i> G. Kuntze		MH
<i>A. nepalensis</i> D. Don		ML,MH
<i>A. rubra</i> Bong.		MH
<i>Cajanus cajan</i> (L.) Millsp		AL,ML
<i>Calliandra calothyrsus</i> Meissn.		ML,MH
<i>Casuarina cunninghamiana</i> Miq.		AL,AH
<i>C. equisetifolia</i> L.		AL,ML,MH
<i>Chamaecytisus palmensis</i> Hutch.		AH,MH
<i>Dalbergia latifolia</i>		ML
<i>D. retusa</i> Hemsley		ML
<i>D. sissoo</i> Roxb.		AL,ML
<i>Enterolobium cyclocarpum</i> (Jacq.) Gris.		AL,ML
<i>Erythrina poeppigiana</i> (Walp.) G. F. Cook		ML
<i>Faidherbia albida</i> (Del.) A. Chev (Acacia albida)		AL,AH
<i>Flemingia macrophylla</i> (Willd.) Merr.		
(<i>F. congesta</i>)		ML
<i>Gliricidia sepium</i> (Jacq.) Steud (P)		AL,ML
<i>Leucaena diversifolia</i> (Schlecht.) Benth. (P)		AH,MH
<i>L. leucocephala</i> (Lam.) de Wit (P)		AL,ML
<i>L. hybrids</i> (P)		AL,AH,ML,MH
<i>Mimosa scabrella</i> Benth.		MH
<i>Paraserianthes falcataria</i> (L.) Nielson		
(<i>Albizia falcataria</i>)		ML
<i>Pithecellobium dulce</i> (Roxb.) Benth.		AL,AH,ML
<i>Prosopis pallida</i> (H.&B. ex Willd.) HBK		
(<i>P. juliflora</i>)		AL,AH
<i>Pterocarpus indicus</i> Willd.		ML
<i>Robinia pseudoacacia</i> L.		AH,MH
<i>Sesbania grandiflora</i> (L.) Poir.		AL,ML
<i>Sesbania sesban</i> (L.) Merr.		AL,ML,AH,MH
<i>Tamarindus indica</i> L.		AL,ML
<i>Tipuana tipu</i> (Benth.) Kuntze		MH

* A = arid and semi-arid, M = mesic, L = lowland, H = highland

FORESTRY AND FOREST PRODUCTS RESEARCH: FAO'S FORTHCOMING PLANNING AND MANAGEMENT GUIDELINES

H. Gregersen, A. Lundgren, D. Bengston and H. Hilmi¹

1. INTRODUCTION

The purpose of this paper is to lay out a systematic framework for discussing the elements involved in forestry and forest products research planning and management². The framework will be used as the foundation for a forthcoming publication on the subject by the United Nations' Food and Agriculture Organization (FAO) Forestry Department.

Obviously, the procedures involved in managing and planning forestry research will vary from institution to institution. A large research organization in a developed country has different planning needs, resource requirements, management practices, etc., than does a small, isolated research organization in a poorer developing country with voids in communication infrastructure, facilities, trained personnel, etc. And different from both of these will be the management and planning needs of an international nongovernmental organization involved in hands-on research within the context of a larger development program. A research institution dealing with natural forest management will have different equipment, facility and communication needs than will a research group dealing with wood processing. So how can we put forth planning and management guidelines that will be widely useful for forestry and forest products research?

A key assumption underlying the decision by FAO to produce these guidelines is that, while specific requirements may differ, there are some basic principles of successful planning and management that will be useful for most types of forestry research. A further assumption is that these general principles can be presented in a such a way that they complement rather than duplicate the available general documentation on research planning and management.

The way in which we intend to bring general principles and practices to life is by introducing throughout the guidelines some specific examples from forestry research illustrating application of the principles under varying circumstances. The examples will draw mainly on the experiences of small and midsized organizations in developing countries, since persons involved with such organizations will be the main audience for the forthcoming guidelines.

An outline for the guidelines was presented at the Alice Holt IUFRO conference on which these proceedings are based. Our intent was to elicit comments on content and on the emphasis given to each subject. (Our view on the emphasis or relative weights is indicated by the number of pages devoted to the subject, as indicated in parentheses behind each heading). The revised outline presented here reflects the advice received at the conference.

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² In the remainder of this paper, we use the term "forestry" to refer to both forestry and forest products.

