A Self-learning Course

Planning and Managing Forestry Research
Volume VI

Module 11
Developing Research Linkages: Learning from Others

Module 12
Communicating Research Results to Users
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

Module 12
Communicating Research Results to Users

International Union of Forestry Research Organizations
Special Programme for Developing Countries
Vienna, Austria
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List of Study Units covered in the module:

Study Unit 12.1. Communicating research results for scientific use
Study Unit 12.2. Communicating research results for application
Study Unit 12.3. Strengthening linkages between research and users

Communicating Research Results to Users

To be effective, research results must reach the intended users, be useful to those users, and actually be adopted and used by the users. Frequently, research results are disseminated, but fail to reach the intended users where and when they are needed because the processes by which research results get adopted in practice are not well understood by forestry research organizations. Unfortunately, even when research results are disseminated to users, the research often is never adopted and used because it fails to meet the needs of the users.

We designed this module to help you to understand the critical importance of successfully communicating research results to users. We’ll present tips on the most effective methods to communicate research results to specific user groups. We’ll also show you many valuable ways to strengthen your organization’s linkages between researchers and the users of research results. These improved linkages will enhance the relevancy of your research, and will increase the chances that your research results will be permanently adopted and adapted.
Skill & Knowledge Assessment

Module 12 - Communicating Research Results to Users

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 this module. These are identical to those listed in Study Unit 0.3 - Self-assessment of Training Needs, which you may have completed initially 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, using the following descriptions:

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>
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<th>Skill or Knowledge Statement</th>
<th>Your Level of Skill or Knowledge</th>
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<td>a) Describe the most effective methods, and their limitations, by which forestry research results are communicated to scientists.</td>
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<td>b) Describe the most effective methods, and their limitations, by which forestry research results are communicated to users for application.</td>
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<td>c) Identify potential users and adopters of your organization's research.</td>
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<td>d) Determine and describe how research produced by your organization is adopted and used by its intended users and identify potentially weak links in the research dissemination-adoption process for your organization.</td>
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<td>e) List seven actions managers can take to promote effective linkages between research, extension, and research users.</td>
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<td>f) Describe nine principles for using linkage mechanisms to improve the usefulness and dissemination of research results.</td>
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Objectives
When you have completed this study unit you should be better able to:
• list the most effective methods by which forestry research results are communicated to scientists;
• describe some limitations in the ways that forestry research results are commonly disseminated to the scientific community; and
• determine your organization’s performance in disseminating research results to other scientists.

Communicating Research Results for Scientific Use

You probably already recognize that scientists must interact in order to keep abreast of important developments in their fields of study. By completing this study unit, we think you’ll better understand the many ways that research results are communicated within the scientific community. We hope this new understanding will help you to improve your organization’s communication strengths and correct its deficiencies.

Importance of Research Dissemination in Science
Science is a social endeavor (Storer 1966). The body of knowledge developing within a scientific discipline is not the work of a single individual, but of a multitude of scientists, interacting with each other. Scientists depend upon the work of other scientists in a field of research as a basis for their own work in the field. Thus, all scientists have a responsibility to ensure that the results of their research are made available to other scientists.

Scientific publications play a major role in the dissemination of research results to other scientists. However, scientists disseminate and obtain information by many other means, such as personal contacts and attendance at professional meetings (see study unit 11.1 on research networking). The various means by which research results are disseminated to scientists are discussed in this study unit. The next study unit describes the dissemination of research results to nonscientific audiences, including practitioners and the general public.

In order to become part of a scientific community, scientists must interact with other scientists. They utilize research results of other scientists to further their own research, submit their work to peer review, and communicate their results to other scientists. If managers of forestry research wish their organization to play
an active role in the development of science, they must provide opportunities for their scientists to interact, in one way or another, with other scientists to further the dissemination of research results. This interaction with peers serves an important quality-control function in scientific research. Submitting research proposals and publications to peer review provides managers with a systematic and relatively inexpensive means of monitoring and evaluating research quality from the scientific viewpoint. By encouraging such peer interaction, research managers help to assure the scientific quality of their research output.

If research is to be useful, it must reach the intended user. It is irresponsible for scientists to expend scarce funds to conduct research, yet not to publish the results. This flagrant abuse of resource funding should not be tolerated by research managers.

Although there are many means to disseminate research results, scientific research is considered incomplete without publication (Price 1980). For scientists, scientific journals, books, and other publications are a primary source of information about the status of science in any given field. They provide one of the chief ways of documenting and verifying research findings, and of communicating those findings to other scientists. Publication of research results in scientific journals is one of the most visible, easily accessible, and lasting contributions to science.

Scientists publish not only to disseminate research results to the scientific world, but also for more personal reasons: to establish a professional reputation, gain access to professional colleagues, gain invitations to professional meetings, and to gain promotion (Maguire and Kench 1981). There is also a need to communicate research accomplishments in a meaningful manner to higher-level administrators, policymakers, and those who fund research to justify funding. Doing this effectively requires special communication skills, with an emphasis on abstracting and summarizing research reports to extract the key results and highlight their importance.

There is reason to be concerned that in many public forestry research organizations around the world the increasing commercialization of research may inhibit the publication of research results. This means not only that the world's scientists may have severely restricted access to the results of commercialized public research institutes, but also that the scientists within those research institutions will no longer have the benefit of subjecting their research results to the public review of their peers. Also, scientists outside of those institutions may be reluctant to exchange information if they receive little or nothing in return. This blocking of the free exchange of information
among the scientific community could in the long run lead to a reduction in research quality, particularly within the research institute that fails to obtain peer review of its research results by making them public.

There is also the problem of determining ownership and dissemination rights to the results of research financed by private sources of funding. Some private funders may provide funding only if they retain full rights to the results of the research, including dissemination rights. In some cases, the restrictions on research dissemination requested by outside funding organizations or firms may directly contradict policies and laws governing public research organizations. In such situations it is critically important that the legal questions regarding dissemination rights and restrictions be resolved prior to finalizing any research agreement, and that those rights be clearly stated in the resulting agreement.

**Overview of the Research Dissemination Process in Science**

Scientists always have used informal systems for exchanging information and disseminating research results. Scientists who share a common interest in a particular research subject often form what has been referred to as “invisible colleges,” an intricate network of personal contacts, where the exchange of ideas, information, and draft papers occurs, often far in advance of more formal publication (Gray and Perry 1975). Those at the forefront of a rapidly expanding field of science find it essential to maintain a close contact with others in the field in order to keep their own research on track, and to share in guiding the new developments. They do this through personal visits, attendance at meetings, letters, mailing lists, exchange of preprints, telephone, and more recently by facsimile (fax) machines and electronic mail networks (see study unit 11.1).

In many fields, a large part of new scientific findings are first distributed to interested colleagues through these invisible colleges and by other informal means, and only later find their way into print. One should not underestimate the power of such informal networks of scientists in disseminating information about current research in progress. Research managers should encourage scientists in their organization to become part of such invisible colleges wherever possible in order to tap into the latest scientific discoveries and gain access to those active scientists who make up these informal networks.

However, such informal exchanges of information are not substitutes for the more formal dissemination of research findings.
to scientists through publication in journals, research reports, and books. Scientific journals provide a verified record of research achievements over time. Journals are the basic scientific information bank that is accessed by scientists in planning and conducting their research. Books provide a synthesis of an accumulated body of knowledge and provide an overview of a subject matter area. Such overviews are especially helpful to students and to those not intimately familiar with a particular subject area.

Access to the various means by which research findings are disseminated is essential to the conduct of research. Those lacking access to scientific information are severely handicapped in their research.

**The Role of Scientific Journals**

Scientific journals are one of the major publication outlets for disseminating research results to other scientists. The publication of research results in a scientific journal provides public documentation of scientific findings, and makes such findings accessible to a wider scientific audience. It provides a permanent record of research results that is available over time for the use of future researchers.

The informal exchange of information, while playing an important role in communication among scientists, lacks the formal verification that a publication in a refereed scientific journal is forced to undergo. Peer review provides a necessary verification of research work before it is widely disseminated, and can improve the quality of scientific writing.

Forestry research organizations disseminate a substantial part of their research results through scientific journals. For example, in fiscal years 1980 and 1981 researchers in the Forest Service of the United States Department of Agriculture, produced 4,523 publications (Jakes and VanDyne 1987). Nearly one-third of these were published in 363 different journals, most of which were scientific journals. These included several journals devoted to forestry, such as the *Journal of Forestry*, *Forest Science*, *Canadian Journal of Forest Research*, *Forest Products Journal*, and *Silvae Genetica*, to name a few. However, many appeared in nonforestry journals, such as *Phytopathology*, *Canadian Entomologist*, *Journal of Arboriculture*, *Journal of Range Management*, and *Water Resources Bulletin*, to name a few.

Most scientific journals are devoted to a particular field of science. However, some strive to be interdisciplinary with respect to particular problem areas, and encourage submission of manuscripts from any discipline that relates to the subject matter of the journal.
Because of the proliferation of scientific journals, and their increasing expense, most forestry research organizations cannot subscribe to more than a fraction of those that would appear to be relevant to the various fields of forestry. Access to the literature in scientific journals is a problem to all scientists, but particularly to those in developing countries. Finding out what has been published in the various journals is difficult. Some of the best sources of information about what is available in older publications are the citations in published articles on a particular subject area. Such citations often provide excellent clues to relevant journals and articles. When they are available, review articles in journals are often excellent sources for obtaining older references to a subject matter area.

For more current information about the literature available in scientific journals, scientists turn to special journals, such as Forestry Abstracts, that publish abstracts of publications. Abstract journals list and briefly describe publications relevant to their subject matter area. The journal Current Contents attempts to meet this need in another way, by publishing reproductions of the table of contents of the major scientific journals, and by listing research institute reports.

Scientific journals are an effective, but imperfect, way to disseminate research results to other scientists. The publication of an article in a scientific journal is only the first step in the dissemination process. There is no guarantee that an article published in a particular scientific journal will ever reach the desired audience. To achieve dissemination through a scientific journal, the following conditions are necessary:

- the article must be accessible to the scientist;
- the scientist must be aware that the article is available; and
- the scientist must read the article to obtain the information contained therein.

Forestry Abstracts provides intensive coverage of the world’s forestry literature. However, many forestry researchers, particularly in developing countries, lack access to all but a few scientific journals. Few, if any, scientists have ready access to all scientific journals published, although rapidly advancing CDROM technology is improving the access to scientific literature. Articles published in journals that are not widely distributed, or that are out of the mainstream of forestry research, are likely to reach only a limited audience of forestry researchers. A proposal to publish an article in a scientific journal should be analyzed to determine whether publication in that journal will, in fact, reach the intended audience and, if not, what can be done to achieve a more desired...
distribution of the article. An attempt could be made to get the article published in a journal with a wider distribution to the desired audience. Or, an effort could be made to obtain reprints of the article, and make them available to a wider audience. Achieving an effective dissemination to scientists through scientific journals may require more effort than simply ensuring publication in a journal.

