Planning and Managing Forestry Research
Volume I

A Guide to the Course

Module 1
Forestry Research Planning and Management: An Introduction
The initial version of this self-learning course was developed by Dr. Allen L. Lundgren, Mr. Scott J. Josiah, Dr. Hans M. Gregersen, and Dr. David N. Bengston at the University of Minnesota, College of Natural Resources, Department of Forest Resources, in collaboration with the International Union of Forestry Research Organizations (IUFRO), Special Programme for Developing Countries (SPDC), and with the advice and assistance of experienced forestry research managers around the world (see the course guide for more detail on the course development).

The course is available from:
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PLANNING AND MANAGING FORESTRY RESEARCH: A SELF-LEARNING COURSE

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Planning and Managing Forestry Research
A Self-learning Course

Module 1
Forestry Research Planning and Management: An Introduction

International Union of Forestry Research Organizations
Special Programme for Developing Countries
Vienna, Austria
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This module provides a background that will help the reader better understand the modules that follow. It begins by reviewing the distinctions between scientific research and technology, and describing the important role that forestry research plays in the technological innovation process through which development occurs. It then explores the diversity of existing forestry research systems, at both the national and international level. It provides an overview of the research planning and management process that will be described in more detail in the following modules. Finally, it highlights some of the important skills and capabilities that managers of forestry research must possess if they are to successfully carry out the responsibilities of their job.
Skill & Knowledge Assessment

Module 1 - Forestry Research Planning and Management: An Introduction

If you would like to find out how much you improve your skills and knowledge by studying this module, we suggest that you complete this exercise before beginning the module. This will establish your current level of skill and knowledge about the topics covered in this module. At the end of the module there is an identical skill and knowledge assessment form which you can complete once you have finished the module. By completing and comparing the before and after assessments, you can determine the extent to which you have improved your skills and knowledge.

Below are listed a number of skill and knowledge statements derived from the objectives of the study units in module 1. These are identical to those listed for this module in Study Unit 0.3 - Self-assessment of Training Needs, which you may have completed to guide your course of study. Please read each statement carefully and indicate with a checkmark the level that best describes your current skill or knowledge, from 1 to 5.

1. I cannot perform this skill, or I have not been exposed to the information.
2. I cannot perform this skill, but have observed the skill or have been exposed to the information.
3. I can perform the skill or express the knowledge with assistance from others.
4. I can perform the skill or express the knowledge without assistance from others.
5. I can perform the skill or express the knowledge well enough to instruct others.

<table>
<thead>
<tr>
<th>Skill or Knowledge Statement</th>
<th>Your Level of Skill or Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Outline the process of technological innovation in forestry research.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>b) Identify the ways in which your forestry research programs are likely to affect economic,</td>
<td></td>
</tr>
<tr>
<td>social, and cultural institutions in society.</td>
<td></td>
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<tr>
<td>c) Identify types of organizations conducting forestry research related to your research</td>
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<td>mission.</td>
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<tr>
<td>d) Compare research programs of your organization with those of other organizations conducting forestry research.</td>
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<tr>
<td>e) Identify potential cooperators and collaborators for your research programs.</td>
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<tr>
<td>f) Describe the differences between strategic, operational, and annual planning.</td>
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<tr>
<td>g) Distinguish between organizational mission, goals, and objectives.</td>
<td></td>
</tr>
<tr>
<td>h) Describe the major responsibilities of research management.</td>
<td></td>
</tr>
<tr>
<td>i) Identify some of the skills, personal characteristics, and attitudes needed for successful research management.</td>
<td></td>
</tr>
</tbody>
</table>
Objectives

When you have read this study unit and completed the exercises you should be better able to:

• outline the process of technological innovation in forestry;
• describe the role of forestry research in technological innovation related to forestry; and
• identify the ways in which your forestry research programs are likely to affect economic, social, and cultural institutions in society.

Scientific Research and the Innovation Process

Since you already are actively involved with forestry research, chances are you are well trained in the basic principles of scientific research. But how long has it been since you've reviewed these principles that underlie much of your professional research activity? We think it is important to revisit and review the fundamentals that guide our research activities, because they affect the way in which we manage forestry research. That is the reason for this study unit.

The development and use of new technologies has had a major impact on our lives, and on the natural world around us. Scientific research plays an important role in the development of new technologies. Forestry research is an applied field of science that seeks to develop new understanding and new technologies related to the management and use of forests and related resources. Its goal is to improve the ways in which we manage and use forest and related resources to meet current and future needs of expanding populations, and improve their standard of living, while protecting the forest resource and the environment.

Too often, those of us in forestry research have assumed that by planning and conducting research projects, and analyzing and publishing the results, we have contributed to the technological innovations desired by society. However, if we wish to develop new information and technologies that can be and will be adopted and used by people to change the ways in which they manage and use forest resources, we must recognize the key, but limited, role of scientific research in technological innovation. We also must recognize the other factors that influence the ultimate adoption of new technologies by the intended users. By better understanding the process by which technological innovations take place, research managers can plan and implement research programs that are more likely to result in useful and effective technological innovations, that is, technologies that are adopted and used by the people for whom they are intended.
Scientific Research

Science is a body of systematized knowledge about the natural world and the human world that is obtained and tested through scientific research. Scientific research is a systematic search for new knowledge, where any new knowledge obtained is continuously tested against both prior knowledge and the real world. Knowledge that survives and is not refuted by critical testing is considered to be scientific knowledge.

In general, the formal approach to developing new scientific knowledge includes:

1. recognizing and carefully defining a problem;
2. formulating testable hypotheses based on what we already know and understand about the problem;
3. testing hypotheses by conducting experiments, making observations, and collecting and analyzing the data to compare predicted and observed results; and
4. reporting the documented results in the scientific literature, through a process of peer review and approval.

This process of scientific research is evolutionary. New knowledge is slowly added to the foundations of previously accumulated knowledge. It may change our interpretation of prior knowledge, or modify or disprove previous knowledge. In this way, scientific research has developed an enormous body of knowledge about the natural and human world. The slow and patient buildup of scientific knowledge about the world during the past three centuries has been one of the outstanding achievements of the human race. It has been a truly cooperative worldwide effort, tying together people from diverse cultures and societies around the world to reach a common goal of improving human knowledge.

Much of this scientific knowledge has accumulated from the work of thousands of individual scientists, loosely organized into groups of disciplines and subdisciplines, based primarily on their own particular training and work experience. This organization of scientific knowledge around rather narrowly focused disciplines is a distinctive characteristic of modern science.

Scientific education is usually focused on scientific disciplines. For example, colleges or universities are often organized around specific disciplines, with separate departments of physics, chemistry, astronomy, geology, botany, ecology, economics, sociology, etc. Potential scientists seek degrees in these or similar areas of scientific study. The literature of science also is organized along scientific disciplines, with books and journals devoted to
physics, chemistry, geology, ecology, for example. Scientific societies are likewise organized around scientific disciplines, as are many of the meetings, symposia, and conferences they organize. In short, science tends to focus on the development of knowledge within specific, rather narrowly defined, scientific specialties.

Each scientific discipline has its own traditions as to appropriate topics for research and its own peer-approved research methods, which strongly influence the direction of scientific research within that discipline. Problems requiring scientific research tend to arise within disciplines. Scientists who seek the approval of their peers (that is, the approval of other scientists within their discipline), are driven to tackle problems important to science (which are not necessarily of immediate importance to society), and to publish their scientific contributions in peer-reviewed journals. Scientists in forestry research are not immune to this influence, and naturally tend to be influenced, at least to some extent, by problem priorities set by their particular scientific discipline. As we shall see, this presents problems for the manager of forestry research.

The division of science into a multitude of distinct branches reflects the analytical approach that has served science so well in developing knowledge. When you encounter a problem you reduce it into relatively simple pieces for study from a particular point of view, with the expectation that once you understand all of the details of the problem from the various points of view, you will be able to assemble all of the individual pieces of knowledge to solve the problem. Although this approach has led to major advances of our understanding in particular fields of knowledge, it has been less successful in improving our understanding of real-world problems. The difficulty is, as Russell Ackoff (1973) has pointed out, “Nature is not organized the way our knowledge of it is.”

The problems we must solve in the real world often go far beyond the bounds of one particular discipline. There is a growing recognition that although research along disciplinary lines can solve some kinds of problems effectively, it is less effective in solving complex real-world problems that involve the interactions of humans and the natural systems of the world. Increasingly we recognize that if we are to develop effective solutions to many of our critical problems involving the use of natural resource systems, some form of multidisciplinary and interdisciplinary research will be needed to develop improved technologies and more comprehensive information that can be and will be applied in the real world.
Although research studies in forestry can and often do contribute to our scientific understanding, forestry research is primarily an applied science. It uses the results of more basic science to develop new technologies that can be used to change the way in which we do things in the real world around us. Forestry research seeks to develop new technologies that can be used to assist in economic development programs designed to improve human well-being, while protecting the natural resource base and the environment. However, this presents the manager of forestry research with some particular problems that arise from the conflicts between the goals of science and the goals of technologies.

There is an important distinction between the goal of science and the goal of technology. In short:

- The fundamental goal of science is to know or to understand, to improve our knowledge or understanding of the natural and human world around us.
- The goal of technology is to do, to improve our ability to utilize and manipulate the world around us.

Just as there has been an explosion of scientific information and knowledge during this century, there also has been a parallel explosion in the development of new technologies, based in large part (but not entirely) on scientific research. These new technologies have transformed human societies and have had a major impact on the natural world. Increasingly, during this century, scientific knowledge has been the catalyst in the development of technologies that have given people capabilities and opportunities for manipulating and controlling their environment that were undreamed of a century ago. The challenge to the manager of forestry research is to formulate and implement a research program that will lead to development of technologies that, upon application, will improve how forest and related natural resources are managed for production and protection.

In order to plan and implement research programs that will be effective in achieving the desired goals of society, the research manager should understand the process by which technological innovations occur, and the particular role that forestry research plays in that process.

**Role Of Research In Technological Innovation**

A common goal of forestry research organizations is to contribute to the sustainable development of a nation, region, or local communities. Development usually implies changing the ways things are done in society to better meet expanding needs and raise the living standards of people. This requires the development,
dissemination, and adoption of new technologies by various segments of society, a process called technological innovation. If forestry research is to produce results that will contribute to development, then it must insure that the results it produces can be used by potential users, will be adopted by them and, if adopted, actually will contribute to development.

Research has an important role to play in the development of new technologies, but it is not the sole source of new technologies, and is only part of the overall technological innovation process. As Burley et al. (1989) have pointed out, forestry research “... forms a part of the long-term continuum of development from basic research, through applied research to development of technologies, and on to their extension and application.” An understanding of the potential contributions and limitations of forestry research in the innovation process should help forestry research managers develop research programs that will contribute more effectively to development.

Technological innovation in forestry is undertaken to improve the management of forest and related resources, and to improve the production, distribution, and utilization of the goods and services obtained from these resources. The technological innovation process in forestry (see figure 1.1.1) can be described in terms of five key components (adapted from Lundgren 1989):

**Research.** Formal and informal forestry and nonforestry research produce knowledge, information, and other outputs (e.g., improved genetic materials) that may be used for further research, or that may contribute to the development of new technologies in forestry. For example, a report on “Virulence of Agrobacterium on Larix decidua and their cellular interactions as depicted by scanning electron microscopy,” published in the *Journal of Experimental Botany,* is likely to be primarily of interest to and read by other researchers. On the other hand, the announcement, circulated to field foresters, of the development, successful testing, and availability of a new disease-resistant variety of a desirable tree species, could lead to the widespread adoption and use of that variety in practice.

New knowledge can be produced by empirical experience and by the interaction of formal and informal research activities. For example, a farmer may notice that vegetable crops mulched with neem (Azadirachta indica) have fewer pest problems, and make a few trials to check on this observation. Brought to the attention of a research scientist, formal research confirms this observation. Continued research isolates the insecticidal compound (azadirachtin) and leads to the development of natural commercial pesticides based on the neem tree.
Figure 1.1.1. The process of technological innovation in forestry.
Development of New Technologies. Individuals working in forestry and related activities use research results, technologies from other nonforestry sources, and rely upon experience gained in actual practice to improve current or develop new technologies that will improve resource management or the production, distribution, or utilization of the goods and services derived from forests. Thus, the development and testing of a new disease-resistant variety of a tree species provides the basis for a potential new technology that may change the way in which such trees are managed and used. New technologies produced from outside the forestry sector (e.g., computers, field and laboratory equipment) are also adapted for use in forestry activities. All of these activities result in the development of new and modified forestry technologies that have the potential for changing the way things are done in forestry. These new technologies may, in turn, lead to the further development and modifications of existing technologies.

Technological Innovation. It is not enough to develop new technologies that could be utilized in forestry. In order for technological innovation to truly occur, technologies must be disseminated to potential users for their adoption, adaptation to local conditions, and utilization. When users adopt new technologies, one can expect improved effectiveness and efficiency in forestry activities, and changes in the way things are done in the forestry sector. Further, technological innovations evolve as newly disseminated technologies are continually adapted by users to local conditions. For example, the adoption and widespread planting of a new variety of tree species could result in improved and more reliable product yields for those who plant that tree.