2. THE FORESTRY RESEARCH MANAGEMENT PROCESS: AN OVERVIEW

Planning is often viewed as a separate function apart from management. In many cases it can be. However, we view planning as an on-going function within the overall management process. We do this because in most cases there is an existing forestry research management structure, and it is within this structure that planning for change will (or should) take place, not as a one-time activity, but as a continuing function of management. In cases where there is no existing research framework--where an entirely new research institution is being considered-- one could argue that planning takes place, at least initially, as an independent function. However, this is the exception rather than the rule. Thus, in the following discussion, we consider planning an integral part of management.

One could focus a set of guidelines for research management (including planning) in a number of different ways. After considerable debate, we decided to focus on and organize the topic in terms of "management by objectives". In this approach to research management the basic process involves:

A. Setting goals and objectives to be accomplished in a given amount of time and developing internal policies. Specific tasks include:

- * developing or maintaining external relations with client groups and public decision makers that influence national policy affecting forestry research and that define the needs to which research should respond;
- * setting goals and objectives that are clearly articulated in an operational fashion and that are consistent with existing laws, regulations and mores; and
- * setting internal policies to guide the functioning of the organization and its employees in achieving the goals.

B. Planning how to achieve the stated objectives. Major steps include:

- * assessing existing research capacity and monitoring and evaluating performance;
- * determining gaps between existing capacity and that needed to achieve objectives;
- * designing a program and activities to achieve the objectives; including choice of organizational options; and decisions regarding personnel, program size, location, and timing;
- * developing a program budget; and
- * securing financing for the program;

C. Implementing the plan and managing research; this includes such functions as:

- * establishing appropriate accounting procedures;
- * managing people--hiring, firing and motivating scientists, technicians, support personnel, and monitoring and controlling performance;

- * training and educating personnel;
- * working with outside research groups; networking, twinning, etc.; and
- * managing and allocating equipment, facilities and infrastructure.

D. Disseminating the results of the research so they may be put to use, including:

- * documenting/publishing/distributing research results,
- * interfacing and coordinating with extension, education and training institutions.

In reality, this management process is not a neat set of sequential steps. Rather, in an existing organization it is a dynamic process, where objectives and priorities change over time as goals, resources and constraints change. Thus, planning is an on-going process, where needs, capacity, and performance are being monitored and evaluated formally and informally on a regular basis and adjustments in plans and activities take place in response to the results of such evaluation. In discussing the management process, this dynamic element needs to be kept in mind.

To implement the above management-by-objectives process, managers have resources and they have constraints to deal with. Specifically, at any given time they have:

- * people (scientists, technicians, support staff)
- * operating funds
- * facilities, equipment, and other infrastructure, and
- * institutional constraints that have to be met--laws and higher level policies, cultural constraints, and so forth.

With regard to these resources and constraints, the task of management is:

- * to deploy available resources in an effective and an efficient way within the bounds of existing constraints;
- * to monitor and account for expenditures of funds and available resources to those who provide the funds;
- * to increase the quality of existing resources, eg., through staff training, development of increased international contact, improved maintenance of equipment and facilities, etc; and
- * to increase the availability of resources and remove the constraints which particularly hinder the achievement of objectives. This management can do by insuring closer concern with client objectives and needs, building political support for research, increasing the relevance of work to potential funding agencies, becoming more involved with the international community of researchers and funding agencies, and so forth.

Given the above considerations and characteristics of the research management process, we decided to organize the guidelines as indicated in section 3 (with page numbers listed at end of each heading representing the relative weight given to each topic):

3. SUGGESTED OUTLINE FOR THE FAO GUIDELINES

FORESTRY AND FOREST PRODUCTS RESEARCH PLANNING AND MANAGEMENT¹

(We envision approximately 180 pages of text, with approximate distribution of pages among topics as indicated in parentheses below; note: in what follows the term "forestry" is used to include both forest products and forestry research)

Introduction (10pp)

Purpose of guidelines; intended audience: (middle and upper level managers/administrators); what we mean by "research" (including discussion of basic/applied, maintenance/productivity enhancing, etc.); scope of "forestry" research (e.g., TFAP areas/Bellagio II); what characterizes a productive research environment; importance of research in economic and social development; specific objectives; scope and limitations; organization of the guidelines.

Part I

The Present Situation In Developing Countries (20-25pp)

This would include a summary of materials from Bellagio II Task Force report, from its background papers, and from selected FAO and other documents dealing with the research systems presently found in developing countries, including the IUFRO/SPDC framework.