**Other Options for Disseminating Research Results to Scientists**

To ensure a wider distribution of research results to scientists, the research manager should explore and encourage the use of other options for dissemination.

*The presentation of papers at scientific and technical conferences* can be an effective way to disseminate research results, although to a relatively limited audience. Presentations and written papers prepared for the conference quickly reach those who attend, and enable researchers to get immediate feedback. However, attendance at conferences is often severely limited for many reasons. Only a relatively small percentage of scientists who might be interested in the subject matter of the conference are likely to attend, whether because of a lack of time or funds, or some other reason. Conferences often cover a broad array of topics, and many of those who do attend may have little or no interest in any particular subject being presented. A larger audience is reached at a later date if the proceedings are published. One of the difficulties with depending upon conference proceedings for disseminating research results is the relatively limited audience reached in the distribution of conference proceedings. It often is difficult to obtain copies after a year or two following their initial publication. Publicity about the availability of conference proceedings is often incomplete, and those who have a need to know may not find out such publications are available. Libraries have a difficult time obtaining copies of all relevant proceedings. Retrieval of articles published in conference proceedings may be difficult, because coverage of such publications in abstract and other reference journals often is incomplete.

*Scientific and technical reports published by forest research organizations* are another important means of disseminating research results to scientists. In addition to reaching scientists, such reports often achieve a wider distribution among field practitioners and other nonscientists than do articles published in scientific journals. Many of these publications are reviewed by peers before publication, but some are not. Because of the large number of forest research organizations that publish such reports,
knowing what has been published by each organization, and what is available, becomes a difficult job for any scientist. Complete collections of such publications are likely to be available in only a few of the major forestry libraries. Few forestry scientists have access to more than a small fraction of the publications from forestry research organizations around the world.

**Technical, general scientific, and popular publications** are aimed more at informing nonscientists, including the general public, than scientists. However, scientists also read these publications, and articles written for them provide another option for disseminating research results to scientists. Trade journals, which are aimed at a specific segment of industry, or other group in society, provide a good outlet for some of the applied research findings. Scientists working in various fields of forestry and forest products often find in such publications information about trends in industry and new developments in products and uses that is useful in their research. Thus, publications such as these do provide a means of disseminating research findings to scientists. General science publications that cover a wide range of scientific topics (for example: *Nature, Science, Science News, Scientific American*), are a good way to reach scientists in other disciplines, who may not have the desire to read some of the more narrowly focused articles published for professional peers in scientific journals.

**Demonstrations** of research studies, results, methodologies, and equipment in the field, laboratory, and office, are a good means of presenting research findings to professional colleagues, as well as to nonscientists. A surprising amount of the most recent scientific information is often passed among professional scientific colleagues in this manner. Demonstrations to visiting scientists of the latest scientific instruments, a new plot layout, a useful computer program, the latest tables and graphs being prepared for a new manuscript, all play an important role in disseminating information among scientists.

**Field tours** conducted during training sessions, or as part of scientific conferences and annual meetings of professional societies, all help to disseminate information about research programs and research findings. They also help to identify and/or demonstrate special resource management problems of particular interest to scientists.

**Workshops and training sessions** that address special problems in forestry and forest products, or that discuss methods and techniques for solving particular problems, provide a good opportunity to exchange ideas, information, and knowledge among those scientists who attend. Working together in a workshop
environment can be an especially effective way of disseminating information among scientists in different disciplines. Learning to communicate effectively with scientists from different disciplinary backgrounds can be a frustrating, but rewarding experience.

Authorship of Research Publications

Authorship of research publications is one of the major rewards prized by researchers, and it is one of the principal ways for judging research productivity of individual scientists. This is especially true with regard to authorship of publications in refereed scientific journals. Recently there seems to be an increasing trend towards more joint authorship in many fields of science, perhaps as the result of the increasing use of research teams to deal with complex interdisciplinary problems. In such situations, bitter controversy can arise over who is entitled to be listed as an author on a scientific paper, and the order in which they are listed.

Authorship policies vary widely from one research institution to another. Many institutions insist that only those who contribute substantially to the writing of the publication should be listed as an author, and the person contributing the most be listed as the senior author. At other institutions, senior scientists in charge of a research unit or laboratory may insist that their name be listed on all publications, regardless of whether or not they actually contributed to the writing. Some institutions may wish to recognize the contributions made by individuals to the research by listing them as authors, even though they may have had no part in the actual writing of the paper. Still other institutions may have no fixed stated policy regarding authorship, but let that be determined by the scientists involved on a case by case basis.

The crediting of senior authorship is particularly important, because it is usually assumed that it is the senior author who has taken the lead in writing the publication, and has contributed the most to it. In bibliographies and literature citations, the publication will be listed first under the name of the senior author. Any credit for the publication (or criticism of it) usually will be directed primarily towards the senior author, as will any questions or correspondence regarding the publication.

Young scientists who are relatively unknown often find that it helps to jointly author a paper with a more well known scientist. Some welcome the chance to become affiliated with more senior scientists in publishing reports of their research results, at least until they become more well established in their profession. Others may be fiercely independent, and resent suggestions that they share authorship with a more senior scientist.
In some situations, senior scientists or research managers may actually have to substantially rewrite an unacceptable paper prepared by inexperienced subordinates. In some cases they may have to take the lead in writing a paper in order to obtain any publication at all when junior scientists find it difficult to prepare material for publication. In such situations, the senior scientist may rightly claim senior authorship, although some may decide otherwise to encourage or advance the careers of younger scientists. Some senior scientists who have responsibility for major projects require that their name be on all publications as a means of securing adequate recognition for project accomplishments.

In the end, the basic question of authorship is the problem of who gets public credit for the research that was conducted. Research managers must either establish clear policies with regard to authorship of research publications, or be prepared to resolve conflicts that may arise over claims to authorship.

The Research Manager's Role in Dissemination

The manager plays a crucial role in the dissemination of research results, both for a scientific audience and for practical application. Managers can improve dissemination by encouraging (and requiring) scientists to publish the results of their research, by ensuring that publications and other means of dissemination are of high quality, and by helping to identify potential outlets for research results.

Some scientists, particularly young scientists, have had little experience in scientific and technical writing. They may be unsure about how best to prepare their research results for publication, and may have little confidence in their ability to produce acceptable publications. They can benefit from encouragement, advice, and help from more experienced researchers and managers in producing publications. Some researchers are reluctant to publish, because in doing so they expose their results to peer review. They fear the possibility of adverse comments and criticism. In some cases, managers may have to put strong pressure on such researchers by setting goals and deadlines in order to get them to publish their results.

People outside of the research organization will inevitably judge the organization by the quality of its research products. It is the job of the manager to insist on a high level of quality in all research outputs of the organization. Premature release of research results that are not of high quality can reflect adversely upon the organization. Thus, the manager will institute some means of checking on the quality of research outputs before releasing them.
for wide distribution, regardless of the media used. This can be done through peer review, internal professional editing, or other means. Poor quality material should be revised to meet acceptable standards. If the quality is found wanting, it may be necessary to provide training to improve quality. A special effort may be needed to provide training to improve scientific and technical writing, which is a common weakness of forestry research scientists in both developed and developing countries.

The research manager can play a key role in highlighting results of the organization’s research program to key stakeholder groups, including scientific groups. The manager often is the most visible and widely known representative of the organization, and is contacted directly and asked to describe parts or all of its research program. To do this effectively, the manager must be well versed in the work and results of the organization, and be able to present its results in a variety of media, often with little advance warning. Managers can prepare for this by having at their fingertips information and materials that can be used to describe and dramatize their organization’s research program, results, and impacts.
Activities

Activity 1

Explain in the space below the concept of the invisible college and describe how it is used to communicate forestry research results to other scientists.

Activity 2

Explain in the space below why scientific journals are an imperfect way to disseminate research results to other scientists.
The invisible college is an informal yet intricate network of scientists who share a similar interest in a particular research subject and communicate directly or indirectly with one another. Invisible colleges are where many exchanges of ideas, information, and draft papers occur, often far in advance of formal publication. For those wishing to stay at the forefront of their field, participating in a personal invisible college is essential to keep their own research on track, and to share in the guidance of new scientific developments.

While effective, scientific journals have limitations in disseminating forestry research results, particularly in developing countries. Even though an article is published in a journal, there is no guarantee that the article will be accessible to a scientist. A scientist must be aware the article is available, and then obtain and read the article to get the information it contains.

Scientific journals are expensive, often prohibitively so for many forestry research organizations in developing countries. Many research organizations can afford to subscribe to only a few of the major journals. Any articles published in less-than-mainstream journals may not reach scientists in the developing world. Language barriers further complicate the situation. Thus, when scientists are submitting an article for publication, it is important to target journals that best reach the intended audience.
Name six alternatives to scientific journals which can be used to channel forestry research results to other scientists.

1. 

2. 

3. 

4. 

5. 

6.
Did you think of at least six alternatives to scientific journals? If so, congratulations! Review our answers below and compare to your own. If you had trouble with this, we suggest you reread the text.

Comment 3

1. Presentations at scientific conferences and publishing papers in the conference’s proceedings provide one means to disseminate research results to scientists working in the same or related fields. Such “gray” literature provides a splendid opportunity for scientists to present their most recent findings to their peers for feedback and critique. Unfortunately, proceedings often have a limited distribution, and often go out of print quickly.

2. Scientific and technical reports published by forestry research organizations can be quite effective in communicating research results to other scientists, and the general public. The drawback, however, is that such reports often have a limited distribution, reaching only a limited number of people.

3. Technical, general scientific, and popular publications, while aimed at nonscientists, reach a considerable percentage of scientists as well. Trade journals are another good option for publishing results useful to scientists in industry.

4. Demonstrations of research studies, results, methodologies, and equipment in the field, laboratory, or office are a good way to disseminate scientific information to visiting scientists and colleagues.

5. Field tours during training sessions, as part of scientific conferences and annual meetings of professional societies reach a significant number of scientists.

6. Workshops and training sessions are especially effective in helping scientists to disseminate information among scientists in different disciplines.
Using the table below, rate your own research organization's efforts to disseminate forestry research results to scientists. Place a check in the column that best describes your organization's performance for each criterion listed.