Changes in the Forestry Sector. The adoption and use of new technologies in forestry (and in other segments of society) will bring about changes in the forestry sector, including: changes in the way in which goods and services are produced, the ways in which these goods and services are distributed to various people in society, and the ways in which these goods and services are consumed and/or used to satisfy the wants and needs of people within that society. The adoption and widespread use of a new variety of tree species may result in the establishment of new tree propagation facilities, new market outlets for that variety of planting stock, and increased production of useful products from the trees once they have matured.

Impacts on Society and the Environment. The various production, distribution, and consumption/use activities of people in society may bring about desired and undesired, expected and unexpected, changes in the economic, social, and cultural
institutions of that society, and have impacts on the environment, including the forest resource itself. The planting of tree stock with higher rates of survival may increase the well-being of those who plant the trees, either through increased sale and/or direct use of the additional products by members of the household. It also may result in expanded tree planting, with unintended positive benefits in terms of increased environmental protection.

The key point to be made here is that the job of the manager of a forestry research organization goes beyond a concern with the production of research results. If the forestry research organization seeks to contribute to sustainable development of the country, then its research managers must take an active role in ensuring that those results are widely disseminated, adapted (if necessary) to local operating conditions, and implemented. To do this well, research managers and scientists must be well informed about the needs of potential users of research results, the operational conditions under which the results will be used, and the institutions, media, and other means that are available to transfer research results to their ultimate users. They also should be aware of the potential economic, social, and environmental impacts (both positive and negative) that are likely to result from the adoption and use of the research results.
As a review of the basic approach to scientific inquiry, describe the formal steps scientists and researchers used to develop new scientific knowledge.
Scientific research systematically searches, tests, and accepts or rejects new knowledge. The formal approach to developing new scientific knowledge includes:

1. recognizing and carefully defining the problem;
2. formulating testable hypotheses based on what we already know and understand about the problem;
3. testing hypotheses by conducting experiments, making observations, and collecting and analyzing data; and
4. reporting the documented results in the scientific literature, through a process of peer review and approval.

We know that you've been exposed to these concepts during your scientific training, and more than likely have incorporated them into your approach to scientific research. We just thought this was a good time to briefly review the subject!
Russel Ackoff has stated that “Nature is not organized the way our knowledge of it is.” What did he mean by this statement? Describe how the message implied in this statement affects forestry research, particularly future research activities.

Activity 3

How do the goals of science and the goals of technology differ? How do these differing goals affect natural resource research and technological innovation?
Science and scientific inquiry has tended to cluster into distinct branches or disciplines, reflecting the analytical approach to the development of knowledge. While successfully leading to major advances in particular fields of knowledge, it only allows a greater understanding of parts of a problem. A broader, more integrated view of complex, real-world problems where natural resources and humans interact is much more difficult to attain using the discipline approach, since the problem often goes far beyond the bounds of a particular discipline.

Thus, in the past, conducting scientific inquiry within the confines of a discipline successfully solved many problems particular to that discipline. However, in today's increasingly complex and integrated world, interdisciplinary or multidisciplinary research will be required to solve real world natural resource problems. We suspect that this comes as no surprise if your organization has been working on problems involving natural resource-human interaction problems.

The fundamental goal of science is to know or to understand, to improve our knowledge or understanding of the natural and human world around us. Importantly, the goal of technology is to do, to improve our ability to utilize and manipulate the world around us.

Science and technology are thus intricately intertwined, with tremendous technological advances being based on acquired knowledge and information. The challenge to you as research manager is to formulate and implement a research program that will acquire new scientific knowledge that will lead to the development of technologies that can be and will be applied in practice to change the way in which natural resources are managed and used so as to achieve both the goals of production and protection. To do this you need to understand the process by which innovation occurs, and what role natural resources research plays in that process.
The technological innovation process involves much more than just research. Briefly describe how forestry research combined with user interaction generates technological innovations and stimulates change in the forestry sector and society. In your description, sketch out the steps or phases in the technological innovation process.

As a research manager, what can you do through forestry research to support the development of technological innovations which may ultimately contribute to the overall economic and social development of your country?
Technological innovation is a process involving, of course, research. New technologies are then developed, based on this newly acquired information, or a resynthesis, recombination, or adaptation of previously acquired knowledge. If technological innovation is to occur, the new technologies must be disseminated to potential users, and adopted and used by them. As these technologies are adopted and used in society, they induce changes in the management and use of forests that stimulate further development of new technologies. Lastly, the impacts of these new technologies on society may have desired or undesired, expected or unexpected, changes in the economic, social, and cultural institutions.

Thus, aspects of the technological innovation process important to natural resources research management are:

- forestry research;
- development of new technologies;
- dissemination and utilization of new technologies;
- induced changes in the forestry sector; and
- impacts of new technologies on society and the environment.

While this is a rather broad question, the response we had in mind was that a manager of research must be aware of, and perhaps take an active role in stimulating the use of research results in the development, dissemination, adoption, and utilization of new technologies. In order to effectively facilitate technological innovation, managers of forestry research need to be well connected to users to ensure that adaptations or modifications by users of disseminated technologies are recognized by the research organization and utilized to further improve these technologies via additional research. As manager, you'll also need to be aware of just how the technologies that are produced and adopted will affect society, the environment, and overall national development.
Scientific research plays an essential role in the development of new technologies. Forestry research in particular is an applied field of science that seeks to develop new understanding and new technologies that will improve the ways in which we manage and use forest and related resources to meet current and future needs of expanding populations, and improve their standard of living, while protecting the resource and environmental integrity.

As managers of forestry research, we must improve our understanding of the role of scientific research in the process of technological innovation, and recognize other factors that influence adoption of new technologies. By better understanding the technological innovation process, research managers can plan and implement research programs that are more likely to result in useful and effective technological innovations, that is, technologies that are adopted and used by the people for whom they are intended.

In this unit, we attempted to outline the process of technological innovation in forestry, to describe the role of forestry research in technological innovation related to forestry, and to identify ways in which your forestry research programs are likely to affect economic, social, and cultural institutions in society. If you would like more information about technological innovation in forestry, we encourage you to obtain and review the interesting articles identified in the literature cited and other references listed at the end of the module. Two key articles directly related to the topics covered in the module, and cited in the text, are reprinted for your use in the section on readings at the end of the module.
Objectives

When you have read this study unit and completed the exercises you should be better able to:

- identify types of organizations conducting forestry research related to your research mission;
- compare research programs of your organization with those of other organizations conducting forestry research; and
- identify potential cooperators and collaborators for your research programs.
Objectives
When you have read this study unit and completed the exercises you should be better able to:
- identify types of organizations conducting forestry research related to your research mission;
- compare research programs of your organization with those of other organizations conducting forestry research; and
- identify potential cooperators and collaborators for your research programs.

Diversity of Organizations Conducting Forestry Research

Forestry research organizations today are faced with complex natural resources problems that are international in scope, and that require interdisciplinary approaches if sound, long-term solutions are to be generated. Research for today's problems is often beyond the capacity of any one forestry research organization to fully support. Thus, interdisciplinary, collaborative, and sometimes international forestry-related research is essential.

This study unit is designed to help you learn more about the existing forestry research system, the types of organizations conducting forestry-related research (perhaps you'll be surprised that they're not all forestry research organizations!), and the general types of research they conduct. Then, as part of the self-assessment activities, you'll have the opportunity to review the various research organizations in your own country to identify opportunities for improved collaboration and interdisciplinary research.

The Scope of Forestry Research
Science today is international in scope, and interdisciplinary. As a manager of a forestry research organization, you should be aware of the general extent of forestry research within your own country and in other countries throughout the world. By knowing which organizations are conducting research related to forestry, you are in a better position to initiate contacts to explore potential cooperation and collaboration with them as a means of strengthening your own research program. Donor agencies and forestry research organizations in many parts of the world are in agreement on the need to develop and strengthen networks linking forestry research organizations and scientists, and to increase coordination between forestry and nonforestry research organizations (e.g., Lundgren, Hamilton, and Vergara 1986).
Each country, of course, faces a unique situation with regard to specific organizations and types of forestry-related research being conducted. We cannot explore these in any detail here. What we can do is briefly review the general status of forestry research organizations around the world, and indicate the types of organizations that do conduct research related to forestry in many countries. The task of identifying the specific units of the forestry research system that are relevant to your own forestry research organization and its research program must be left entirely to you.

Many different types of organizations are involved in forestry research in developing countries. Most countries have some form of national forestry research program carried out by different kinds of organizations. These forestry research organizations may range from semi-autonomous research institutes, to research branches of forest land management agencies, to a single part-time research officer within a forestry land management agency, depending upon the size of the country, the extent and importance of its forest resources, and its financial resources. There also are formal programs of research carried out by forestry departments within universities, by private forest products industries, and others.

However, regardless of what type of formal forestry research organizations may exist within a country, it is important to recognize that a considerable amount of research directly related to forestry often takes place outside of these forestry research organizations. National research institutes, universities, regional research groups, international research organizations, nongovernmental organizations, industries, and various other organizations conduct formal and informal research studies related to forestry as an ongoing part of their programs. Forestry research managers should recognize that having nonforestry research organizations working on forestry-related problems provides some flexibility in expanding research programs. That is, one can look beyond forestry research organizations for competent and experienced researchers to work on various specialized forestry problems.

**Number of forestry research organizations by regions**

The Food and Agriculture Organization of the United Nations (FAO 1986) has developed a list of 538 organizations in developing countries that work on research related to forestry and forest products (table 1.2.1). The largest number of organizations is in Latin America and the smallest in Africa. As was suggested above, the actual number of organizations working on some aspect
of forestry R&D is much larger than 538. It should be emphasized that a majority of the 538 organizations listed by FAO are of small size. Some have only one or two persons—sometimes not even trained scientists—working on tropical forestry research problems. Even with 538 organizations, the research effort is quite small on a global basis. In general, there is a low level of support for individual scientists and generally low levels of research intensity compared with research intensities for agriculture.

Of the 85 organizations that provided information to the Bellagio II International Task Force on Forestry Research (ITFFR), 27 percent said there were two or less organizations of all types in their countries working on forestry-related research; 58 percent said that there were fewer than five; and three-quarters of the respondents said that they had ten or less (ITFFR 1988).

Table 1.2.1. Numbers of forestry and forest products research institutions, by major ecological regions, and major geographic regions, in developing countries.

<table>
<thead>
<tr>
<th>Major Ecological Regions</th>
<th>Africa</th>
<th>Asia and Pacific</th>
<th>Latin America and Caribbean</th>
<th>Near East</th>
<th>Total, Four Geographic Regions</th>
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<td>Total All</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compendium</td>
<td>59</td>
<td>58</td>
<td>108</td>
<td>13</td>
<td>238</td>
</tr>
<tr>
<td>Total</td>
<td>76</td>
<td>192</td>
<td>244</td>
<td>26</td>
<td>538</td>
</tr>
</tbody>
</table>

Source: FAO 1987b.

* "Compendium" refers to those listed in FAO Forestry Paper 71, whereas "Total" refers to the numbers in FAO’s master list. (Only 44 percent responded to the Compendium questionnaire.)

Types of forestry research organizations

Based on responses to this same FAO questionnaire returned by 238 organizations (44 percent of the 538 organizations on FAO’s master list of research organizations), national/provincial public research bodies (107) make up almost half of the total (table 1.2.2). The next largest category consists of universities (67).
Again, it should be pointed out that the FAO questionnaire was sent out only to organizations identified in the "formal" forestry and forest products research system.

Table 1.2.2. Numbers of research institutions on forestry and forest products, by type and by major geographic region in developing countries (238 institutions listed in the FAO Compendium).

<table>
<thead>
<tr>
<th>Type of Institution</th>
<th>Africa</th>
<th>Asia and Pacific</th>
<th>Latin America and Caribbean</th>
<th>Near East</th>
<th>Total, Four Geographic Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>10</td>
<td>15</td>
<td>40</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Forestry Service Branch</td>
<td>12</td>
<td>16</td>
<td>7</td>
<td>2</td>
<td>37</td>
</tr>
<tr>
<td>National/provincial research bodies</td>
<td>26</td>
<td>26</td>
<td>48</td>
<td>7</td>
<td>107</td>
</tr>
<tr>
<td>Agricultural research institutes</td>
<td>6</td>
<td>—</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Private bodies/development projects</td>
<td>5</td>
<td>1</td>
<td>12</td>
<td>—</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>58</td>
<td>108</td>
<td>13</td>
<td>238</td>
</tr>
</tbody>
</table>

Source: FAO 1987b.

Types of forestry research undertaken

Of the organizations sampled by FAO, a majority (148) engage only in forestry research, while 28 organizations engage only in forest products research, and 46 engage in a mixture of forestry and forest products research (table 1.2.3). The latter two categories are significant since a number of the potential early breakthroughs in research are in the utilization/products field, including utilization of nonwood forest products. Detailed discussion of types of research being carried out by different organizations is available elsewhere (cf. FAO 1987a,b; World Bank 1981).
Table 1.2.3. Numbers of institutions engaging in pure forestry research, pure forest products research, and in both types of research for the major geographical regions in the developing countries (the 238 institutions listed in the FAO Compendium).