1. The nature of organizations involved in forestry and forest products (FFP) research (5pp)
2. Types of FFP research being undertaken (5pp)
3. Resources devoted to forestry research (5pp)
4. Weaknesses in existing capacity and the need for strengthening (5-10pp)

Part II

Developing Research Organization Objectives and Policies (20pp)

5. National policies affecting FFP research organizations and their work (10 pp)
 - national science and technology policies; political support for research;
 - impacts of non-forestry related policies on forestry research;
 - the nature of national forestry research policies (ideal and real examples);
 - level and type of national coordination for forestry research;
 - location of public forestry research within national and local government;
 - the importance to research organizations of interaction with policy makers;
 - the importance of interaction with client support groups;
 - evaluation of research impacts for policy makers and client support groups;

- policies of international bodies and their influence on national **research**;
- highlights and key issues;

6. Developing internal organizational research objectives and policies (10pp)

- defining what we mean by the terms: objectives, goals, needs, policies;
- identifying and defining client groups and their interests and needs;
- setting research objectives that adequately reflect client interests and **needs**;
- translating objectives into program goals;
- the role of administrators, managers and researchers in setting goals **and policies**;
- strategic, tactical and operational considerations in setting objectives, **goals policies**;

Part III

Planning research programs (55pp)

7. Monitoring and evaluating performance and output (10pp)

- research management as an on-going process
- defining research "performance" and "output";
- monitoring and evaluation (M & E) as a starting point in the planning **process**;
- the purposes of M & E;
- techniques for monitoring performance and output quality and quantity;
- techniques for evaluating research effectiveness and efficiency;

8. Assessing research needs and opportunities (10pp.)

- the purpose and dimensions of a forestry sector needs assessment;
- techniques used in carrying out a forestry sector needs assessments;
- linking forestry sector needs to information needs
- linking forestry sector (client group) information needs to research **needs and opportunities**;
- the roles of administrators, managers, researchers in identifying **opportunities and priorities for research**;

9. Assessing gaps in research capacity required to meet identified needs and opportunities (10 pp)

- defining in practical terms the dimensions of forestry research capacity;
- defining indicators of research "capacity" and measuring capacity;
- linking needs to existing capacity: the issues and methods;
- defining the capacity needed to meet identified research needs;
- comparing existing capacity with that needed to meet identified needs and opportunities;

10. Designing programs to meet the needs and take advantage of opportunities (15 pp)

- identifying means of strengthening capacity;
- designing action programs to meet needs/take advantage of opportunities;
- decision criteria and processes for program formulation;
- the role of different disciplines and specialties;

- adjusting to available resources; dealing with constraints;
- role of the external sector (national and international);

11. Budgeting and financing FFP research organizations and programs (10pp)

- developing budgets to implement programs; top down/bottom up approaches;
- core funding in relation to project funding; recurrent funding needs;
- tied vs. discretionary funding;
- sources and mechanisms for financing forestry research programs;
- role of international financing;

Part IV

Implementing and Managing Research Programs (45-50pp)

12. Administrative services (10-15pp)

- supporting vs. policing functions;
- procurement, contracts and purchasing;
- controlling and accounting for expenditure;
- secretarial services;
- management of facilities and equipment;
(use scheduling, maintenance, engineering services, construction, etc.)

13. Libraries and other internal information, statistical and computing services (10pp)

- role and function of libraries in research;
- options for accessing scientific documentation (journals, books, reprints, etc);
- options for accessing new technology (trade journals, etc.);
- statistical services;
- computing services;

14. Managing researchers: creating the appropriate environment and incentives (10pp)

- the key importance of hiring the right people;
- redirecting and reassigning people; guiding researchers;
- performance appraisal: concepts and methods;
- appropriate research environments;
- the importance of motivation and leadership;
- rewards and incentives used to motivate and guide researchers and technicians;
- career ladders and tenure considerations;
- role of researchers in management and decision-making;

15. Training and education (10pp)

- what is the nature of effective education and training for different personnel;
- determining training needs for different personnel within organizations;
- education and training options, nationally and internationally;
- the importance of continuing education;

16. Networking to increase research effectiveness and efficiency (10pp)

- functions of research networks; examples from forestry;
- types of research networking; twinning as a special case;
- facilitating and encouraging networking;
- coordination and collaboration among networks;
- contacts and collaboration with non-forestry research organizations;
- linkages between forestry researchers and educators/trainers;

Part V

Disseminating and utilizing research results (20pp)

17. Documentation and other forms of dissemination of research results (10pp)

- overview of the dissemination process
- dissemination in relation to information utilization;
- alternative dissemination mechanisms
- written documentation of research results;
- verbal dissemination methods; the role of "people to people" contact;
- the role of the press/mass media;

18. Linkages with extension and other communication channels (10pp)

- what characterizes good extension for applied research;
- the importance of structured linkages between research and extension; the role of technology transfer specialists;
- the role of extension in providing feedback on research applications and needs; the importance of two-way communication (e.g., researchers learning about "best practices" in the field and research needs from extensionists;)
- the extension role of different people in the research organization;

4. CONCLUDING COMMENTS

We view these guidelines as being part of a dynamic process in which the guidelines will be modified and expanded as additional results of actual experience in research management are communicated to the FAO. Thus, the authors would welcome any comments, suggestions, or examples that would help make the guidelines more useful in planning and managing forestry and forest products research.