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<th>Very Good</th>
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<th>Fair</th>
<th>Poor</th>
<th>Very Poor</th>
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<td>Research results formally reported in some fashion</td>
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<td>Research results promptly published</td>
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<td>Submitted papers accepted for publication by peer reviewed journals</td>
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<td>Majority of research results published in peer reviewed journals</td>
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<td>Research results published in cohesive and comprehensive form, not split into a number of smaller subpapers</td>
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<td>High percentage of research results are original in content and findings, repeated publishing of older findings limited</td>
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<td>Promotion advancement of scientists based on quality of research and publishing record, not on quantity of published articles alone</td>
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<td>Adequate number of skilled editorial staff available in-house</td>
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<td>Editorial support staff not overwhelmed with work</td>
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<tr>
<td>Adequate computer word processing programs available in-house</td>
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<tr>
<td>Functioning and competent internal peer review system</td>
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<td>Staff scientists requested to frequently contribute to books</td>
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<td>Frequent external requests for reprints, and for research reports</td>
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<tr>
<td>Emphasis on excellence</td>
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<tr>
<td>Subscriptions to most of the scientific journals, newsletters, and periodicals that are most relevant to the focus of the research agenda</td>
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<tr>
<td>Frequent presentations of research results at conferences by staff scientists</td>
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<tr>
<td>Periodic use of the forestry research station for regional or national meetings, workshops, field days, seminars, etc.</td>
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<tr>
<td>Occasional reporting of research results and synthesis in technical, general scientific, and popular publications (magazines, newspapers) for scientists and the informed public</td>
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</table>
How did your organization do? You probably identified some weaknesses in your organization’s approach to the dissemination of research results. Armed with this information, you can now proceed to reduce those weaknesses and improve communication of the excellent research results your organization produces!
How would you suggest your organization address those dissemination criteria that you determined need improvement (those in the fair, poor, or very poor categories)?

We hope you were able to suggest ways to improve dissemination of your organization's research results, where improvement was needed. Acting upon these suggestions should help you more effectively communicate your research results to users.
Science is a social endeavor. Scientists depend on the work of other scientists in a field of research as a basis for their own work in the field. Thus, all scientists have a responsibility to ensure that each scientist spends some time communicating research results to others. Scientists communicate with each other by using a wide variety of means, ranging from scientific journals and other periodicals, books, conferences and their proceedings, presentations, informal and formal networks, workshops, seminars, field days, etc.

By completing this study unit, we hope that you’ve gained a better understanding of the many ways that research results are communicated within the scientific community. If you completed the activities, you generated some practical information regarding your own organization’s performance in disseminating research results, information you can act on to improve its communication efforts.

If you would like more information about communicating forestry research results to the scientific community, 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. A key article directly related to the topics covered in the module, and cited in the text, is reprinted for your use in the section on readings at the end of the module.
Objectives
When you have completed this study unit you should be better able to:

- identify the potential users and adopters of your organization’s research results;
- list the most effective ways forestry research results are communicated to users for application;
- determine and describe how the research results produced by your organization are communicated to the intended users;
- identify potentially weak links in the research dissemination- adoption process used by your organization, and suggest improvements.

Communicating Research Results for Application

Other people besides scientists use research results. Research organizations will make no contribution to a nation’s development goals or to solving social, economic, and environmental problems if research results are not successfully communicated to final users and put to use. Further, users of research are fundamentally important stakeholders whose input is vitally important in research planning and the setting of research priorities. Thus it is essential that research managers develop and maintain strong linkages between researchers and the users of the research results.

By completing this study unit, you’ll learn the importance of communication between scientists and the users of research. We hope this new knowledge will enable you to better appreciate the critical importance of two-way communication between users and researchers. This unit should also help you to improve your ability to evaluate your organization’s performance in communicating with users of your research results, and to envision improvements.

Facilitating the Dissemination, Adoption, and Use of the Results of Applied Research

Much of the research conducted by forestry research organizations can best be called applied research. Its purpose is to produce information and other research outputs that will help forest land managers, forest users, and other people change the ways in which they do things. The intention is to help develop new technologies that can be adopted, adapted, and implemented by people carrying out their day-to-day activities. This adoption and use of new or revised technologies is called technological innovation (for a discussion of the role of research in technological innovation, see study unit 1.1). One of the most important activities in technological innovation is the dissemination and utilization of new technologies.
Note that the interest here is not just the communication or dissemination of research results to users. Applied research is ultimately evaluated, not by how successfully results were distributed, but by how widely and successfully they were adopted and put into practice, and by the effects on society and the environment that resulted from their adoption and use.

Research managers who want to have an effective research organization that generates widespread support will be obliged to play an active role not only in producing useful results from research, but also in facilitating their adoption and use. They dare not leave the responsibility for this task to others, but must take the lead in ensuring the usefulness of the research results that their organization produces. They also must take steps to ensure that the research results produced and distributed meet standards of high quality.

Research results that do not meet the needs of potential users, that cannot be used by them to improve the ways in which things are done, will not be adopted and used by them. Thus, one of the key responsibilities of the applied research manager is to ensure that the research being conducted by the organization is indeed meeting the needs of users. This can best be done by encouraging and facilitating interactions between researchers and users throughout the process of planning and conducting research (see study unit 12.3 on strengthening linkages between research and users).

The Process of Technological Innovation

In order to produce, effectively disseminate, and facilitate the adoption and use of research outputs, the manager of forestry research needs to understand the process by which technological innovation takes place. This was covered briefly in study unit 1.1, but a further discussion of this process is in order here. The technological innovation process involves four major stages (figure 12.2.1):

- **Research and the development of technologies.** Scientific research by itself is not likely to produce much in the way of results that can be directly applied by field-oriented resources managers and users. As we have seen in study unit 12.1, the results of scientific research are generally disseminated through scientific journals, conference proceedings, and similar sources. This information is rarely accessible to field practitioners, or in a form that is useful to them. For example, reports of the amount of tree growth over a period of five years of the species found on a particular research plot contributes to our knowledge of growth and yield in general. However, it is likely to be of
little direct use to either resources managers or users who need
growth and yield data covering a wide variety of conditions over
a considerable period of time. Before the results of research can
be applied, they often have to be developed further in
conjunction with some potential users to ensure that the new
technology will meet their needs.

• **Diffusion of technology.** Once useful technologies have been
developed, the next step is to disseminate the information and
knowledge about the technology to all those who may find it
useful so they become aware that it is available and know its
advantages and disadvantages. This process of diffusion may be
carried out through: (1) education at the elementary, secondary,
college/university, graduate school levels; (2) training done by
individual instruction on the job, through programs of self-study,
or through specialized training courses; (3) extension involving
the transfer of technology from research to extension to the final
users; and (4) other methods, including direct interaction of
researchers and developers of technology with potential users,
word-of-mouth contacts among potential users, and other means.

• Utilization of technology. Once potential users become aware
that a technology exists, and they are well informed of what it
can do, the next step is to decide whether or not to adopt and
implement the technology for their own use. In some cases it
may be possible to adopt and use the technology directly. In
other cases, it may be necessary to modify the technology to
adapt it to existing operations. If substantial changes in the
technology are required to make it useful, this may require
consultation with the original developers, and perhaps some help
from them to adapt it successfully.

• Impacts of technological innovation. Once the technology has
been adopted or adapted by the intended users, and has been put
into operation, the changes brought about by the use of the
technology may have substantial economic impacts (on the
organization or firm, or on members of society); social, cultural,
and political impacts on individuals and groups in society;
adverse or beneficial environmental impacts; and impacts on the
natural resources base. All of these direct and indirect, current
and future impacts should be considered as part of the
 technological innovation process.

Before research results and new technologies can be adopted and
used, potential users must be aware of them. The dissemination of
new information and technologies to potential users is an
important step in technological innovation. This may take place
through scientific, technical, or more popular publications; contact
with technology transfer agents (such as extension organizations);
direct contact between researchers and users of the technology;
word-of-mouth from other users; newspapers and newsmagazines;
advertisements; or in a number of other ways. Over the past
decade or so, several studies of the diffusion of innovations in
forestry have found that one of the most effective ways to
disseminate information on new technology and knowledge, is
through personal contact among peers (Muth and Hendee 1980;
Roggenbuck and Watson 1980; Nicholls and Prey 1982; Straka,
Anderson, and Bullard 1986). Once potential users become aware
of new technologies, they must then decide whether or not it
makes sense, in the context of their environment, to adopt and use
the technology.

Muth and Hendee (1980) have identified five stages in the process
of adopting innovations:
1. **Awareness**—the stage where individuals first become aware of an innovation, often from mass media or personal contact.

2. **Interest**—the stage where individuals seek to find out more about the innovation, to find out whether or not it might be useful to them.

3. **Evaluation**—the stage where individuals have enough interest in the innovation to evaluate its potential usefulness to them in terms of its feasibility and potential costs and benefits.

4. **Trial**—the stage where individuals try out the innovation on a small scale to test and validate how well the innovation works in practice, without making a major commitment of time or other resources.

5. **Adoption**—the stage where individuals decide, based on the trials they have conducted, to adopt or reject the innovation. In some cases, the stage between trials and adoption may be preceded by a series of modifications of the innovation in order to better adapt it to the person's own circumstances.

Those seeking to disseminate innovations should be aware of this innovation adoption process, and be prepared to help potential users as they go through this process. This innovation adoption process takes time; several years may elapse between the time an individual first becomes aware of an innovation and the final adoption, particularly if the evaluation and trial stage requires considerable time to produce the results needed to move on to the adoption stage. Further, each stage is a process of elimination, and very few innovations are likely to go through the entire sequence of steps. Many, if not most of the innovations of which we become aware do not survive the awareness stage. Only some are likely to progress beyond the interest stage. It is likely that very few will ultimately be adopted in practice.

In general, only some of the technology that is developed is ever adopted. Midgley (1977), in summarizing a number of marketing studies, reported that 5 out of 10 new products never reach the market, and that of those that do, less than 10 percent survive in the market beyond one year. We don't know what the adoption rate of new technologies is in forestry, but there is no doubt but that many research outputs go unused by those for whom they were intended.

### Identifying Users and Their Needs

Important questions that every research manager must address include: Who are the users and potential users of our research results? What are their information needs? Identification of the end users of research results should not take place after completion of a particular research project or program. Rather, identification of
and interaction with potential users should take place early in the planning stages of research. Users need to help define the problem and specify the kind of information and other research results that they need for their purposes. Research that has been designed with input from users and with their needs in mind will be much more likely to be adopted and implemented.

It may be helpful to conduct a simple user analysis, similar to the stakeholder analysis discussed in study unit 2.3. Recall that stakeholders are defined as people, groups, or organizations that have a claim on the research organization's attention or resources, or are affected by the research output. Examples of stakeholders for a research organization include public officials, governing bodies, special interest groups, employees, other research organization, and the full range of end users of research results. These end users of research results are easily the most important stakeholder group for a research organization.

