FORESTRY RESEARCH NETWORKS: A PRELIMINARY SURVEY OF FACTORS INFLUENCING SUCCESS AND SUSTAINABILITY

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FORESTRY RESEARCH NETWORKS

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We also thank many of our colleagues who have contributed to the development of the existing base of understanding on research networks. We especially note the contributions of the authors whose literature we cite in Chapter 3. Most importantly, we thank the many scientists and research administrators who took time from their busy schedules to provide thoughtful and insightful observations and opinions about forestry research networking. Without their input, this study would not have been possible.

Hopefully, it goes without saying that Parker and McFadden stand responsible for the analysis and reporting of the findings from the literature and the responses of the scientists who filled out the questionnaire. The opinions expressed herein reflect only those of the authors and do not necessarily represent those of the Agency for International Development, Tropical Research and Development, Inc., or any of the authors or respondents cited in the list of references and list of contacts.

EXECUTIVE SUMMARY

A great part of the challenge to forestry is to better understand not only the contributions of forestry research as it addresses complex forestry and natural resource problems but also the best means to organize research efforts to produce new knowledge and to strengthen institutions. One organizational form or tool to address complex issues in agricultural and natural resource-related development efforts receives considerable favorable press in the scientific and development communities today. That is the forestry research network.

Objectives

The objectives of this study were to undertake research to: 1) ensure that the assumptions that research networking is indeed a major useful tool for addressing common problems across a region or around the world are correct, and 2) if the assumptions are correct, to identify the factors that contribute to the long-term success and sustainability of these networks.

The study looks most specifically at the role of forestry research networks. It responds to the need to understand what factors make networks successful and what factors make networks sustainable. One hypothesis that is being tested is that factors for success and those for sustainability may not be the same. The report does not evaluate any particular network or networks. Our intent, rather was to look at the nature, magnitude, and results of interactions between scientists within an array of existing networks so that we might lend insight into how to enhance:

- the relationships within networks,
- the effectiveness and efficiency of members of the research network community, and
- the long-term sustainability of their efforts (if it is appropriate).

Literature Review

In this study, we looked at a diverse array of literature, some of which is quite "fugitive" (i.e., not readily available), on research networks. The specific focus is on forestry research networks in developing countries. We identified the major contributions from both the agricultural and forestry sectors. In general, the existing literature is based mostly on the experiences of the authors; few are based on actual formal evaluations of research networks. It is not at all clear how systematically derived any of the conclusions are in any of the references reviewed.

Findings

This study is the first systematic study on forestry research networking. We tested some existing ideas. We found that a number of authors are working from assumptions about research networks that may be appropriate for agricultural research networks but which may or may not hold true for forestry. We found a number of "fuzzy" concepts that inhibit any mutual understanding of what forestry research networks are and are not. We found a number of contradictions, such as whether research networks should be selective, whether contributions could be made if a national institution is weak. We found that opinions and expectations have a lot to do with what all of us in the forestry community are talking about. And, from our results, we found that we are able to build on some of the ideas that we tested, contradict some, and question still others.

Our findings are that while some literature exists, little research has been done on the subject of forestry research networks to capture the existing knowledge, experience, and ideas of scientists who comprise research networks; to test the rationale and assumptions about them; and, to systematically understand the nature of existing forestry research networks.

A major finding is that the definition of a forestry research network remains unclear. This has important implications for understanding networks in their various forms and for identifying the factors which may

ensure their success and sustainability as appropriate. We provide a definition of a forestry research network that will likely be controversial, but we submit that it is essential to move the debate one step further.

As anticipated, we found various models for forestry research networks exist, but some pose problems that should be better understood. Among these are some of the models provided by the experience of the agricultural research community. And, again as expected we found that forestry research networks are not necessarily an appropriate form of organization for every researchable problem in forestry.

We found that forestry research networks are predictably plagued by a number of constraints. Foremost among these is funding.

We found that the primary rewards to individuals from participating in a research network include: access to information; solving a problem; funds to do research; collegiality that helps them develop and refine knowledge; and equipment to conduct research. Interactions with colleagues appears to be a strong theme.

Our main focus was on the factors for success and sustainbility of forestry research networks. In our study, we found that he most important factors that contribute to the success of research networks are (in order of their perceived contribution): 1) clearly defined problem and well-planned research agenda; 2) continuity and commitment of institutions in support of their participating scientists; 3) outside funding; 4) information sharing; and, 5) strong self-interest on the part of the participants.

A number of the factors for success of forestry research networks identified in this study are different than those identified in the existing literature on research networks. These include the importance of continuity among the participants and the role of training. One aspect of success to note is that institutional strengths and weaknesses do not have a major direct impact on research networking. Another aspect of particular note is the role of the individual scientists as a fundamental aspect of research networking and their desire for interaction, not just

sharing of genetic materials and information.

We also identified five of the most important factors for the sustainability of a forestry research network (as indicated by respondents to our questionnaire). These are: 1) network meets priorities/needs of end-users; 2) financial support is available; 3) network meets priorities/needs of institutions; and, 4) network meets priorities/needs of nations. As hypothesized at the outset of our work, these are not necessarily the same factors as those for success of a forestry research network.

Two factors for sustainability seemed particularly important to address. These include our confirmation of two concerns. One is that the links between research and end-users are an important aspect for the sustainability of forestry research networks and merit more attention. The second is the valuing of research. This can serve as a constraint to research network support and may be a key factor for the sustainability of forestry research networks.

Recommendations

The information presented in this report must be considered as an introduction to the general subject of forestry research networking. Some opportunities for follow-up exist in the areas of action and research. These are:

1. We recommend that the following be implemented as soon as possible by the Agency for International Development:

   - We recommend that until more is known, blueprint approaches should not be applied to the design of any forestry research networking efforts. Different problems, approaches, interests, conditions, and priorities require different research strategies to produce knowledge to resolve those problems. (If A.I.D. is interested in funding only one model of research network, it should be careful that the model is appropriate to the situation. It should also be sure that it isn't contributing

to the development of "networking" activities that may, in fact, keep scientists from doing research.)

- o We recommend that forestry research networks provide more support for increased interactions among scientists. The respondents to the questionnaire seemed to be implying that mere access to information was not enough, interaction is required.

- o We recommend that factors such as the role of participants in network management and implementation be given more attention as soon as possible in order to move towards increased sustainability. (This seems to be a critical area since many of the individual factors for success are highly linked among themselves as are many of the factors for sustainability.)

- o Development and use of standardized terminology to describe networks and the networking process. (This is not to imply that if existing organizational structures that are currently called research networks are subsequently referred to by a different name that they aren't worthy of being funded. To the contrary, we would argue that they would continue to deserve consideration for funding based on their merits and their purposes. For example, a network which has the primary purpose of <u>sharing information</u> among researchers, rather than <u>producing knowledge</u>, would perhaps best be denominated an Information Network for Forestry Researchers and be funded to further promote that activity.)

2. As we indicated in Chapter 3 (Findings) a considerable amount of work is still needed to follow up on the many contradictions and inconsistencies reported there. While it may sound self-serving, we recommend a longer term, more detailed study of forestry research networking to look at the following: analysis of the sociology of science research base; analysis of the networking experience of various IARCs (e.g., IRRI, CIAT, CIP) and the form of organization used for various kinds of research activities; testing and validating

some of the factors for success and sustainability of forestry research networks; and testing and validating the rationale for forestry research networking.

CHAPTER 1: INTRODUCTION

Problem Statement

The Eyes of the World Are on Forests

With increasing world attention being directed at the role of forests in global environmental security, we cannot help but notice that funds for forestry research have not increased commensurately. And, in some cases, they have actually diminished.

Researchers in forestry, ecology and related-natural resource fields typically have to deal with complex biophysical and socioeconomic problems. Similarly, issues related to resource use, sustainable development and economic growth also reflect a commonality and level of complexity that requires concerted effort through local, national, regional, and international research efforts to address.

Thus, it becomes ever more crucial that we enhance the effectiveness and efficiency of our efforts and resources to address complex biophysical and socioeconomic issues and problems in development. The return on our research investment and the positive impact in meeting human needs for goods and services and augmenting incomes must be increased if the root causes for problems such as tropical forest degradation, global climate change and loss of biological diversity are to be resolved.

The Challenge of Forestry Research

A great part of the challenge is to better understand not only the contributions of forestry research as it addresses these problems but also the best means to organize research efforts to produce new knowledge and to strengthen institutions. One organizational form or tool to address complex issues in agricultural and natural resource-related development efforts receives considerable favorable press in the scientific and development communities today. That is the forestry research network.

In this report, we will spend some time discussing the nature and organizational forms of forestry research networks. In the meantime, however, we present a simplistic definition to serve as a common frame of understanding until the results of our analysis provide a basis for better understanding and definition. A forestry research network, therefore, is a community or organization of scientists within the scientific community which/who collaborate on various aspects of a common problem. A network, then, is a conceptual tool to address a problem or set of problems and must be shaped to address the problem(s) at hand (Parker 1984).

Advantages of Joint Efforts

Many scientists acknowledge the advantages of jointly addressing complex problems that are common across regions. Efforts such as these are believed, among other things, to: avoid duplication in research efforts (Burley 1989), compensate for lack of a critical mass of trained personnel in individual countries (Tannous 1969), enhance opportunities for communication among scientists (The Rockefeller Foundation and others 1988), and provide positive "spillover effects" from one region to another (Greenland, Craswell, and Dagg 1987). The generally agreed upon value of forestry research networks includes the following considerations:

> Many of the forestry research problems facing the world today go far beyond the administrative boundaries and exceed the financial and human resources of any national forestry research institute. Modern science is truly international. Much can be gained by cooperative research among forestry research institutes in several countries, and by sharing expertise and exchanging information among scientists working on common problems in many different areas of the world. No single research institution has a monopoly on research expertise for all fields of forestry. Each can gain by interchanges of information among scientists, and by fostering some form of research collaboration through research networking. Organized collaborative research often can produce far more than the sum of what would be produced by individuals working in isolation. (Gregersen, Lundgren and Bengston 1990: 142)

A number of experts from the agricultural and forestry research communities have described the factors that their experience suggests lead to successful networks (Plucknett and Smith 1984; Burley 1985, 1987, 1989; Gregersen, Lundgren and Bengston 1990). They talk about clearly defined problems, commonality of problems among network participants, need for external funding, local institutional continuity and other factors.

The Problem

No follow-on studies, however, have systematically and comparably tested and/or substantiated these experiences and insights. Literature from cross-national studies of research organizations suggests that other factors (e.g., quality of research environment) might be equally important to consider (Stolte-Heiskanen and others 1977). A major concern about these existing pieces of literature is that they may not distinguish clearly enough answers to questions such as:

- success at doing what?
- success as perceived by whom and for what reasons?
- success, at what cost and to whom?

Concern about what makes networks "successful" is compounded by concern about what makes networks "sustainable". Sustainability of research networks may contribute to solving the major problems confronting the forestry research community, but this will require a better understanding of the structure of networks, the functions of their managers and participants, and the process of networking. In reports about constraints (e.g., lack of human resources, political factors that affect collaborative efforts, and limited long term funding), to achieving the full potential of research networking, little direct discussion deals with issues of the sustainability of networks. In spite of a reasonable base of literature (see References), research to actually document the critical factors related to the long-term sustainability of these networks appears non-existent. And, no where does anyone address the issues of criteria for determining whether a network should be sustained.

Objectives of the Study

The objectives of this study are to undertake research:

1) to ensure that the assumptions that research networking is indeed a major useful tool for addressing common problems across a region or around the world are correct, and

2) if the assumptions are correct, to identify the factors that contribute to the long-term success and sustainability of these networks.

This study looks most specifically at the role of forestry research networks. It responds to the need to understand what factors make networks successful and what factors make networks sustainable. One hypothesis that is being tested is that factors for success and those for sustainability may not be the same. No particular foe exists here, nor any intent to debunk the scientific community nor the research networks that it has formed. This report does not evaluate any particular network or networks. Our intent, rather was to look at the nature, magnitude, and results of interactions between scientists within an array of existing networks so that we might lend insight into how to enhance:

- the relationships within networks,
- the effectiveness and efficiency of members of the research network community, and
- the long-term sustainability of their efforts (if it is appropriate).

Methodology and Outputs

The general methods for the study include a review of existing literature on research networks and the survey and interview of a select group of research administrators and scientists around the world on factors for success and challenges to sustainability of forestry research networks. Annex C provides greater detail on the methods used and some thoughts on their potentials and problems.

The effort to characterize and analyze research networks (in part in the literature review and in part from analysis of the responses to the questionnaire we applied) has permitted us to outline preliminary general lessons learned (see Chapter 3) about: 1) factors for success; 2) implementation of networks; and 3) opportunities for and constraints to sustainability of forestry research networking. We also discuss the possible implications of our findings for future support of forestry research networking activities.

CHAPTER 2: LITERATURE REVIEW

This chapter provides an overview of what a range of authors and observers have been writing about research networking. We have divided the materials into a set of categories to help with the synthesis of diverse ideas and issues. We have also tried to maintain the order in which any specific points were raised by authors in their text. Insofar as possible, we have tried to use literature from the field of forestry research. However, we have drawn on some relevant experience from the agricultural research literature as well. While more literature exists that focuses directly on the topics of LDC research capabilities, problems, and potentials, we have not included it to any great degree since it is beyond the scope of work of this study on research networking.

Context of Forestry Research Networks

The commonality of similar soil types and climatic conditions in parts of Chile and Sudan or the similarity between general adaptive strategies of mountain pastoral peoples in Switzerland and Nepal allows them to be investigated in similar ways. The understanding of one area or issue derived from one research effort often can shed light on the nature of another area or issue. When jointly conceptualized, planned, administered and shared, research can serve to concentrate and mobilize generally limited financial and human resources (Parker 1984).

An example from the Middle East illustrates the value of multinational agricultural research:

> ...each country in the Middle East can reap greater benefits from a regional organization. Such organization requires increasing cooperation among countries in various projects, and the coordination of national plans and programmes within the regional framework. ...No one country in the Middle East has the trained personnel, the research and educational facilities, the equipment and supplies to meet all its needs for enhanced agricultural development. Pooling of resources pays off in greater results for all concerned. ...Through regional coordination, successful experience can be publicized and widely adopted, and the repetition

of failures avoided. ...Regional coordination allows each country to concentrate its effort along its lines of specialization and skills. (Tannous 1969:77)

This not only reflects the nature or means for addressing problems in a developing region, it also reflects the very nature of science itself which "is a purely human pursuit" and "a highly organized social institution in which knowledge is built up by a process of deliberate intellectual cooperation" (Ziman 1981:31). Research shows a direct relationship exists between the level of social interaction and the exponential growth of knowledge (Crane 1972) and that "Opportunities for developing a long-term commitment to an area with concomitant productivity appear to be related to the availability of a 'critical mass' of colleagues in the same geographical region" (Crane 1972:65). Direct interaction among scientists provides opportunities for learning, for information sharing, for cooperative action, for collaborative research and for validating empirical results through peer review, (Gregersen, Lundgren, and Bengston 1990), and for establishing a consensus within the scientific community about what is agreed upon to be "known".

The problems of doing science in developing regions, however, are exacerbated, in part, because of this lack of interaction among scientists. In fact, Herzog (1983:341) suggests that research establishments cannot thrive in developing countries since these kinds of establishment "require intense cultivation and have no source of sustenance other than the already thriving major centers of activity." Others believe that this lack of interaction causes duplication of many efforts, inefficiencies in the use of existing but scarce resources in most cases and waste of resources in many cases. Mechanisms do exist to increase the number, kind and quality of interactions among scientists in the forestry research sector of the developing world--mechanisms which experience suggests can promote and achieve "significant progress in a reasonable time" (The Rockefeller
Brothers and others 1988:44), especially where a 'critical mass' of forestry researchers does not exist in any one country alone.

The situation is aptly described as:

> In real terms this means supporting the expansion of the research capacities of local institutions, upgrading the skills of individual scientists at these institutions and having them be involved in the actual research work. It also means establishing more linkages and networks between forest research institutions within the region to facilitate the performance of research on topics of common interests thus reducing expensive duplication. The network system coordinated and supported by the International Development Research Center, Canada (IDRC) for the rattan and bamboo, and by the United States Agency for International Development (USAID) for the multi-purpose tree species projects are good examples. There is a growing pool of scientific talent within each of the DCs [Developing Countries] in the region but without external initiatives from developed countries, opportunities for these scientists to interact sometimes even among themselves within their own countries, are limited. Such interactions need not be limited to the technical aspects of research topics alone but extend into general research management, an area much neglected by practitioners of forestry research in DCs. (Cheah Leong Chew, 1988:30-31)

Thus, as a minimum, the similarity of interest or problems and the opportunity for interactions provides scientists with the basis for networking. Also critical is effective communication that may arise out of interactions about the common interest or problem. Freeman (1984:203) suggests in fact that:

> The whole of the scientific enterprise depends on effective communication among people working in an area. To be effective, scientists need to talk to one another, write to each other and read each other's work. Science is essentially a collective expression that is based entirely on such communication. Particularly in the early stages of the emergence of a new specialty, progress requires communication in order to establish the sorts of norms and consenses that define both the problem and approach.

Organizational Forms of Research Networks/Networking

Research networks have been characterized in a number of ways. They appear highly variable. They may be informal or formal. They may be simple or complex or they may evolve from the simple to the complex (see Figure 1). They may have a center of excellence as a lead institution or a national institution with lead responsibility within a region. They may have a coordinated institutional approach, a regional center approach or they may have a group of scientists rather than institutions as the primary arrangement of interaction (Parker 1984; Gregersen, Lundgren, and Bengston 1990), or representatives of a group of independent research projects who meet periodically but who do no collaborative research (MacDicken, Dove, Brewbaker and Hyde 1986). They may have a coordinator who serves a brokering or facilitating role (Hansen 1984) or a management structure that plays a major role in scientific and/or organizational management of the network (Mulkay and others 1975).