<table>
<thead>
<tr>
<th>Main Field of Research</th>
<th>Africa</th>
<th>Asia and Pacific</th>
<th>Latin America and Caribbean</th>
<th>Near East</th>
<th>Total, Four Geographic Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure forestry research</td>
<td>35</td>
<td>36</td>
<td>67</td>
<td>10</td>
<td>148</td>
</tr>
<tr>
<td>Pure forest products research</td>
<td>5</td>
<td>11</td>
<td>12</td>
<td>—</td>
<td>28</td>
</tr>
<tr>
<td>Mixture</td>
<td>15</td>
<td>9</td>
<td>20</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>58</td>
<td>108</td>
<td>13</td>
<td>238</td>
</tr>
</tbody>
</table>

Source: FAO 1987b.

It should be mentioned here that research on domesticated forest tree crops producing nonwood products, such as rubber, coconuts, and oil, is quite intensive in some countries. For example, there are 11 national rubber research institutes and a number of research stations maintained by the private sector.

**Nonforestry research organizations doing tropical forestry research**

As mentioned previously, a considerable amount of forestry research is done by nonforestry research organizations. For example, a majority of scientists working on such topics as nitrogen fixing trees were found to be associated with non forestry research organizations in one survey (Bengston et al. 1988). In a study of scientists in Asia working on agroforestry research, it was found that some 160 nonforestry organizations in 27 countries report on agroforestry research (Polson and Lundgren 1987). These included: various agricultural research institutes; many different university departments, including agronomy, animal nutrition, biology, botany, plant sciences, and soil science, among others; and several governmental organizations. A report for Africa also indicates many nonforestry research institutions are involved in various types of forestry research (FAO 1987a).

In some cases, key issue areas have not been researched by any organization. For example, watershed management research has been ignored in many countries because it is not considered to be either a part of traditional agricultural research, or of traditional forestry and natural resources research. Some serious thought needs to be given to the problem of ensuring that important issues in forestry are adequately represented in forestry and other research institutions.
In the international arena a number of organizations support and/or conduct research programs and other activities related to forestry. One is the Food and Agriculture Organization of the United Nations (FAO). Another is the Center for International Forestry Research (CIFOR) that was recently established within the structure of the Consultative Group on International Agricultural Research (CGIAR), with a worldwide mission to fund and conduct forestry research. Another CGIAR center, the International Center for Research on Agroforestry (ICRAF), directly addresses agroforestry issues and conducts research on agroforestry. A number of other international organizations fund and do research related to agroforestry, including: Centro Internacional de Agricultura Tropical (CIAT), the International Board for Soil Research and Management (IBSRAM), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Institute of Tropical Agriculture (IITA), among others. Regional organizations such as CATIE (Centro Agronómico Tropical de Investigación y Enseñanza), and a number of international conservation organizations such as the United Nations Environment Programme (UNEP), United Nations Educational, Scientific, and Cultural Organization/Man And the Biosphere program (UNESCO/MAB), the International Union for Conservation of Nature and Natural Resources (IUCN), the World Wildlife Fund, The Nature Conservancy, and others conduct and/or fund research activities related to forestry. The common theme linking these types of organizations to forestry research is land/soil use.

**Increasing Need for Collaboration**

Increasingly, a considerable amount of research directly related to forestry is taking place outside of forestry research organizations, and is being conducted and disseminated by scientists who are outside the more traditional mainstream of forestry research. This is particularly true of issues related to the management and use of natural forests. This has implications regarding new funding sources for forestry research, and new potentials for collaboration and cooperation in research programs with these nonforestry research organizations. Any program to enhance forestry research should recognize the importance of these nonforestry research programs, and seek to develop linkages and cooperative programs to strengthen national forestry research programs.

In many countries forestry research organizations have not established effective communication and collaboration with other institutions conducting research related to forestry. This is true in...
both developed and developing countries. Individual scientists within a forestry research organization often know and communicate with scientists from other organizations and disciplines. They may develop effective working relationships with individual scientists. However, there appears to be little attempt by forestry research organizations themselves to systematically identify and appraise the potential for collaborating with the many institutions that conduct forestry and related research within a country.

Given the increasing need for marshalling a wide range of talents in solving the complex problems facing forestry today, a desirable first step would be to identify potential sources of research collaboration. This could be done by the forestry research organization as part of its strategic planning process. The next step would be to make a preliminary appraisal of opportunities for collaboration in terms of proposed programs of research. This could be followed by discussions with potential collaborators to explore the prospects for collaboration. If collaboration appears to be mutually advantageous, the next step would be to develop appropriate collaborative arrangements, which could be formal or informal, general or specific. Collaborative arrangements for specific research activities could then be developed.

However collaboration is initiated and carried out, the important point in forestry research planning is to recognize and explore the possibilities for collaboration with other research institutions, both within and outside the country.
Activities

Activity 1

Consider all the different organizations conducting forestry or natural resource research in your country and list them in the space provided below. Be sure to include organizations that are presently conducting forestry-related research but are not normally considered research organizations, for example, nongovernmental organizations, universities, agricultural extension organizations, etc. Be thorough, since your responses to questions 2 to 3 depend on your response to this question!

Once you have listed the organizations, consider the following: What is the main focus and orientation of the research conducted by each of the organizations you listed above? How do the research activities of these other organizations compare with those of your own organization? Do the research agendas of these organizations complement, compete with, or exist completely independent of your own organization’s research activities? Jot down your thoughts in the space below.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Major Focus</th>
<th>Relationship with Your Own Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Complement</td>
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</tbody>
</table>
Comment 1

There are most likely a number of organizations (besides your own) conducting forestry-related research in your country. For instance, many scientists working on biological nitrogen fixation are associated with nonforestry research organizations. Another example would be agricultural extension organizations that often sponsor onfarm research which investigates tree-crop interactions (agroforestry). Nongovernmental organizations may conduct forestry-related research of their own, in order to enable them to better understand their constituents’ available resources, and to enable them to better target their development assistance programs. Foundations, and international and bilateral aid organizations often sponsor natural resources research as well.

We’re sure that if you gave this question much thought, you’ve generated quite a list of organizations conducting forestry-related research in your own country. We also suspect that these organizations have widely differing agenda, missions, and activities. Their purposes for conducting forestry-related research may also be quite different, and their activities may compliment, compete with, or exist independent of your own organization’s research activities. Once you have determined the kinds of relationships your organization has with these other organizations, you can consider improvements to enable greater interorganizational effectiveness.
Considering your responses to the previous question, what are the opportunities for increased collaboration with some of these other organizations presently conducting natural resources research? Are these organizations tapping funding sources which your organization could also utilize? Suggest ways to reduce overlapping or competing research agenda to make your country’s national forestry research system more effective.
Resources to conduct forestry-related research are nearly always in short supply. Most research organizations are searching for ways to maximize the effectiveness of their research funds. One very effective way to make more effective use of scarce resources is to collaborate with other organizations to share resources and information for the mutual benefit of both (and for the ultimate benefit of the beneficiaries of the research!). Competition among organizations and overlapping or duplicative research agenda will result in inefficient use of scarce research resources, and reduced effectiveness in solving forestry-related problems in your country.

Many (if not most) of today’s complex natural resources problems are rooted in a number of traditional disciplines having nothing to do with forestry. For instance, deforestation is a problem caused in part by the demand for agricultural land, population pressure, changes in traditional approaches towards common property allocation and management, official relocation policies, world prices for particular commodities, etc. These require complex research for the generation of sound, long-term solutions, research that is far beyond the capacity for any one forestry oriented research organization to tackle. Thus, interdisciplinary, collaborative research is essential if durable, successful solutions are to be found for these serious problems.

We hope you identified opportunities for increased collaboration and cooperation with other organizations conducting forestry-related research in your country. If you couldn’t think of any, perhaps it was because you needed more information regarding the current research activities and resources of the other organizations. If this is the case, it may be necessary for you to become better acquainted with the current or proposed research activities of these other organizations. Research managers must be well connected to all other research organizations operating in their country, and knowledgeable of their research agenda.
Are you comfortable with the level of communication and interaction between your research organization and these other organizations? If not, in the space below suggest ways that you could improve overall communication and interaction (through both formal and informal means).
A key to achieving a high level of researcher and organizational productivity in natural resources research is through high levels of interorganizational collaboration and communication. One of your many jobs as research manager is to identify opportunities for collaboration with other organizations conducting forestry-related research, and to ensure that these collaborative interdisciplinary research activities are successful. Good communication between participating organizations is absolutely essential if effective collaboration is to be achieved. Some mechanisms to improve interorganizational communication are:

- regular interorganizational meetings;
- periodic “field days” or “open house” to promote your organization’s activities;
- informal and formal collaborative agreements and memoranda of understanding;
- personal visits and phone contact;
- joint projects; and
- social activities.
Science today is interdisciplinary and international in scope. As a manager of a forestry research organization, you should be aware of the general extent of forestry-related research conducted within your own country and in other countries around the world. By being aware of the forestry-related activities of other organizations, you can more effectively foster collaborative, interdisciplinary research efforts that make better use of scarce resources, and more effectively address the natural resource problems your organization is working to resolve.

If you would like more information about the existing forestry research system in the developing world, we encourage you to obtain and review the interesting articles identified in the literature cited and other references listed at the end of the module. Two key articles directly related to the topics covered in the module, and cited in the text, are reprinted for your use in the section on readings at the end of the module.
Objectives

When you have read this study unit and completed the exercises you should be better able to:

- explain why planning is essential for successful implementation of forestry research programs;
- describe the differences between strategic, operational, and annual planning;
- distinguish between organizational mission, goals, and objectives;
- outline some key characteristics of effective research planning; and
- develop a "management by objectives" framework that you can use in managing your organization's forestry research programs and activities.
Objectives

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- outline some key characteristics of effective research planning; and
- develop a "management by objectives" framework that you can use in managing your organization's forestry research programs and activities.

Overview of the Planning and Management Process

Planning is essential in forestry research activities. Research planning should be viewed as an aid to research management, not simply as a formal exercise that must be gone through in order to comply with some administrative directives. Good planning can greatly assist the research manager in identifying and implementing research programs that address critical problems of both science and society, and that are attractive to those who fund and support forestry research.

The focus of this study unit and of the following units that deal with planning is on research planning at the organizational level, rather than with planning of an entire national research system at the national level. Strategic planning and some form of operational planning should also take place at the national or highest policy level, but the intent here is to focus on research planning activities that are most relevant for managers in forestry research organizations.

This study unit will provide a short introduction to the importance of the planning process (which will be covered in greater detail in later modules). Three types of planning will be discussed, including strategic, operational or program, and annual planning. Some key planning terms will be defined, and the characteristics of effective research planning identified. We'll also provide you with an overview of the forestry research management process, including a discussion of one approach to management, that of management-by-objective.

The Importance of Forestry Research Planning

Planning is a vital activity in research, particularly in developing countries, for several reasons. First, planning is especially important where resources are limited and must be used as efficiently as possible to solve high priority problems. Second, planning is more important when much of
the research program is mission-oriented or applied in nature, as opposed to basic research. Gregersen (1984) reports that basic research in forestry research institutions is emphasized less in developing countries than in developed countries. Third, research organizations in the early stages of institutional development, with a significant proportion of relatively inexperienced scientists, often adopt a project-oriented approach to research planning and management rather than a researcher-oriented approach, which is characterized by more autonomy for scientists. This requires careful planning, monitoring, and evaluation (McLean 1988). Fourth, effective planning is related to political support for research. There is a greater likelihood of obtaining funds for research if an organization can demonstrate it is responsive to high-priority forestry and national development goals. Finally, the uncertain and long-term nature of research in general, and of forestry research in particular, suggests the importance of planning.

Many countries have developed, or are in the process of developing, a master plan for forestry that will be consulted by international donors and other funding agencies when making funding decisions. Managers of forestry research should be involved in these master planning efforts to ensure that the role of forestry research in forestry development activities is explicitly recognized in the plans. Where master plans exist, then planning for forestry research should take place within the context of that plan, and wherever possible, should be closely linked to approved plans. Such a plan, formally approved and adopted by a country and by the international donor community, can provide strong justification for supporting forestry research as an integral part of any forestry-based development activity.

**Definition of Key Planning Terms**

A set of definitions for the planning process is necessary so that everyone involved in research planning has a common understanding of the terminology. Terms such as goals and objectives are often used loosely in everyday speech, and clear definitions are important to avoid ambiguity. In this course the following definitions will be used.

**Mission** is the broad statement of purpose that shapes and guides what an organization is, what it does, and why it does it. A mission statement defines the boundaries of the organization's territory (Theron 1989). It should grow out of answers to the following questions: Why are we here? Who are we as an organization? What social needs should we be filling? What is our philosophy and what are our key values? What makes our organization unique?
For example, ICRAF has formulated the following mission statement:

The mission of ICRAF is “To increase the social, economic, and nutritional well-being of peoples of developing countries through the use of research and related activities to integrate woody perennials in farming and related land-use systems in order to increase productivity, profitability, sustainability, diversity of output, and the conservation of natural resources.”