A user analysis should ideally be carried out for every major research project or program, since different types of research will often have different sets of potential users. The user analysis can be structured around two fundamental questions:

1. Who are the potential end users of the type of information or output to be generated by the proposed research project or program?
2. What are the specific information or output needs of these potential users that relate to the proposed research project or program?

The first question can be answered adequately in most cases through a brainstorming session involving research managers, scientists, and, if possible, extension specialists. The second question requires directly contacting the potential users and user groups to determine their needs and request their input. Pierce (1987) notes that input and feedback from users does not arise automatically, but must be specifically invited.

**Potential Barriers to Technological Innovation**

As Rogers (1983) has pointed out so well, there are many barriers to the adoption of new ideas and technologies. For example: potential users may not be aware that the technologies are available; they may not know how to use them; they may not be able to afford to use them; or they may be uncertain about the potential costs and benefits of using them. Many firms and organizations operate considerably below the levels of efficiency that would be possible if all existing technology were used effectively (Leibenstein 1966). They do so for many of the same
reasons mentioned above: managers may not be aware of what new technologies are available; the effects on the organization of adopting the new technology may be unknown; the new technology may not be compatible with the technologies currently being used; the costs of the new technologies are expected to outweigh the potential benefits; or people may lack the special skills needed to utilize the new technology effectively. Rogers (1983) has listed five characteristics of an innovation that affect its rate of adoption (box 12.2.1). These five factors should be considered in planning programs of applied research that are intended for dissemination and application.

**Box 12.2.1. Characteristics of an innovation, as perceived by individuals, that affect the rate of adoption (Rogers 1983; pp. 15-16):**

1. **Relative advantage.** "... the degree to which an innovation is perceived as better than the idea it supersedes. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is going to be."

2. **Compatibility.** "... the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is not compatible with the prevalent values and norms of a social system will not be adopted as rapidly as an innovation that is compatible."

3. **Complexity.** "... the degree to which an innovation is perceived as difficult to understand and use. In general, new ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understandings."

4. **Trialability.** "... the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible."

5. **Observability.** "... the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt."

New technologies are almost always adopted and implemented within existing organizations or working environments in which a wide range of existing technologies are already in use. A key factor in deciding whether or not to adopt a new technology is how well it will fit in and work in harmony with the existing complex operation. The introduction of new technologies into existing operations creates problems in adjusting and adapting those new technologies to mesh with ongoing operations. This may require retraining people to acquire new skills or learn new processes, readjusting habitual work patterns, reorganizing the work force, modifying old facilities, or constructing new facilities, among other activities. Additional work may be needed to modify the new technology so it will operate effectively in the unique environment of the current operation. Substantial new
investments may have to be made to acquire and implement the new technology, and in the process productivity may fall for a period of time while new work patterns are being put into place.

Many potential users are reluctant to adopt new technologies because the potential costs and benefits of doing so are not well known, and may be highly uncertain. Technological innovation is perceived by many as being risky, particularly if it entails drastic changes in current ways of doing things. This may result in other changes that are difficult to foresee. These and other concerns present real barriers to technological innovation that must be overcome if the results of research, in the form of new technologies, are to be implemented.

The increasing commercialization of forestry research, where research results are produced under contract with firms and/or organizations in the private sector, may create barriers to the dissemination of research results, and thus to certain types of technological innovation. Commercialization may greatly restrict access of research results to the general public and other users who did not finance the research. Research results obtained through the support of private firms or organizations are not likely to be viewed as a public good, to be made freely available to everyone, but rather as a private good, to be given to a restricted few who provided support for the research, or sold to those who can afford the price. As a result, dissemination to the public is reduced, particularly to those potential users who lack the financial resources to pay for research results. Commercialization also tends to direct research programs towards those areas of research for which there is financial support and a commercial market for the results. This would tend to favor research for industrial and commercial firms with larger financial resources, and reduce research that might primarily benefit small landowners and rural people, who could not afford to support long-term research programs or pay for the results of that research.

Foreseeing potential barriers to the adoption of promising research results, and developing strategies to overcome those barriers, are important parts of the research manager's job. One way to deal with this problem is to strengthen the linkages between research and user groups so as to better understand potential barriers to technological innovation, anticipate potential problems, and deal with them before they become too severe. Strengthening research and user linkages is the topic of study unit 12.3.
Effective Channels of Communication with Research Users

Once users of research results and their needs have been identified, and potential barriers to technological innovation overcome, the research manager must decide what are the most effective channels for communicating research results to various user groups. A Canadian survey of research users sheds some light on this question (Cayford and Riley 1986). Users ranked the several alternative means of technology transfer in order of effectiveness as follows:

1. field demonstrations;
2. informal and personal communication;
3. audio-visual presentations;
4. publications;
5. seminars and meetings; and
6. other forums, newsletters.

The relatively low ranking of publications as an effective means of communicating with users is noteworthy. Publications are often the primary means of communicating research results to other scientists, but they are viewed as relatively ineffective in communicating with users. This is particularly true where the potential user groups have high rates of illiteracy. Moreover, communication by way of publications is a one-way flow of information, and provides no input and feedback from users. The effectiveness of publications would likely rank even lower for developing countries.

It is interesting to compare the Cayford-Riley survey results with a survey of forestry research managers in developing countries conducted by Gregersen (1984). In this survey, research managers were asked to rate the frequency with which they used various channels to disseminate research results. The following ranking of communication channels most frequently used emerged:

1. reports to research contractors;
2. professional journals and meetings;
3. response to inquiries;
4. lectures;
5. direct demonstration; and
6. popular media.

The fact that printed matter is viewed as a relatively ineffective communication channel by users, and yet is the most frequently used channel by forestry research organizations, is cause for concern. It suggests the need for change in the way in which research results are disseminated. If forestry research managers wish to ensure that the results they produce reach intended users
and are adopted by them, they should encourage and facilitate more direct interaction between researchers and the users of research results.

**Improving the Transfer of Technology**

A scientist can get considerable satisfaction from carrying out research and achieving a successful outcome. However, the research organization will get credit for this work only if the results are effectively disseminated to their intended users in a useful form. This is a responsibility of the research manager. Managers have a role to play in encouraging research scientists to explore and use several of the different channels of communication with research users outlined above in disseminating research results. They also must see that the necessary resources are provided to utilize those communication channels. It makes little sense to provide resources to conduct research, but not provide for the resources needed to effectively disseminate the results produced by that research. Because research dissemination is so important to a research organization, managers should devote time to improve the process by which the resulting technology is transferred to the appropriate users.

The following recommendations have been suggested as a means of improving the transfer of technology in forestry (Moeller and Seal 1984):

**Involve users in the early stages of research planning, by:**
- helping identify problems and set priorities;
- establishing reasonable expectations and commitments; and
- understanding the user market.

**Create an organizational environment that encourages innovation, by:**
- encouraging direct contacts between researchers and users;
- keeping users appraised and involved throughout the research process;
- attending management meetings;
- encouraging staff exchanges between research and management;
- training researchers in technology transfer and communications techniques;
- committing adequate resources to technology transfer;
- recognizing and rewarding scientists for application work;
- establishing an organizational focal point for technology transfer;
- taking initiative to motivate managers; and
- recognizing technology transfer as a continuing commitment.
Be involved in application and evaluation activities, by:
- quantifying benefits of research;
- concentrating efforts on the most beneficial results;
- involving users in application efforts;
- understanding users’ capability to implement results;
- providing state-of-the-art summaries;
- using the most appropriate means of transferring results to users;
  and
- asking for and using evaluation feedback from users.

Managers of forestry research can improve the transfer of technology by developing partnerships with research users, and by encouraging development of an effective extension system that is trained to work with potential user groups to make them aware of new technologies and to facilitate their adoption and use.

Such an extension system can become far more effective if extension personnel are trained by research personnel in the new technologies generated by research. In turn, extension personnel can provide feedback to researchers on problems encountered in adopting research to operational problems. What is needed is to develop a carefully planned system for technology transfer that goes beyond the traditional publication of research results.
**Activity 1**

For a research topic currently being considered for implementation by your organization, conduct a stakeholder or user analysis of the potential users of any results produced as a result of this research. Using the format below, describe the users, how these results will be important to these potential users, and note the criteria they will use to judge whether the results are useful.

<table>
<thead>
<tr>
<th>Research Topic:</th>
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<tr>
<td>Projected Outcomes of the Research Effort:</td>
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</table>

<table>
<thead>
<tr>
<th>Users of the Research</th>
<th>How Will the Research Results Be Useful?</th>
<th>Performance Criteria Users May Use to Judge Value of Research</th>
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<tbody>
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<td>12.</td>
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</table>
For a hypothetical research problem, we have identified users of the research, listed how the research will be useful, and have determined some criteria these users may use to judge research results. Your table will, of course, be different; we only present this response as a means to assist you in your own analysis.

**Research Topic:** Identification of the most productive tree species for use in hedgerows on sloping lands.

**Projected Outcomes of the Research Effort:** Identification of one or several tree species that exhibit the highest productivity when planted and managed as hedgerows on sloping lands.