Various organizational forms of research networks/networking have been characterized as:

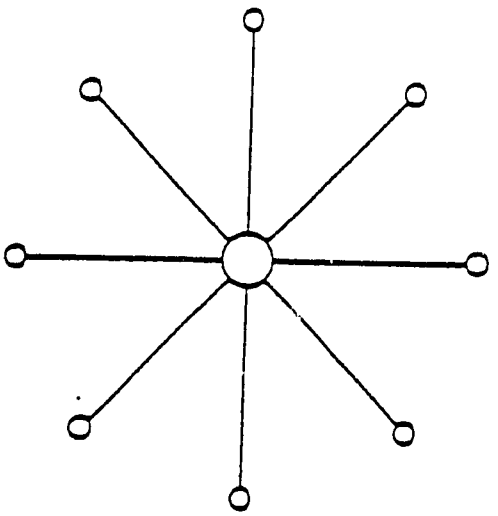
1. interconnected lines of communication (Grayzel as cited by Taylor 1989)

2. "'lines or strings woven together to capture something' ... how tightly or loosely the net is woven is important in determining the problems that it will address" (Grayzel as cited by Taylor 1989:9)

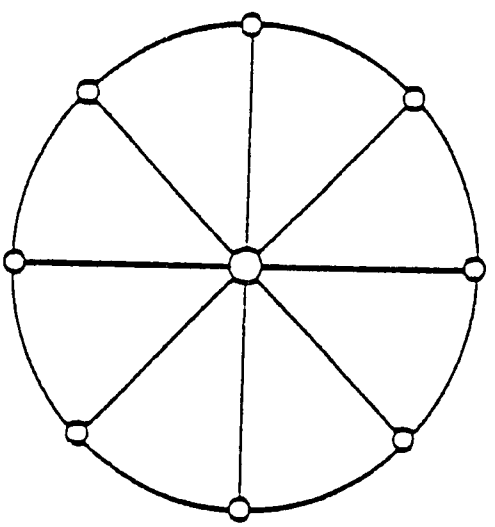
3. informal and formal means by which institutions and individuals "contact one another and develop working relationships" (Gregersen, Lundgren, and Bengston 1990:142); appears to be much like Burley's "Collegiate Voluntary" type of network

A Schematic View of Networking, Using the Wheel as a Means to Illustrate Linkages between Participants; Relationships Become More Complex as the Network Evolves Until More Than One Hub Emerges

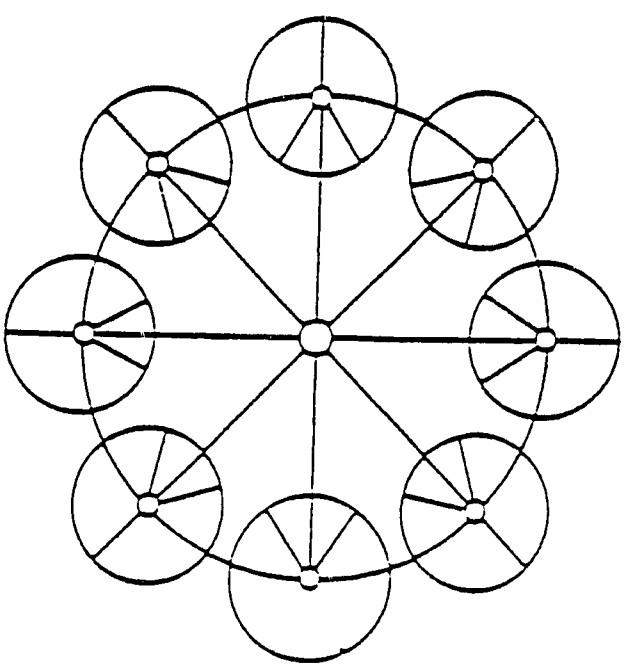
(a)



(b)



(c)



4. cooperation between institutions "with similar conditions and problems but without the immediate resources for finding solutions to these problems individually" (Burley 1987:68)

5. "...an extension of twinning and multiple twinning between institutions (Burley 1988:186)

6. loose association of researchers "who divide research problems into work assignments which are then carried out primarily by a lead institution" (MacDicken, Dove, Brewbaker and Hyde 1986); this seems to be somewhat like Burley's (1988) category of a "Collegiate voluntary" type of network, except for the variation here that a lead institution rather than working party leaders play the major roles

7. mechanism for collaborative research by participants who have comparable trials (MacDicken, Dove, Brewbaker and Hyde 1986)

8. "groups of people who communicate in areas of common interest" (MacDicken, Dove, Brewbaker and Hyde 1986)

9. "loose association of independent national projects.... Each member institution has pursued its research in its own unique way. ...some common aspects to research ...give a certain unity to the work of its members. ...." (Rambo and Sajise 1985)

10. 'Invisible Colleges'--informal contacts among peers with interest in a common problem area for the purpose of exchanging ideas (Crane 1972; Gregersen, Lundgren, and Bengston 1990)

11. Professional societies--scientific associations for professionals at the national and international level (e.g., International Society for Tropical Foresters); (Gregersen, Lundgren and Bengston 1990)

12. Information networks--clearinghouse facilitating information exchange (e.g., Overseas Development Institute's Social Forestry Network) (Gregersen, Lundgren and Bengston 1990)

13. Research Project Networks [a variation of Burley's (1988) "Institutional Type" of operational system of network with considerable financial support]--Organization to coordinate a variety of research projects that focus on similar problems (e.g., CATIE's MADELENA Project, F/FRED) (Gregersen, Lundgren and Bengston 1990)

14. Organizational Networks [also called a "Catalytic" operational system by Burley (1988)]--such as IUFRO which provides a forum for exchange of research information (Gregersen, Lundgren and Bengston 1990)

15. "Invitational type with little financial support"--Burley (1988: 195) suggests that, in this case, the donor uses funds "to collect, distribute and assess material for trials of species that are recognized as having high potential value throughout the tropics.... Developing country institutions are invited to share fully in all activities."

These characterizations of the various forms of organization of research networks have often been translated into definitions of what a research network is. The result is an apparent lack of a common concept or framework that can provide a common basis for understanding. We address this concern in greater detail in Chapter 3, Findings 3 and 4.

Rationale for a Using a Network Approach for Forestry Research

Several authors have offered various rationale for using a network to organize forestry research efforts. These include:

1. reduce cost

2. minimize duplication

3. increase efficiency

4. enhance national research and research management capability (Burley 1987)

5. take advantage of similarities (geographic and ecological)

6. political advantages

7. synergistic effects of working together (Sene 1988).

Burley adds an additional rationale by stating that it is important to remember that: "although combined analysis in the network concept offers more information than the sum of the participants' individual results, the prime reason for most networks is to provide material for individual participants to make their own decisions and to develop future programmes" (Burley 1988:73).

Aims/Objectives/Bases of Research Networks

The only author who uses the word "aims" of networks is Peter Oram of the International Food Policy Research Institute (IFPRI). He (as cited by Burley 1988:186) enumerates the following aims:

(i) Facilitate the identification of common problems
(ii) Facilitate communication and scientific bonds
(iii) Increase individual and national research competence
(iv) Accelerate research and application
(v) Accelerate transfer of materials and experience, and verify their local application
(vi) Provide 'critical mass' of research effort but not all concentrated in one place
(vii) Economize in fixed capital costs and overhead administrative charges associated with large institutions.

Objectives of research networks may include:

1. Problem-solving through production of new knowledge

2. Joint effort

3. Strengthening of research institutions

4. Development of human resources (MacDicken, Dove, Brewbaker, Hyde 1986).

Importantly, these same authors add that if a network is designed to develop human resources then "the development or breeding of trees is only a means to that end, not an end itself" (MacDicken, Dove, Brewbaker, Hyde 1986:11).

IDRC, in the early 1980s, defined the objectives of its research networks as:

1. Institutional strengthening

2. Human resource development

3. Obtaining research results

4. Translating results into information for policy making (Hansen 1984).

And, in a slightly different way, Greenland, Craswell and Dagg (1987) talk about the "bases" for forming networks. Their work attempts to better link some of the more specific anticipated outputs of research networks with the purposes. Thus, they suggest that for:

1. Information Exchange, networks facilitate the exchange of methods, ideas and results,

2. Scientific Consultation, networks promote meetings for scientists to actively participate in: a) the joint planning of research activities that involve different approaches to solving a common problem and b) the discussion of results,

3. Collaborative Research, networks promote joint planning, a common research format, the distribution and sharing of materials for testing by network participants, exchange of results, and monitoring of research activities.

Benefits of Research Networks

Some overlap exists between what have been articulated as "rationale" and "aims" and what are outlined as "benefits" in the literature. The benefits of research networking for scientists and research institutions include:

1. sharing of expertise and information

2. opportunities to develop skills of personnel

3. exchange of technologies

4. access to skills and knowledge from other organizations

5. reduction of the costs of research

6. better use of human resources

7. reduction of duplication

8. improved problem-solving through coordinated research efforts

9. links between research and education and training to speed the transfer of new knowledge (Gregersen, Lundgren and Bengston 1990).

The benefits of research networking for development enumerated by Brady (1984) are:

1. able to address major problems that cross political boundaries

2. increased probability of long-term sustained support

3. facilitates and expands opportunities for adaptive, site-specific research

4. builds individual institutions and strengthens international research linkages

5. compensates for limitations of individual institutions and uses comparative advantages of participating institutions.

Functions of Research Network Managers and Participants

Network managers and participants tend to have a range of functions. Drawing from the experience of the international agricultural research programs, international forestry, and U.S. forest pest management, these functions include:

1. Information exchange, collaborative planning, implementation of research activities, monitoring (ISNAR and SPAAR 1987)

2. Research planning and management, network development and research (including meetings, site visits, publications, training, research support), and global research (i.e., database management) (A.I.D. 1985)

3. Communication, information, peer interaction, training, and research support (Sastry 1987)

4. Accountability, which relates to the definition of reachable objectives for the research effort. Often the investigators will define their own objectives and hold themselves accountable to those objectives if those of the overall program are not well defined. Accountability is an important aspect of the monitoring and evaluation functions of a research network (Campbell and McFadden 1977).

5. Planning of an approach to the research by investigators and research managers that helps compartmentalize work into more appropriate units (working groups), with manageable objectives, with coordination by working group leaders (Campbell and McFadden 1977).

6. Development and refinement of conceptual models, starting with a first approximation model that helps visualize: a) the potential

contributions of each working group and individual investigator to the overall model; b) the interfaces between each; and c) the linkages among them (Campbell and McFadden 1977).

7. Recruitment of scientists and development of guidelines for selection of research activities (Campbell and McFadden 1977).

8. Evaluation to provide information to management on what working groups and scientists are doing and to provide information to scientists about what management wants done. Updating or changing the nature of the research effort or specific activities based on a determination of their relevance and the risk that the study will prove successful (Campbell and McFadden 1977).

9. Research network managers and participants have many functions which include comparable research designs and methodologies and the sharing of information. "Moravcsik (1986) points out that sharing facts is a relatively unimportant part of communication among scientists... . He states that scientists in the developing countries need to share not only technical information, but also information about scientific methods, the management of science, and the philosophy of science" (Gregersen, Lundgren and Bengston 1990:143).

Stages/Steps in Research Network Development

Some of the literature identifies more specific aspects of research network development. Two examples are useful here. The F/FRED project has defined a three stage approach to research network development. These stages, in brief, are:

1. Organization of design and logistical support

2. Establishment of linkages among institutions

3. Sustainable operations (MacDicken 1989).

A different network--the Southeast Asian Universities Agroecosystem (SUAN) Network--followed these steps:

1. Organization and getting acquainted

2. Sharing a sense of commonality of problems and frameworks for research

3. Increasing flow of information

4. Emerging partnership (Rambo and Sajise 1985).

Assumptions about Collaborative Research Management

Campbell and McFadden suggested that six major assumptions had to be made about the kind of collaborative research program (fundamentally a network of researchers) for pest management that they describe. These assumptions were that:

1. Clearly stated, attainable program objectives can be defined, and resulting knowledge will provide an adequate basis for the development of an improved pest management system.
2. Coordination of investigators and synthesis and integration of information will be initiated at the onset of the program and will be continuing functions.
3. A centralized management team will be assembled.
4. The program manager will have maximum flexibility both to define and achieve program objectives.
5. Management can develop and sustain a high-level monitoring capability across the entire region.
6. Control of funds will be vested in program management. (Campbell and McFadden 1977:219)

Factors for Success of Research Networks

The literature abounds with lists of factors for success of research networks. Science published a central article on the topic of factors for success by Plucknett and Smith in 1985. Since then, a number of authors from the agricultural and forestry research communities have added to that list or developed their own lists. No lack of factors affecting the

success of research networks exists.

It is perhaps useful, if not interesting, to show the range of opinions on these factors, where they converge, where they complement each other, where they supplement each other and, at times, where they seem to differ from each other. (See Annex B, Table 3 for a summary of all these factors, and see Chapter 3, Finding 10 for a discussion about the factors of success.) The following overviews the vast array of factors identified in the literature.

Plucknett and Smith on Agricultural Research Networks

In 1985, Plucknett and Smith articulated seven factors critical for the success of agricultural research networks. These were:

1. The problem must be clearly defined and a realistic research agenda agreed upon

2. The problem should be widely shared by the participants

3. Strong self-interest among participants must exist

4. Institutional participants must commit resources such as facilities and personnel

5. External funding must exist from the outset and for a number of years into the implementation of network research

6. Participants must be adequately trained in order to make productive contributions

7. Strong and efficient leadership, having the confidence of all the participants in a network, must be present

Burley on Forestry Research Networks

Burley (1985) contributed some additions to the Plucknett/Smith list. These relate specifically to forestry research networks. These

additions were:

1. A variety of media should be used to share information among participants

2. Mechanisms must be developed by participants for the extension of research results to end users

3. Networks should be flexible to cope with the variety of skills and needs of the participants

4. Local institutions must provide commitment and continuity.

Greenland, Craswell, and Dagg on Agricultural Research Networks

In 1987, Greenland, Craswell and Dagg also added to the Plucknett and Smith list with the following factors for success:

1. The network should find ways to nourish the development and sharing of new materials, technologies and ideas

2. Network participants should be involved in network management through coordinating committees or other appropriate mechanisms.

The Consultative Group for International Agricultural Research in 1981

The Consultative Group for International Agricultural Research in its 1981 report stated that the criteria for successful research networks were:

1. The research must be "well-defined and sharply focused"

2. The network should be restricted to a specific geographical region to enhance communication and to ensure that the research topic is of common interest

3. Participation should be formalized at an institutional level, but national government level clearance also is required

4. Institutional participants should be involved as equal partners

5. Each participant should believe that it will benefit from participation in the network; this will ensure greater support and commitment

6. Participating institutions must have funds or be able to obtain them to ensure their participation

7. Lead institutions must provide scientific leadership.

8. Funding must be available to ensure that participants have opportunities to meet, to plan together, share information, and to be trained.

9. Network leadership must be committed to a networking approach and to the development of an equal partnership with scientists. (CGIAR, 1981:64-65)

The Consultative Group on International Agricultural Research in 1983

In 1983, the Consultative Group on International Agricultural Research noted that to have an effective network, the following were required:

1. regional focus

2. participants are equal partners--they each gain from it and they each support it

3. participants have sufficient funds to participate fully

4. lead institution has strength to provide direction

5. mechanisms for: exchanging research information and materials, and for training and multidisciplinary approaches

6. hub that serves as facilitator or lead research institution (Parker, 1984).

Sene on International Forestry Research Projects

Sene (1988:133) stated that to have effective multinational research projects and to minimize their difficulties, the following factors are required:

1. A reasonably long period for planning in order to achieve consensus

2. Strong national and regional institutional involvement to ensure support to individual participants and provide continuity

3. Training

4. A coordinated/cooperative approach to increase the possibility for heightening impact and advantage

5. A long enough timeframe to avoid rapid withdrawal of external resources and to ensure development of self-sufficiency by participating local institutions.

Hansen's Review of IDRC Research Networks

Hansen (1984) in his analysis of research networks for A.I.D.'s Bureau for Science and Technology, Office of Rural Development, noted that for an IDRC network to be considered effective, it had met its objectives, typically by facilitating the following activities:

1. encouragement of the development or adaptation of appropriate research methodologies

2. trained participants

3. built a critical mass of individuals to tackle a problem on a

larger scale

4. increased contact between scientists working on common themes

5. disseminated the findings of participants in the network

De Camino on the Madelena Project Network

Ronnie de Camino (1988) outlines the factors for the success of the Madelena project in Central America. These include:

1. Clear, relevant objectives defined by CATIE (the lead regional institution) and the national institutions

2. Well-funded relative to objectives, activities, and anticipated products

3. Donor has provided long term support

4. Personnel at CATIE and the national institutions exist in the numbers, quality and at the appropriate levels

5. Research plans from various disciplines (e.g., silviculture, socioeconomics)

6. Standardized methodologies and a powerful database have been developed

7. Training and education have helped prepare a "critical mass" of researchers

8. Dissemination of network-developed technologies has occurred in existing reforestation projects

9. Frequent interactions among participants occur for planning, analysis of research results, and administrative purposes

10. Strong emphasis on experimental and demonstration areas on farms reaches farmers more directly

11. Provision of a regional documentation center

12. Provision of facilities from CATIE are available for project purposes.

Nuances and Variations on Previous Research Network Themes

Nuances of themes listed above and variations on themes other than those listed above include:

Funding

o Level of funding--"... project networks should begin and remain at a personal level, and should start small and provide only limited funding to project participants. If the project provides too much funding then its activities will never become institutionalized (e.g., the activities will have no life beyond the life of the project" (MacDicken, Dove, Brewbaker and Hyde 1986:71).

o Timeliness of funding (Butterfield and others 1988:56).

o Long-term support--"The willingness of a single funding agency to provide sustained support over a prolonged period for what was clearly a high risk effort is a key factor in the successful formation of SUAN" (Rambo and Sajise 1985:295).

o "The funding of networks should be an integral part of the financing of the national research systems concerned" (ISNAR and SPAAR 1987:14).

o Funding agencies must understand the value of research (Gregersen, Lundgren and Bengston 1990).