Study unit 2.5 describes the formulation of mission statements in some detail, and provides additional examples of mission statements. A copy of the ICRAF strategic plan is provided as a reading in Module 4.

Goals are broad statements of the intended outcomes of each research program or major activity of the organization; they are the desired impacts on society of the outputs of research (see box 1.3.1 for examples). In order to serve as useful guides to research managers, goals should be well defined and achievable. They should answer the question: “What do we want to achieve in the next few years?”

Box 1.3.1. Stated goals of the Forest Research Institute of Malaysia (FRIM).

“Goals. FRIM shall —
- develop economic and environmentally sound management and conservation systems for natural forests.
- develop economic practices for the establishment and management of forest plantations.
- develop practical and economic agro-forestry practices.
- develop appropriate forestry systems for the rehabilitation of degraded lands.
- develop the economic potential of forest genetic resources.
- develop technologies for optimum recovery of timber and other forest products.
- promote product diversification and value-added manufacturing by developing efficient and economic technologies for: local primary, secondary, and tertiary processing of timber; utilization of other cellulosic resources such as oil-palm stems; and utilization of other forest produce such as rattans, bamboos, resins, essential oils and pharmaceutical materials.
- upgrade professional and technical skills through a continuous programme of staff training and exposure.
- develop and maintain an efficient and comprehensive system for the dissemination of information and reference service.
- provide a full range of consultancy and advisory services.”

Goals of a forestry research organization should relate to broader national development goals. Several categories of goals may be distinguished, including:

**Economic goals**, such as:
- increased productivity of timber production;
- increased foreign exchange earnings through exports of forest products; and
- increased national self-sufficiency in wood products.

**Social goals**, such as:
- increased productive employment in forest-based rural enterprises;
- more equitable distribution of income between sectors, regions, income groups, etc.;
- increased net income to small landowners; and
- increased community stability.

**Environmental goals**, such as:
- protection of endangered species;
- preservation of threatened or fragile ecosystems;
- preservation of biodiversity;
- development of environmentally sustainable forestry practices; and
- maintenance and protection of water quality.

**Scientific goals**, such as:
- increased basic understanding of tropical forest ecosystems; and
- increased basic understanding of wood properties.

Note that goals may sometimes be in conflict with each other. For example, increased self-sufficiency in wood products may conflict with the preservation of biodiversity. One of the main functions of research planning is to develop research goal priorities while explicitly recognizing trade-offs between conflicting goals.

**Objectives** are statements of the specific results which the research organization seeks to accomplish in a relatively short period of time. Objectives are the tangible outputs of research, and they should be stated in terms of specific quantities or targets, and the time and cost needed to achieve them. Each broad goal is supported by one or more specific objectives. For example, under a social goal of “Increased productive employment in forest-based rural enterprises,” research objectives might include:

- development and dissemination of small-scale portable sawmill technology that will result in 2,000 new jobs nationwide when fully adopted in 5 years; and
development of high efficiency wood stove technology and promotion of village-level businesses to produce and distribute these stoves.

Explicit research objectives are necessary to effectively monitor and evaluate research that is aimed directly at application. The progress of a research program or project should be monitored and performance evaluated against a set of well-defined objectives. In order to evaluate the relevance of a research program or project, these objectives must be clearly stated and relate to broader research goals and to national development goals.

In practice, the distinction made here between the terms *objectives* and *goals* often is not followed. For example, the Statements of Research Objectives given in box 1.3.2, could have been termed Statements of Research Goals.

### Three Research Planning Levels

Three distinct types of research planning may be distinguished: strategic, operational or program, and annual. These categories differ in terms of purpose, time frame, level of detail, exactly who is involved in the planning process, and the criteria for priority setting.

**Strategic planning** is concerned with defining the overall direction and purpose of an organization. As such, strategic planning should address the mission and broad goals for the entire research organization and strategies for accomplishing the mission. This is a critical part of research planning that often is neglected, or not given the attention it deserves. The time frame for strategic planning is most often long-term, perhaps 5 to 10 years or more, and is intended to guide the organization into an uncertain future.

Senior research managers typically have the responsibility for strategic planning, but others should be involved in the planning process, including top researchers or team leaders and key stakeholders. Modules 2, 3, and 4 describe strategic research planning in some detail.
Box 1.3.2. Statement of “research objectives” of national forestry research institutes in Africa, as reported at the SADC regional workshop, 21-25 September 1992, Gaborone.

Botswana
"...to achieve development, while utilising the natural resources in a sustainable manner.”

Lesotho
"...to provide technical information, which will increase the benefits provided by trees and shrubs to the Basotho in a sustainable way.”

Malawi
"...to ensure cost effective afforestation, management of natural resources, plantations and woodlots and utilisation of forest resources in order to meet existing and future demands for biomass fuels, sawntimber, environmental protection, non-wood products, and gene conservation.”

Mozambique
"...to produce technologies which contribute towards: (a) management of the country's forest resources in a sustainable manner, (b) conservation and rehabilitation of the forest ecosystems, (c) integration of the forest component in the traditional land use systems, (d) development of biomass production and utilisation technologies, and (e) sustainable commercial and industrial utilisation.”

Namibia
"...to: (a) back-up forestry sector in providing scientific as well as technical information for increased productivity of natural forests, for improved utilisation of forest products, and for planning and policy formulation, (b) enhance sustainable utilisation of wood products, (c) upgrade the role of trees (woody vegetation) in environmental improvement through conservation of soil, water resources and degraded lands, (d) increase the knowledge on natural forests and woodland ecosystems, and thereby improve sustained management and maintain genetic diversity, and (e) strengthening of natural research capacities through training, improved physical facilities and research networks.”

Tanzania
"...to: (a) enhance efficient and environmentally conscious development through sustainable management and utilisation of forest resources, (b) uplift the contribution of forestry to GNP and to earning of foreign currency, (c) build a wealth of knowledge in forestry which can contribute to global forestry development, (d) develop research expertise, facilities and the appropriate environment to respond to the forestry research needs of Tanzania, (e) facilitate rapid adoption, adaptation and diffusion of forestry technologies into Tanzania, (f) develop and propagate viable endogenous forestry into Tanzania.”

Zambia
"...to improve the standard of living of the people of Zambia through increased food production, employment creation, and self-sufficiency in forest products while maintaining a stable environment on which the majority of the people depend for clean water and air.”

Operational or program planning uses the output of strategic planning as an important input. The operational plan provides much more detail on specific goals and objectives that relate to the organization’s mission that have been identified in the strategic plan. Proposed research programs should be clearly defined in terms of the organization’s mission and goals, and the relevance of the proposed program to national development goals. Estimated resource requirements for each program should be given, and individual research projects that fall under each program should be specified to the extent possible. The time frame for program planning is typically three to five years. Program planning is described in more detail in module 6.

Annual planning and budgeting uses the output of strategic and program planning as input to develop a well-defined plan of work for a specific period of time, usually a year. Objectives, resource requirements, and the allocation of resources among programs and projects within programs are very specific at this planning level. An annual research plan outlines what the organization expects to achieve over the next fiscal year and the inputs required (money, person-years, etc.). The annual plan is important in monitoring and evaluating programs and projects (comparing planned and achieved outputs), personnel appraisal, and financial control. Budgeting is an integral part of annual planning. Annual planning and budgeting is described in more detail in modules 6 and 7.

Characteristics of Effective Research Planning
Research planning should be viewed as an aid to research management, not as simply a formal exercise that must be gone through in order to comply with some administrative directives. A good job of planning can greatly assist the research manager in identifying and implementing research programs that address critical problems of both science and society, and that are attractive to those who fund and support forestry research. However, planning requires considerable resources, particularly in terms of the demands it makes on research management, staff, and scientists. Investing large amounts of time and other resources in planning potential research programs or projects, where there is a low probability of obtaining the necessary funding, diverts resources from ongoing research programs and reduces the output of research results. Plans that are never implemented, for whatever reason, can be a real cost to an organization. For planning to be effective, careful consideration needs to be given to striking an appropriate balance between the planning and doing of research.
In carrying out the planning process, several characteristics of effective planning should be kept in mind. To be effective, planning should:

**Address critical problems and issues.** In developing plans for a research organization, particular attention should be given to planning research that attempts to solve some of the critical and important problems facing science and society. It is easy to become distracted by the endless number of minor and relatively unimportant problems that could be solved readily by research. Those who successfully solve a series of minor problems in science or society, often gain approval of their peers. Those who attempt to solve big important problems, but fail or only partially succeed, are not likely to gain peer approval. Important problems are often difficult to solve, with no assurance of success. They often require complex interdisciplinary approaches that are difficult to plan and organize. The necessary research may require special talents and experience that are not readily available. Despite these difficulties, considerable thought should be given to how the research organization can contribute to solving these important problems. In making an attempt to solve these problems the research organization indicates to research policy makers, funders, and users that it is working on problems that are important to them. This is likely to generate more support for any research program that is proposed.

**Incorporate bottom-up input.** Planning should not be overly centralized, and should not rely solely on input from the top levels of management. Personnel at all levels of the organization must be involved in any planning effort to ensure that it is realistic, and addresses goals that may be important at a local level but are not well recognized or fully understood by those in top management positions. It is especially important to get input from those who will be required to implement the plans to make sure that any plans developed can be carried out. This is of particular importance when there are regional and field experiment stations, located at some distance from the headquarters unit, that serve a diverse clientele, and develop their own unit plans. Such regional or unit plans must be consistent with national planning, and with national mandates, objectives, and budgets. However, the reverse is also true, that national plans must be consistent with regional or unit planning. Thus, there must be good communication among all levels of personnel in developing plans at the various levels within a forestry research organization.

**Be user-focused.** In an applied research field such as forestry, research is intended to help solve problems in the management or use of forests and related natural resources. Much of the research proposed in a forestry research organization should be focused on
the problems of clearly identified user groups, such as forest managers, farmers, forest industry, forest users, or others. If such research is to be effective, it must provide outputs that can be readily adopted for use in practice. To produce such results, those who plan research must clearly understand and define the actual research needs of the various user groups they seek to help. Researchers cannot assume that they know what the problems are of these user groups. Rather, they must work closely with particular users in order to define precisely just what the problem is, and to specify the kind of data, information, knowledge, or other research output that is needed to provide an effective solution to the problem being addressed. The more closely research scientists work with potential users in defining the problem, the more likelihood there is that the research outputs will be adopted and put into practice.

Be dynamic. The objectives, goals, and even the mission of a research organization must be responsive to changing social, economic, legal, environmental, and other conditions. Government policies and national development goals are not constant. To be relevant, the research mission and goals must be periodically re-evaluated and adjusted in light of such change. Indeed, one of the fundamental purposes of strategic planning is to examine trends in the external environment and assess the implications of change for the research organization. Yet strategic planning is often lacking, even in well-established research organizations.

Be realistic. The planned program of research or research project should be tailored to the anticipated size and resources of the organization. It must be capable of being carried out with the human, financial, and physical resources that are expected to be available. Research plans that are beyond the capacity of the organization to accomplish, however desirable that research would be, will be counterproductive. Such plans set up unattainable expectations for the productivity of individual scientists, projects, programs, and the entire organization. Failure to achieve the objectives or contribute to the goals specified in planning documents because of unrealistic planning may also weaken political support for the organization. It is important to strike a balance between insufficient planning and over-planning, or devoting excessive managerial time and other scarce resources to planning activities given the size and resources of the organization. If the planning effort is insufficient, an organization will lack direction and purpose, and ultimately will be less effective in its contribution to society. If planning is excessive, planning may become an unproductive end in itself, resulting in
organizational stagnation. Effective planning systems are those that are appropriate to the size and resources of the organization.

**Not overly burden scientists.** All research planning systems require some input from scientists. But planning systems that place heavy demands on working scientists and keep them from their research will adversely affect the productivity of the research organization. In a review of agricultural research systems, Ruttan (1981) states: "I am concerned about excessive administrative burden that stifles both routine investigation and research entrepreneurship." A survey of forestry research institutions found that some developing countries' institutions do place a very heavy workload on scientists (Bengston 1989). Effective planning systems do not place excessive demands on scientists.

### The Management-by-Objectives Approach

Planning often is viewed as a separate function apart from management, and in many cases it is carried out that way. However, planning should be considered as an ongoing function within the overall management process. 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, planning is considered as an integral part of management.

One could organize a set of guidelines for forestry research management (including planning) in a number of different ways. Here the topic is organized using the process of management-by-objectives. In this approach to research management the basic process involves:

1. **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.
2. **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, research priorities, and decisions regarding personnel, program size, location, and timing;
   - developing a program budget; and
   - securing financing for the program.