<table>
<thead>
<tr>
<th>Users of the Research</th>
<th>How Will the Research Results Be Useful?</th>
<th>Performance Criteria Users May Use to Judge Value of Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farmers</td>
<td>• clear and obvious improvement in productivity of on-farm plantings, both with hedgerows and crops</td>
<td>• productivity gains relative to species/varieties currently in use</td>
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<td></td>
<td>• better erosion control</td>
<td>• local availability of germplasm</td>
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<td></td>
<td>• higher yields</td>
<td>• noncompetitive with crops</td>
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<td></td>
<td>• higher off-farm income</td>
<td>• low cost, low labor requirements</td>
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<td></td>
<td>• to reduce their risk</td>
<td>• improve diversity</td>
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<td></td>
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<td>• simple technique</td>
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<td>2. Field extension agents</td>
<td>• to improve off-farm income via improved productivity and higher yields</td>
<td>• clear and obvious improvement in productivity of on-farm plantings, both with hedgerows and crops</td>
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<td>• identification of clearly superior species or varieties to ease resistance to change in extending the new varieties</td>
<td>• multiple use of species promoted</td>
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<td>• availability of germplasm</td>
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<td></td>
<td></td>
<td>• research done on-farm</td>
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<td></td>
<td></td>
<td>• research trials accessible for field training programs</td>
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<td></td>
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<td>• easily replicable, easily diffused</td>
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<tr>
<td></td>
<td></td>
<td>• simple technique</td>
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<td>3. Local community groups and village cooperatives</td>
<td>• to utilize the new information to encourage members to improve their farming practices</td>
<td>• clear and obvious improvement in productivity of on-farm plantings, both with hedgerows and crops</td>
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<td>• to encourage membership and solidarity in the group by tapping into the latest improved agroforestry practices and improving member standard of living</td>
<td>• multiple use of species promoted</td>
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<td></td>
<td></td>
<td>• availability of germplasm</td>
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<td></td>
<td></td>
<td>• research done on-farm and in or near the local community</td>
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<td></td>
<td></td>
<td>• research trials accessible for field training programs and inspection</td>
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<tr>
<td>4. Landowners</td>
<td>• to improve the sustainable use of their land</td>
<td>• clear and obvious improvement in productivity of on-farm plantings, both with hedgerows and crops</td>
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<td></td>
<td>• to improve their incomes derived from the land</td>
<td>• multiple use of species promoted</td>
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<td></td>
<td>• to reduce their risk</td>
<td>• availability of germplasm</td>
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<td></td>
<td></td>
<td>• research done on-farm and in or near the local community</td>
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<td></td>
<td></td>
<td>• research trials accessible for field training programs and inspection</td>
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<td>5. Policy makers</td>
<td>• to improve the standard of living for rural dwellers</td>
<td>• technique is readily adopted and used by farmers</td>
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<td>• to stimulate the rural development process</td>
<td>• significantly improves on-farm income</td>
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<td>• to enhance sustainable use of agricultural land, eventually on a national basis</td>
<td>• technique is easily and quickly diffused throughout the country, attaining a large aggregate impact</td>
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</tbody>
</table>

*Comment 1*
From the point of view of users of research results, what are the most effective means for research organizations to disseminate research results? List them below in order of their user-perceived effectiveness, with 1 having the highest effectiveness, 2 being viewed as less effective, etc.

1. 

2. 

3. 

4. 

5. 

6. 
Comment 2

Users of research results often have very different preferences for the manner in which research results are disseminated. Users frequently and consistently rate the methods of communicating research results listed below in the following order of preference:

1. field demonstrations;
2. informal and personal communications;
3. audio-visual presentations;
4. publications;
5. seminars and meetings; and
6. other forums, newsletters.

Of course, this order of preference may vary significantly from country to country. For instance, if the intended users of the research live in areas without electrical service, audio-visual presentations would not be appropriate or preferred. However, note how low on the list users rate publications, the favorite vehicle for researchers to communicate their research results.

Generally, the more closely linked the research activity is to the targeted users (for instance, via on-farm testing, demonstration plots on farmer's land, etc.), the more likely the research will be adopted and used by these clients.
What are the methods currently used by your organization to disseminate information and research results? List them below in order of their frequency of use, with 1 having the highest frequency of use, 2 being used less often, etc.

1. 

2. 

3. 

4. 

5. 

6. 

Are there any discrepancies between the way users feel research results are most effectively disseminated, and the means by which your organization is currently disseminating research results? If so, why do you think these discrepancies exist? Note your thoughts to these questions in the space below.
If your research organization is like most others worldwide, methods to communicate research results to intended users can usually be listed in order of frequency of use as follows:

1. reports to research contractors;
2. professional journals and meetings;
3. response to inquiries;
4. lectures;
5. direct demonstration; and
6. popular media.

It appears that research organizations prefer very different ways to communicate research results than do the users!

If your organization's approach to research results dissemination closely resembles that found in the response to question 2, Congratulations! This means that your organization is closely linked to the intended users of its research efforts, and is maximizing its effectiveness at promoting development through forestry research.

However, there are many pressures and incentives for researchers to instead focus on the more traditional means of communicating research results. Career advancement and promotions often are based on the quantity of papers presented and published. Applied and adaptive research, often done on-farm, is often considered (incorrectly so) to be less intellectually challenging and important than more theoretical, basic research. These biases create strong incentives for forestry researchers to adhere to established channels of communication of research results, even though they fully recognize that there exist more effective means to communicate research results to nonscientific users.

*Research managers have a grave responsibility to ensure that their organization's forestry research activities address the most important needs of intended users of the research, and that the hard-won research results are communicated to these intended users in the most effective manner possible.*
STUDY UNIT ACTIVITIES

Activity 5

Is there room for your organization to improve its current efforts at successfully communicating research results? How can your organization improve its effectiveness, as measured by the rate of adoption and subsequent use of research results by targeted users.
It is rare to find a research organization that cannot improve in some way its current efforts at communicating research results. The acid test of the effectiveness of forestry research is whether the research results will be used. If they are not used, then the research results were not relevant, useful, or communicated clearly and effectively to the intended users.

Research managers must develop effective mechanisms that will address both the career aspirations of scientists, and the ultimate purpose of the research organization: that is, to meet the needs of the intended users.

Methods which you can use to strengthen research and user communication, increase research utilization, and improve your organization's effectiveness in disseminating research results and promoting adoption include:

• post specialists from the extension service in research organizations;
• ensure that summaries of research results are written in plain language and targeted to specific audiences;
• provide better career opportunities for extension agents;
• collaborate closely with extension;
• reward researchers for interaction with users;
• emphasize training activities to communicate research results;
• monitor and evaluate research and user linkages;
• involve users in planning and evaluation;
• organize field days;
• create a unit to produce extension documentation;
• establish a research-extension liaison unit; and
• establish research advisory committees.

For more suggestions for strengthening research-user linkages, please proceed to study unit 12.3.
Research results must be used if they are to contribute to a nation's development goals or to solve social, economic, and environmental problems. Thus, effective communication between researchers and users of the research is essential if new or improved technologies are to be successfully developed and adopted by users. Communication serves to improve planning and priority setting, facilitate testing and adaptive research, facilitate the transfer of research results, and strengthen research capacity.

In this study unit you learned of the importance of communication between scientists and the users of research. By completing the exercises, you evaluated your organization's communication with users of the research, and envisioned improvements in its performance.

If you would like more information about communicating forestry research results for application by nonscientists, 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. A key article directly related to the topics covered in the module, and cited in the text, is reprinted for your use in the section on readings at the end of the module.
Objectives

When you have completed this study unit you should be better able to:
• define linkages that are formal or informal, top-down or bottom-up, internal or external, upstream or downstream, or direct or indirect;
• describe how your organization is linked to users of forestry research;
• discuss five functions or benefits of establishing and maintaining linkages to facilitate the flow of information;
• list seven actions managers of research can take to promote effective linkages between research, extension, and research users; and
• describe nine principles for using linkage mechanisms to improve the usefulness and dissemination of research results.

Strengthening Linkages Between Research and Users

It is essential that research managers develop and maintain strong linkages between researchers and the users of the research results. For research organizations to be effective, there must be effective linkages between the following groups: on-site researchers and users; on-site research and technology transfer agencies; researchers conducting adaptive research on-site and those working in applied research on experiment stations; and researchers working in various disciplines. Forestry research results are often disseminated through intermediary extension and field-oriented organizations that may or may not be closely linked to the research organization. One of the more important responsibilities of forestry research managers is to facilitate stronger linkages between members of the research organization, the extension and/or field organizations, and the users of the research.

This study unit presents essential information that will help you, as a research manager, to improve your organization's linkages with extension and other field organizations. You'll learn of several linkage mechanisms you can use to improve interorganizational communication and relations. You'll discover that there are many practical and easily implemented activities that will enhance these linkages. You'll also learn about a number of basic principles that will help guide your linking efforts, and of institutional conditions that you can create in your organization that will improve linkages. Finally, with an eye toward making improvements, you'll take a look at your own organization to determine the status of its own interorganizational linkages.
Moreover, the users of research results are organizational stakeholders who play an important role in research planning and priority setting. One of the key functions of research management is therefore to ensure that strong linkages are established and maintained between researchers and the various users of research results, including extension agents, farmers, landowners, forest products firms, policy makers, researchers in other organizations, educational institutions, and the public.

Despite the importance of research and user linkages, lack of interaction between forestry researchers and users of research results has been identified as a significant problem (cf., Iyamabo 1975, Dada 1984, Gregersen 1984). In a survey of public forestry research organizations in developing countries the frequency of information exchange with users of research results was surprisingly low (see table 11.1.1). The fact that 18 percent of the organizations surveyed report that they never formally exchange information with users and 54 percent only occasionally interact in this manner suggests the need for improving research and user linkages.

Temu et al. (1987) identified several factors that may have contributed to the lack of interaction between forestry researchers and end users in many developing countries:

- researchers and managers often tend to emphasize writing technical and scientific reports without putting the research results contained in them in a form suitable for application by various end users;
- many research institutions have overlooked the importance of disseminating research results;
- dissemination and implementation of research findings tends to receive low priority in terms of funding;
- there is a lack of trained forestry extension personnel in most forestry research institutions; and
- the shift in emphasis from industrial forestry to social forestry has broadened the spectrum of end users of research results, and many forestry research organizations have not fully adjusted to this change.

**Types of Research and User Linkages**

Linkages between research and users take a variety of forms. Four major types of linkages are discussed here. Stoop (1988) notes that each type of linkage relates to either different ways of communicating (informal vs. formal, top-down vs. bottom-up), or to different communication channels (internal vs. external,
upstream vs. downstream). These four types of linkages are not mutually exclusive, e.g., formal linkages may also be top-down linkages.

**Formal vs. informal.** Formal research and user linkages typically involve administratively approved, written agreements. Formal, structured linkages may be formed through research councils, working groups, job assignments, and so on. They typically are linkages between organizations, not individuals. In contrast, informal linkages are not institutionalized, and tend to involve personal contacts between individual researchers and individual users. Informal linkages typically arise spontaneously from a perceived need for interaction between individual researchers and research clients, and sometimes function as a substitute for ineffective formal linkages (Stoop 1988). Some of the strengths and weaknesses of formal and informal linkages include:

- formal linkages are stored in the *institutional memory* of the research organization, while informal linkages are much less likely to feed into an institutional memory;
- information resulting from formal linkages is more likely to be passed on to decision makers than informal communication;
- informal linkages are typically a lower cost means of interaction than formal linkages;
- informal linkages are often more direct, immediate, and active than formal linkages; and
- informal linkages may be less threatening to certain users than interaction through formal channels.

Thus, formal and informal linkages are complementary, and scientists and research organizations should be encouraged to develop and maintain both types.