Communications/Interactions

o Meetings are not enough, "these contacts belie the need for shared goals and priorities that comes through face-to-face working relationships" (Winrock International 1990:15).

o Communications--"With efforts that span continental regions as well as various cultures, institutions, and disciplines, the need for clear and complete communication of plans and responsibilities is essential" (Winrock International 1990:17).

o Cultivating flow of information (Winrock International 1990)

o Cultivating new working relationships (Winrock International 1990).

o Allowance for free exchange of germplasm and information (Sastry 1987; Brewbaker 1990)

o Linkages to 'upstream' research and expertise in other regions (Sastry 1987)

Participation

o Bottom-up process --"For some, this type of approach consists in limiting the western role in the project and increasing the role of Asians. Unless the Asian participants are given some responsibility, 'they will not commit themselves'" (MacDicken, Dove, Brewbaker and Hyde 1986:71).

o "In collaborative networking, each participant assumes the responsibility for specific research tasks for the benefit of the whole" (ISNAR and SPAAR 1987:14).

o Researchers (not administrators) must participate actively in meetings, travel, etc. (MacDicken, Dove, Brewbaker and Hyde 1986).

o Establish an umbrella framework within which individual scientists can follow their own interests (MacDicken, Dove, Brewbaker and Hyde 1986).

o "Networks with a limited scope, clearly defined in technical terms and arising out of genuine local initiatives, have the best chance of success" (ISNAR and SPAAR 1987:14).

o "the resolution of the research objectives should be meaningful for the largest number of the people in the countries concerned (Sene 1988: 128).

o "the project should take due account of the regional/subregional institutions and their programmes" (Sene 1988:128).

o "...it is necessary for a successful research network to be run with some independence of the government bureaucracies, but that this independence is possible only by obtaining the good will of these bureaucracies through patient and determined political lobbying" (MacDicken, Dove, Brewbaker and Hyde 1986: 69).

o Country coordinators with a high status position (MacDicken, Dove, Brewbaker and Hyde 1986)

Flexibility

o Flexibility of donor to permit evolution of research network through time (Butterfield and others 1988)

o Flexibility of network--"The program of small research grants initiated in 1988 supplied a way for the network to investigate important research problems and at the same time encourage researchers throughout the region with funding support for innovative proposals on topics important to meeting small-scale farmers' needs" (Winrock International 1990:17).

o Flexibility of scientists--"Network scientists left the field tour with a clearer understanding of the potential benefits of a network of

experiments, and of what is required of each of them if these benefits are to be realized. They agreed to compromises intended for the benefit of the group, but which required sacrifices by many cooperators" (Winrock International 1990:16)

Leadership

o Leadership-- in a facilitator-coordinator-supporter-cheerleader role (Rambo and Sajise 1985)

Critical Management Factors

o core of active participants

o conflict management skills

o resource support is long-term, sustained and flexible

o institutional base is neutral

o professional and scientific interest is strong

o research program is based on cooperation

o compromise

o appropriate levels of grant monies available for research

o secretariat is effective

o coordination and cooperation of donors (MacDicken 1988).

Factors for Sustainability of Forestry Research Networks

Literature about the sustainability of forestry research networks is essentially nonexistent. From the agricultural research community comes one observation from Vernon Ruttan that:

> I am increasingly convinced that the long-term viability of agricultural research systems depends on the emergence of organized producer groups that are effective in brining [sic] their interests to bear on legislative and executive budgetary processes. The support of finance and planning ministries for agricultural research is undependable. Their tenure in office is often short. And their support tends to fluctuate with perceived severity of food crisis and foreign exchange demands. (1986:324)

From the forestry community, most of the focus in the literature has arisen from the managers and participants in the MPTS Network. The discussion revolves around the following considerations:

o the need for the secretariat of the Network to delegate some of its activities (e.g., small grants program administration) to committees or individuals within the network, to encourage development of national MPTS networks, to increase involvement of the MPTS Research Committee, and the like (Winrock International 1990).

o communications, aided primarily by the national MPTS networks, will continue to play an important role in the sustainability of the network, and increasingly each individual participant must communicate more about their actions to their colleagues in the network (Winrock International 1990:15).

o One perspective was raised by Karim Oka (IDRC) at a MPTS Steering Committee meeting. Oka asked: "Is it more important to gauge the sustainability of the structure or the lines of communication that the structure creates? These communication lines may continue to serve without structural support, once the need for them has been established" (Taylor 1989:10 summarizing comments by Oka).

o Pyakuryal responded to question about sustainability by saying that "MPTS research provides a perspective of addressing needs, a perspective that may become embedded in the plans and decision-making processes of policymakers. If so, the objective of sustainability has been achieved." (Taylor 1989:10 citing Pyakuryal)

o Development of national MPTS Networks, such as those in the Philippines, Thailand and Malaysia, may be an important contributer to the sustainability of the international MPTS network (Taylor 1989).

o "External stimuli are important, but ultimately the capability, awareness, and commitment of Asian scientists are more important. The importance of the Network lies in fostering these qualities and characteristics" (Taylor summarizing comments by Salleh Nor 1989:10).

Cautions about Research Networking

The literature appears to report more cautions about networking than it does factors that contribute to its success. Out of these cautions come insights about some of the more practical pitfalls of networking. These, in turn can serve as guidance to ensure greater success.

The following provides a list of the major cautions found in the literature that we have summarized in categories on: environment for networking, priorities, cultural issues, participants-participation in networking, incentives, approaches to networking, inputs, costs of networking, information, management of networks, and some general concerns.

Environment for Research Networking

Research Environment

1. It is important to recognize that the lack of funds, barriers to communication, and the like are inhibiting the research potential of developing countries' research institutions. It is also important to keep in mind "that a mere supply of funds alone will not achieve ... a conducive environment where research can flourish. The characteristics and essential criteria of these environments are fairly common-place in the industrialized world. They were not achieved overnight, neither was the development totally endogenous" (Sastry 1987:1).

2. The experience in the United States with agricultural research suggests some potential lessons for forestry research. In the U.S.,

agricultural research has been well linked ("articulated") with extension programs and the farming community itself. Decentralization of the system of agricultural research experiment stations enhanced these links so that new knowledge and technologies have been produced and applied more directly and effectively in specific localities. Yet, these characteristics of articulation and decentralization, which might be and quite likely are essential for forestry research, are difficult to develop and sustain institutionally (Evenson, Waggoner and Ruttan 1979).

3. Another lesson from U.S. agricultural research that may have relevance to forestry research as well is the issue of the general undervaluation of research. Evenson, Waggoner and Ruttan (1979: 1107) suggest that there are two causes for this: "(i) the benefits to farmers spill over across state lines to those who do not pay for the research, and (ii) the benefits to consumers are partitioned into such small amounts that the individual consumer cannot feel the connection". The potential role of farmers and consumers in encouraging government support for agricultural research, therefore, becomes diminished. This may be even more true for forestry.

Political Environment

1. The history of some efforts in Africa illustrates how the political environment can be either a positive or a negative force in support of research networks. CILSS, IGADD and SADCC have all had some successes in support for regional forestry or natural resources management research on such arid zone topics as sand dune stabilization and genetic resources. On the other hand, political differences in some of the countries of East Africa as well as in Northern Africa and the Maghreb subregions affected the ability of individual countries, who were interested, but could not work cooperatively in regional efforts (Sene 1988).

2. Additionally, the political problems internal to one country may cause problems for regional efforts. Therefore, forestry research networks need to develop mechanisms that ensure some degree of national commitment and the sharing of responsibility that can assure the success of the regional effort even if one of the actors is unable to meet its

responsibilities (Sene 1988:125).

3. A final consideration here is that: When participating countries spontaneously meet to discuss and set their priorities in the framework of a politically backed institution, the process may be long and difficult but once decisions are taken, they are respected" (Sene 1988:127-128).

Policy

A major set of problems in the development and implementation of forestry research networks relates to the lack of "well developed research policies, especially for the long term, and the multitude of governmental bodies and institutions undertaking research" (El-Lakany 1988:115).

Criteria for Consensus for Multinational Research Efforts

Sene reports that:

In many cases, when the following criteria have been respected, consensus has been confirmed or reestablished:

- the subject should interest the majority of countries in an homogeneous region:
- the resolution of the research objectives should be meaningful for the largest number of the people in the countries concerned;
- the subject should be significant to development or help resolve development related problems;
- the project should give opportunity to each national institution to contribute;
- the project should take due account of the regional/subregional institutions and their programmes. (1988: 128)

In still another section, Sene (1988:126) states that: "stability of personnel, a team spirit and an active endeavour to share information are

strong prerequisites for international, regional or subregional research projects".

Priorities/Priority Setting in Research Networks

1. Political considerations also play a role in the setting of priorities (e. g., problem areas to focus on) in a research network. Some of the cautions here relate to the skills (e.g., tact) needed to develop a consensus, the management of conflict, and the problems of assuming that national perspectives are one way or another without full participation of the countries in articulating those perceptions (Iyamabo 1988). Problems related to turnover of personnel and subjective biases may cause problems in priority-setting for research networking as well (Sene 1988).

2. A further caution is that when regional priorities and programs are developed, they should not promote activities that might duplicate or smother activities promoted by national institutions. Rather they should promote activities that build on existing national capabilities and enhance those capabilities and opportunities to participate in the network (Sene 1988).

Cultural Issues Affecting Research Networks

A number of cultural issues appear in the literature that suggest some useful cautions. These include:

1. Values related to the free flow and exchange of information may not be the same in the scientific community of Asia, for example, as it is in the United States. MacDicken, Dove, Brewbaker, Hyde (1986:53) even suggest that "there is some reason to think that they may not".

2. Whether a cultural or political value, some countries do not accept the results of research that is done elsewhere until it is validated in their own country. Bangladesh is one such country. In general, it is important not to assume that things are done elsewhere like they are done in the U.S. (MacDicken, Dove, Brewbaker, Hyde 1986).

3. Another cultural issue related to forestry research networks involves the concept of status. The perception of both weakness and

strength among institutions and individuals in Asia, for instance, plays an important role in the level of status and respect that is accorded in the context of the network (MacDicken, Dove, Brewbaker, Hyde 1986).

Participants-Participation in Research Networks

The vast majority of cautions for the development and implementation of forestry research networks lie in a category that focuses on participants and their participation in networks. These include, some of which are apparently contradictory (see points 1 and 2 below):

1. Networks should not be closed clubs; rather they should be open to increase the number of field trial sites (Burley 1987).

2. Be careful not to lump members with totally disparate capabilities. It is better to select those that can contribute to the collective effort (Anon. 1982 b).

3. Some nations, institutions, and individuals may not see a good reason for participating in networking or may not have adequate resources to participate in networking activities even though the research problems are important for their countries (Burley 1987).

4. Structural barriers to participation exist. These include distance, language, culture, and competition for limited resources (MacDicken, Dove, Brewbaker, and Hyde 1986).

5. The overall strength of the network depends in great part on the strength of its institutional and individual participants as well as the strength of the relationships among the participants (Lovelace and Romm 1984).

6. Many excellent scientists work outside of more mainstream institutions for a variety of reasons (e.g., choice, necessity). These individuals should be identified ...because these isolated researchers ...may not only be some of the best researchers around, but they are clearly also

the ones who could benefit most from participation in a research network" (MacDicken, Dove, Brewbaker and Hyde 1986:55).

7. Network planners and managers must acknowledge and deal with LDCs' fear of developed country domination in a network (Hamilton 1984). Network leadership must give due credit to all who contribute to the production of any research results (Sene 1988). Participation of LDCs in what developed countries initiate often encourages the technical agenda of the developed countries to prevail and the creation of a scientific community in the West's own image (Ivory 1984).

8. Many networks involve the more developed LDC institutions to a greater degree than they involve weaker research institutions. This very likely widens existing gaps between stronger and weaker institutions (Hansen 1984).

9. Differences in institutional capabilities may hinder acceptance of leadership and discussion about and development of comparable designs, data collection methods, and the like (Sene 1988).

10. Networks should not substitute for national research institutions or systems. They should complement them. "Without a strong national scientific capability, a country can neither contribute to a network nor effectively screen and import technology (ISNAR and SPAAR 1987:14).

Incentives for Participating in Research Networks

The implications of incentive structures within the scientific research community must be understood. For example, in most research centers, more incentives exist to do basic research than applied. A tendency toward 'brain-drains' often exists within a region where incentives may encourage researchers to move from national-level institutions to international centers of excellence. Incentive structures such as money, research support, and prestige may perpetuate the maldistribution of human and financial resources among institutions (Parker 1984).

Approaches in Research Networks

This section details with various thoughts focused on: network activities; the ways that organizers, managers, and participating scientists organize themselves· the methods they use; and so forth. These include:

1. It is important to understand the various types of research networks, the characteristics of each, the situations for which each is designed, and the advantages and disadvantages of each type (Anon 1982a).

2. Focusing on species and/or subjects with the greatest potential benefit (i.e., socioeconomic) can help maximize the cost-effectiveness of forestry research networking (Burley 1987).

3. Many difficulties arise in carrying out interdisciplinary research but strategic approaches must be found to integrate knowledge (CGIAR 1983).

4. In a discussion of the evolution of the Southeast Asian Universities Agroecosystem Network (SUAN), Rambo and Sajise (1985) observe that the network had reached a point where participants needed to increase the: analysis and critique of their conceptual frameworks, quality control on data collection, and extension of results of their work to the general public and to decisionmakers.

5. Protocols for collaborative research should include guidelines for experimental designs and comparable assessment methods and should address issues of precision and freedom from bias (Burley 1987).

6. Leadership (internal or external) must be strong and efficient and must provide guidance, information, comparable designs and methodologies, and data analysis capabilities where needed. Leadership should leverage and mobilize resources. Leadership should also assist in quantifying and clarifying the benefits to nations from participating in research networks (Burley 1987).

Inputs for Research Networking

A number of cautions arise related to the nature, magnitude, and duration of inputs into networking. These include:

1. Networks must be built, supported and nurtured in order to be successful (Lovelace and Romm 1984). This means time, money and effort.

2. Funds for networking, communication, travel and research activities are a concern. However, funds "fulfill a pump-priming function but should not replace funds that normally should come from participants' budgets" (CGIAR 1983:9).

3. This question of national funding relative to external funding of a research network receives still more attention. Sene (1988) notes that choices about research networking made by national institutions might not be the same if they had more control over the funds that were being put into the network by external donors. Each has its own strategies and priorities, and they likely are different. He also suggests that funding from national governments may not be the most critical factor for a successful network, but he notes that too little funding will likely reap a limited response of nations to international networks. He continues by cautioning that the following conditions, related to both national level and international level funding, must be met in order for a network to achieve some success: international funding must be continued for a reasonable period (no less than 5 years, more appropriately 10 years) to achieve "meaningful results"; some level of national level funding that is used both to prepare their institutions and scientists to participate in networks and to continue once external funding ends; and stable funding from national governments.

4. Human resources and institutional strength along with funding are essential to the participation and level of performance of developing country scientists and institutions (Sene 1988).

5. Rapid turnover of personnel in many countries is a serious problem for many institutions and networks. It can cause discontinuity

and instability in network implementation. On the other hand, too much stability may cause a network to become a "club" where newcomers are not necessarily welcome (Sene 1988).

6. External human resource inputs must be considered as well as those internal to the network. Donor agencies must tap their own expertise to provide support to forestry research networks (Sastry 1987).

7. Plant materials need to be made available in vast quantities to ensure successful research efforts. This will require concurrent development of technologies to ensure quality, and certification, quarantine and other measures to ensure efficient and safe exchange of these research inputs are required (Burley 1987).

8. Increasing amounts of materials for testing will cause some potential problems. These include problems of specification of actual genotype-site interactions as the number of different environmental conditions in field testing sites grows and varies. Also, even as the varieties of species being tested increase in number, it is likely that few of them will actually end up being used (Burley 1987).

Costs of Research Networking

1. A major concern is that networks can draw participants from their responsibilities at their home institutions. Network strategies, therefore, must be linked to national strategies. This means that the time the participant puts into network activities must be covered by someone else, but this rarely happens. It is critical not to underestimate the costs of the development and sustainability of networks (Lovelace and Romm 1984). And, this is exacerbated as the number of research networks increases (Walsh 1985).

2. These points are underscored by Salleh Nor and Chan Hung Tuck (1986:40) who note that: "To collaborate fully, FRIM has to sacrifice time and human resources. Often, this happens at the expense of its own programs and activities. While some programs need little administrative support, others require close monitoring and frequent reporting, especially when financial support is involved".

Information for Research Networks

While networks are supposed to play a major role in the sharing of information, the difficulties of this are not to be underestimated. Tremendous amounts of information exist in many forms and in many places, but the problems related to this include:

1. most of this information is not accessible to institutions in developing countries

2. field staff rarely receive the information even if it has arrived at the national headquarters

3. the cost of obtaining and disseminating it is too great (El-Lakany 1988).

Management of Research Networks

1. A range of management issues arises since networks are composed of participants from diverse institutions. The CGIAR system has found that: more time and money are needed for communications, the rate of scientific progress is often slowed and is likely to be more variable than if one institution had responsibility for all research, and that excessive demand on some national institutions can be extremely burdensome (CGIAR 1981).

2. Other management problems exist because of the nature of national research programs. Research management responsibility is often in the hands of non-scientists or scientists who are not trained in research management. In some cases, donor-funded expatriates are managing research programs and when they leave so does their experience. Few have experience in managing increasingly more complex interdisciplinary research efforts. Additionally, the lack of experienced junior field staff, who are often put in charge of major research efforts, causes more problems for the quality of the research.

Conclusion

Our analysis of some of the literature reviewed herein appears in Chapter 3. We would like to note that although we do not necessarily agree with a number of the ideas and issues reported in the literature, we have included them without analysis in this chapter. In the following chapter, Findings and Discussion, we have focused on a selected group of issues related directly to the objectives and scope of work of this study.