3. **Implementing the plan and managing research:** this includes managing such functions as:
   - establishing appropriate accounting procedures;
   - managing people—hiring, motivating, monitoring and controlling performance, and (if necessary) terminating scientists, technicians, support personnel;
   - training and educating personnel;
   - working with outside research groups—networking, twinning, etc.; and
   - managing and allocating equipment, facilities, and infrastructure.

4. **Disseminating the results of the research** so they may be put to use, including:
   - documenting/publishing/distributing research results; and
   - coordinating dissemination activities 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. In the same way, planning is an ongoing 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 incrementally in response to the results of such evaluation. In discussing the management process, this dynamic element needs to be kept in mind.

To implement this management-by-objectives process, managers have resources and 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, mandates, and higher level policies, cultural constraints, political considerations, and so forth.

With regard to these resources and constraints, the task of management is:
• to deploy available resources in an effective and efficient way within the bounds of existing constraints to achieve the goals and objectives of the organization;
• to delegate responsibilities, and to supervise, manage, and otherwise oversee the activities of their staff and subordinates to ensure that they properly carry out their assigned responsibilities;
• to monitor and account for expenditures of funds and available resources to those who provide the funds;
• to increase the quality of existing resources, e.g., 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 ensuring 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.
Activities

Situation Analysis

Imagine that you are the manager of a forestry research organization. Your organization's purpose is to conduct research that promotes the sustainable development of your country's forest resources, and ensures that these resources are used efficiently while protecting basic productivity. While the organization seems to you to be running quite well, some key beneficiaries of your organization's research, as well as some researchers within the organization, have begun to express some displeasure with the organization's direction and outputs.

For instance, several field staff members have complained that the organization is too slow in moving from problem identification to the generation of useful research results. Further, over the years individual scientists have narrowed their research activities to topics that are of interest to them, resulting in a highly fragmented and disjointed organizational research agenda. Some scientists on your staff claim that the organization lacks direction and is fragmented into disciplines (with little communication or collaboration between disciplines). They claim that not enough planning is done, and that there are too many demands for research in disciplines of little interest to them.

Donor organizations and your national government are pressuring your research organization to initiate forestry research on newly emerging issues and topics not being addressed by the current research agenda, nor reflected in the organization's mission statement.

Your organization has a long-range plan, done quite some time ago, that you still consider appropriate (though you haven't consulted it for several years). With things not going as well as you thought, you are beginning to think that perhaps it's time to update the older plan.

You recognize that comprehensive planning contributes to a successful and effective research program. In order to plan your organization's activities for both the short- and the long-term, you have decided to form a planning team that includes some of your key staff.
What is the primary problem of this organization? How does this problem relate to research planning?

Activity 1

What kinds of planning does this organization need to do?

Activity 2
The primary problem of this research organization is the lack of focus or direction of the research agenda. This muddled direction results in research that is of limited relevance to users, is not forward looking nor user-oriented, and is fragmented in focus. There is no long-term central concentration and the mission is not relevant to the current demands for research.

This organization needs to conduct comprehensive planning at the strategic, operational or program, and annual levels. If you had problems with this question, please go back and reread the text carefully. Thoroughly understanding the difference between the various kinds of planning is essential for the development of your overall management skills and ability.
If you were manager of this organization, how would you direct the planning team to deal effectively with the problems facing this organization?
The manager of this fictitious organization has ignored planning as an important activity, with the results being that external stakeholders and interested parties were dissatisfied, and that there was internal confusion regarding the overall direction of the organization. Managers of research are often so busy with their daily responsibilities that they have little time to spend planning beyond the immediate demands for annual work plans and budgets by their funders. However, research managers who ignore long-range (operational or program planning) and strategic planning do so at great risk to their research organization's effectiveness, as well as to the longevity of their own careers! The world is changing rapidly, and research organizations must be prepared to anticipate these changing circumstances, and be well prepared for the unexpected.

While it may be tempting to focus on annual research planning to satisfy immediate needs, developing such a short-term research program without knowing or acknowledging the critical strategic and/or long-term issues facing the organization, will most likely fail to effectively address key issues important to the research organization's stakeholders. In fact, it would be much more effective for the research manager in this situation to conduct strategic planning first, then proceed on to operational planning, then finally to the annual plan and budget preparation.

Thus, the planning team needs to take a comprehensive approach to planning, looking at the short- and long-term, soliciting the views of key stakeholders, involving them in the planning process, and including this information into the organizational plans.

Modules 2 to 6 will provide you with the tools and knowledge to enable you to direct planning for your organization at the strategic, operational, and annual levels.
Six characteristics of effective research planning were identified in the text. What are they, and why are they important?

1. 
2. 
3. 
4. 
5. 
6.
Six characteristics of effective research planning are:

**Planning must address critical problems and issues.** Because critical problems that are important to science or to society are often difficult to solve, they also are difficult to plan for. It is tempting to set such problems aside (just temporarily, of course) and plan research programs around problems that are easier (and sometimes more scientifically interesting) to solve. Research organizations that make an effort to address important and critical problems in science and society are likely to generate stronger public support for forestry research.

**Planning should incorporate bottom-up input.** Planning should not be done solely at the higher levels of administration. It should incorporate input from all levels in the organization. If planning is to be realistic, particular attention should be given to obtaining input from those who will be called upon to ultimately carry out the plan.

**Planning must be user-focused.** Forestry research is supported by the public because they expect it to help improve the way in which forest and related resources are managed and used. To be effective, those who plan and conduct the research should work closely with those who are expected to use the research, to clearly define the problem and expected research outputs before the research is undertaken. This will increase the chance that the research results will meet the needs of the user, will be applied by the user, and will actually improve the way in which forest resources are used and managed.

**Planning must be dynamic.** That is, planning must prepare the organization to meet the constantly changing social, economic, legal, legislative, environmental, and other conditions. Periodic reevaluations are essential to keep the organization abreast of current trends and assess the implications of change for the research organization.

**Planning must be realistic.** If planned programs of research are to be effective, they must be capable of being carried out given available or expected human, financial, and physical resources. Failure to achieve the goals and objectives because of unrealistic planning may weaken the organization’s political support. It is important to strike a balance between insufficient planning and overplanning. Effective planning systems are appropriate to the size and resources of the organization.

**Planning should not be burdensome to scientists.** Obtaining input from your research staff during the planning process is essential for the planning of realistic, implementable research programs. However, placing heavy time and administrative demands on your research staff for planning activities may adversely affect their productivity and thus the effectiveness of your research organization.
Management-by-objectives is a common approach to management in many organizations, including those conducting forestry research. What are the four steps of the management-by-objectives approach?

1. 

2. 

3. 

4. 

How can the management-by-objectives approach be integrated into the overall planning process of your research organization?
The four steps of management-by-objectives are quite logical and straightforward. You probably use this process in managing your own personal affairs, but just never called it management-by-objectives!

Comment 5

The steps of management-by-objectives are:
1. Setting goals and objectives;
2. Planning how to achieve the stated objectives;
3. Implementing the plan and managing research; and
4. Disseminating the results of the research.

An example from everyday life could be as follows. Let's say you wanted to build a new house for yourself and your growing family. First you set your broad goal: to build a house. One specific objective (among many) could be the deadline for when the house would be built. Second, you need to do some planning. You need to determine what size house you need, where to build it, who will build it, how you will pay for it, etc. In other words, you need to look at your resources, determine gaps (in this case between the size of the house you want and your existing financial resources!), and design a plan for executing your plans. Third, once you have carefully planned your housebuilding program, you need to implement the plan, and build your house by hiring the people, purchasing the materials, and managing the work. Lastly, once your house is built, you need to move your family into the house, advise friends, colleagues, and various authorities of your new address (i.e., advise people of the results of your efforts), etc.

Again, the management-by-objectives is a logical framework that most people use every day to plan for and deal with events in their personal and professional activities.

In general, to implement a management-by-objectives approach, research managers must deal with their available resources and existing or future constraints, and deploy these available resources in an efficient way within these constraints. They also need to monitor and account for expenditures of funds and resources, increase the quality and availability of resources, and where possible remove or reduce the impact of constraints that hinder the research program.

Planning should be an ongoing process, where needs, capacity, and performance are constantly being monitored and evaluated formally and informally. Being an iterative and dynamic process, many adjustments are continually required to readjust the organization's plans and programs to quickly changing conditions. Since the management-by-objectives process utilizes planning as an integral component, use of this management system implies an emphasis on planning at all levels.
Planning is a vital activity in research, particularly where resources are limited, where the majority of the research is applied in nature, or in young organizations where a project-oriented approach is utilized rather than a researcher oriented approach. Good planning can greatly assist the research manager in identifying and implementing research programs that address critical problems of both science and society, and that are attractive to those who fund and support forestry research.

This study unit has provided a short introduction to the importance of the planning process. Three types of planning were discussed, including strategic, operational or program, and annual planning. Some key planning terms were defined, and the characteristics of effective research planning identified. Lastly, we provided an overview of the forestry research management process, including a discussion of one approach to management, that of management-by-objective.

If you would like more information about the general process of planning and management of forestry research organizations, we encourage you to obtain and review the interesting articles identified in the literature cited and other references listed at the end of the module. Two key articles directly related to the topics covered in the module, and cited in the text, are reprinted for your use in the section on readings at the end of the module.
Objectives

When you have read this study unit and completed the exercises you should be better able to:

- describe the major responsibilities of research management;
- identify some of the skills, personal characteristics, and attitudes that research managers generally need to successfully manage forestry research organizations;
- identify some of the key differences between managers and scientists; and
- determine your own skills and capabilities, strengths and weaknesses in terms of research management.
Responsibilities of the Research Manager

The job of managing research involves a number of responsibilities that require skills and capabilities that not everyone possesses. Those considering, or being considered for a position of research manager should be familiar with the tasks and responsibilities necessary for the effective management of forestry research. They also should be aware that to effectively do their jobs managers need different skills and abilities than those required by scientists.

In this study unit, you'll learn some of the particular skills, personal characteristics, and attitudes that successful research managers generally possess. We'll identify some of the key differences between managers and scientists, as well as help you determine your own skill and capability levels for the management of forestry research.

Responsibilities of Research Management

The International Service for National Agricultural Research (1984) has identified seven basic responsibilities of agricultural research management that apply equally well to forestry:

1. Directing activities toward the country's priorities, opportunities, and problem areas;
2. Mobilizing and effectively utilizing the needed financial resources;
3. Developing and maintaining a physical infrastructure that responds to the country's agroecological characteristics and economic potential;
4. Developing and maintaining a critical mass of well-qualified scientific personnel;
5. Taking advantage of all scientific capabilities available at the national and international levels;
6. Assuring the flow of information between research and extension workers, farmers, policy makers, and the public; and
7. Monitoring and evaluating program implementation.

Objectives

When you have read this study unit and completed the exercises you should be better able to:

- describe the major responsibilities of research management;
- identify some of the skills, personal characteristics, and attitudes that research managers generally need to successfully manage forestry research organizations;
- identify some of the key differences between managers and scientists; and
- determine your own skills and capabilities, strengths and weaknesses in terms of research management.
In addition to these seven areas of responsibility, the research manager also must devote a considerable amount of effort to developing effective relationships between the research organization and the outside world. Contacts must be developed and maintained with: various groups and organizations that use the research outputs; organizations and agencies that are a source of funding; other research organizations with whom collaborative working relationships have been or could be established; the general public; and many other individual, group, and organizational stakeholders. The manager also has the responsibility for encouraging and developing the managerial and administrative skills of promising subordinates. Improving their skills, through temporary assignments as “acting ...,” and judicious delegation of responsibilities, can improve the performance of the entire organization. It also provides a pool of trained managers, should they be needed to fill vacant administrative positions.

These responsibilities are critically important to the successful planning and implementation of a forestry research program. All of these responsibilities are addressed in the research modules that follow, although not necessarily in the order indicated above.

In order to successfully carry out these responsibilities, research managers must have skills and capabilities that differ considerably from those of a successful research scientist. Some of the differences in required skills and capabilities between managers and scientists are described in the following section.

Skills and Capabilities of the Research Manager

From a review of the literature, Gratton (1987) has identified the following key factors that differentiate managers from scientists:

• Managers tend to have an interest in people and the social aspects of their work life, to be interested in developing, persuading, and influencing people, and to be extroverts rather than introverts. In contrast, scientists tend to be less interested in dealing with people, and tend to be independent and self-reliant, introverted, and highly involved in their own work.
• Managers tend to be more oriented towards action rather than thought, in doing things rather than thinking about them. They prefer to work on concrete problems. In contrast, scientists tend to be more oriented to theory, and in solving abstract problems.
• Managers tend to be more interested in the commercial and business aspects of their work, in solving problems in the real world. In contrast, scientists tend to be more interested in solving conceptual problems of science.
Managers tend to have a strong motivation to gain positions of managerial responsibility, and tend to regard a technical job as merely a stepping stone to a managerial career. In contrast, scientists are more strongly oriented towards developing technical competence, and in gaining approval and recognition from their scientific peers.