1. Where possible we will draw on actual forestry and forest products research cases/examples to illustrate points, e.g., in sections dealing with training, research evaluation, needs assessments, etc. We also can draw on our surveys of research organizations in developing countries.

APPENDIX

**PROGRAM FOR THE APRIL 17-19, 1989 MEETING OF IUFRO SUBJECT GROUP S6.06
AT ALICE HOLT LODGE, FARNHAM, SURREY, ENGLAND**

**PEOPLE ATTENDING THE APRIL 17-19, 1989 MEETING OF IUFRO SUBJECT GROUP
S6.06 AT ALICE HOLT LODGE, FARNHAM, SURREY, ENGLAND**

PROGRAM FOR
A MEETING OF IUFRO SUBJECT GROUP S6.06
MANAGEMENT OF FORESTRY RESEARCH
APRIL 17-19, 1989
ALICE HOLT LODGE, FARNHAM, ENGLAND

**THEME: THE MANAGEMENT OF LARGE-SCALE FORESTRY RESEARCH
PROGRAMS AND PROJECTS**

Monday Morning, April 17

WELCOME - Arnold J. Grayson, Director of Research, Forestry Commission, Farnham,
Surrey, England

MEETING OVERVIEW - Dr. Denver P. Burns, Chairman of IUFRO Subject Group
S.6.06, and Director, Northeastern Forest Experiment Station, USDA
Forest Service, Broomall, Pennsylvania, USA,

**EXPANDING FORESTRY RESEARCH FOR DEVELOPING COUNTRIES - THE
WISTON HOUSE CONFERENCE AND BEYOND**

Moderator - Oscar Fugalli, Coordinator, IUFRO Special Programme for
Developing Countries, Wien, Austria

- * Report on the Wiston House Conference -
George D. Holmes, Chairman, Special Task Force on Forestry Research
in Developing Countries, Edinburgh, Scotland
- * Challenges and opportunities for expanding forestry research in Africa.
Dr. Dominic E. Iyamabo, Research Coordinator, IUFRO Special Program
for Africa, ICRAF, Nairobi, Kenya
- * Challenges and opportunities for developing countries in Asia.
Cheah Leong Chew, Head, Research Planning and Evaluation, Forest
Research Institute Malaysia, Kuala Lumpur, Malaysia
- * Expanding forestry research for developing countries: changes and opportunities
for Latin America.
Ronnie de Camino, Head, Forestry & Agroforestry Area, Centro
Agronomico Tropical de Investigacion y Ensenanza (CATIE) Turrialba,
Costa Rica

Monday Afternoon, April 17

FIELD TRIP

Tuesday Morning, April 18

MANAGING LARGE RESEARCH ORGANIZATIONS AND BROAD RESEARCH PROGRAMS - CHALLENGES AND OPPORTUNITIES

Moderator - Mr. A.D. Kiil, Deputy Leader, IUFRO S6.06, and Regional Director General, Northwest Region, Northern Forestry Center, Forestry Canada, Edmonton, Alberta, Canada

- * Management of forestry research on the national level in Switzerland: experiences from changing times 1979-1988.
Dr. Fritz Hans Schwarzenbach, Swiss Federal Institute of Forestry Research, Birmensdorf, Switzerland
- * Forestry research in Honduras: experiences and future expectations.
Dr. Ruben Guevara-Moncada, Director, Escuela Nacional de Ciencias Forestales, Siguatepeque, Honduras
- * Training and education for management of R&D activities.
Dr. Robert Callaham, Consultant on Research Management, Orinda, California, USA
- * Research needs, assessment, and evaluation: identifying emerging issues as a key to forestry research planning.
Pamela A. Jakes, Project Leader, North Central Forest Experiment Station, USDA Forest Service, and Dr. Hans M. Gregersen, Professor and Dr. Allen L. Lundgren, Adjunct Professor, Department of Forest Resources, University of Minnesota, St. Paul, Minnesota, USA

Tuesday Afternoon, April 18

MANAGING LARGE RESEARCH PROJECTS - LESSONS LEARNED

Moderator - Dr. Hans M. Gregersen, Professor, Department of Forestry,
University of Minnesota, St. Paul, Minnesota, USA