CHAPTER 3: FINDINGS AND DISCUSSION

The findings and discussion reported in this chapter arise from four major sources: literature, interviews, responses to a questionnaire given to a sample of individuals with experience in forestry research networking, and experience of the authors with the design and/or implementation of a number of forestry research networks. We have ordered the findings in what we consider to be a logical progression of major thoughts and ideas on forestry research networks and networking, based on this study. We have not reported any but the major findings, nor have we reported any but those that relate most directly to the scope of work for this activity.

First, we present a complete list of the findings. Then, we repeat each individual finding and provide discussion on the nature and implications of each. We present recommendations based on these findings in Chapter 4.

Methodological considerations appear in ANNEX C. We would like to emphasize that this is the first time that systematic sampling has been used to tap the experience of individuals around the world on the topic of forestry research networking. The results do not provide the final word on the subject, but they do represent an important baseline for future research to better understand forestry research networks.

Summary List of Findings

Finding 1: *Literature on forestry research networking exists, but little research has actually been done on the subject.*

Finding 2: *Numerous rationale have been cited for forestry research networks, but it is unclear whether or not they have been empirically tested for forestry.*

Finding 3: *The definition of what a forestry research network is or is not remains unclear.*

Finding 4: *A variety of organizational forms and models exist. In many cases these forms seem to have evolved.*

Finding 5: *Forestry research networking is the best means to produce new knowledge.*

Finding 6: *Forestry research networks are not necessarily an appropriate form of organization for every researchable problem in forestry.*

Finding 7: *By far, the most common constraint to forestry research networking is funding.*

Finding 8: *The primary rewards to individuals from participating in a research network include: solving a problem; access to information; funds to do research; collegiality that helps them develop and refine knowledge; and equipment to conduct research. Interactions with colleagues appears to be a strong theme.*

Finding 9: *The most important factors that contribute to the success of research networks are (in order of their perceived contribution): 1) clearly defined problem and well-planned research agenda; 2) continuity and commitment of institutions in support of their participating scientists; 3) outside funding; 4) information sharing; 5) commitment of national resources; 6) strong self-interest on the part of the participants.*

Finding 9a: *A number of the factors for success identified in this study are different than those identified in the existing literature on research networks.*

Finding 9b: *One aspect of success to note is that institutional strengths and weaknesses do not have a major direct impact on research networking.*

Finding 10: *Five of the most important factors for the sustainability of a forestry research network are: 1) network meets priorities/needs of end-users; 2) financial support is available; 3) network meets priorities/needs of institutions; 4) network meets priorities/needs of*

nations; 5) and it contributes to effective problem solution.

Finding 10a: *The results of this analysis confirm existing concerns that the links between research and end-users are an important aspect for the sustainability of forestry research networks.*

Finding 10b: *The valuing of research is a concern; it can serve as a constraint to research network support and may be a key factor for the sustainability of forestry research networks.*

Findings and Discussion

Finding 1: *Literature on forestry research networking exists, but little research has actually been done on the subject.*

Discussion: Finding so little systematic research on forestry research networking is not particularly surprising. Little literature existed at the time of an earlier study (Campbell and McFadden 1977) in the U.S. on large research and development (R&D) programs. Review of the sociology of science and social network literature yields similar results, and what literature does exist is in the form of discussion of "invisible colleges" and the social dimensions of the production of new knowledge. . Only a few articles and books identified during the extensive database search for this study address scientific research networks per se.

Considering the magnitude of funds being applied to various forms of forestry research networking today, both in the U.S. and internationally, it is remarkable that so little has been done to systematically capture the experience, define the concepts, and identify the factors that lead to greater success and/or help avoid mistakes in forestry research networking.

Finding 2: *Numerous rationale have been cited for forestry research networks, but it is unclear whether or not they have been empirically tested for forestry.*

Discussion: It is not clear in the literature whether or not the rationale for forestry research networks (e.g., reduce costs, minimize duplication, increase efficiency, enhance capabilities, take advantage of similarities, political advantages, synergistic effects of working together) found in the literature have been derived empirically from the experience of existing forestry research networks or whether they arise from the experience of the agricultural research models and are assumed to be true for forestry as well. It also is not clear whether or not these rationale are valid for the range of forms of forestry research networking that are outlined by various authors. For example, several authors noted that research networks are politically acceptable or have political

advantages. These statements need to be tested, and the nature of potential acceptability or advantage needs to be better understood. Finding 10 b below may suggest some of the reasons for political acceptability (e.g., that research funded by one country may provide solutions, at no cost for another country).

Finding 3: *The definition of what a forestry research network is or should be remains unclear.*

Discussion: In moving through the literature (as summarized in Chapter 2, pages 13-16) and in interviews, we were impressed both with the abstract concepts of how networks are perceived and the potential contradictions (e.g., whether individuals or institutions are networked). Need exists to more clearly define the concept of a "forestry research network". This will involve clarification of a number of other terms, such as, coordination, cooperation, twinning, and collaboration, because they often are used interchangeably to describe research networks and the process of networking. These terms must be more clearly understood and used appropriately when talking about forestry research networking.

Accordingly, we have developed a series of definitions that we hope will provide a common basis for better understanding.

Coordination - Action based on a realization that other individuals are doing similar or related kinds of studies independently and that it would be mutually advantageous to be aware of each others' work while continuing to maintain the independent nature of the individual studies. (Here, we can talk about a first level interaction that involves little more than awareness of other studies on a general topic.)

Cooperation - Similar to coordination but includes a willingness on the part of the individuals concerned to plan a rudimentary aspect of working together for some mutual benefit, e.g., using the same field plots for multiple studies. (Here we are talking about

a second level interaction among individuals, which may or may not be directed at resolving a common problem.)

Collaboration - Agreement by two or more individuals to work jointly to resolve a common problem or objective with shared research plan and implementation responsibilities. (Here, we are talking about third level interaction and the use of standardized methods, minimum data sets, and joint research planning for problem solution.)

Research Network - A research network is an aggregation of individual scientists who are committed to work collaboratively to resolve a common problem or objective using a common research plan or agenda to produce new knowledge.

Accordingly, we propose that:

- Coordination and cooperation describe interactions that are precursors of collaborative research and that research networks evolve from these lower level interactions (see Finding 4).

- Collaborative research is the basis for and the only effective form of research networking.

- Problem definition and approach to resolving a problem or set of problems in relation to the agreed upon objectives by a group of individuals (scientists and/or administrators) may be the key to operationalization of the term "research network".

- A research network is not a physical entity like a research center. A research network, if not physical, is conceptual, a mental construct to describe a form of social organization. A research network does not do anything. Research managers and scientists do things that are attributed to the network.

Therefore, to suggest that a research network should undertake this, that or the other activity, is inappropriate. This is not just a semantic concern. The networks we are talking about are groups of people, therefore a major focus of design and implementation efforts must be people-oriented and must account for their desires for interaction, their motivations for action, their perceptions of what is or is not a primary reward, and so forth.

- Although other networks may actually be forestry research networks, we believe that, based on the information that we have on hand and on our experience, that the Multipurpose Tree Species, Leucaena Psyllid and Bamboo-Rattan networks best fit our definition of a forestry research network.

- Networks which have a primary purpose of sharing information among researchers are not research networks. They should be referred to as "information networks for forestry researchers" or some similar phrase.

- There may be other kinds of networks as well, and we refer the reader to the publication by Plucknett, Smith and Ozgediz (1990:i) where the authors recognize four types of networks (i.e., information exchange, material exchange, scientific consultation, and collaborative research). The authors categorize each of the sixty-eight agricultural and forestry networks by type of network and provide brief descriptions. Plucknett and others state that in "collaborative research networks, members jointly plan research and adopt common methodologies". We disagree with the authors regarding the need for common methodologies. While common methodologies may enhance the success of some research networks (e.g., those heavily involved in provenance testing), it is by no means true for all collaborative research networks.

- Twinning is not a form of research networking. Twinning is agreement by two or more institutions to have members of their staff become involved in one or more of the research

interactions defined above. These agreements often include opportunities for training and exchange of personnel. They may or may not be focused on a common problem or have joint research planning. (Here, we might be talking about linking two institutions to expand the horizon of individuals at each

- institution. Only if the individuals undertake collaborative research would this constitute a research network.)

These definitions and the mutual understanding they provide are important for donors, nations, institutions, and participating scientists. All need to be more aware of the difficulties raised by having different mental or philosophical constructs that confuse or inhibit the means for implementing research networks successfully and thereby inhibit the ends from being met. Donors can benefit from clearer definitions because networks never intended to be developed may arise; they will not be able to tell what kind of network will be developed with their funding unless it is clearly defined. Nations can benefit because clear understanding provides a better basis for the development of policy to shape their national institutional responses and to support forestry research at a national and regional level. Institutions can benefit because clear understanding provides a better basis for the establishment of priorities, the weighing of costs and benefits for alternative actions and the allocation of typically scarce resource. Scientists can benefit because clear understanding provides them with a better basis for deciding what kind of action and what level of continuity and commitment that feel appropriate to invest vis-a-vis what rewards they anticipate from their participation in any particular research network or other scientific relationship.

Finding 4: *A variety of organizational forms and models exist. In many cases these forms seem to have evolved.*

Discussion: While existing literature suggests that research networks can, and probably should, come in different organizational forms and models, it is not clear what criteria should be used to determine which form of networking is appropriate for each set of conditions. Certainly, the objectives of the network; level of funding; and interests of scientists, their institutions and their nations provide relevant

guidelines for determining what network organizational form is most appropriate for a specific forestry research network. Donor interests, as well, often play a part in the process of defining these networks.

On the other hand, there is considerable evidence that research networks (e.g., the Bamboo and Rattan Network and the Leucaena Psyllid network) evolve over time and space to meet local, regional, or global constraints and opportunities. The case of the Leucaena Psyllid Network is an illustrative case to consider:

"Scientists in almost every country affected by the psyllid immediately initiated studies to learn more about the pest and how to control it. Some investigated the use of chemical insecticides, some studied population dynamics, but most began looking for opportunities for biological control using commonly occurring insect parasites or predators, spiders, and fungi." (In some countries this early research effort was truly cooperative as defined earlier). . . .

"To help improve coordination of psyllid research in Asia, the F/FRED Project established a Psyllid Advisory Team and co-sponsored a series of national meetings and one regional meeting in Hawaii with the Nitrogen Fixing Tree Association (NFTA) to develop an action plan to control the psyllid. The resulting document aggregated information from many different sources but did not provide a mechanism for regional coordination nor a detailed plan for research that would insure that the problem was being thoroughly addressed. . . . .

"Immediately following the Los Banos meeting, the F/FRED Leucaena Psyllid Regional Research Workshop was held in Manila. Participants included psyllid research coordinators from Thailand, Indonesia, Republic of China, Malaysia, and the Philippines, and researchers from Australia and Hawaii. Also attending were the donor representatives from the FAO Regional Office for Asia and the Pacific, and USAID/Manila along with the F/FRED Psyllid Advisory Team. The objectives of the meeting were to:

* Develop a regional psyllid research plan
* Select a regional psyllid research coordinator
* Communicate current status of the problem and need for research

* Prepare for implementation of the regional plan"

(These few paragraphs from McFadden, 1988 serve to show the evolution of the Leucaena Psyllid Research Network from a series of non-related studies through the intermediate steps of cooperation and coordination which led to the collaborative regional effort which describes the current status of the network).

We found the proverbial set of "apples and oranges" when looking at the range of research networks that exist and/or are emerging. Some are very different from others. Some are successful at meeting their objectives, even though they may be organizationally quite different. Different models may satisfy the needs of scientist participants for a variety of reasons and therefore be perceived as successful.

Some aspects of existing agricultural research models provide potentially instructive lessons for forestry research (e.g., the need for better linkages between research, extension, and farmers (i.e., articulation) and decentralization of research systems as well as for more appropriate valuation of forestry research). However, other aspects of the agricultural research models continue to provide problems for forestry research. These include: the nature of agricultural research funding where funding levels for agricultural research are generally higher than for the forestry sector; much agricultural research is commodity-driven (with strong end-user interests in support of them); decisionmakers have an interest in finding ways to increase production and reduce food prices to avoid unrest in urban areas; time frames for agricultural research are shorter than for forestry research.

These agricultural research models also include the International Agricultural Research Centers, typically with their infrastructure, critical mass of scientists in one location, and complementary research networking. At the moment, the "research center" does not seem to be the approach favored by the donor community for forestry. On the other hand, some IARC networking experience has potential to serve as a guide for some forestry research programs.

Finding 5: *Forestry research networking is the best means to produce new knowledge.*

Discussion: We asked respondents to our questionnaire: "In your opinion, is research networking the best means to produce new knowledge?" The results were:

60.7% agreed
10.5% believe that it is the best means in some cases
28.6% disagreed (even here, one said "no", but then added that it might be in some cases)
5.3% said they didn't know.

These responses reflect, to some degree, the range of issues that this kind of question elicits. Those who agreed expressed some of the following thoughts about why research networking is the best way to produce new knowledge. Forestry research networking provides more resources for tackling a problem, avoids duplication, and permits useful ways to deal with spatial and temporal variation. Those who disagreed with the idea that forestry research networking is the best way to produce new knowledge noted that research is the best way to produce new knowledge and that research networking is a means for sharing that new knowledge by providing assistance for the development of new knowledge and transferring existing knowledge.

Those who said that networks may or may not be the best means for producing new knowledge did not indicate when research networks were the best means to produce new knowledge. One suggested that it required further study. One suggested that in developing countries it may be the best means, whereas in developed countries other means may be better.

Several respondents noted that a better alternative to networking as a means to produce new knowledge is direct support to researchers or small teams. One indicated that networks become an important strategy when research produced by individuals or small teams reaches the point of application.

Respondents believe that, in general, forestry research networking contributes to the production of new knowledge by providing: (NOTE: The following are not necessarily in the order of their importance.)

1) a cost effective, interactive approach which focuses on a common problem or set of problems
2) standards that ensure comparability and, presumably, quality of results
3) opportunities for more rapid and widespread dissemination of existing and emerging knowledge, and
4) the expertise and the conditions (e.g., funding and enhanced regional capabilities) to address problems over the long term.

Also, in a more specific sense, one respondent said that research networks contribute to the production of new knowledge by providing opportunities for the testing of germplasm over greater areas than a single institution could possibly do.

Finding 6: *Forestry research networks are not necessarily an appropriate form of organization for every researchable problem in forestry.*

Discussion: Other forms of research organization need to be identified and evaluated in order to determine the most appropriate means to address a specific problem or set of problems. One respondent to the questionnaire noted for example that networking of chemistry is much more difficult than networking acid rain research. Another respondent recommended that the form of organization for various kinds of research activity requires more study. On a somewhat similar note, Burley (1987) suggested that forestry research networks are perhaps more suited to the collection and evaluation of germplasm than to other topics such as natural forest management which is more site specific.

Finding 7: *By far, the most common constraint to forestry research networking is funding.*

Discussion: A number of constraints to forestry research networking exist. The most commonly mentioned is lack of adequate

funding. The strength of feeling about this constraint may be related to the individual experience and frustrations that have resulted over time from lack of funding.

Other constraints are: communications [one of the most repeatedly mentioned problems]; international problems (e.g., divergent national priorities, political problems,), institutional problems (e.g., divergent institutional priorities, lack of human resources [one of the most repeatedly mentioned problems], governmental regulations), participant problems (e.g., with different backgrounds, procrastinators, lack of stability, lack of commitment); network management/coordination problems (e.g., untrained staff, lack of management capabilities); technical problems (e.g., limits to seed exchange); and termination problems (i.e., lack of incentives to terminate when a problem is resolved, when a network approach is not working, or otherwise).

Finding 8: *The primary rewards to individuals from participating in a research network include: solving a problem; access to information; funds to do research; collegiality that helps individuals develop and refine knowledge; and equipment to conduct research. Interactions with colleagues appears to be a strong theme.*

Discussion: In response to the questionnaire, the respondents named the following as primary rewards to them from participation in their respective networks. These are listed in the order in which the rewards were most named. The numbers in brackets [ ] indicate the number of responses who listed these as primary rewards. We asked for multiple responses to the question as appropriate.

1) Access to information [20]
2) Solving a problem [15]
3) Funds to do research [15]
4) Collegiality that helps develop and refine knowledge [11]
5) Equipment to conduct research [8]
6) Opportunities for short-term training [8]
7) Opportunities for long-term training [2]
8) Opportunities for career advancement upon completion of training [1]

9) Other (NOTE: Some of the following appear very closely related to a number that appear above. We have listed them separately below, however, because they seem to reflect apparent nuances identified by the respondents that may be important.)

a) Uniform standards for implementing experiments which allows for comparison of results across participating countries [1]
b) Facilitates visit of scientists to other developing countries to interact with scientists on similar problems [1]
c) Increased knowledge of the ... forest sector, in order to help in the solution of problems through research
d) Networks provide a decentralized system to address local problems, yet provide an interconnection that shares information. [1]
e) Exchange of seeds of several species of value for our project. Evaluation of results in comparison with other parts of the world [1]
f) Helps promote collective self-reliance [1]
g) Share information and experiences with other scientists in the region [1]
h) Opportunities to work with other scientists in the region [1]
i) Share my own ideas with others and get them confirmed or rejected. At times, make others believe the way I believe. [1]
j) To interact with scientists of other countries [1]
k) Long-term collaboration and strengthening of research network [1].

Analysis of the possible significance of some of these additions suggests that an important theme to many forestry research network participants seems to be a desire for interactions with other scientists. These desired interactions include sharing of information and experiences, working together, confirming or rejecting ideas, and/or convincing others that one's own ideas are correct. This implies perhaps that mere access

to information is not necessarily enough; it may be more important for scientists to interact (Refer to comments by Winrock International about communications summarized on pages 24 and 25 of this report). Sociology of science literature tends to bear this out (See pages 7-9 of this report).