Many candidates for research management positions are drawn from the ranks of scientists. In identifying potential candidates for research management, it is important to recognize these differences in interests and attitudes between managers and scientists. Not every scientist may want the changes in responsibilities that go with a research management position, and not every scientist may be qualified to fulfill the duties of such a position. Scientists who are considering a career change to research management may find this course helpful in understanding the wide array of responsibilities that confront research managers.

Gratton (1987) identifies several characteristics possessed by successful managers of research organizations who have close links with the business and commercial environment. These following skills and capabilities would apply equally well to managers of forestry research organizations:

**Business Acumen**
- understands the environment and context within which the research organization operates; and
- takes a strategic approach in developing a program of forestry research.

**Creativity**
- generates a wide range of potential solutions to problems; and
- approaches problems in unexpected ways.

**Professional Skills**
- demonstrates technical excellence by having high personal skills; and
- demands and adheres to high standards.

**Interpersonal Skills**
- relates well with people, and establishes rapport with members of the research team; and
- communicates frequently with subordinates and involves them in decision making (see module 9).

**Leadership**
- leads effectively, motivates, and delegates responsibilities to research team members; and
- develops skills of others by monitoring their work and providing training when needed (see module 9).
Time Management
- plans and organizes work, making explicit timescales, and monitoring progress; and
- establishes realistic deadlines, and demands high performance in meeting established deadlines (see module 6).

Self Confidence
- expresses confidence in their own abilities to do the job; and
- influences performance of others.

Although not all research managers have all of these particular skills and capabilities, those who may be considering research management as a career should carefully examine this list to see if they have, or could develop, these particular characteristics and abilities. Those whose personal characteristics more closely parallel those listed above may have a better chance of becoming a successful research manager, than if their personal characteristics and style of behavior differs greatly from these.
Based on what you have read in this study unit, and on your own experience, list five characteristics, skills, or attributes that you believe are most important for managers to successfully run forestry research organizations.

1.

2.

3.

4.

5.
Simply stated, managers manage people and resources to achieve the organization's goals and objectives. To do these jobs effectively, they need skills in the following areas:

- business acumen;
- creativity;
- professional skills;
- interpersonal skills;
- leadership;
- time management; and
- self-confidence.

Perhaps you also listed some personality characteristics which you feel contribute to being a successful manager.

If you had trouble with this question, or couldn't state many characteristics of successful managers, try this exercise in imagination: considering all the various supervisors or managers you have worked under in past or current positions, select one or two persons whom you felt were the most effective at their jobs, and the most desirable for whom to work. Now think about why they were effective in their work. What personal characteristics seemed to contribute to their success? Why did you enjoy working for them? How did they motivate you to work harder or better? What characteristics do you think were important enough for you to emulate or incorporate into your own management approach.

For instance, you may have worked for a very capable administrator who enjoyed interacting with persons at all levels of the organization, as well as politicians and national policy setters. Perhaps the administrator also continually encouraged and, in fact, solicited participation from the staff in most activities, and used a consensus decision-making approach whenever possible. While these characteristics were important for professional success of personally and that of the organization, the strongest point was that the administrator thought and acted strategically and always anticipated and was prepared as possible for unexpected change. Thus, this person's individual characteristics that contributed to their success as a manager may have included skills and capabilities in human interaction and communication, group management, participation and consensus decision making, and strategic planning, thinking, and acting. The administrator also may have been quite organized.

With this in mind, and based on your own experience and what you have read, you might want to develop your own list of criteria for what you think makes managers effective.
Scientists and managers of scientists are different in substantial and important ways. Considering the list of factors below, indicate (by a checkmark) whether you think the particular factor is more likely to be a characteristic of successful scientists or managers. In some cases you’ll find that some of these characteristics can be associated with both scientists and managers.

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<tr>
<th>Characteristic</th>
<th>Manager</th>
<th>Scientist</th>
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<td>interested in people</td>
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<tr>
<td>interested in social aspects of work life</td>
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<td>interested in persuading, developing, and influencing people</td>
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<td>strongly desires approval and recognition from scientific peers</td>
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<td>tends to think of technical positions as stepping stones to a managerial career</td>
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<td>demands and adheres to high standards</td>
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Below are our ideas on how scientists and managers differ in fundamental ways. Of course, there is great overlap. Some scientists may be highly skilled in some or all of these management characteristics, but chose to remain scientists. The important point is to understand that basic differences do exist between the two groups. But try not to be too rigid on the classifications!

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<td>strongly desires approval and recognition from scientific peers</td>
</tr>
<tr>
<td></td>
<td>tends to think of technical positions as stepping stones to a managerial career</td>
</tr>
<tr>
<td></td>
<td>has a business sense of the organization plans, thinks and acts strategically</td>
</tr>
<tr>
<td></td>
<td>creative</td>
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<tr>
<td></td>
<td>leads effectively</td>
</tr>
<tr>
<td></td>
<td>able to delegate responsibility</td>
</tr>
<tr>
<td></td>
<td>skilled in communications</td>
</tr>
<tr>
<td></td>
<td>relates well with people</td>
</tr>
<tr>
<td></td>
<td>organized, and manages time carefully</td>
</tr>
<tr>
<td></td>
<td>self-confident</td>
</tr>
<tr>
<td></td>
<td>demands and adheres to high standards</td>
</tr>
</tbody>
</table>
For each of the following list of characteristics common to managers of research, indicate the level of skills and capabilities that you have, in your own estimation.

### Activity 3

<table>
<thead>
<tr>
<th>Degree of Competence</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>interested in people</td>
</tr>
<tr>
<td>medium</td>
<td>interested in social aspects of work life</td>
</tr>
<tr>
<td>low</td>
<td>interested in persuading, developing, and influencing people</td>
</tr>
<tr>
<td>high</td>
<td>extroverted</td>
</tr>
<tr>
<td>medium</td>
<td>self-reliant</td>
</tr>
<tr>
<td>low</td>
<td>oriented towards action and doing things</td>
</tr>
<tr>
<td>high</td>
<td>prefer to work on concrete problems</td>
</tr>
<tr>
<td>medium</td>
<td>prefer to work on abstract problems</td>
</tr>
<tr>
<td>low</td>
<td>interested in commercial and business aspects of their work</td>
</tr>
<tr>
<td>high</td>
<td>prefer to work on real world problems</td>
</tr>
<tr>
<td>medium</td>
<td>strongly motivated to attain managerial positions</td>
</tr>
<tr>
<td>low</td>
<td>tends to think of technical positions as stepping stones to a managerial career</td>
</tr>
<tr>
<td>high</td>
<td>has a business sense of the organization</td>
</tr>
<tr>
<td>medium</td>
<td>plans, thinks and acts strategically</td>
</tr>
<tr>
<td>low</td>
<td>creative</td>
</tr>
<tr>
<td>high</td>
<td>leads effectively</td>
</tr>
<tr>
<td>medium</td>
<td>effective communicator, both interpersonally and in public</td>
</tr>
<tr>
<td>low</td>
<td>relates well with people</td>
</tr>
<tr>
<td>high</td>
<td>manages time, logistics, and resources effectively</td>
</tr>
<tr>
<td>medium</td>
<td>self-confident</td>
</tr>
<tr>
<td>low</td>
<td>demands and adheres to high standards</td>
</tr>
<tr>
<td>high</td>
<td>skillful in preparing budgets and managing financial resources</td>
</tr>
<tr>
<td>medium</td>
<td>understands work incentives, particularly to motivate scientists</td>
</tr>
<tr>
<td>low</td>
<td>skillful in monitoring and assessment</td>
</tr>
<tr>
<td>high</td>
<td>skillful in program evaluation</td>
</tr>
<tr>
<td>medium</td>
<td>understands importance of extension in research results dissemination</td>
</tr>
<tr>
<td>low</td>
<td>ability to look ahead to identify emerging issues for research</td>
</tr>
<tr>
<td>high</td>
<td>skillful in team building</td>
</tr>
<tr>
<td>medium</td>
<td>effective planner at strategic, program, and annual levels</td>
</tr>
<tr>
<td>low</td>
<td>good group facilitator</td>
</tr>
<tr>
<td>high</td>
<td>encourages participatory and consensus management</td>
</tr>
</tbody>
</table>
Comment 3

By using this self-test, you may have identified some aspects of management in which you feel you do better than others. For those attributes which you rated your competence as “low,” we suggest that you determine how essential they are to the successful performance of your job. Critical attributes which need improvement should be addressed by using this training course in a targeted manner.

We strongly suggest that you give special emphasis to the individual modules or study units contained within this training course that deal with the particular skills or capabilities you would like to improve. By doing so you will strengthen your weak spots and considerably improve your overall competence as a manager of forestry research.

*Good luck with the rest of the course!*
Summary

Being a manager of research requires certain skills and capabilities. Many of these skills can be learned through formal training (such as this self-study course) and more informal means (such as on-the-job observations and learning-by-doing).

This study unit reviewed the various personal characteristics and particular skills, capabilities, and attitudes that successful managers require. You also learned of some of the key differences that exist between scientists and managers of research. Finally, you completed an exercise that allowed you to gage your own capacity for the management of research, to pinpoint your own strengths and weaknesses, and to provide some direction and focus for further work in this self-study course in the management of forestry research.

If you would like more information about the skills and capabilities needed for effective management of forestry research organizations, we encourage you to obtain and review the interesting articles identified in the literature cited and other references listed at the end of the module. Two key articles directly related to the topics covered in the module, and cited in the text, are reprinted for your use in the section on readings at the end of the module.
Below are listed a number of skill and knowledge statements derived from the objectives of the study units in module 1. These are identical to those listed in the initial skill and knowledge assessment at the beginning of the module. Now that you have completed the module, please read each statement carefully and indicate with a checkmark the level that best describes your current skill or knowledge, from 1 to 5.

1. I cannot perform this skill, or I have not been exposed to the information.
2. I cannot perform this skill, but have observed the skill or have been exposed to the information.
3. I can perform the skill or express the knowledge with assistance from others.
4. I can perform the skill or express the knowledge without assistance from others.
5. I can perform the skill or express the knowledge well enough to instruct others.

<table>
<thead>
<tr>
<th>Skill or Knowledge Statement</th>
<th>Your Level of Skill or Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Outline the process of technological innovation in forestry research.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>b) Identify the ways in which your forestry research programs are likely to affect economic, social, and cultural institutions in society.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>c) Identify types of organizations conducting forestry research related to your research mission.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>d) Compare research programs of your organization with those of other organizations conducting forestry research.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>e) Identify potential cooperators and collaborators for your research programs.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>f) Describe the differences between strategic, operational, and annual planning.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>g) Distinguish between organizational mission, goals, and objectives.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>h) Describe the major responsibilities of research management.</td>
<td>1  2  3  4  5</td>
</tr>
<tr>
<td>i) Identify some of the skills, personal characteristics, and attitudes needed for successful research management.</td>
<td>1  2  3  4  5</td>
</tr>
</tbody>
</table>
LITERATURE CITED - MODULE 1


ADDITIONAL SOURCES OF INFORMATION


READINGS FOR MODULE 1

The following readings have been chosen related to the material covered in this module:


READINGS FOR MODULE 1

The following readings have been selected to provide you with additional information related to the material covered in module 1. We hope you will find them of interest.


MANAGING LARGE RESEARCH PROJECTS
IN DEVELOPING COUNTRIES

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P.O. Box 2511, Cairo, Egypt

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 fulfill the objectives of the sponsor(s) and the executor(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 to non-professionals such as students.

It is quite common in research is managed by a limited management team, those funded by internal managers. Adaptation conditions may not be to countries insist on it to be in charge of research solution.

Physical Resources

Non-technical physical facilities, land and off-site nature, while technical scientific instruments, types of instruments and the project, some plans eliminated if the project is costly to justify its availability must be a project. On the other hand, acquire modern research executed.

Finance

Funds are required for projects and management. Countries receive funds for example, are agreements and external funds are raised only if authorities, with income for the managers of the management caused by unstable resources.

In certain instances, research projects were completed without even consulting the research personnel. Suddenly changes in legislation planning and implementation.

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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 important example is usually conducted in service. One of the demonstrated the need and value of training under conditions which are focused. For this to be expected, and is usually quite simply may be the best means of aspects to be considered is rather unfortunately appropriate training is an reluctance among the latter but common features. It is preferable to work in these field.

Finally, in developing countries extension services in research projects in developing countries. The projects are often very large and their responsibilities are extensive.
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


Introduction: purpose and format

The purpose of this paper is to introduce readers to the role of the forest sector in national economies and to highlight the need for increased and improved forestry research in developing countries. The term, "issue" can be used to refer to the capacity of a research organization to undertake research which cause a reduction in uncertainty.

The issues which affect forestry research are those issues which affect the forestry research sector itself. This can occur directly, or indirectly can affect the size and nature of the organization, so as not to get too bogged down with the details of the individual organization.

The background on which we look at the role of the forest sector in national economies and the role of forestry research in the forest sector will be provided by the Technical Advisory Group of the International Forestry Sector Research Program (IFSRP) and the three appointed by the Technical Advisory Group (TAFG) of the International Agricultural Research System (IAR-AS) to include forestry research.