**Top-down vs. bottom-up.** The distinction between top-down and bottom-up linkages refers to the direction of the flow of information. Top-down linkages involve the flow of information from scientists to extension agents and on to final users. Research results are disseminated to potential users. This is a one-way flow of information that is often reinforced by a hierarchical structure in the research organization and society, where information (and orders, direction, and instruction) flow from the top down. In the top-down mode of action, information dissemination and technology transfer are viewed as a one-way action. Top-down linkages between researchers and users are too often the only type of communication that takes place between researchers and users. Little attention may be given to obtaining information from research users regarding the usefulness of the research results.
disseminated. Bottom-up linkages, involving a flow of information in the opposite direction, recognize the practical knowledge base of farmers and other potential final users of research results. They provide a channel of communication that encourages the reverse transfer of information about research needs and the usefulness of past research results. Both top-down and bottom-up linkages are clearly required for effective research.

**Internal vs. external.** Internal linkages facilitate communication among researchers, either within an organization or across different research organizations. External linkages facilitate communication between researchers and user groups outside of the research organization and the broader scientific community. The distinction between internal and external linkages is important because scientists are often neglected as an intermediate user of research. Moreover, a high level of interaction among scientists both within and between research organizations tends to increase the productivity of researchers, the quality of research produced, and the capacity of a research organization (Pelz and Andrews 1966, Barnowe 1973).

**Upstream vs. downstream.** Another way of looking at research and user linkages is to divide them according to the type of user. Thus, some users are upstream (policy makers, donor and technical assistance agencies, etc.), while others may be considered downstream (extension agents, farmers, firms, etc.). Research dissemination tends to focus on downstream users, and tend to neglect the upstream users, who are vitally important in securing adequate political support and funding for research. They, too, need to be kept informed about the research results produced by the research organization, and their usefulness to society.

### Functions of Research and User Linkages

Basically, linkages facilitate the two-way flow of information between researchers and various users. This flow of information serves several important purposes. Major functions of research-user linkages include:

**Improve planning and priority setting.** The perceived needs of downstream users should be regularly communicated to researchers. These constitute a vital input into research planning and priority setting. Feedback information from downstream users about new technologies and management practices being implemented in practice is useful in setting research priorities. Providing information to and obtaining feedback from high-level policy makers and decision makers also is important in research planning and priority setting, particularly in designing broader
research strategies to address major problems facing society. Research planning and priority setting is too important to be left entirely up to the forestry research establishment. Other stakeholders in society must be involved in the process.

**Improve design of research to generate appropriate technologies.** It is important not only to get input from users as to research needs, but also to engage in a continued interaction with users as research is designed and conducted to ensure that the new knowledge and technologies being generated by research will indeed fit the user’s needs. Few research scientists have the practical operational experience to fully understand just how data, information, knowledge, and new technologies are likely to be applied in practice. To ensure that research will produce results that can and will be used, potential users of research results need to be consulted in designing research to produce the needed information.

**Facilitate testing and adaptive research.** On-the-ground testing of research results and adaptive research are both important parts of the research process. Close linkages between researchers and potential users can promote relationships and provide information needed to successfully test research results and adapt new technologies developed elsewhere to local conditions.

**Facilitate the communication of research results.** This is the function of research and user linkages that is most often emphasized: The one-way, top-down flow of research results from scientists to extension workers and on to final users. This flow will be greatly enhanced if well-developed research and user linkages are in place, and a mutual respect has developed between researchers and users.

**Strengthen research capacity.** In general, research organizations with strong research and user linkages will function more effectively and efficiently than organizations with weak linkages. They are more likely to generate public and user support for research program activities, and increase funding levels for the organization. This translates into greater research capacity.

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**Management Options for Strengthening Research and User Linkages**

Two general responses for strengthening research and user linkages may be distinguished:

1. Maintain the current structure of the organization but adjust research strategies and management of research and user interactions to strengthen linkages. Some management options under this approach include the following (ISNAR/SPAAR 1987):
Transfer subject matter specialists from the extension service to research organizations. Extension specialists could help interpret research findings in ways that are appropriate for users and serve on research planning committees.

Provide better career opportunities for extension agents. There should be career ladders in the extension service, as well as in research. Providing training would help extension workers to qualify for promotion to higher grades.

Improve collaboration with extension. Research organizations and extension organizations could collaborate on verification trials, demonstrations, field days, radio broadcasts, newspaper and magazine articles, and other activities to help inform users of research accomplishments. Also, because extension personnel often work closely with the users of research results, they are aware of their problems and research needs. Research managers should take advantage of this knowledge by seeking to increase the participation of extension personnel not only in the dissemination of research results, but also in the planning and implementation of research studies.

Reward researchers for interaction with users. The formal reward system for researchers must recognize and promote linkages with extension and other research clients and participation in technology transfer activities. Research-user linkages will be neglected if researchers are not formally recognized and rewarded for such activity through promotions, cash awards, nonmonetary awards, or other means.

Training. Research and user linkages can be strengthened through various types of training programs (seminars, workshops, etc.). Through training, researchers can learn how to be more effective in disseminating their research results. Training that involves researchers as instructors can serve as a tool to achieve more effective interaction among researchers, extension workers, and various users. Also, training may be a very effective means to transmit research results.

Monitor and evaluate research and user linkages. Monitoring and evaluation can identify weak and inadequate research and user interaction and point out appropriate actions to strengthen them. Ruttan (1978) recommends a separate review and evaluation of the “outreach” component of a research program.

2. Modify the organizational structure and assignment of responsibilities to establish and strengthen research and user linkages. Some management options under this second approach to strengthening research and user linkages include:
Create a unit to produce extension documentation. A new, central unit may be set up in a national research system to produce and distribute documentation intended specifically for use in the extension service. A need often overlooked in research organizations is the production of simple, short reports that summarize and interpret research results in a way that is practical and understandable by managers who have little or no interest in research per se, or time to read lengthy and detailed research reports. There is also a need to synthesize information from fragmented and scattered research literature in a form that would be more useful to users.

Establish a research/extension liaison unit. Dada (1984) reports on a research/extension liaison unit established in the Forestry Research Institute of Nigeria to form a link between research and users, including most importantly the state forestry departments. “The Unit is expected to bring results of research to the state foresters, and forestry problems from state foresters back to the research institute” (Dada 1984). Unlike most extension organizations, this research/extension liaison unit was set up as a division equal in status to the research division, giving it more clout to carry out its mission.

Establish research advisory committees. Local and regional research advisory committees which include representatives from important user groups should be formed, if such committees are not part of the current organizational structure, to review existing research programs and provide advice on research priorities.

What Managers Must Do to Strengthen Research and User Linkages

ISNAR (the International Service for National Agricultural Research) has identified seven key institutional conditions which promote effective linkages between research, extension, and research users (Merrill-Sands and Kaimowitz 1989):

1. Develop a shared goal.
2. Promote understanding of interdependence.
3. Seek agreement on assigned tasks.
4. Cultivate mutual respect.
5. Minimize competition.
6. Create opportunities for interaction.
7. Ensure that staff benefit from collaboration.
For each of these institutional conditions, ISNAR has developed suggestions as to what managers need to do (Merrill-Sands and Kaimowitz 1989).

1. To develop a shared goal, managers need to:
   • support words with action by providing a consistent internal policy which supports the declared goal and places emphasis on links;
   • provide leadership by taking part in linkage activities and giving them high visibility and priority;
   • provide incentives and rewards to encourage commitment to linkage activities; and
   • use mechanisms such as joint problem diagnosis, joint training, and joint priority-setting and planning to set a clear goal and complementary objectives.

2. To promote understanding of interdependence, managers need to:
   • create demand in each group for the other group’s services and products by promoting collaborative professional activities and improving communication facilities;
   • create opportunities for staff to become familiar with each other’s work and approaches by using mechanisms such as seminars, joint field visits, joint review meetings, and collaboration in professional activities;
   • encourage groups to work together to diagnose problems and set priorities;
   • exert pressure for impact, to force groups to recognize their interdependence; and
   • reward achievements based on collaboration, not simply on separate activities.

3. To seek agreement on assigned tasks, managers need to:
   • develop a clear policy on groups’ respective roles and responsibilities;
   • build this policy on consensus among participants, rather than by decree;
   • ensure groups consider the roles assigned to them are legitimate, feasible, and important;
   • provide incentives for staff to perform assigned tasks and fulfill obligations;
   • make effective use of joint planning and review mechanisms so that groups feel accountable to one another; and
   • encourage collaborative activities to help groups define how they can best work together.

4. To cultivate mutual respect, managers need to:
   • set realistic objectives for collaboration that are in line with the capacities and resources of both groups;
• ensure that groups are staffed with competent professionals, or that junior staff are supported by senior staff;
• provide strong scientific or professional leadership to ensure quality of work;
• provide specialized training in required skills, and joint training so that staff adopt similar approaches;
• use linkage mechanisms which foster mutual respect, such as joint field visits and joint problem diagnosis; and
• assign staff from one group to another, or rotate staff between groups, so that they develop an appreciation of each other’s aims, methods, and constraints.

5. To minimize competition, managers need to:
• ensure a balanced build-up in both sets of activities;
• avoid giving any particular activity or group special status;
• experiment with resource sharing between the groups, particularly in terms of personnel and equipment;
• formally allocate staff time and operating funds to linkage activities in order to minimize competition or disputes over the funding of these activities;
• assign coordination responsibilities to a neutral person or unit; and
• allow some competition between groups to stimulate creativity, but manage it carefully.

6. To create opportunities for interaction, managers need to:
• bring groups together in the same organizational unit;
• post members from different groups to the same station, office, or region;
• improve communication facilities;
• sponsor social events which bring groups together informally;
• cluster on-farm activities to permit more frequent contacts in the field; and
• actively encourage members of groups to consult each other and meet together informally.

7. To ensure that staff benefit from collaboration, managers need to:
• take part in linkage activities to demonstrate their importance;
• build linkage responsibilities into job descriptions;
• provide guidelines for staff on how much time to allocate to linkage activities;
• reward participation in linkage activities;
• provide funds explicitly for linkage activities; and
• minimize, or compensate for, hardships involved in linkage activities.

As the above lists indicate, the manager of forestry research has
many options for improving formal and informal linkages between research, extension, and research users. Better linkages can make forestry research more effective in meeting the needs of society. However, research managers need to manage these linkages carefully. Establishing and maintaining linkages, regardless of whether they are formal or informal, top-down or bottom-up, can use a considerable amount of valuable research and management time, funds, and other scarce resources. A careful appraisal of existing and potential linkages is needed to determine whether the potential benefits will outweigh the costs (Merrill-Sands and Kaimowitz 1989).

**Principles for Using Linkage Mechanisms**

Drawing upon considerable experience and study, the International Service for National Agricultural Research has suggested the following basic principles for using linkage mechanisms as a guide for research managers (Merrill-Sands and Kaimowitz 1989):

- **There is no formula or recipe for strengthening links.** What works well in one institutional context may not work well in another. Special linkage mechanisms may have to be developed for each situation.