Finding 9: *The most important factors that contribute to the success of research networks are (in order of their perceived contribution): 1) clearly defined problem and well-planned research agenda; 2) continuity and commitment of institutions in support of their participating scientists; 3) outside funding; 4) information sharing; 5) strong self-interest on the part of the participants.*

Discussion: In one section of the questionnaire, we asked respondents to list the five most important factors in order of their contribution to the success of forestry research networking. These are:

1) clearly defined problem and well-planned research agenda

2) continuity and commitment of institutions in support of their participating scientists

3) outside funding

4) information sharing

5) strong self-interest on the part of the participants.

These can be compared with those of other authors that we summarized in Annex B, Table 3. Also refer to Finding 10a below for more discussion on the topic.

Respondents collectively enumerated twenty-two different major factors that contribute to the success (See Annex B/Table 1). We analyzed the information by looking at what percentage of the respondents included any individual factor in their list of five; we also weighted each of the responses (5 points for number one in each respondent's list, 4 for number two, and so forth--a total of 140 points was possible for the most important factor).

Before asking the question about the five most important factors, we asked a series of questions about which items would be key factors for determining the success of forestry research networks. In Annex B/Table 2, we have included from the questionnaire responses, each of those factors for which over two-thirds of the respondents considered to be key. The numbers following each factor represent the level of agreement among the respondents, i.e., 92.9% felt that continuity and commitment were key factors.

Two different ways of looking at the results arise when comparing Table 1 and Table 2 (Annex B). On the one hand, it might be possible for many of the respondents to agree that any single factor might be key, but overall the same respondents might not consider them to be the most important for the success of a research network. On the other hand, greater credence may be given to at least three out of the first five listed in Table 1 since they appeared among the top six in Table 2 as well (i.e.,. continuity and commitment, information sharing, and outside funding). This level of consistency is an important cross-check for the validity of any answers; it can also suggest where further research should test and validate some factors where there is reasonably high discrepancy between the results of the two questions.

Much of the literature contains generalized statements about the factors of success without differentiating between the nature and objectives of a specific network and those factors for success. Some factors appear to be more generalizable, no matter what network is being evaluated, as the trends from this study illustrate. Our sample is too small to suggest whether differences exist in the factors of success for one organizational form of network from those in any other form of network. Some hypothesized differences of factors for success include: 1) level of specificity of problem definition by network form; 2) approach (e.g., coordinated, cooperative, collaborative) to research; and 3) level of priority given to information exchange. Certainly, questions such as "success at what?" and "success to whom?" need to be looked at more deeply as well.

One of the most puzzling of all the results of this analysis is that while funding was named as a primary constraint to research networking

(see Finding 7), it appears lower on the lists of key factors than we had anticipated, based on the literature review.

Finding 9a: *A number of the factors for success identified in this study are different than a number of the factors identified in the existing literature.*

Discussion: Here, we reintroduce a summary of the lists (See Annex B, Table 3) of factors for success for research networks that we presented in Chapter 2. As anticipated, a number of the factors in our study are consistent with the lists of other authors. However, some interesting differences do appear. These include:

1) Our respondents indicate that the continuity of participants is highly important for the success of a research network.

2) Information sharing seems relatively lower on the list of others and does not appear at all in some, whereas it received higher importance in our study.

3) Training is lower on our list than on many others.

4) Factors for success and sustainability (see below) do seem to be different in some cases, as we hypothesized. While funding, self-interest for various actors, and national commitment seem important to both success and sustainability, other factors like the role of the participants in network management and implementation undoubtedly may need more attention.

Finding 9b: *One aspect of success to note is that institutional strengths and weaknesses do not have a major direct impact on research networking.*

Discussion: The criteria by which a national institution is judged to be strong or weak is usually a reflection of the institution itself and the total assemblage of its staff. It is quite possible therefore that a national institution could be considered weak in its totality, but

nevertheless might be the home base for an outstanding individual scientist, who, in turn, might be one of the shining lights of a research network. In fact, as mentioned in Chapter 2, these may be some of the best scientists and therefore some of those who could benefit most from participating in a research network. We believe this to be true in spite of observations to the contrary. We also believe that institutions play an important support role that continues to merit attention.

Finding 10: *Five of the most important factors for the sustainability of a forestry research network are: 1) network meets priorities/needs of end-users; 2) financial support is available; 3) network meets priorities/needs of institutions; 4) network meets priorities/needs of nations; and 5) national commitment and financial support; and 6) it contributes to effective problem solution.*

Discussion: We have listed the results of the questionnaire on the issue of sustainability in Table 4 (See Annex B). As with our analysis of the results related to the most important factors for success, we analyzed the responses by looking at what percentage of the respondents included any individual factor in their list of five most important ones. We also weighted each of the responses (5 points for number one in each respondent's list, 4 for number two, and so forth--a total of 140 points was possible for the most important factor). For this question, respondents collectively enumerated 19 different major factors that contribute to sustainability of a research network.

Five factors reflect the concerns of over 50% of the respondents. These are:

1) network meets priorities/needs of end-users

2) financial support is available

3) network meets priorities/needs of institutions, and

4) network meets priorities/needs of nation.

A number of others also received support, including the nature of national commitment, the contribution to effective problem solution, the avoidance of duplication, and the primary role of scientists in implementing activities.

Like the results about the most important factors for success, these results suggest that funding is critical but may not be the most important factor. In part, this may be explained by the potentially crucial links between the level and kind of support provided and the perceived needs and priorities of end-users, institutions, and nations

Finding 10a: *The results of this analysis confirm existing concerns that the links between research and end-users are an important aspect for the sustainability of forestry research networks.*

Discussion: When we start looking at sustainability issues such as relationships with end-users, our study seems to suggest a stronger role for them than others have previously identified. Authors of existing literature have not, to any extent, highlighted the importance of the end-user in forestry research networking much.

Also, according to our respondents, the actual experience of many of their networks with end-user participation is reasonably limited. For example, only 48% of the respondents agreed that the network they described had end-users participating in problem definition, and only 51.9% agreed that communication between their network participants and the end-user occurred frequently. Yet, the respondents indicated that communication with end-users results in: better problem definition (77.8% of the respondents agreed); more appropriate solutions (62.9% agreed); better acceptance of solutions (59.2% agreed); more support for future research (62.9% agreed), good will between researchers and end-users (submitted by one respondent); and more work (submitted by one respondent). Additionally, one interviewee suggested that the end-user should be involved as appropriate, but conceded that the meaning of "appropriateness" needs to be investigated further. One interviewee also cautioned that end-user input might have politically adverse impacts on scientific and technical decisionmaking.

Finding 10b: *The valuing of research can serve as a constraint to research network support and may be a key factor affecting the sustainability of forestry research networks.*

Discussion: Two questionnaire respondents raised points about the valuing of research. One, for example, suggests that a major constraint to forestry research networking in his country is to demonstrate the benefits of the research effort to his country. Another notes that a key to network sustainability is "making the supporters believe that the gains are still greater than the investments in the research".

Additionally, in the literature reviewed, we found some potentially contradictory points about the valuation of the results of research. We noted (page 2) that existing literature suggests that joint research efforts provide positive "spill over effects" from one region to another, as results from one place are adapted and applied in another place (Greenland, Craswell and Dagg 1987). We also noted (page 30) that Evenson, Waggoner and Ruttan (1979:1107) attribute the undervaluation of research to, among other things, those spill-over effects, because the "results spill over ...to those who do not pay for the research". The direct links between funding of research and the return on the investment to that research seem blurred when a country, region or other entity providing no funding may actually bring benefit from research network activities.

CHAPTER 4: SUMMARY AND RECOMMENDATIONS

SUMMARY

Before summarizing the results of this study, it is important to make a cautionary statement. As with all summaries, this touches only the highlights of many of the ideas that are presented in the report. Accentuating only the highlights becomes a problem when the nuances of analysis and understanding are not included, when the implications of certain points cannot be drawn to their full conclusion, or when certain steps in logic must be omitted for the sake of brevity. It is with these concerns in mind that we present the following summary.

We reviewed a diverse array of literature on research networks, some of which is quite "fugitive" (i.e., not readily available). We focused primarily on forestry research networks in developing countries and identified the major contributions from both the agricultural and forestry sectors. In general, the existing literature is based mostly on the experiences of the authors. Few are based on formal evaluations of research networks and it is not at all clear how systematically derived any of the conclusions are in any of the references reviewed.

Our study appears to be the first systematic study on forestry research networking. We tested some existing ideas. We found that a number of authors are working from assumptions about research networks that may be appropriate for agricultural research networks but which may or may not hold true for forestry. We found a number of "fuzzy" concepts that inhibit any mutual understanding of what forestry research networks are or are not. We found a number of contradictions, such as whether research networks should be selective, whether contributions can be made if a national institution is weak. We found that opinions and expectations have a lot to do with what all of us in the forestry community are talking about. And, from our results, we found that we are able to build on some of the ideas that we tested, contradict some, and question still others.

Our findings show that while some literature exists, little research has been done on the subject of forestry research networks to capture the existing knowledge, experience, and ideas of scientists who comprise

research networks; to test the rationale and assumptions about them; and, to systematically understand the nature of existing forestry research networks.

A major finding is that prior to our study, the definition of a forestry research network remained unclear. This has important implications for understanding networks in their various forms and for identifying the factors which may ensure their success and sustainability as appropriate. We provide a definition of a forestry research network that will likely be controversial, but we submit that it is essential to move the debate one step further.

As anticipated, we found several models for forestry research networks in existence, but some pose problems that should be understood before they are widely used. Among these are some of the models provided by the experience of the agricultural research community. And, again as expected, we found that forestry research networks are not necessarily an appropriate form of organization for every researchable problem in forestry.

We found that forestry research networks are predictably plagued by a number of constraints. Foremost among these is funding.

We found that the primary rewards to individuals from participating in a research network include: access to information; solving a problem; funds to do research; collegiality that helps to develop and refine knowledge; and equipment to conduct research. Interactions with colleagues appears to be a strong theme.

Our main focus was on factors for success and sustainability of forestry research networks. We found that the most important factors that contribute to the success of research networks are (in order of their perceived contribution): 1) clearly defined problem and well-planned research agenda; 2) continuity and commitment of institutions in support of their participating scientists; 3) outside funding; 4) information sharing; and 5)) strong self-interest on the part of the participants.

A number of the factors for success of forestry research networks identified in this study are different than those identified in the existing literature on research networks. These include the importance of continuity among the participants and the role of training. Of particular note is the relative importance of individuals in research networks as compared to that of institutions. This has critical implications for network design and implementation. A related finding is that institutional strengths and weaknesses do not have a major direct impact on research networking.

We also identified five of the most important factors contributing to the sustainability of a forestry research network (as indicated by respondents to our questionnaire). These are: 1) network meets priorities/needs of end-users; 2) financial support is available; 3) network meets priorities/needs of institutions; and, 4) network meets priorities/needs of nations. As hypothesized at the outset of our work, these are not necessarily the same factors as those identified as contributing to the success of a forestry research network.

Two factors for sustainability seemed particularly important to address. These include our confirmation of two concerns. The first is that the links between research and end-users is an important aspect for the sustainability of forestry research networks and merits more attention. The second is the valuing of research. This can serve as a constraint to research network support and may be a key factor influencing the sustainability of forestry research networks.

RECOMMENDATIONS

The information presented in this report must be considered as an introduction to the general subject of forestry research networking. Some opportunities for follow-up exist in the areas of action and research. These are:

1. We recommend that the following be implemented as soon as possible by the Agency for International Development:

- We recommend that until more is known, blueprint approaches should not be applied to the design of any forestry research networking efforts. Different problems, approaches, interests, conditions, and priorities require different research strategies to produce knowledge to resolve those problems. (If A.I.D. is interested in funding only one model of research network, it should be careful that the model is appropriate to the situation. It should also be sure that it isn't contributing to the development of "networking" activities that may, in fact, keep scientists from doing research.)

- We recommend that forestry research networks provide more support for increased interactions among scientists. The respondents to the questionnaire seemed to be implying that mere access to information was not enough, interaction is required.

- We recommend that factors such as the role of participants in network management and implementation be given more attention as soon as possible in order to move towards increased sustainability. (This seems to be a critical area since many of the individual factors for success are highly linked among themselves as are many of the factors for sustainability.)

- Development and use of standardized terminology to describe networks and the networking process. (This is not to imply that if existing organizational structures that are currently called research networks are subsequently referred to by a different name that they aren't worthy of being funded. To the contrary, we would argue that they would continue to deserve consideration for funding based on their merits and their purposes. For example, a network which has the primary purpose of <u>sharing information</u> among researchers, rather than <u>producing knowledge</u>, would perhaps best be denominated an Information Network for Forestry Researchers and be funded to further promote that activity.)

2. As we indicated in Chapter 3 (Findings) a considerable amount of work is still needed to follow up on the many contradictions and inconsistencies reported there. While it may sound self-serving, we recommend a longer term, more detailed study of forestry research networking to look at the following:

- Further analysis of the sociology of science research base. A follow-up study could provide useful insights coupled with more in-depth examination of the existing experience with forestry research networking. This should also include:

- Further analysis of the networking experience of various IARCs (e.g., IRRI, CIAT, CIP) and the form of organization used for various kinds of research activities.

- Testing and validating some of the factors for success where there is reasonably high discrepancy between the results of the questions about success and sustainability.

- Testing and validating the rationale for forestry research networking.

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ANNEXES

ANNEX A

ACRONYMS

ACFTSC	ASEAN-Canada Forest Tree Seed Center Working Group
ACIAR	Australian Centre for International Agricultural Research Forestry Network
A.I.D.	Agency for International Development
APFEN	Asia-Pacific Forestry Educators Network
ASEAN	Association of South East Asian Nation.
CAMCORE	Central America and Mexico Conifers Genetic Resources Cooperative
CATIE	Centro Agronomico Tropical de Investigacion y Ensenanza
CGIAR	Consultative Group for International Agricultural Research
CILSS	Inter-State Committee to Combat Drought in the Sahel
CIP	Centro Internacional de la Papa
CPP	Cooperative Planting Program (of NFTA)
DCs	Developing Countries
F/FRED	Forestry/Fuelwood Research and Development Project

FPAN	Family Planning Network
FRIM	Forestry Research Institute of Malaysia
IARC	International Agricultural Research Center
IBPRG	International Board for Plant Genetic Resources
ICARDA	International Center for Agricultural Research in the Dry Areas
IFPRI	International Food Policy Research Institute
IGADD	Intergovernmental Agency for Drought and Development
IDRC	International Development Research Centre
ILT	International Leucaena Trials
INFORM	Informal Network of Forestry Research Managers
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
IUFRO	International Union of Forestry Research Organizations
LDC	Less-developed Country
MADELENA	Regional Tree Crops Production Project
MPTS	Multiple Purpose Tree Species

NAMP	North American Sugar Maple Decline Project
NARS	National Agricultural Research System
NFTA	Nitrogen-Fixing Tree Association
NGO	Non-Governmental Organization
OFI	Oxford Forestry Institute
QA	Quality Assurance
QC	Quality Control
R & D	Research and Development
RECOFTC	Regional Community Forestry Training Center
SADCC	Southern Africa Development and Cooperation Conference
SPAAR	Special Program for African Agricultural Research
SUAN	Southeast Asian Universities Agroecosystem Network
TFAP	Tropical Forestry Action Plan

ANNEX B

TABLES

The following represent information found in CHAPTER 3: FINDINGS in tabular form. For analysis of these figures, please refer back to Chapter 3.

Table 1
Most Important Factors for Success of Forestry Research Networks

[Note: Table 1 provides the following information based on 26 responses: factor in order of importance; percentage of the respondents who included any individual factor in their list of five; points on a weighted scale for each of the responses (5 points for number one in each respondent's list. 4 for number two, and so forth--a total of 95 points was possible for the most important factor).]

	Factor in Order of Contribution	% of Respondents	Points
1)	the problem must be clearly defined and a research agenda planned	69.2%	80
2)	continuity and commitment of participating institutions are needed since in developing countries individuals must be strongly backed by their institutions to ensure continuity	38.5%	27
3)	outside funding should exist at least for the birth and initial functioning of the network	38.5%	29
4)	information should be shared among all research collaborators through a range of media	34.6%	20

5)	strong self-interest must exist in each network institutional participant	34.6%	34
6)	the problem must be common to several participants	30.7%	27
7)	national institutions must be willing to commit some resources to research networking for it to be successful	30.7%	17
8)	staff must be sufficiently trained and expert to make significant contributions to network management and implementation	26.9%	20
9)	a strong training component is the best future guarantee for continuity and enthusiastic participation	26.9%	19
10)	strong leadership	23.1%	14
11)	the problem must be common to all participants	16.7%	20
12)	a long timeframe, permitting progressive withdrawal of external support at the end of the project period and subsequent self-sufficiency building of local institutions	19.2%	12
13)	a research center extending invitations and considerable financial support to potential network participants is the best approach to networking	7.7%	6
14)	a 'critical mass' of research effort that is networked always facilitates problem solution	7.7%	5

15)	network should not be permanent	7.7%	2
16)	joint approaches or sufficient coordination/cooperation between cooperating agencies, to heighten impact and advantages expected from multinational projects	7.7%	2
17)	a catalytic, yet more top-down approach to networking is the best approach	5.6%	2
18)	identity of network theme to national/ institutional priorities	3.8%	5
19)	research must be field-oriented/ problem-solving	3.8%	5
20)	network must focus on end-user problems	3.8%	5
21)	research motivation [may be same as self-interest above]	3.8%	5
22)	collegial/informal	3.8%	5
23)	generation of good quality results	3.8%	4
24)	institutional support	3.8%	3
25)	participatory networking approach adopted in determining policy, direction and programs of network research	3.8%	3
26)	selection of the best persons at the beginning phase	3.8%	3
	develop national capability	3.8%	3

	respect for leadership	3.8%	3
27)	a research center extending invitations and some limited financial support to potential network participants is the best approach to networking	3.8%	2
28)	adoptability	3.8%	2
29)	network controls should not override institutional controls	3.8%	1
30)	excellent germplasm materials for evaluation	3.8%	1

Table 2

Key Factors for Success by Level of Agreement

[Note: Table 2 provides the following information: each of those factors on which over two-thirds of the respondents considered to be key and percentage of agreement among the respondents, i.e., 100% felt that continuity and commitment were key factors.