The four surveys are as follows:

- A survey of forestry needs and priorities carried out by the University of Washington (1984)

† Note that we are including here the term "forestry".
Issues facing managers of forestry research in developing countries

Hans Gregersen and David Bengston

Introduction: purpose and background

The purpose of this paper is to provide an overview of some major issues facing administrators of forestry research programs in developing countries.

The term, "issue" can be used in a variety of contexts. Here, we focus on issues that relate to the capacity of a research organization to do research. Issues arise when there are factors which cause a reduction in existing capacity, or hinder desired and planned growth in capacity.

The issues which affect forestry research go far beyond the boundaries or confines of the forestry research sector itself. Figure 1 indicates the types of external factors that directly or indirectly can affect the size and effectiveness of a national forestry research system. However, so as not go get too broad and diffuse, we will focus mainly on issues from the point of view of the individual organization, always keeping in mind the external factors.

The background on which we base this discussion of issues includes four global surveys and participation of the senior author on the Bellagio II International Task Force on forestry Research (ITFFR) and, more recently, the International Panel on Forestry Research appointed by the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR), which recently voted to expand its mandate to include forestry research.

The four surveys are as follows:

* A survey of forestry research planning and evaluation in developing countries, undertaken by the University of Minnesota in collaboration with IUFRO (Gregersen 1984)

† Note that we are including forest products and utilization research under the broad heading of "forestry".
A variety of national and international characteristics may affect a nation's research capacity.

- A survey of factors influencing research capacity in forestry research organizations in developing countries, undertaken by the University of Minnesota in collaboration with IUFRO (Bengston 1986; Bengston and Gregersen 1988a)
- A survey of all IUFRO member institutions in developing countries, undertaken by the ITFFR as background material for the Bellagio II (Wiston House) meeting; (ITFFR 1988)
- Regional surveys undertaken by members of the ITFFR, published as background papers to the main report of the Task Force (e.g. Iyamabo and El-Lakany 1988, Juguet 1988)

We also have utilized a number of excellent surveys and reviews published by the FAO and other groups (FAO 1984, 1986, 1987a, 1987b, Burley et al., 1989; see also literature cited.)

Several of these focus specifically on issues related to research capacity in African countries.

After reviewing the various studies, one is struck by the differences in issues faced by different research organizations. Yet, one also clearly sees some common themes; and these are what we want to concentrate on in this discussion.

In addition to the surveys, the overview presented here benefits from discussions with researchers and administrators over the past 25 years. During that time, there have been remarkable changes and improvements in forestry research as it is carried out in developing countries. A number of issues which existed in earlier days have been resolved. Just as surely, many of the issues we discuss below will be resolved in the future and others will emerge.

Discussion of the issues.

The research administrator is most concerned with human resources of his or her organization, i.e. ways of developing the organization's capacity to do research. There are some conditions as being widespread and constraining to research in developing countries. In the following sections, we establish issues within the following subjects:

- Manpower and training
- Political environment and social change
- Communication, information, facilities, and equipment
- Networking and interagency coordination

We provide only some brief comments here, since details are found elsewhere available from the authors on the subjects of factors influencing research capacity and the issues that are key to the discipline.

Manpower and training

How best to strengthen human resources of research administrators in developing countries? How best to strengthen the capacity to do research? We recognize that averages of variables in variables may be misleading, but a rough estimate would be roughly 40 percent Ph.D., 31 percent M.Sc., equivalent to the distribution in developed countries.

Some small institutions have more than one third of their staff holding Ph.D. degrees.
This is an exciting time for forestry research. It finally is being noticed by those who make major funding and strategy decisions. Forestry research is being recognized as a key ingredient in strategies to resolve some of the major development issues facing developing countries, such as food insecurity, energy insecurity, environmental deterioration, and unemployment.

Discussion of the issues.

The research administrator is searching for ways to resolve the specific issues facing his or her organization, i.e. ways of dealing with the specific factors or conditions hindering his or her organization's capacity to do research. While many issues differ from organization to organization, there are some common ones which emerge from our surveys and discussions as being widespread and critical ones for a broad array of forestry research administrators in developing countries. In this discussion, we want to concentrate on these common issues within the following subject areas that relate to research capacity.

- manpower and training
- political environment and funding levels and stability
- documentation, information and extension services
- facilities and equipment
- networking and internationalization

We provide only some brief comments on the issues which have surfaced in each subject area, since details are found elsewhere (cf. references cited for our surveys, all of which are available from the authors on request). Rather, recognizing the high level of decision-making represented at this workshop, we concentrate on the policy implications of the issues, i.e. how can they be dealt with in a given policy environment.

Manpower and training

How best to strengthen human resources is a key management issue for forestry research administrators in developing countries. Improvements in the level of training of researchers received the highest average rating of 24 factors associated with increasing research capacity in a survey of forestry research administrators in developing countries (Bengston and Gregersen 1988b). Increased size of the research staff ranked seventh (See Figure 2).

- Bengston and Gregersen (1988a) report the following average educational levels for forestry researchers from their global survey of institutions in developing countries: 12 percent Ph.D., 31 percent M.Sc. and 57 percent B.Sc.. These percentages are roughly equivalent to the distribution of agricultural researchers by educational level in developing countries as reported by Oram and Bindlish (1981). It is important to recognize that averages of educational levels by region or subregion hide a great deal of variability between institutions and countries.

Some small institutions have no Ph.D. or M.Sc. scientists. In other institutions, the majority of researchers have advanced degrees.
Issues facing managers of forestry research in developing countries: Gregersen and Bengston

Figure 2.
Average rating of factors affecting research capacity in forestry research institutions (46 developing country institutions, 45 developed country institutions. Standard errors range from 0.079 to 0.136 for developing countries, and from 0.093 to 0.164 for developed countries.)

<table>
<thead>
<tr>
<th>Factors:</th>
<th>Impact on Increasing Research Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td>1. Level of training of researchers* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>2. Stability of funding from year to year</td>
<td>[ ]</td>
</tr>
<tr>
<td>3. Library &amp; information services* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>4. Total funding level</td>
<td>[ ]</td>
</tr>
<tr>
<td>5. Research equipment &amp; supplies</td>
<td>[ ]</td>
</tr>
<tr>
<td>6. Political support for forestry research</td>
<td>[ ]</td>
</tr>
<tr>
<td>7. Size of research staff</td>
<td>[ ]</td>
</tr>
<tr>
<td>8. Level of salaries* (.004)</td>
<td>[ ]</td>
</tr>
<tr>
<td>9. Funding for research support activities* (.031)</td>
<td>[ ]</td>
</tr>
<tr>
<td>10. Coordination of research effort* (.006)</td>
<td>[ ]</td>
</tr>
<tr>
<td>11. Interaction: users of research results</td>
<td>[ ]</td>
</tr>
<tr>
<td>12. Social attitudes regarding science or change* (.001)</td>
<td>[ ]</td>
</tr>
<tr>
<td>13. Economic stability in country* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>14. Interaction: international organizations* (.010)</td>
<td>[ ]</td>
</tr>
<tr>
<td>15. Interaction: research in other countries* (.043)</td>
<td>[ ]</td>
</tr>
<tr>
<td>16. Educational system in country</td>
<td>[ ]</td>
</tr>
<tr>
<td>17. Availability of foreign exchange* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>18. Interaction: educational institutions, other countries* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>19. Language barriers to scientific communication* (.036)</td>
<td>[ ]</td>
</tr>
<tr>
<td>20. Buildings</td>
<td>[ ]</td>
</tr>
<tr>
<td>21. Size of research support staff</td>
<td>[ ]</td>
</tr>
<tr>
<td>22. Interaction: researchers in country</td>
<td>[ ]</td>
</tr>
<tr>
<td>23. Communication &amp; transportation systems in country* (.000)</td>
<td>[ ]</td>
</tr>
<tr>
<td>24. Interaction: educational institutions, same country* (.009)</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

* Indicates significantly different ratings by developed and less-developed country respondents. Numbers in parentheses indicate levels of statistical significance as calculated for the chi-square statistic.

Another partial solution is to create at tists working on the same problems, "networking and internationalization."

A key to attracting and retaining top available. As mentioned, although is only thing which attracts good researcher.

• Based on one of our surveys, one top researchers in their institutions were the same country (Bengston, Xu, and rated researchers' salaries at 40% below.

• A number of factors other than salary. Those thought to be personal career advancement and financial survev found that financial awards were most frequently used, but (Gregersen, 1988).

Political environment and funding

Sustained political commitment is certainly the major factor in development, and all other factors depend inevitably leads to inadequate and government officials who make decisions.
MANAGEMENT OF FORESTRY RESEARCH IN AFRICA

The small numbers of forestry researchers is an issue of concern in African countries. The low number of researchers in many institutions is sometimes insufficient to form the "critical mass" needed for productive research.

- An FAO (1987a) review of forestry research found an average of 12 researchers per organization in 41 African national institutes south of the Sahara. This compares to an average of 61 in Asia and Pacific countries, 20 in Latin America and the Caribbean, 28 in the Near East, and 28 in all four regions combined. The shortage of researchers is also indicated by the fact that Africa is the only region in which the average number of technicians per institution exceeds the average number of scientists. It should be noted that average numbers of scientists and technicians per institution likely presents an inflated picture of the number of personnel in most research institutions since distributions of numbers of forestry research personnel are highly skewed, with a few large institutions pushing up the averages (Bengston, Xu, and Gregersen 1988).

A suggested solution to the problem of not enough scientists and inadequate training is to coordinate public research in LDC's (less developed countries) with development projects supported by international donor and technical assistance agencies. This approach is being taken with apparent success in some countries (cf. Shepherd and Griffin 1984). Joint efforts provide practical training for local researchers, help to create a critical mass of scientists as local researchers cooperate with project personnel, and help to ensure that research is oriented towards development goals.

Another partial solution is to create strong national and international networks of scientists working on the same problems. This is discussed below under the heading of "networking and internationalization of research".

A key to attracting and retaining top researchers is to have the right kinds of incentives available. As mentioned, although a competitive salary level is a key factor, it is not the only thing which attracts good researchers to a program.

- Based on one of our surveys, one half of LDC respondents reported that the salaries of researchers in their institutions were less than salaries of comparable professionals in the same country (Bengston, Xu, and Gregersen 1988). Almost 17% of LDC respondents rated researchers' salaries at 40% below that of comparable professionals.

Another factor, other than salary level, also provide important incentives for researchers. Those thought to be particularly effective by research administrators include career advancement and financial awards. Given available resources, however, our survey found that financial awards were least used in practice and non-financial awards were most frequently used, but thought to be least effective (Bengston, Xu, and Gregersen, 1988).

Political environment and funding level and stability

Sustained political commitment is crucial for a sustained research effort: "political commitment is certainly the major factor in determining the place of science and technology in development, and all other factors depend on this" (Majisu 1983). Lack of political support inevitably leads to inadequate and unstable funding. According to some observers, government officials who make decisions about forestry research in developing countries often...
Issues facing managers of forestry research in developing countries: Gregersen and Bengston
do not appreciate the potential benefits of research, resulting in research efforts that are
inadequate to meet national needs (FAO 1978, Callaham and Buckman 1982).

- A workshop of forestry research directors in the Asia-Pacific region identified lack of pol-
  itical support and low status of research as the number one external obstacle to effective
  research (Brunig, 1982). Lack of stability of funding from year to year and inadequate total
  funding ranked 2 and 4, respectively, as factors affecting research capacity in a survey of
  LDC forestry research administrators carried out by Bengston and Gregersen (1988b). Lack
  of political support ranked 6th.

- Inadequate operational (recurrent) funding for research is often a problem in developing
countries. In some agricultural research institutes, up to 90% of the total budget is spent
  found that inadequate operational funds as indicated by operational funding falling bel-
  low 100% of personnel costs - was a serious problem for the majority of countries. The
capacity of a research institute may be severely impaired when operational funds are
insufficient, resulting in a lack of travel funds, maintenance of equipment and facilities,
  fuel for vehicles, and many other items needed for research.

Obtaining additional and more stable resources is one key to resolving many of the most
widest issues mentioned by research administrators in the various surveys discussed here.
Expansion of funding depends on how well we convince those who control resources
that forestry matters (both politically and economically) and that it has a major role to play
in resolving some of society's most critical issues. It also depends on convincing decision
makers that increased long term funding needs to be secured, since forestry research pro-
grammes involve long term elements.

Table 1.
Indicators of financial resources devoted to forestry research by regions (agricultural figures given in
parentheses). Note: Production value includes only industrial forestry, i.e., the value of fuelwood and
other non-market forest outputs are excluded. (Source: Adapted from Morgen, et al., 1988; and Judd et
al., 1986).