- **Linkage mechanisms supplement, or compensate for, structural arrangements.** Although structural rearrangements may be helpful in solving some technology transfer problems, where structural arrangements are weak, special linkage mechanisms may have to be developed to compensate for those weaknesses.

- **Linkage mechanisms should be developed at multiple levels of the administrative hierarchy.** Most successful and sustainable linkages are developed at several administrative levels. The various mechanisms at different levels tend to reinforce each other.

- **Because linkage mechanisms cost time and money, they should be used selectively.** Limit the choices of mechanisms to the minimum required to achieve a given objective. Managers need to make tough choices, and reevaluate those choices periodically.

- **Managers should not overuse, or abuse, linkage mechanisms.** Participation in linkage mechanisms takes time away from regular jobs, and may create conflicts among staff members, which could erode the effectiveness of the linkages.
• Managers should allocate resources explicitly to support linkage mechanisms. To demonstrate commitment to linking, they must allocate staff time and resources to support communication, coordination, and collaborative activities, otherwise the linkages become mere rhetoric.

• Managers should anticipate the need for links. The costs of linkage problems are high. Managers should forge strong linkages at the beginning of the technology transfer process, not at the end of it.

• Different technologies require different types or sets of linkage mechanisms. A diverse set of linkages may be needed to cope with diverse technologies.

• Managers should stimulate informal links as well as formal ones. Managers should provide opportunities for informal collaboration as a way of motivating staff to work together and coordinate their efforts.
Activities

Activity 1

There are at least nine principles that managers of forestry research can use to help guide them in creating more effective linkages between research and extension organizations. Name at least five of these principles below in the space provided. We realize you probably haven't committed these to memory, so feel free to refer to the text to help you answer this question.

1.

2.

3.

4.

5.
According to ISNAR (Merrill-Sands and Kaimowitz 1989), there are nine (9) principles that managers of forestry research can use to help guide them in creating more effective linkages between research, extension, and research users. They are:

1. There is no formula or recipe for strengthening links.
2. Linkage mechanisms supplement, or compensate for, structural arrangements.
3. Linkage mechanisms should be developed at multiple levels of the administrative hierarchy.
4. Because linkage mechanisms cost time and money, they should be used selectively.
5. Managers should not overuse, or abuse, linkage mechanisms.
6. Managers should allocate resources explicitly to support linkage mechanisms.
7. Managers should anticipate the need for links.
8. Different technologies require different types or sets of linkage mechanisms.
9. Managers should stimulate informal links as well as formal ones.

We hope you successfully identified at least five of these principles. For more detailed information regarding this topic, please refer to the text, or to the ISNAR (1989) report listed in the literature cited at the end of this module.
Read the following situation analysis.

**Situation Analysis**

There are often a number of institutional conditions which help to promote effective links between groups. The following fictitious Ghosa Department of Forestry has crafted successful linkages and produced and disseminated relevant research results. See if you can identify reasons for its success.

The Government of Ghosa's Department of Forestry is composed of the Division of Forest Research, the Division of Forest Extension and Small-Holder Assistance, and several other divisions. The department has been very effective in its efforts to manage the nation's forests, conduct relevant forestry research which addresses critical national needs, and disseminate the research results to appropriate users. While their activities and mandates are quite different, all divisions have participated in the preparation of, and have consensually agreed to, a departmental strategic plan which clearly defines the organization's mission and goals. Through interdivisional cooperation, consensus, and participation, each division recognizes its interdependence on other divisions to successfully carry out their mandates. Careful planning at the strategic and operational levels has helped divisional staffs to agree upon the priority of various activities and tasks, and to determine specific task assignments. By working closely with each other during the planning process, and by everyone carrying their load, the members of the various divisions have come to appreciate and respect the professionalism of members of the other divisions. Since they formulated and agreed upon their plans together, there exists a spirit of cooperation, not competition. Spontaneous friendships among members of the divisions, and departmental picnics and social events facilitate much informal interaction. Formal communication between members of the various divisions is enhanced through regular meetings and communication. While most employees recognize that collaboration requires greater amounts of time, effort, and compromise, it seems clear that the benefits of collaboration outweigh the costs.

Name five conditions (there are seven in the example) exploited by the Ghosa Department of Forestry that have contributed to its success at linking its various divisions.

1. 
2. 
3. 
4. 
5. 

If you have trouble with this activity, reread the text which covers institutional conditions that promote effective links between groups, and then try again to complete this exercise.
The Ghosa Department of Forestry utilized both the strategic and operational planning processes to establish a number of institutional conditions that promoted effective links between and among their divisions. These institutional conditions alluded to or implied in the departmental description are listed below (ISNAR 1989):

1. Share a common overarching goal and sense of mission.
2. Feel that they depend on each other to successfully accomplish their tasks.
3. Agree upon the tasks each should perform to get the job done and on their relative importance.
4. View each other as professionally credible, with the capacity to follow through on agreements.
5. View each other as partners, not as competitors.
6. Have adequate opportunities for formal and informal interaction.
7. Consider that the personal benefits of collaboration outweigh the costs.
Activity 3

In the space below, describe the linkages your research organization currently maintains within your organization, or with other units, departments, or organizations.

---

Activity 4

Describe in the space below how your organization communicates with users of forestry research, and determine whether these linkages are formal or informal, top-down or bottom-up, internal or external, upstream or downstream, or direct or indirect.
By this time, you should be able to recognize and list a number of mechanisms used by your organization to create both internal and external linkages. These may include activities or strategies listed in activity 1, and possibly others unique to your organization. You might have also identified areas where your organization can improve its linkages, and thus improve its overall performance and contribute to society.

We cannot know how you will respond to this activity. However, thinking about how your organization communicates with users in terms of formal or informal top-down or bottom-up, internal or external, and upstream or downstream linkages may suggest new ways of effectively communicating research results to users. This also provides a means of obtaining important feedback from them as to their needs and about the usefulness of your research products.

Congratulations on finishing these exercises!
Research managers must develop and maintain strong linkages between the research organization, the organization(s) that extend the research results, and the people that use the research. Intermediary extension organizations that disseminate research results may not be closely linked to the research organization, resulting in poor technology transfer to the users of the research results.

There are a number of tools and mechanisms which management can use to promote links among researchers and between researchers and technology transfer workers. Among these tools, it appears that formal mechanisms such as incentives and rules, joint review meetings, joint diagnosis, and joint programming and priority-setting are among the most effective in promoting strong linkages.

This study unit examined in depth these and other mechanisms, as well as other aspects that can contribute to improve links. By reviewing this study unit, you should have improved your understanding of the importance of maintaining and improving research, extension, and research user linkages. You may also have acquired some new tools to improve your own organization’s performance and effectiveness through stronger linkages.

If you would like more information about linking units of forestry research to extension and other field-oriented organizations, we encourage you to obtain and review the interesting publications identified in the literature cited and other references listed at the end of the module. A key article directly related to the topics covered in the module, and cited in the text, is 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 12. These are identical to those listed in the initial skill and knowledge assessment at the beginning of the module. Now that you have completed all of the study units in 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, using the following descriptions:

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.

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<thead>
<tr>
<th>Skill or Knowledge Statement</th>
<th>Your Level of Skill or Knowledge</th>
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<tr>
<td>a) Describe the most effective methods, and their limitations, by which forestry research results are communicated to scientists.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>b) Describe the most effective methods, and their limitations, by which forestry research results are communicated to users for application.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>c) Identify potential users and adopters of your organization's research.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>d) Determine and describe how research produced by your organization is adopted and used by its intended users and identify potentially weak links in the research dissemination-adoption process for your organization.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>e) List seven actions managers can take to promote effective linkages between research, extension, and research users.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>f) Describe nine principles for using linkage mechanisms to improve the usefulness and dissemination of research results.</td>
<td>1 2 3 4 5</td>
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LITERATURE CITED - MODULE 12


**ADDITIONAL SOURCES OF INFORMATION**


READINGS FOR MODULE 12

The following reading has been selected to provide you with additional information related to the material covered in module 12. We hope you will find it of interest.

Forestry extension methods†

H.A. Hilmi

Introduction

It is the task of the forestry extension staff:

• to provide the people with an opportunity to learn by methods and in circumstances appropriate to them; and

• to stimulate in their clients mental and physical activity which leads to effective learning.

To achieve their objectives, forestry extension methods must meet these two major requirements.

People learn in different ways: some by listening, some by observing or doing, and some through discussion. Generally, a person will learn more effectively by using a combination of two or more methods. Studies suggest that the more varied the methods of extension used in an area, the more people change their attitudes and practices.

Variety of extension methods

Different extension methods have been found to be more effective in different situations and at different stages in the adoption process. All people do not learn or change their practices at the same speed. Some may be ready to adopt a new practice and need to know how to carry it out, while others are as yet scarcely aware that it exists or are just beginning to show an interest in it. For these reasons, the use of a variety of extension methods, suited to the needs of the people, and used either consecutively or in some cases simultaneously, is necessary to carry out an effective forestry extension programme. Appropriate methods which forestry extension staff can use fall into three main categories:

• individual methods,
• group methods, and
• mass methods.

† For further details, see FAO Forestry Paper No. 80 on the same subject.
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Individual methods

Individual, face-to-face, contact has been found to be the most effective way of facilitating the learning process in an individual. In such contacts, people will listen to the advice and suggestions of extension staff whom they feel they know and like personally, and whose knowledge they respect. It becomes easy, therefore, to secure their cooperation and participation in extension activities and in the adoption of improved practices. It is also possible to obtain immediate feedback on whether the extension message has been understood in the sense intended.

However, there are considerable problems in adopting these methods in most developing countries. There are usually serious shortages of mature and experienced staff available and extension organizations have to rely mainly on young urban, recently qualified, people who lack a depth of field experience and who find it difficult to establish the trust and mutual respect necessary between extension staff and their clients. This may be a particularly serious problem in communities where there is more respect for age and wisdom than formal education.

In such a situation, a small core of experienced and well rewarded staff assisting a larger, more mobile, group of younger and less experienced people may be the best that many countries can afford.

Home visits. Home visits enable the extension staff to gain first-hand knowledge of the actual problems faced by their clients, to see the circumstances in which they arise and to suggest or adopt a remedial course of action.

Such visits are, however, expensive in terms of time and transport required and can only be made at times convenient to the client. In addition, the number of people who can be contacted satisfactorily is very limited. Another disadvantage is that a tendency may develop to visit some families, with whom good relations have been established, more frequently, at the expense of trying to establish better relations with others. This situation may result in loss of contact with the community as a whole and cause jealousy and resentment amongst some members of it.