	Factor	Percent agreement
1)	continuity and commitment of participating institutions are needed; in developing countries individuals must be strongly backed by their institutions to ensure continuity.	92.9%
2)	information should be shared among all research collaborators through a range of media.	92.9%
3)	staff must be sufficiently trained and expert to make significant contributions to network management and implementation.	85.7%
4)	national institutions must be willing to commit some resources to research networking for it to be successful.	82.1%
5)	joint approaches or sufficient coordination/cooperation between cooperating agencies, to heighten impact and advantages expected from multinational projects.	78.6%
6)	outside funding should exist at least for the birth and initial functioning of the	

	network.	78.6%
7)	strong self-interest must exist in each network institutional participant	75.0%
8)	participants in the network should not develop mechanisms for the extension of research to the eventual user. (NOTE: In this case, the percentage reflects level of disagreement with this statement)	75.0%
9)	a strong training component is the best future guarantee for continuity and enthusiastic participation in networking.	75.0%
10)	a "critical mass" of research effort that is networked always facilitates problem solution.	71.4%
11)	networks should not be considered permanent institutions but should show flexibility to cope with the range of skills and requirements of the participants. (NOTE: Percentage represents level of disagreement with the statement)	71.4%
12)	the problem must be common to several participants	67.9%
13)	the problem must be clearly defined and a research agenda planned.	67.9%

Table 3

Summary of Factors for Success by Author(s)

[Note: The following table shows the array of factors for success of research found in the existing literature. We have arrayed them in this Table to show where they converge and where they diverge. We have begun with column 1 being the baseline for representing the rest of the lists that were provided in Chapter 2. Different authors may have listed a factor similar to one in the Plucknett/Smith list but in different order which accounts for the arrangement of numbers in the various columns. A reasonable degree of agreement appears to exist on a number of factors. However, clearly the number of factors in the available literature is rather long, with many of the factors appearing in the list of only one author.]

Summary of Factors of Success by Author(s)

Plucknett and Smith on Agricultural Research Networks

1 The problem must be clearly defined and a realistic research agenda agreed upon

2. The problem should be widely shared by the participants

3 Strong self-interest among participants must exist

4 Institutional participants must commit resources such as facilities and personnel

5 External funding must exist from the outset and for a number of years into the implementation of network research

6. Participants must be adequately trained in order to make productive contributions

7. Strong and efficient leadership, having the confidence of all the participants in a network, must be present (Plucknett and Smith 1987)

Burley on Forestry Research Networks

1 The problem must be clearly defined and a realistic research agenda agreed upon

2. The problem should be widely shared by the participants

3. Strong self-interest among participants must exist

4 Institutional participants must commit resources such as facilities and personnel

5 External funding must exist from the outset and for a number of years into the implementation of network research

6. Participants must be adequately trained in order to make productive contributions

7. Strong and efficient leadership, having the confidence of all the participants in a network, must be present

8. A variety of media should be used to shared information among participants

9. Mechanisms must be developed by participants for the extension of research results to end users

10. Networks should be flexible to cope with the variety of skills and needs of the participants

11 Local institutions must provide commitment and continuity (Burley 1985)

Greenland, Crasswell, Dagg

1 The problem must be clearly defined and a realistic research agenda agreed upon

2. The problem should be widely shared by the participants

3 Strong self-interest among participants must exist

4 Institutional participants must commit resources such as facilities and personnel

5 External funding must exist from the outset and for a number of years into the implementation of network research

6 Participants must be adequately trained in order to make productive contributions

7 Strong and efficient leadership, having the confidence of all the participants in a network, must be present

8. The network should find ways to nourish the development and sharing of new materials, technologies and ideas

9 Network participants should be involved in network management through coordinating committees or other appropriate mechanisms. (Greenland, Crasswell and Dagg 1987)

The Co[illegible]tative Group for Agricu[illegible] Research in 19[illegible]

1 The research must be "[illegible] and sharply focused"

2. The network should be [illegible] specific geographical region [illegible] communication and to ensure [illegible] research topic is of commo[illegible]

5 Each participant should b[illegible] it will benefit from participati[illegible] network; this will ensure gr[illegible] and commitment

6 Participating institutions [illegible] or be able to obtain them to [illegible] participation

8 Funding must be available [illegible] participants have opportunitie[illegible] plan together, share informati[illegible] trained.

7 Lead institutions must pro[illegible] leadership.

3. Participation should be form[illegible] at an institutional level, but na[illegible] government level clearance als[illegible]

4 Institutional participants sho[illegible] involved as equal partners

9. Network leadership must be [illegible] a networking approach and to t[illegible] of an equal partnership with s[illegible]

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The Consultative Group on International Agricultural Research in 1983	Sene on International Forestry Research Projects	Hunsen's Review of IDRC Research Networks	De Camino on Mardena
			1 Clear, relevant objectives defined by CATIE (the lead regional institution) and the national institutions 5 Research plans from various disciplines (e.g., silviculture, socioeconomics)
1 regional focus,			
			11. Provision of a regional documentation center 12. Provision of facilities from CATIE are available for project purposes
3. participants have sufficient funds to participate fully;	5. A long enough timeframe to avoid rapid withdrawal of external resources and to ensure development of self-sufficiency by participating local institutions		2. Well-funded relative to objectives, activities, and anticipated products 3. Donor has provided long term support
	3 Training	2. trained participants;	7. Training and education have helped prepare a "critical mass" of researchers
4 lead institution has strength to provide direction;			
5 mechanisms for exchanging research information and materials, and for training and multidisciplinary approaches;		5. disseminated the findings of participants in the network	
			8 Dissemination of network developed technologies has occurred in existing reforestation projects 10. Strong emphasis on experimental and demonstration areas on farms reaches farmers more directly
2. participants are equal partners--they each gain from it and they each support it;			
6. hub that serves as facilitator or lead research institution (Parker 1984).			
	1. A reasonably long period for planning in order to achieve consensus 2. Strong national and regional institutional involvement to ensure support to individual participants and provide continuity 4 A coordinated/cooperative approach to increase the possibility for heightening impact and advantage (Sene 1988:133)		
		1. encouragement of the development or adaptation of appropriate research methodologies; 3. built a critical mass of individuals to tackle a problem on a larger scale; 4 increased contact between scientists working on common themes (Hansen 1984)	6 Standardized methodologies and a powerful database have been developed 4 Personnel at CATIE and the national institutions exist in the numbers, quality and at the appropriate levels 9. Frequent interactions among participants occur for planning, analysis of research results and administrative purposes (de Camino 1988)

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Table 4

Most Important Factors for Sustainability of Forestry Research Networks

[Note: Table 4 provides the following information for 26 responses: list of factors in order of their contribution to forestry research network sustainability; percentage of the respondents included any individual factor in their list of five most important ones; points on a weighted scale for each of the responses (5 points for number one in each respondent's list, 4 for number two, and so forth--a total of 95 points was possible for the most important factor).

	Factor in Order of Contribution	% of Respondents	Points
1)	Network is meeting priorities/needs of the end-users involved	61.5%	53
2)	Sustainability of research networks is entirely dependent on availability of financial support whether internal or external to the network	61.5%	44
3)	Network is meeting priorities/needs of institutions involved	55.6%	42
4)	Network is meeting priorities/needs of the nations whose institutions are involved	53.8%	60
5)	National commitment and financial support to network make the effort sustainable with less external funding	46.2%	33
6)	Networking of scientists contributes to effective problem solution	46.2%	26
7)	Scientists assume a primary role in net-		

	working implementation	34.6%	21
8)	The network is meeting the priorities/ needs of the scientists involved	26.9%	30
9)	Networking of scientists avoid considerable duplication of effort	26.9%	16
10)	Networking of scientists contributes to more efficiency in problem solving	19.2%	12
11)	Realization of common problem	3.8%	5
12)	Increased training of young scientists	7.7%	7
13)	Internalization of the problems by network members	3.8%	4
14)	Leadership	3.8%	4
15)	Adequate participation of beneficiaries	3.8%	3
16)	Mechanism of funnelling adequate funds on a regular basis	3.8%	1
17)	More efficiency in coordinating, controlling and developing the forest research network	3.8%	1
18)	Commitment	3.8%	1
19)	Implementation of network results	3.8%	1

ANNEX C

SOME NOTES ON THE METHODOLOGY

The methods used in this study include:

a) literature review
b) personal interview
c) questionnaire.

The following discusses some of the important problems and potentials of the methods used.

1. We conducted an intensive literature review, using the resources of the Yale University School of Forestry and Environmental Studies in New Haven, Connecticut, and the National Agricultural Library in Beltsville, Maryland. A colleague did a database search at the World Bank, which added a few references. Selected sources appear in the references section. We looked at primary key words which included: networks, research, research networking, forestry, forestry research, forestry research networking, social networks. In both the books and the journals, almost no literature is available on research networking, and much less on forestry research networking. We summarize the relevant literature in CHAPTER 2: LITERATURE REVIEW, discuss our analysis of the literature in CHAPTER 3 FINDINGS, and present a summary and recommendations based on our findings in Chapter 4.

2. We developed a questionnaire using, in great part, the existing literature. In other words, we included many points in the existing forestry research networking literature that could be tested and/or validated through systematic survey results. We did a pre-test and modified the questionnaire prior to its broader distribution.

The <u>objectives of the questionnaire</u> were to:

- Identify factors determining success of forestry research networks

- Identify factors determining potential for sustainability of forestry research networks

- Provide data for analyses of networks included in the study

- Develop characterizations of networks included in the study

- Obtain relevant information about interviewees

We divided the questionnaire into five sections each of which addressed one of the objectives listed above.

We ensured that each survey instrument had a full complement of questions even though we realized that a good many of the questions might not have been relevant to the nature of any given network or to the particular role of a respondent in any given network. Therefore, for many questions, a respondent's answer might have been "not applicable".

3. The findings arise from analysis of the questionnaire. We distributed 38 questionnaires distributed, but two were returned since the individuals could not be located at the address we had. Therefore, we had a total distribution of 36 questionnaires. We have had a preliminary response from 28 individuals. Their responses comprise the basis for the results reported in this draft of the report. We figure the total response rate to be approximately 80 %. The figure is actually greater since two respondents declined to respond by saying that the responses of one of their colleagues also reflected their views. We have not included their responses, however.

We believe that the trends suggested by the responses provide us with a basis for drawing some preliminary conclusions and raising some useful hypotheses for future study.

4. From the outset, we were aware that the questionnaire was quite long. It likely seemed even longer (figuratively) to those who use English as a second language. The benefits of a lengthy instrument are that much useful information can be obtained; nuances can be explored in greater detail; and cross-checking consistency of answers can occur. The

negative aspects of a lengthy instrument include respondent fatigue; frustration; and moving too quickly through some of the answers (especially those toward the end) in order to complete the instrument.

In a study such as this, with little or no opportunity for follow-up with the respondents because of cost, distance, and lack of time, we took the risk that the respondents would provide careful answers in spite of the length of the questionnaire.

5. The concern of one individual is of particular interest: that the instrument appeared to be designed to favor one kind of forestry research network. We acknowledge the concern and respond. At this point in the process of trying to refine the concept(s) of what forestry research network(s) is/are and what factors make them successful, we believe that it was most fruitful to include a range of possibilities from the most simple to the most complex. The results of the questionnaire seem to reflect the range of forestry research networks that exist--i.e., that there are a lot of apples and oranges out there that are being called forest research networks.

6. The respondents for this study were identified primarily by the authors of this study. As a first set, we gave the questionnaire to individuals who are participants, research network managers, and donors who attended the IUFRO meetings in Montreal. From them, we used a "snowball approach" (they gave us three more names who we sent questionnaires to and those respondents gave us three more names, and so forth) to identify others who they suggested should participate in the study. We also used the membership directories of other networks and used the suggestions of research network managers and network participants to identify members of the network who could provide useful information. A larger study would have provided an opportunity to study a larger, potentially more diversified sample of forestry research network participants.

7. The results of the questionnaire reflect opinions and insights of people who are participants in and observers of forestry research networks. We reflect the collective perspectives of these respondents in the analysis of the results and report in a variety of ways (e.g.,

percentage of response in agreement, direct quote of respondent, weighted scaling). Again, we understand that it is important to emphasize that the size of the sample is not large, however, we believe that the responses do provide useful information for further consideration.

8. We specifically asked the respondents if they wished for us to maintain the confidentiality of their responses. Very few requested confidentiality. In order to ensure the confidentiality of any who so desired it, we have maintained the confidentiality of all responses in the text.

9. Relating to the logistics of the questionnaire, we found it costly but helpful to work with an international courier service to provide for collect billing to ensure that the respondents did not have to bear the costs of the return of the questionnaire. This hopefully ensured that more of the questionnaires were returned in timely fashion than had their been no coverage of expenses. It was not, however, always that effective, but for the most part it worked reasonably well.

ANNEX D

LIST OF CONTACTS

QUESTIONNAIRE RESPONDENTS

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PERSONAL COMMUNICATION

Brewbaker, James, NFTA. August 8, 1990.

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Behny, Clyde. Office of Technology Assessment. August 16, 1990

Chubin, Darryl. Office of Technology Assessment. August 16, 1990.

Nair, P.K. University of Florida. October 15, 1990.

Ruttan, Vernon. University of Minnesota. October 16, 1990.

Ugalde, Luis, CATIE, Costa Rica. October 18, 1990.

Scott, Bruce. ICRAF, Kenya. October 19 and November 1, 1990.

ANNEX E

LIST OF NETWORKS PARTICIPATED IN BY QUESTIONNAIRE RESPONDENTS

Forestry Research Networks in Which Respondents Report that they Participate:

Alley Farming Network for Tropical Africa (AFNETA)

Agroforestry Research Network for Africa (AFRENA)

Australian Centre for International Agricultural Research (ACIAR) Forestry Network

ASEAN-Canada Forest Tree Seed Center (ACFTSC) Working Group

Bamboo-Rattan Network of IDRC

BIOFOR*

Central America and Mexico Conifers Genetic Resources Cooperative (CAMCORE)

Cooperative Planting Program (CPP of NFTA)

Forest Pest and Diseases Working Group

Informal Network of Forestry Research Managers (INFORM)

International Leucaena Trials (ILT)

International Union of Forestry Research Organizations (IUFRO)

IUFRO Seed Problem

IPCC*

LRTAP (Acid Rain)*

Leucaena-Psyllid Network

MADELENA

Multipurpose Tree Species (MPTS)

National Fuelwood Research (China)

NAFC*

North American Sugar Maple Decline Project (NAMP)

PNFP (Brazil)*

Other Networks that Respondents Reported:

Asia-Pacific Forestry Educators Network (APFEN)
Benchmark Soils
Family Planning Network (FPAN)
Maize Network Trials
Regional Community Forestry Training Center (RECOFTC)
Tropsoils

*Acronym given but name not identified in full by respondent

ANNEX F

LIST OF A RANGE OF FORESTRY AND RELATED RESEARCH NETWORKS

Forestry Research Networks

- Multipurpose Tree Species Networks (MPTS) supported primarily through the Forestry/Fuelwood Research and Development (F/FRED) Project

- Leucaena Psyllid Research Network coordinated under the MPTS Networks

- Association of South-East Asian Networks-United States of America (ASEAN-US) Watershed Network--watershed management

- Special Program for Developing Countries (SPDC)--IUFRO

- World Wildlife Fund Network--23 national organizations and 2 associates; research components related to conservation of biodiversity and related natural forest management

- Bamboo/Rattan Network--IDRC-funded research and networking activities in the areas of conservation and genetic improvement of species, propagation and nursery techniques, management systems, etc.

- Tropical Pine Provenance Research Network of OFI

- Central American and Mexican Cooperative in Conifer Resources (CAMCORE)--seed provenance trials

- French funded/FAO executed network project (GCP/RAF/234/FRA)--proposed; institutional development and genetic improvement and conservation of species in CILSS countries

- AFRENA--Agroforestry Research Networks in Africa, coordinated by ICRAF

- MADELENA--Tree Crops Project, funded by A.I.D., implemented through CATIE (based in Costa Rica)

International Agricultural Research Centers with Forestry Related Research and Networks

- Centro Internacional de Agricultura Tropical (CIAT)

- International Institute of Tropical Agriculture (IITA)

- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

- International Livestock Center for Africa (ILCA)

- International Board for Plant Genetic Resources (IBPGR)

- International Food Policy Research Institute (IFPRI)

- International Service for National Agricultural Research (ISNAR)

Other Organizations with Forestry Research Network Programs

- The International Center for Integrated Mountain Development (ICIMOD)

- Centre Technique Forestier Tropical, France (CTFT)--primarily watershed management in Africa (African hardwoods and Pacific insular eucalypts)

- International Union of Forest Research Organizations (IUFRO)

- Danish International Development Agency (DANIDA) Forest Seed Centre (DFSC)--training, evaluates provenance trials and seed collection that are coordinated internationally (Asian tropical pines,

Gmelina and *Tectona*)

- Commonwealth Scientific and Industrial Research Organization (CSIRO)--tree seed distribution, training in seed technology (*Acacia*, *Casuarina* and *Eucalyptus*)

- Instituto Nacional de Pesquisas da Amazonia (INPA)--Amazonian development in Brazil

- Instituto de Pesquisas Tecnologicas (IPT)--deals with forest products utilization and marketing in Brazil; lead in IUFRO/SPDC in these areas

- East-West Center, Environment and Policy Institute (EAPI)--network of collaborators on policy problems of common interest

Selected Miscellaneous Agricultural and Forestry Research Networks and Information Networks

- The Australian-Asian Fibrous Agricultural Residues Research Network

- Germplasm Resources Information Network

- International Research Network on Drought Resistance

- National Network for Water Policy Research and Analysis Pilot Project

- African Research Network for Agricultural Byproducts

- Australian-Southeast Asian and Pacific Forage Research Network

- The Northern Science Network: Regional Co-operation for research and cooperation

- Asian Buffalo Research and Development Network

- European Cooperative Research Network on Olives
- U.S. Cooperative Fertilizer Study (provenance research)
- Tree breeding (Universities of Florida, N.C. State, Texas A&M)

ANNEX G

FORESTRY RESEARCH NETWORKING QUESTIONNAIRE

Prepared by
J. Kathy Parker and Max W. McFadden

General Instructions

A.I.D.'s Science and Technology Bureau, Office of Forestry, Environment and Natural Resources is funding us to do a study on forestry research networking. The ultimate goal of this study is to characterize the elements that comprise successful forestry research networks. Please be assured that this study is not an attempt to evaluate specific networks that you are involved in. Rather, we are looking to develop a general paradigm for what comprises a successful forestry research network.