<table>
<thead>
<tr>
<th>Regions</th>
<th>Western Europe</th>
<th>N. America &amp; Oceania</th>
<th>Eastern Europe &amp; USSR</th>
<th>Africa</th>
<th>Asia</th>
<th>Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Research Expenditures as a % of World Total (1980)</td>
<td>25.3 (20.2)</td>
<td>38.2</td>
<td>19.3</td>
<td>3.0</td>
<td>11.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Forest Research Expenditures as a % of Production Value (1980)</td>
<td>0.27</td>
<td>0.27</td>
<td>0.15</td>
<td>0.12</td>
<td>0.07</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Forestry researchers and forestry research administrators often do not think "big" enough.
They can be too modest in their requests for increased recognition and funding. Forestry re-
lated problems increasingly are being recognized at high levels of government as key barri-
ers to moving towards more sustainable development. We need to act on this new interest
in our research development and budgeting plans.
MANAGEMENT OF FORESTRY RESEARCH IN AFRICA

Forestry researchers in developing countries have a strong argument for increased resources if one compares current levels of investment with those in agriculture and those in developed countries for forestry.

- As indicated in Table 1, forestry research expenditures in developing nations as a percent of production value is far below the percentages found in developed countries, and far below those for agricultural research in both developing and developed countries. It should be noted that the production figures used in these calculations do not include the value of non-commercial forest products such as fuelwood, fodder, etc.

- Looking at official development assistance, it also is evident that investment in forestry research is low compared to agriculture. Thus, while agricultural research gets about 10% of official development assistance to agriculture, forestry research gets only about 5% of the total assistance to the forestry sector.

We have to convince key decision makers even more that forestry can help to resolve major development issues they face - food insecurity, energy insecurity, unemployment, environmental degradation, and so forth. The ITFFR report is a good starting point for specifying these linkages between forestry and development in general. Evaluations of local research impacts would be even more convincing. Such "impact evaluations" demonstrate to policy makers the value of research programmes to society and help justify continued budgetary support.

Economic impacts - or rates of return to investment in research - are often calculated in impact evaluations. The highest rates of return often reported (usually in the range of 30-60% per year) provide evidence of under-investment in research (Ruttan 1982). A large number of impact evaluations of agricultural research have been carried out both in developed and developing countries. Recent economic impact evaluations of forestry research have found rates of return similar to agricultural research (Jakes and Risbrudt, 1988). But no formal evaluations of the impacts of forestry research in developing countries have been carried out to date. A review of such evaluation procedures for research is given in Jakes and Leatherberry (1986); this document is available from us free of charge, together with other materials on the subject of research evaluation for decision makers.

**Documentation, information, and extension services**

Issues associated with access to information services are important in many countries, since these services are crucial to conducting and utilizing scientific research. Improvements in library and information services ranked as the third most important factor in increasing forestry research capacity in developing countries in the survey by Bengston and Gregersen (1988b). The actual availability and quality of library and information services in forestry research institutions ranges from poor to excellent, with many in the poor category. Furthermore, in many countries, information services and sources are fragmented.

- For example, it was concluded that access to the findings of past forestry research in Kenya is limited by its fragmentation in various libraries, offices and private collections scattered throughout the country (Government of Kenya and USAID 1983).

- An indicator of the adequacy of information services is the number of scientific and technical journals of an institution's library. Of 39 developing country institutions and 45 developed country institutions surveyed, the median number of journal subscrip.
Issues facing managers of forestry research in developing countries: Gregersen and Bengston (1988b).

Figure 3 shows the availability of five information services thought by research administrators to be important in carrying out research. They include document exchange with other libraries, abstracts of foreign language research publications, computerized literature searches, employment of information specialists in institutions, and translations of foreign research publications. Survey results from developed country institutions are provided as a point of comparison.

In disseminating research results, a large proportion of forestry research institutions in Africa rely heavily on annual reports and other publications. Research conferences, seminars and colloquia also play an important role in dissemination in English-speaking institutions but play a much smaller role in French-speaking institutions. Other means of dissemination of research results - such as leaflets or notes, exhibitions, and open-days are used least often (FAO, 1984).

Extension of forestry research results to users is an issue frequently mentioned by both research administrators and personnel in operating agencies. In many cases, such extension is non-existent or severely deficient. One survey of forestry research administrators found that the need to improve the dissemination of research results was felt much more strongly in developing country institutions than in developed country institutions (Gregersen, 1984).

Facilities and equipment

The issue here is adequacy of research facilities and equipment between them and between them and between them and the developing countries. In most, the priority is on research capacity in developing countries. Improvement in research capacity ranked fifth in the Bengston and Gregersen 1988b.

A survey of fuel wood research centres included responses from 33 African

<table>
<thead>
<tr>
<th>Type of organization:</th>
<th>N</th>
<th>O</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Forestry research organizations in your country</td>
<td>43</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>2. Agricultural research organizations in your country</td>
<td>46</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>3. Educational institutions in other countries</td>
<td>54</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>4. Research organizations in other countries</td>
<td>51</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>5. Educational institutions in other countries</td>
<td>59</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>6. International institutions (FAO, World Bank, etc.)</td>
<td>54</td>
<td>28</td>
<td>1</td>
</tr>
<tr>
<td>7. Organizations that use research results (firms, landowners, etc.)</td>
<td>54</td>
<td>36</td>
<td>1</td>
</tr>
</tbody>
</table>

*N=Never, O=Occasionally, F= Frequently

Legend: 
- Developing Country Institutions
- Developed Country Institutions
### Interaction with other organizations

This table is concerned with formal interaction - e.g., through written agreements, contracts and other administratively approved agreements - between forestry research institutions in developing countries (n=39) and seven types of organizations. Numbers in the table are the percent of respondents for each level of interaction (never, occasionally and frequently), type of interaction and type of organization with which interaction occurs. Thus, the first cell in the table indicates that 43% of the institutions included in the sample never interact with other forestry research organizations in their country through cooperative research, 32% occasionally interact in this way, and only 24% frequently interact.

<table>
<thead>
<tr>
<th>Type of organization</th>
<th>Cooperative research</th>
<th>Training or staff exchange</th>
<th>Exchange information</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>N</td>
</tr>
<tr>
<td>1. Forestry research organizations in your country</td>
<td>43</td>
<td>32</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>2. Agricultural research organizations in your country</td>
<td>46</td>
<td>38</td>
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<td>62</td>
</tr>
<tr>
<td>3. Educational institutions in your country</td>
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<td>8</td>
<td>38</td>
<td>44</td>
</tr>
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<td>4. Research organizations in other countries</td>
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<td>54</td>
<td>28</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td>7. Organizations that use research results (firms, landowners, etc.)</td>
<td>54</td>
<td>36</td>
<td>10</td>
<td>59</td>
</tr>
</tbody>
</table>

*N=Never; O=Occasionally, F=Frequently

### Facilities and equipment

The issue here is adequacy of research facilities, equipment and supplies and balance among them and between them and the availability of researchers to effectively utilize them. The adequacy of facilities and equipment varies greatly between organizations in developing countries. In most, the priority need is for well-equipped and supplied laboratories rather than buildings. Improvements in the provision of research equipment and supplies was ranked fifth in the Bengston and Gregersen (1988b) survey of factors affecting research capacity in developing countries. Improvements in buildings ranked down at sixteenth position.

A survey of fuelwood research capabilities in Africa found that only a few institutions have well-equipped laboratories which fully meet their research needs (FAO, 1984). This survey included responses from 33 African institutions, including 19 English-speaking and 14
French-speaking institutions. Specialized research equipment was found to be lacking in many instances.

Research equipment manufactured in developed countries is in many cases unsuited to conditions in LDC's due to lack of maintenance facilities, spare parts and long delivery times. Yet, it quite often is the only equipment available, particularly if being financed through a foreign donor agency.

Networking and internationalization

Isolation and inadequate communication linkages are key issues which many research administrators feel are important. The development of strong communication linkages is a key function of research management and an important factor affecting research systems. This relates to the previously mentioned issues associated with information services. Research institutions must develop and maintain a variety of linkages with the outside, including linkages with other national research organizations, educational institutions, various user groups and international donor and technical assistance agencies.

Table 2 addresses the issue of communication linkages or cooperation by summarizing the type and frequency of interaction of a sample LDC forestry research institutions (Bengston, Xu, and Gregersen 1988).

- Of the four types of interaction shown in Table 2 - cooperative research, training or staff exchange, information exchange, and other - information exchange was used most frequently on average across all types of organizations. Cooperative research occurred most frequently with forestry research organizations in the same country, with 56% of respondents indicating that their institutions interacted occasionally or frequently in this manner. Training or staff exchange occurred most frequently with educational institutions in other countries.

It is noteworthy that the frequency of information exchange with users of research results was relatively low, roughly the same as the frequency of information exchange with international institutions and with research organizations in other countries. The fact that 18% of the institutions surveyed report that they never exchange information with users of research results and 54% only occasionally interact in this way suggests the need for improving this type of interaction. Perhaps the most striking feature of Table 2 is the relatively low frequency of interaction of all types and with all types of organizations.

In the area of international cooperation, the number of contacts with international organizations by 53 forestry research institutions in Africa was found to be quite limited (FAO 1987b). The scope of cooperation was broadly defined to include everything from exchange of information to requests for financial assistance to out-posting of foreign experts. Only 11 of the 53 institutions reported more than 5 regular contacts with foreign organizations, 16 institutions reported 3-5 regular contacts, 20 reported 1 to 4 contacts and 6 reported no contacts. Also significant was that only about 43% of the institutions surveyed were members of IUFRO. Clearly there is great need for increased international cooperation in forestry research.

A systematic approach to assessment

The relative importance of the various institutions. The most critical issues are the attention, although the extent to which a systematic resolution of the whole set of

In this regard, a simple assessment tool relative importance of various factors interaction (Bengston, Gregersen, Lundgren et al.)

First, values for eight "research capacity" estimated (see Table 3 for the eight indices established by survey responses from a given region. Third, based on this comparison show how the organization being studied information provides the research administra
tion or her organization. Fourth, more
dertaken and means can be developed to

While this type of capacity assessment de
dient way for the administrator to look at

A detailed discussion of the above proce from the authors.
MANAGEMENT OF FORESTRY RESEARCH IN AFRICA

Forestry research organizations are developing means of interacting more productively, particularly through formation of various types of networks related to research. Four types have been used in forestry:

• Information networks, which merely involve the sharing of information on a variety of topics. Many of the IUFRO subject groups fall in this category.

• Networks of research projects or activities, where researchers working on the same problems, but in their own research projects, share information on methods, results, etc.

• Research project networks of decentralized type. In this type of network, a limited number of organizations or researchers agree to work on different aspects of a common problem. They meet frequently and work closely together generally through a lead organization that coordinates and often funds some of the work.

• Research project networks of centralized type. This involves a structure designed specifically for the network project. A lead institution provides funding and generally has personnel outposted to the member institutions.

A systematic approach to assessing research capacity issues

The relative importance of the various issues raised above will vary from institution to institution. The most critical issues are the ones which generally will require most immediate attention, although the extent to which research capacity is improved will depend on the systematic resolution of the whole set of issues confronting an administrator.

In this regard, a simple assessment tool has been developed to systematically analyze the relative importance of various factors influencing research capacity in a specific organization (Bengston, Gregersen, Lundgren and Hamilton 1988).

First, values for eight 'research capacity indicators' (RCI's) for a given institution are estimated (see Table 3 for the eight indicators). Second, the results are compared to norms established by survey responses from IUFRO member institutions worldwide or from a given region. Third, based on this comparison, a research capacity profile is constructed to show how the organization being studied measures up relative to the norms. The resulting information provides the research administrator with a view of the relative weaknesses of his or her organization. Fourth, more detailed analysis of the weakest links can then be undertaken and means can be developed to deal with them.

While this type of capacity assessment does not solve problems, it does provide a convenient way for the administrator to look systematically at issues related to research capacity and a way for the administrator to get a preliminary view of the relative weaknesses of his or her organization.

A detailed discussion of the above process, including an example, is available free of charge from the authors.
Table 3: Research Capacity Indicators

External interaction/communication indicators
1. Scientific communication, or interaction with other research organizations
2. Interaction with institutions of higher education
3. Interaction with users and potential users of research results

Internal environment indicators
4. Non-salary incentives for researchers
5. Salary incentives for researchers
6. Use of formal and informal evaluations in decision-making with the organization;

Research resource indicators
7. Degree of focus in a research program relative to the organization’s scientific resources; and
8. Technical support for researchers.


Concluding comments

The process of building up research systems is clearly highly complex, involving a large number of interrelated issues. This paper has highlighted a few key management issues and suggested approaches for dealing with them. Building up capacity also is a long-term process. Ruttan (1982) observes that "it took 50-70 years of persistent effort to organize a productive agricultural research and advisory (extension) system in the United States". Developing countries that are in the process of building national forestry research systems cannot afford to wait this long. The urgent development issues facing many countries — including food insecurity, energy insecurity, environmental deterioration, and unemployment — require a strong response from indigenous forestry research institutions.

For this reason, forestry research managers need to draw on sound management practices and the experience gained by successful research institutions in developing countries. For example, the International Service for National Agricultural Research has produced many publications — some available in English, French and Spanish — that provide practical guidelines for research planning, organization and management (ISNAR, 1989).

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MANAGEMENT OF FORESTRY RESEARCH IN AFRICA


Issues facing managers of forestry research in developing countries: Gregersen and Bengston


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Special Programme for Developing Countries
Vienna, Austria