- * Managing large research projects in developing countries -
M. Hosny El-Lakany, Professor of Forestry and Associate Director,
Desert Development Center, American University of Cairo, Egypt
- * Managing multinational research projects to solve problems in developing
countries.
El Hadji Sene, Arid Zone Forestry Officer, Forest Resources Division,
FAO, Rome, Italy
- * Researcher incentives in public forestry institutions.
Dr. David N. Bengston, Resource Economist, North Central Forest
Experiment Station, USDA Forest Service, St. Paul, Minnesota, USA

STRATEGIC PLANNING IN FORESTRY RESEARCH ORGANIZATIONS

Moderator - Dr. Allen Lundgren, Adjunct Professor, Department of Forestry,
University of Minnesota, St. Paul, USA

- * Program review and strategic planning for the Newfoundland Forestry Centre,
Forestry Canada.
Dr. Grant R. Milne, Chief, Policy, Planning and Economics Branch,
Newfoundland Forestry Centre, St. John's, Newfoundland, Canada
- * Corporate planning in a user-pays environment at the Forest Research Institute,
New Zealand.
Dr. Margriet J. Theron, Planning Manager, Forest Research Institute,
Ministry of Forestry, Rotorua, New Zealand

Wednesday Morning, April 19

MANAGING RESEARCH NETWORKS - PITFALLS AND OPPORTUNITIES

Moderator - Dr. Hans M. Gregersen, Professor, Department of Forest Resources, University of Minnesota, St. Paul, Minnesota, USA

- * The new Forest Service International Forest Products Program: experience to date -
Dr. Gary R. Lindell, Program Manager, International Forest Products RD&A Program, USDA Forest Service, Madison, Wisconsin, USA
- * Options for forestry research networking.
Dr. Jeffery Burley, Director, Oxford Forestry Institute, University of Oxford, Oxford, England
- * Managing MPTS research networks in Asia.
Kenneth G. MacDicken, Team Leader/MPTS Network Specialist, Winrock International, F/FRED Coordinating Unit, Faculty of Forestry, Kasetsart University, Bangkok, Thailand
- * Hawaii's experience with network trials of nitrogen fixing trees.
Dr. James L. Brewbaker, Professor of Horticulture and Genetics, University of Hawaii, and President, Nitrogen Fixing Tree Association, and Bill Macklin, Research Associate, NFTA, Waimanalo, Hawaii, USA

Wednesday Afternoon, April 19

DEVELOPING GUIDELINES FOR THE MANAGEMENT OF FORESTRY RESEARCH PROGRAMS AND PROJECTS

- * Forestry and forest products research: FAO's forthcoming planning and management guidelines.
Dr. H. Gregersen, Professor, and A. Lundgren, Adjunct Professor, Department of Forest Resources, University of Minnesota; Dr. D. Bengston, Resource Economist, North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minnesota, USA, and H. Hilmi, Chief, Institutions Branch, Forestry Department, FAO, Rome, Italy

WRAP-UP DISCUSSION ON THE MANAGEMENT OF FORESTRY RESEARCH: CRITICAL ISSUES FOR THE FUTURE AND FOR IUFRO SUBJECT GROUP S.6.06.

Moderator - Dr. Denver Burns, Chairman of IUFRO S.6.06, and Director, Northeastern Forest Experiment Station, USDA Forest Service, Broomall, Pennsylvania, USA

PEOPLE ATTENDING THE APRIL 17-19, 1989 MEETING OF IUFRO SUBJECT GROUP
S6.06 AT ALICE HOLT LODGE, FARNHAM, SURREY, ENGLAND,

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Broomall, Pennsylvania U.S.A.

Dr. Robert Z. Callaham, Consultant on Research Management, Orinda, California U.S.A.

Ronnie de Camino, Coordinator, Regional Tree Crops Production Project, Centro Agronomico
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Mr. F. J. Kruger, Director, South African Forestry Research Institute, Pretoria, SOUTH
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John Palmer, Director for Tropical Forestry, Tropical Forestry & Computing Ltd., Oxford England, UNITED KINGDOM

Dr. F.C. Pollett, Director General, Science, Forestry Canada, Ottawa, Ontario, CANADA

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Lundgren, Allen L., ed. 1989. **The management of large-scale forestry research programs and projects.** Proceedings of a meeting of IUFRO subject group S6.06, management of forestry research; 1989 April 17-19; Alice Holt Lodge, Farnham, England. Gen. Tech. Rep. NE-130. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 236 p.

Documents the efforts of the International Union of Forestry Research Organization's (IUFRO) working group S6.06--The Management of Forestry Research--to learn about the issues associated with research management of large and complex international research programs.