The objectives of this study are to:

1. Identify and survey a group of 30-50 individuals with experience in forestry research networking

2. Develop and apply a questionnaire (see attached materials) to:

   a. Identify and/or test for factors determining the success of a forestry research network

   b. Identify factors for determining the potential sustainability of forestry research networking

3. Draw conclusions about:

   a. Implications of survey results for design and/or implementation of existing and future forestry research networks

   b. Research needed to further refine our knowledge about state-of-the-art forestry research networking

The objectives of the questionnaire are to have you help us:

1. Identify factors determining success of forestry research networks

2. Identify factors determining potential for sustainability of forestry research networks

3. Provide data for analyses of networks included in the study

4. Develop characterizations of networks included in the study

5. Obtain relevant information about interviewees such as yourself

The attached questionnaire is divided into five sections which address the objectives listed above.

We decided to ensure that each survey had a full complement of questions even though we realize that a good many of the questions may not be relevant to that nature of any given network or your particular role in any given network. Therefore, for many questions, your answer may be "not applicable".

We realize that this is a very lengthy questionnaire. We anticipate that it will take a considerable amount of your time to complete it, but we ask that you be patient with our many questions. We do believe that they will contribute to better understanding the nature of forestry research networking.

We would also like to provide you with several definitions that might help clarify some of the words used here:

- Participant--anyone involved in network activities at any level
- Short-term training--less than one year, typically non-degree oriented
- Long-term training--one year or more of training

Should you have additional thoughts or concerns that arise while you are completing the questionnaire, please jot them down in the margin by the question or elsewhere on the questionnaire pages. We will provide you with an opportunity to make additional comments at the end of the questionnaire.

We would like to include your name in the list of individuals contacted during the course of this study.

Candor/Confidentiality

We ask that you be very candid in your responses. We are willing to ensure complete confidentiality in order to encourage candor in your responses. Please be assured, however, that if you wish your answers to remain confidential, we will honor your request. We will ask you after all questions have been raised about whether you wish for us to maintain confidentiality.

Thank you for your assistance.

FORESTRY RESEARCH NETWORKING QUESTIONNAIRE

1. Obtain relevant information about interviewee

1.1. General Information

Instructions: The following set of questions is designed to obtain relevant information about each interviewee. We would appreciate as brief an answer as possible to each question.

1.1.1. Name

1.1.2. Address/Fax/Phone

1.1.3. Position/Title

1.1.4. In what forestry research network(s) do you participate and what is your role in each (scientist, research administrator in your home institution, network manager--i.e. salaried and in a management role, donor)? Please write the name of the networks and then place a check in each box that corresponds to your specific role in each of the networks)

	Network Name	Scien-tist	Res. Admin.	Network Manager	Donor
1.1.4.1.					
1.1.4.2.					
1.1.4.3.					
1.1.4.4.					
1.1.4.5.					

1.2. Perspectives on Research Networks

Instructions: Select one forestry research network in which you actively

participate. Provide answers to the following questions, focusing specifically on that network.

1.2.1. What is the name of the network to which you will address the following answers?

1.2.2. Are you generally satisfied with the network? Circle one of the following.

1.2.1.1. Yes

1.2.1.2. No

1.2.3. If yes, why are you satisfied with the network?

1.2.4. If no, why are you not satisfied?

1.2.5. Has participation in the forestry research network contributed to the success of your own work? Please circle one of the following:

1.2.4.1. Yes

1.2.4.2. No

1.2.6. From the following list, please put a check by those items that best answer the question: What are the primary rewards to you for participating in the network? We emphasize the words "primary rewards to you" to try to get a sense of those things that are more important. Please feel free to select more than one item if appropriate. Put a check by those that you consider to be primary rewards.

1.2.6.1. Solving a problem
1.2.6.2. Opportunities for short-term training
1.2.6.3. Opportunities for long-term training
1.2.6.4. Opportunities for career advancement upon completion of training
1.2.6.5 Funds to do research
1.2.6.6. Equipment to conduct research
1.2.6.7. Access to information
1.2.6.8. Collegiality that helps you develop and refine knowledge

1.2.6.9. Other (please indicate what you have in mind)

_____

_____

_____

1.2.7. Would your personal research be affected in a negative way if you did not participate in a research network? Please circle one.

1.2.6.1. Yes
1.2.6.2. No

1.2.8. If yes, in what ways would your research be negatively affected if you did not participate in a research network?

1.2.9. If no, why would your research not be negatively affected?

1.2.10. In your opinion, is research networking the best means to produce new knowledge? Please circle one

1.2.10.1. Yes
1.2.10.2. No

1.2.11. If "no", what is/are a better alternative(s) to produce new knowledge?

1.2.12. Why?

1.2.13. In your opinion, what is the contribution of research networking to the production of new knowledge?

2. Develop characterizations of various networks

Instructions: The following statements have been developed for you to help us characterize forestry research networks. They are designed in closed-ended format to elicit more readily comparable answers. In other words, for each question we would like you to answer whether you agree, or disagree with the statement, or whether you have neutral feelings toward the statement, whether you have no knowledge on which to base a judgement, whether it is not applicable to your experience in the network, or whether it is planned for but not yet implemented to a point where it can be assessed. Use the following key for the appropriate answers:

A	=	Agree with the statement
D	=	Disagree with the statement
N	=	Neutral feelings about the statement for any reason
NK	=	No knowledge on which to base a judgement
NA	=	Not applicable to your own experience in the network
P	=	Planned actions which cannot yet be assessed

For each statement, please circle the appropriate letter. Remember to focus your answers on the specific network you named above and base your answers on your role in that specific network.

2.1. Approach to Networking

2.1.1. The network developed spontaneously.	A	D	N	NK	NA	P
2.1.2. The network was planned from the outset.	A	D	N	NK	NA	P

2.2. Structuring of Network

2.2.1. This is a highly structured network.	A	D	N	NK	NA	P
2.2.2. Centralized leadership exists in the network.	A	D	N	NK	NA	P
2.2.3. Participatory decisionmaking exists in the research network	A	D	N	NK	NA	P

2.3. Implementation and Management of Networks

2.3.1. Implementation of this network can be characterized as having evolved gradually.	A	D	N	NK	NA	P
2.3.2. Implementation of this network can be characterized as having been rigid and inflexible.	A	D	N	NK	NA	P

2.3.3. This network has been responsive to participant requests to address new problems arising in their countries.	A	D	N	NK	NA	P
2.3.4. The individuals responsible for managing this network are experienced at network management	A	D	N	NK	NA	P

2.3.5. On a scale of one to five, how would you rate each of the following on-going functions in terms of their importance for meeting network objectives. Consider one (1) to be lowest priority and five (5) to be highest. Please circle one for each item below.

2.3.5.1.	Research	1	2	3	4	5
2.3.5.2.	Research management and support	1	2	3	4	5
2.3.5.3.	Institutional development	1	2	3	4	5
2.3.5.4.	Short-term Training	1	2	3	4	5
2.3.5.5.	Long-term Training	1	2	3	4	5
2.3.5.6.	Information exchange (i.e., person to person communication)	1	2	3	4	5
2.3.5.7.	Information management	1	2	3	4	5
2.3.5.8.	Technology transfer (i.e.,published information)	1	2	3	4	5
2.3.5.9.	Network monitoring and evaluation	1	2	3	4	5
2.3.5.10.	Other _____	1	2	3	4	5

2.4. <u>Role of Funding</u>

2.4.1. Institutional participants have committed some financial resources to networking from the outset	A	D	N	NK	NA	P
2.4.2. External funding has been the major financial resource from the outset	A	D	N	NK	NA	P
2.4.3. External funding has been reduced considerably since the outset of the network	A	D	N	NK	NA	P

2.5. <u>Problem Definition and Focus of Networks</u>

2.5.1. A single problem is the focus of the network.	A	D	N	NK	NA	P
2.5.2. The problem addressed by the network is clearly defined.	A	D	N	NK	NA	P
2.5.3. The problem addressed is common to the participants.	A	D	N	NK	NA	P
2.5.4. The end-users of the research participated in definition of the problem.	A	D	N	NK	NA	P

2.6. Research Planning, Design and Implementation Functions

2.6.1. Extensive network planning occurred and resulted in an acceptable research agenda.	A	D	N	NK	NA	P
2.6.2. A clear research agenda was established by the organizers.	A	D	N	NK	NA	P
2.6.3. A clear research agenda was established by participants in the network.	A	D	N	NK	NA	P
2.6.4. The network encourages collaborative research.	A	D	N	NK	NA	P
2.6.5. The network funds collaborative research.	A	D	N	NK	NA	P
2.6.6. Field research is carried out in other countries using a standard network design.	A	D	N	NK	NA	P
2.6.7. Field research in your country is carried out by multidisciplinary teams using a standard network design.	A	D	N	NK	NA	P
2.6.8. Research not based on standard design is conducted concurrently and makes a contribution to network objectives.	A	D	N	NK	NA	P
2.6.9. Your network research includes use of a standardized minimum data set .	A	D	N	NK	NA	P
2.6.10. A standardized minimum data set evolved over time with experience gained by working in the network.	A	D	N	NK	NA	P

2.6.11. A standardized minimum data set is imposed by the network.	A	D	N	NK	NA	P
2.6.12. Your network research includes use of a standardized experimental design.	A	D	N	NK	NA	P
2.6.12. A standardized experimental design evolved over time with experience gained by working in the network.	A	D	N	NK	NA	P
2.6.13. A standardized experimental design is imposed by the network.	A	D	N	NK	NA	P

2.7. <u>Information Management Functions</u>

2.7.1. Data collected by the research network is:						
2.7.1.1.maintained where it is collected.	A	D	N	NK	NA	P
2.7.1.2.summarized where it is collected.	A	D	N	NK	NA	P
2.7.1.3.analyzed where it is collected.	A	D	N	NK	NA	P
2.7.1.4.reported where it is collected.	A	D	N	NK	NA	P
2.7.2. Data collected is transmitted or sent to a centralized database where it is:						
2.8.2.1. maintained.	A	D	N	NK	NA	P
2.8.2.2. summarized.	A	D	N	NK	NA	P
2.8.2.3. analyzed.	A	D	N	NK	NA	P
2.8.2.4. reported.	A	D	N	NK	NA	P
2.7.3. The function of the centralized database is to aggregate and structure information uniformly from all sources for use in developing results applicable to both general and specific network objectives.	A	D	N	NK	NA	P
2.7.4. Results, summarized from multidisciplinary studies, are integrated and synthesized in the research network.	A	D	N	NK	NA	P
2.7.5. Results, summarized from multidisciplinary studies, are integrated and synthesized at:						

2.7.5.1.	the institutional level	A	D	N	NK	NA	P
2.7.5.2.	the country level	A	D	N	NK	NA	P
2.7.5.3.	the regional level	A	D	N	NK	NA	P
2.7.6.	You have access to the data you collect.	A	D	N	NK	NA	P
2.7.7.	You have control over the data you collect.	A	D	N	NK	NA	P
2.7.8.	The network has a data sharing agreement that protects the scientist(s) who collect the data.	A	D	N	NK	NA	P
2.7.9.	Models are being developed with network data.	A	D	N	NK	NA	P
2.7.10.	Models developed in the network are helpful in understanding processes being investigated.	A	D	N	NK	NA	P
2.7.11.	Models are or will be validated with data sets not used in the development of the models themselves.	A	D	N	NK	NA	P

2.8. <u>Communication and Information Exchange Functions</u>

2.8.1	Formal, centralized information exchange among network participants is a critical function of the network.	A	D	N	NK	NA	P
2.8.2	Decentralized, information exchange among network participants is a critical function of the network.	A	D	N	NK	NA	P
2.8.3.	Network meetings are the primary source of information exchange in the research network for participating scientists.	A	D	N	NK	NA	P
2.8.4.	Newsletters are the primary source of information exchange in the network for						
2.8.4.1.	participating scientists	A	D	N	NK	NA	P
2.8.4.2.	potential end users of network research	A	D	N	NK	NA	P
2.8.4.3.	research administrators	A	D	N	NK	NA	P
2.8.4.4.	in-country decisionmakers	A	D	N	NK	NA	P

2.8.4.5. donors	A	D	N	NK	NA	P

2.9. Training Functions

2.9.1. Short-term training is provided by the research network.	A	D	N	NK	NA	P
2.9.2. Long-term training is provided by the research network.	A	D	N	NK	NA	P
2.9.3. After your most recent network-sponsored short-term training you returned to your institution, and:						
2.9.3.1. applied the new knowledge and skills in your former position.	A	D	N	NK	NA	P
2.9.3.2. applied the new knowledge and skills in a new position.	A	D	N	NK	NA	P
2.9.3.3. were promoted into a position where the new knowledge and skills are not directly applicable.	A	D	N	NK	NA	P
2.9.3.4. promoted into a position where the new knowledge and skills are not applicable.	A	D	N	NK	NA	P
2.9.4. Generally speaking, incentives to apply the new knowledge and skills from short-term training exist in your institution.	A	D	N	NK	NA	P
2.9.5. The incentives to apply new knowledge and skills from short-term training include:						
2.9.5.1. Promotion	A	D	N	NK	NA	P
2.9.5.2. Salary increase	A	D	N	NK	NA	P
2.9.5.3. A better office	A	D	N	NK	NA	P
2.9.5.4. More recognition	A	D	N	NK	NA	P
2.9.5.5. Increased financial support for research program	A	D	N	NK	NA	P
2.9.5.6. Other _____	A	D	N	NK	NA	P

2.9.6. After your most recent network-sponsored long-term training, you returned to your

institution and:

2.9.6.1.	applied the new knowledge and skills in your former positions	A	D	N	NK	NA	P
2.9.6.2.	applied the new knowledge and skills in a new position.	A	D	N	NK	NA	P
2.9.6.3.	were promoted into a position where the new knowledge and skills are not directly applicable.	A	D	N	NK	NA	P
2.9.6.4.	were promoted into a position where the new knowledge and skills are not applicable.	A	D	N	NK	NA	P

2.9.7. Generally speaking, incentives to apply the new knowledge and skills from long-term training exist in your institution. A D N NK NA P

2.9.8. The incentives to apply new knowledge and skills from long-term training include:

2.9.8.1. Promotion	A	D	N	NK	NA	P
2.9.8.2. Salary increase	A	D	N	NK	NA	P
2.9.8.3. A better office	A	D	N	NK	NA	P
2.9.8.4. More recognition	A	D	N	NK	NA	P
2.9.8.5. Increased financial support for research program	A	D	N	NK	NA	P
2.9.8.6. Other _____	A	D	N	NK	NA	P

2.10. <u>Institutional Development Functions</u>

2.10.1. Involvement of institutional scientists in networking activities is a positive force for your institution(s). A D N NK NA P

2.10.2. Your institution has benefitted from network affiliation in the following ways:

2.10.2.1. Increased financial support for research	A	D	N	NK	NA	P
2.10.2.2. Increased national recognition for accomplishments and contributions	A	D	N	NK	NA	P

2.10.2.3.	New equipment that benefits other training activities in the institution	A	D	N	NK	NA	P
2.10.2.4.	New equipment that benefits research activities in the institution	A	D	N	NK	NA	P
2.10.2.5.	New infrastructure (e.g., buildings)	A	D	N	NK	NA	P
2.10.2.6.	Other _____	A	D	N	NK	NA	P

2.11. Technology Transfer Functions

2.11.1. Technology transfer techniques utilized by the network are:

2.11.1.1.	Newsletters	A	D	N	NK	NA	P
2.11.1.2.	Scientific publications	A	D	N	NK	NA	P
2.11.1.3.	Newspaper articles	A	D	N	NK	NA	P
2.11.1.4.	Radio presentations	A	D	N	NK	NA	P
2.11.1.5.	TV presentations	A	D	N	NK	NA	P
2.11.1.6.	Videotape presentations	A	D	N	NK	NA	P
2.11.1.7.	Field demonstrations	A	D	N	NK	NA	P
2.11.1.8.	Public meetings	A	D	N	NK	NA	P
2.11.1.9.	Extension materials (e.g., brochures, pamphlets)	A	D	N	NK	NA	P
2.11.1.10.	Other _____	A	D	N	NK	NA	P

2.11.2. Communication with end-users promoted by the network occurs:

2.11.2.1.	almost never	A	D	N	NK	NA	P
2.11.2.2.	occasionally	A	D	N	NK	NA	P
2.11.2.3.	frequently	A	D	N	NK	NA	P

2.11.3. Communication with end-users promoted by the network results in:

2.11.3.1.	better problem definition	A	D	N	NK	NA	P
2.11.3.2.	more appropriate solutions	A	D	N	NK	NA	P
2.11.3.4.	better acceptance of solutions	A	D	N	NK	NA	P
2.11.3.5.	more support for future research activities	A	D	N	NK	NA	P
2.11.3.6.	other _____	A	D	N	NK	NA	P

2.12. Factors External to the Network

2.12.1.	There is national commitment in support of the network.	A	D	N	NK	NA	P
2.12.2.	National commitment to solve problems addressed by the network comes in the form of:						
2.12.2.1.	financial support	A	D	N	NK	NA	P
2.12.2.2.	additional staff	A	D	N	NK	NA	P
2.12.2.3.	supportive policy	A	D	N	NK	NA	P
2.12.2.4.	institutional mechanisms to link research with extension	A	D	N	NK	NA	P
2.12.2.5.	institutional mechanisms to link research with professional and technical educational programs	A	D	N	NK	NA	P
2.12.2.6.	other _____	A	D	N	NK	NA	P
2.12.3.	There is formal national policy in support of country participation in the research network	A	D	N	NK	NA	P
2.12.4.	There is formal institutional policy (agreements) in support of scientist participation in the research network	A	D	N	NK	NA	P
2.12.5.	Institutional leadership in support of the network has <u>not</u> been sustained even when government support has been strong	A	D	N	NK	NA	P

<u>Instructions</u>: The following questions require you to finish the statement:

2.13. The objectives of this network are:

2.14.1.