Office calls and enquiries. Clients should be encouraged to call at the extension office if they are in the area. Extension staff should set aside particular times of the week for these visits if possible. For example, market days when people are likely to be in the area rather than on their farms.

Calls and enquiries dealt with in this way are less expensive and time consuming than home visits. It is important to keep a careful record of them, especially for follow-up or as an index of public interest or participation in a particular extension activity.

Personal letters. Personal letters may be of limited importance in extension activities in some areas at present, but their importance, will increase as literacy becomes widespread. People usually derive some satisfaction or pleasure from receiving a helpful, well written, personal letter. This, in itself, may help to establish good working relations in the area. Letters are the main form of communication both within an extension organization and with other public organizations. All extension staff should try to acquire some skills in letter writing.
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Telephone calls. Telephone calls are useful in requesting and receiving specific information quickly, provided it is possible to convey the information accurately by word of mouth alone.

Staff should be trained to make and receive calls effectively. It should, however, be emphasized in training that, unless a tape recorder is used, there is no permanent record of what was said during a telephone call and great care must be taken to ensure that all detailed instructions given during one are fully understood. Where important instructions or decisions are given during telephone conversations, they should be followed by written confirmation as soon as practicable.

Many rural areas lack an efficient telephone service and, in some areas, few people have access to telephones. Another disadvantage is that face-to-face contact is not possible and poor reception may lead to misunderstandings or frustration.

Informal contacts. Informal contacts are based on casual or chance meetings between extension staff and members of the public, which can be turned to good account by gathering information on attitudes towards forestry extension in an area or on problems faced by the public. They also provide good opportunities for introducing extension ideas to the public. At places where people gather informally (e.g. the market place or coffee shops), discussion of such matters is normal and socially acceptable. If not used with care, however, they can seriously upset a programme of work for a particular day. Extension staff should be encouraged to use them with discretion so that other members of the public will not get the impression that they are “never out of the coffee shop”.

Group methods

Group methods consist of a number of activities in which there are direct personal contacts between extension staff and the public, but not on a one-to-one basis. They include such important extension activities as community meetings, method and result demonstration, field days and tours. They provide excellent opportunities for extension staff to present information to a group of people, which is often one in which there is already some common interest or bond. They also provide opportunities for discussion and direct contact between the group members themselves and the extension staff. This process can assist people to reach a decision to take joint action on a problem.

A disadvantage of group methods is that it is not always easy to get all members of a group of people together at the same time for discussion or action. It may also take a long period of discussion for a group to arrive at a decision on a matter.

Group meetings. These are the oldest and most popular methods of contacting and communicating with people largely because they have been, for a long time, a familiar means of receiving and discussing information of importance and taking decisions. Relative to their cost, they are also a very effective method of spreading new ideas.

To be effective, meetings must be systematically planned, organized and conducted. They should also be followed up, in particular with regard to implementing any decision taken and assistance promised.

The use of visual aids such as charts, diagrams or slides will greatly increase the understanding of most topics and these should be used during the meeting or displayed at the meeting place, as far as the circumstances allow.
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Training and visit system. The training and visit system (T&V) is now much used in certain areas in agricultural extension and has been well covered in literature. Whether it can be adapted to forestry extension depends on local circumstances such as the number of people willing to participate in an area, the nature of the work they wish to undertake and the need or justification for regular visits at short intervals throughout the year. Where the T&V system is being used for agriculture or rural extension in an area, a forestry component might well be built into it. Use could then be made of existing staff who have already established good working relations with the local people to spread information on forestry practices or to assist people in implementing tasks already commenced.

Result demonstrations. A result demonstration shows what can be expected after a particular forestry practice has been in use for a certain period of time. It is intended to stimulate interest in the practice and induce people to learn more about it and to give it a trial. The comparison between the old practice or technique and the new one is an essential feature of a result demonstration. The differences are there to be seen and discussed by the group. Result demonstrations in forestry involve a much longer time span than in agriculture and it may only be possible to show some stages in the whole process.

Result demonstration may be relatively costly to organize, particularly if travel to the site is involved at the extension organization's expense. They also take time to plan and carry out, especially for forestry activities.

Method demonstrations. Method demonstrations are the oldest form of teaching. They are the basis of the apprentice system which has trained skilled craft-workers for many hundreds of years. In forestry extension they can be used to show a person how to do a job, such as potting seedlings or planting trees, step by step, until he or she has acquired sufficient proficiency in the task.

It is important to draw a clear distinction between method demonstrations and training courses. Because of the members present and the time available at method demonstration, people may gain only a superficial knowledge of the procedure and may, therefore, be unable to apply it on their own successfully without additional training.

Field days. Field days are best held on land belonging to local persons who have successfully adopted improved forestry practices, or, if at all possible, on experimental stations or government demonstration centres.

The main purpose of field days are to commence or inspect progress, or observe the outcome of result demonstration and to see, by field demonstration, the scientific basis on which advisers work is based.

The use that can be made of field days is limited as frequent visits may cause an unacceptable inconvenience to the hosts or to the experimental stations and may interfere with their main function of research.

Field trips and tours. Field trips and tours can be regarded as a series of field demonstrations arranged in sequence. They are extension activities which appeal to people's desire to travel and to see things in other areas. On account of the expense involved, however, they can only be undertaken occasionally and must, therefore, be very carefully planned and carried out to gain the maximum benefit from them. Activities which may be visited range from small demonstrations or tree test plots to established forestry plantations or industries as appropriate.
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Field trips and tours can present information in a clear way to enable the visitors to understand the message. Considering their important educational impact on the members, they may be amongst the most effective and economical methods of teaching the broader aspects of extension.

Panel discussions. This is a process by which a number of persons pool their knowledge and experiences together and, through discussion and general agreement, clarify the issues under consideration. The leader of the panel should serve as a moderator rather than as a resource person. He should ensure that every member gets a reasonable chance to be heard. His function is to keep the discussion going in an orderly manner. He should discourage anyone from trying to dominate the discussion.

Such a meeting can be used when a group of people has already acquired some knowledge about the possibilities of undertaking a forestry extension programme in an area, and are considering in more detail what they might do about it.

In using this method, the organizers must exercise great care in selecting members of the panel who can speak to the local audience in a level of language they can understand.

Mass extension methods

As neither individual nor group methods can reach everyone who may want or need information on forestry extension matters, various methods of mass communication such as print, broadcast or audio-visual methods are employed to reach large numbers of people quickly and often at low cost. The information they convey must, in most cases, be generalized but it can play an important role in certain phases of an extension campaign such as creation of general awareness and interest in a new forestry topic or of favourable attitudes amongst the general public towards forestry extension programmes.

While the mass media can increase the impact of extension staff in the field by the rapid spread of information, it must be remembered that comparatively few people in rural areas in developing countries have regular access to newspaper or television.

Some examples of mass media and the ways in which they can be used most effectively are given below.

Circular letters. Circular letters are relatively cheap to produce in large numbers and can be kept by the receiver and studied repeatedly if necessary.

They can be used to inform people about a new forestry extension practice, to give advance warning to local leaders of anticipated forestry problems such as shortages of fuelwood or to reinforce the effects of personal contact methods. Circular letters are of value only to those who can read reasonably well and understand the content without further explanation.

Newspaper stories. The functions of newspaper stories are largely the same as those of circular letters. They are an inexpensive extension method as they only require the staff to write acceptable stories or press releases and send them to suitable outlets. However, newspaper editors often shorten stories for their own reasons and the full information intended may not be included.
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Posters. A poster is basically a large sheet of paper or cardboard with an illustration and usually a few simple words. They may, less commonly, be painted or enamelled metal which is more durable but much more expensive.

Posters are used to catch the eye of passers-by to impress a fact or idea on them or to encourage them to support an idea.

Posters can be produced in quantity by letterpress, by silk-screen, by some more expensive duplicating machines, or by hand-work if only a few are needed.

Wall newspapers. These are generally similar in size and appearance to posters but can be prepared in various forms. Their value depends to some extent on the level of literacy in the area in which they are used and whether they can be exhibited in places protected from the weather where they can remain on view for a reasonable period of time. They may be prepared in a combined form with a portion used as bulletin board and a portion for photographs or newspaper cuttings of interest to the public.

Printed matter and pictures displayed in wall newspapers may be subject to copyright and prior arrangements may have to be made with the publishers for their use. This can usually be obtained but it may involve a delay before the material can be displayed and will almost certainly require full acknowledgement of the source from which it was taken.

Pamphlets and leaflets. These can often be produced locally, quickly and cheaply and can be used in many ways in forestry extension programmes. They are useful to supplement larger publications when new information is available but when reprinting of the whole publication is not necessary or practicable. They may also be used as single items, for example, to explain proper tree planting techniques and in a series covering broader topics such as woodlot establishment, with separate leaflets on nursery establishment, seedling production, planting and management of woodlots as well as felling and sales of timber.

Pamphlets and leaflets can be handed out after meetings and offered to listeners of radio programmes to supplement the information given in the program or to serve as a lasting reminder or further explanation of the topics discussed.

Fact sheets. Fact sheets make it possible to present, in a condensed form, information or items or subject matter of general interest. They usually cover a single topic and are often limited to one page. Most sheets are illustrated with drawings or photographs. They are mainly used to provide information on current forestry subject matter to field workers or community leaders.

Exhibits and displays. The materials in exhibitions and displays have some of the characteristics of posters. The main difference is that the exhibits are three-dimensional, usually larger and more detailed than posters, and may contain real objects or models where appropriate.

They can be used very effectively in the entrance halls of offices, at local fairs, agricultural shows, or on important national forestry occasions such as Arbor Days.

Radio. Radio is one of the fastest, most powerful, and in many countries the only effective way of communicating with the majority of rural people. It can be a very valuable and inexpensive means of spreading an understanding of forestry amongst people.
Radio broadcasts are commonly recorded in advance on tape. This enables them to be edited and adjusted for timing before being broadcast. There is often no charge for air time if the topic is of wide public interest.

**Television.** Television adds both vision and movement to broadcasting and in many areas it can now also add colour. These qualities greatly increase its value as a means of forestry extension where an effective T.V. service exists and where there are sufficient sets to cover a reasonable proportion of the population. Unfortunately, this stage has not yet been reached in many developing countries and its spread to rural areas may take several years. In other countries, however, TV is already playing an increasingly important role in broadcasting programmes of educational and entertainment value to rural people.

Television can also play a major role in training extension staff. Used in conjunction with simple video recorders, it enable such staff to monitor their own performance as extensionists in a wide variety of situations. It can further enable the individual extensions to study critically and at leisure, the reactions of an audience to his performance, based on facial expressions, body movements or reactions to statements and questions raised during a meeting.
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