2.14.2.

2.14.3.

2.14.4.

2.14. Networks have a number of functions. We presented this list in a different context previously. This time, however, using the list below, please indicate the

major functions of this network in order of their priority. Number 1 should be the highest priority. For example: Research 2
Research Support 4, etc.

Functions	No. of Priority
2.14.1. Research	
2.14.2. Research management and support	
2.14.3. Institutional Development	
2.14.4. Short-term training	
2.14.5. Long-term training	
2.14.6. Information exchange	
2.14.7. Information management	
2.14.8. Technology transfer	
2.14.9. Other _____	

2.15. The major constraints of the network are _____

3. Provide Analysis of Networks Included in this Study

Instructions: The majority of the questions in this section are closed-ended like those in the previous section. Please respond in like form. Many of the questions will appear very familiar since they were stated in different form in the previous section. Please respond to these questions based on your experience in any or all research networks in which you have participated.

3.1. Approach to Networking

3.1.1. Networks arising spontaneously among participants are less successful over the long run than those designed and planned by or through external sources. A D N NK NA P

3.1.2. A mixture of spontaneous development and more planned implementation of the network is an important model for development of future forestry research networks.

3.1.3. The greater the opportunity provided by the network to draw on a range of disciplines as appropriate, to address a problem, the greater the potential effectiveness of the

effort to solve the problem.	A	D	N	NK	NA	P

3.2. Structuring of Networks

3.2.1 Highly structured networks achieve the greatest accomplishments.	A	D	N	NK	NA	P
3.2.2. Highly structured networks are the most successful.	A	D	N	NK	NA	P
3.2.3. Decentralized leadership is required for the research network to meet its objectives.	A	D	N	NK	NA	P

3.3. Implementation and Management of Networks

3.3.1. Research networks should not be flexible and able to evolve as the skills of the participants evolve.	A	D	N	NK	NA	P
3.3.2. Networks should not be flexible and able to evolve as related problems arise that merit attention.	A	D	N	NK	NA	P
3.3.3. New networks should be created when new problems arise; existing networks should continue to focus on their existing problems.	A	D	N	NK	NA	P
3.3.4. The higher the level of end user participation in setting the research agenda, the more sustainable the national interest and support for the research network.	A	D	N	NK	NA	P
3.3.5. The greater the experience of individuals responsible for managing the network, the higher the level of success of the network.	A	D	N	NK	NA	P
3.3.6. Monitoring and evaluation of network activities serve a valuable function by providing information about networking activities.	A	D	N	NK	NA	P

3.4. Role of Funding

3.4.1. Funding should be more substantial from external sources at the outset and should be assumed by the participating national institutions over time.	A	D	N	NK	NA	P

3.4.2. Financial support of personal research in exchange for participating in network research is a not primary function of a research network. A D N NK NA P

3.4.3. Research funded directly by the network makes a greater contribution to network success than research that is drawn into the network while funded by sources external to the research network. A D N NK NA P

3.5. Problem Definition and Focus of Networks

3.5.1. Clear definition of the problem is a not critical factor for success of the network. A D N NK NA P

3.5.2. The more narrowly defined the problem for network resolution, the greater the chances of network success. A D N NK NA P

3.5.3. The more complexly defined the problem, the more improbable it is that the network will be able to address it effectively. A D N NK NA P

3.5.4. The greater the level of agreement among scientists about selection of the problem, the greater the chances for network success. A D N NK NA P

3.5.5. The earlier the input of end users in defining the problem, the greater the success of network participants in developing new knowledge to resolve the problem. A D N NK NA P

3.6. Research Planning, Design and Implementation Functions of Networks

3.6.1. Collaborative research is a critical function of a research network. A D N NK NA P

3.6.2. The higher the quality of research planning, the higher the level of success of the network. A D N NK NA P

3.6.3. High level of scientist participation in the development of the network's research agenda is a critical factor for success of the

network.	A	D	N	NK	NA	P
3.6.4. The more disciplinary interaction, the more effective efforts are to solving complex problems.	A	D	N	NK	NA	P
3.6.5. The better the theoretical and methodological integration of the various sciences, the more effective the integration of the research. efforts and their results.	A	D	N	NK	NA	P
3.6.6. Field research carried out in multiple countries using a standard network design is a critical factor to network success.	A	D	N	NK	NA	P
3.6.7. Field research carried out by multidisciplinary teams using a standard network design is a critical factor for network success.	A	D	N	NK	NA	P
3.6.8. Research not based on standard design that is conducted concurrently can make an important contribution to network objectives.	A	D	N	NK	NA	P
3.6.9. Network research which includes use of a standardized minimum data set is critical to research network success.	A	D	N	NK	NA	P
3.6.10. Highly structured research networks provide the best means of obtaining results in forestry research.	A	D	N	NK	NA	P

3.7. <u>Information Management Functions</u>

3.7.1 Data collected and maintained where it is collected is less useful than data maintained in a centralized system.	A	D	N	NK	NA	P
3.7.2. Access to the data you collect is critical to your success as a scientist.	A	D	N	NK	NA	P
3.7.3. Control over the data you collect is critical to your success as a scientist.	A	D	N	NK	NA	P
3.7.4. Models should be a tool of research network activities.	A	D	N	NK	NA	P

3.7.5. Networks must support the validation of models with data sets not used in the development of the models themselves.	A	D	N	NK	NA	P

3.8. Communications and Information Exchange Functions

3.8.1 Provision of resources and opportunities for informal communication between participating scientists improves the research network's chances for success.	A	D	N	NK	NA	P
3.8.2. Research network meetings and workshops should be the primary source of information exchange for participating scientists.	A	D	N	NK	NA	P

3.9. Training Functions of Networks

3.9.1. Short-term training should be provided by the research network.	A	D	N	NK	NA	P
3.9.2. Long-term training should be provided by the research network.	A	D	N	NK	NA	P
3.9.3. In most cases, after network-sponsored short-term training, trainees should be returned to their institution, to:						
3.9.3.1. apply the new knowledge and skills in their former position.	A	D	N	NK	NA	P
3.9.3.2. apply the new knowledge and skills in a new position.	A	D	N	NK	NA	P
3.9.3.3. be promoted into a position where the new knowledge and skills are not necessarily directly applicable.	A	D	N	NK	NA	P
3.9.4. Generally speaking, incentives to apply the new knowledge and skills from short-term training should exist in host country institutions.	A	D	N	NK	NA	P
3.9.5. The incentives to apply new knowledge and skills from short-term training should include:						

3.9.5.1. Promotion	A	D	N	NK	NA	P
3.9.5.2. Salary increase	A	D	N	NK	NA	P
3.9.5.3. A better office	A	D	N	NK	NA	P
3.9.5.4. More recognition	A	D	N	NK	NA	P
3.9.5.5. Increased financial support for research program	A	D	N	NK	NA	P
3.9.5.6. Other _____	A	D	N	NK	NA	P

3.9.6. In most cases, after network-sponsored long-term training, trainees should be returned to their institution, to:

3.9.6.1. apply the new knowledge and skills in their former pcsitions	A	D	N	NK	NA	P
3.9.6.2. apply the new knowledge and skills in a new position.	A	D	N	NK	NA	P
3.9.6.3. be promoted into a position where the new knowledge and skills are not necessarily directly applicable.	A	D	N	NK	NA	P

3.9.7. Generally speaking, incentives to apply the new knowledge and skills from long-term training should exist in host country institutions.	A	D	N	NK	NA	P

3.9.8. The incentives to apply new knowledge and skills from long-term training should include:

3.9.8.1. Promotion	A	D	N	NK	NA	P
3.9.8.2. Salary increase	A	D	N	NK	NA	P
3.9.8.3. A better office	A	D	N	NK	NA	P
3.9.8.4. More recognition	A	D	N	NK	NA	P
3.9.8.5. Increased financial support for research program	A	D	N	NK	NA	P
3.9.8.6. Other _____	A	D	N	NK	NA	P

3.10. <u>Institutional Development Functions</u>

3.10.1. Involvement of institutional scientists in networking activities is a positive force for your institution(s).	A	D	N	NK	NA	P
3.10.2. Your institution should benefit from research network affiliation in the following ways:						
3.10.2.1 Increased financial support for research.	A	D	N	NK	NA	P
3.10.2.2. Increased national recognition for accomplishments and contributions.	A	D	N	NK	NA	P
3.10.2.3. New equipment that benefits other training activities in the institution.	A	D	N	NK	NA	P
3.10.2.4. New equipment that benefits research activities in the institution.	A	D	N	NK	NA	P
3.10.2.5. New infrastructure (e.g., buildings).	A	D	N	NK	NA	P
3.10.2.6. Other _____	A	D	N	NK	NA	P

3.11. <u>Technology Transfer Functions of Networks</u>

3.11.1. Mechanisms for transfer/extension of technologies, information and other products of the network to end users must be a directly supported function of the research network.	A	D	N	NK	NA	P
3.11.2. Mechanisms for transfer/extension of technologies, information and other products of the network to end users can function adequately even if they are not directly supported by the research network.	A	D	N	NK	NA	P
3.11.3. The network should promote communication with end-users:						
3.11.3.1 almost never	A	D	N	NK	NA	P
3.11.3.2. occasionally	A	D	N	NK	NA	P
3.11.3.3. frequently	A	D	N	NK	NA	P

3.11.4. Communication with end-users sponsored by the research network should result in:

3.11.4.1.	better problem definition	A	D	N	NK	NA	P
3.11.4.2.	more appropriate solutions	A	D	N	NK	NA	P
3.11.4.3.	better acceptance of solutions	A	D	N	NK	NA	P
3.11.4.4.	more support for future research activities	A	D	N	NK	NA	P
3.11.4.5.	other _____	A	D	N	NK	NA	P

3.11.5. Network newsletters should be the primary source of information exchange for

3.11.5.1.	participating scientists	A	D	N	NK	NA	P
3.11.5.2.	potential end users	A	D	N	NK	NA	P
3.11.5.3.	research administrators	A	D	N	NK	NA	P
3.11.5.4.	in-country decisionmakers	A	D	N	NK	NA	P
3.11.5.5	donors	A	D	N	NK	NA	P

3.11.6. The most useful network technology transfer techniques are:

3.11.6.1	Scientific publications	A	D	N	NK	NA	P
3.11.6.2.	Newspaper articles	A	D	N	NK	NA	P
3.11.6.3.	Radio presentations	A	D	N	NK	NA	P
3.11.6.4.	TV presentations	A	D	N	NK	NA	P
3.11.6.5.	Videotape presentations	A	D	N	NK	NA	P
3.11.6.6	Field demonstrations	A	D	N	NK	NA	P
3.11.6.7.	Public meetings	A	D	N	NK	NA	P
3.11.6.8.	Extension materials (e.g., brochures, pamphlets)	A	D	N	NK	NA	P
3.11.6.9.	Other _____	A	D	N	NK	NA	P

3.12. Personal Factors

3.12.1. A high level of participant self-interest is a critical motivating factor for increased research productivity. A D N NK NA P

3.12.2. The greater the level of potential/perceived benefit to the individual scientists, the greater the chance of commitment to the research network. A D N NK NA P

3.12.3. The greater the level of actual benefit to individual scientists, the greater the chance of continuing commitment to the research network. A D N NK NA P

3.12.4. Scientist satisfaction with their network colleagues is important to perception of the success of the research network. A D N NK NA P

3.12.5. Scientist satisfaction with the extent and quality of communication in the network is important to perception of the success of the research network. A D N NK NA P

3.12.6. Scientist satisfaction with availability of information about network research is important to perception of the success of the research network. A D N NK NA P

3.12.7. Scientist satisfaction with their level of input into network decisionmaking is important to perception of the success of the research network. A D N NK NA P

3.12.8. Scientist satisfaction with the activities (e.g., study tours, training) is important to the perception of the success of the research network. A D N NK NA P

3.12.9. Scientist satisfaction with the personal number of scientific publications (i.e., peer reviewed) they produce as a result of network-related work is important to the perception of the success of the research network. A D N NK NA P

3.12.10. Scientist satisfaction with the morale of other network participants is an important factor to the perception of the success of the research network. A D N NK NA P

3.12.11. Participant satisfaction with their level of national recognition is important to the perception of success of the research network. A D N NK NA P

3.12.12. Participant satisfaction with their level of international recognition is important to the perception of success of the research network. A D N NK NA P

3.13. Factors External to the Network

3.13.1. The higher the level of national commitment to solve the problem(s) addressed by the network, the higher the level of government support for network activities by participating institutions and scientists. A D N NK NA P

3.13.2. The greater the level of potential/perceived benefit to the end user, the greater their support and commitment to the research network. A D N NK NA P

3.13.3. The higher the degree of individual institutional continuity in participating in the network, the higher the level of network success. A D N NK NA P

4. Identify factors determining success of forestry research networks

Instructions: Please address the following statements using the closed ended responses as before.

4.1. Which of these would be key factors for determining the success of forestry research networks in general?

4.1.1. the problem must be clearly defined and a research agenda planned. A D N NK NA P

4.1.2. the problem must be common to several participants A D N NK NA P

4.1.3. the problem must be common to all participants A D N NK NA P

4.1.4. strong self-interest must exist in each network institutional participant A D N NK NA P

4.1.5. outside funding should exist at least for the birth and initial functioning of the network. A D N NK NA P

4.1.6. a long timeframe, permitting progressive withdrawal of external support at the end of the project period and subsequent self-sufficiency building of local institutions.	A	D	N	NK	NA	P
4.1.7. staff must be sufficiently trained and expert to make significant contributions to network management and implementation.	A	D	N	NK	NA	P
4.1.8. strong leadership , having the confidence of all participants in the network, is not required.	A	D	N	NK	NA	P
4.1.9. information should be shared among all research collaborators through a range of media.	A	D	N	NK	NA	P
4.1.10. participants in the network should not develop mechanisms for the extension of research to the eventual user.	A	D	N	NK	NA	P
4.1.11. a "critical mass" of research effort that is networked always facilitates problem solution.	A	D	N	NK	NA	P
4.1.12. networks should not be considered permanent institutions but should show flexibility to cope with the range of skills and requirements of the participants.	A	D	N	NK	NA	P
4.1.13. continuity and commitment of participating institutions are needed; in developing countries individuals must be strongly backed by their institutions to ensure continuity.	A	D	N	NK	NA	P
4.1.14. a relatively long planning period is needed, as it takes time to reach consensus on a research agenda and action plan.	A	D	N	NK	NA	P
4.1.15. a strong training component is the best future guarantee for continuity and enthusiastic participation in networking.	A	D	N	NK	NA	P
4.1.16. joint approaches or sufficient coordination/cooperation between cooperating agencies, to heighten impact and advantages						

expected from multinational projects.	A	D	N	NK	NA	P
4.1.17. a catalytic, yet more top-down approach to networking is the best approach to networking.	A	D	N	NK	NA	P
4.1.18. a colleagial, informal, voluntary approach is the least effective to research networking.	A	D	N	NK	NA	P
4.1.19. a research center extending invitations and some limited financial support to potential network participants is the best approach to research networking.	A	D	N	NK	NA	P
4.1.20. a research center extending invitations and considerable financial support to potential network participants is the best approach to networking.	A	D	N	NK	NA	P
4.1.21. national institutions must be willing to commit some resources to research networking for it to be successful.	A	D	N	NK	NA	P
4.1.22. other factors that contribute to the success of research networks _____	A	D	N	NK	NA	P

Instructions: Please answer the following questions.

4.2. Please choose the five most important factors drawn from the list above in their order of contnbution to the success of research networks:

4.2.1. _____

4.2.2. _____

4.2.3. _____

4.2.4. _____

4.2.5. _____

4.3. What is the best way to organize a forestry research program to ensure that

results to solve a problem are timely, efficiently-obtained and appropriate?

4.4. Would this organization be appropriate at the following levels:

4.4.1 local	Yes	No
4.4.2 national	Yes	No
4.4.3. regional	Yes	No
4.4.4. global	Yes	No

4.5. If the organization that you proposed above is not appropriate for all levels, please suggest an alternative organization for forestry research for those levels.

5. Identify factors determining sustainability

Instructions: Please answer the following:

5.1. What would make a forestry research network sustainable?

5.2. Are the following criteria critical for determining whether a network should be sustained or not

5.2.1. The network is meeting the priorities/ needs of the nations whose institutions are involved.	A	D	N	NK	NA	P
5.2.2. The network is meeting the priorities/ needs of the institutions involved.	A	D	N	NK	NA	P
5.2.3. The network is meeting the priorities/ needs of the scientists involved.	A	D	N	NK	NA	P
5.2.4. The network is meeting the priorities/ needs of the end-users involved.	A	D	N	NK	NA	P
5.2.5. Networking of scientists contributes to effective problem solution.	A	D	N	NK	NA	P
5.2.6. Networking of scientists contributes to more efficiency in solving the problem.	A	D	N	NK	NA	P
5.2.7. Networking of scientists avoids considerable duplication of effort.	A	D	N	NK	NA	P

5.2.8. National commitment and financial support to network make the effort sustainable with less external funding. A D N NK NA P

5.2.9. Scientists assume a primary role in networking implementation. A D N NK NA P

5.2.10. Sustainability of research networks is entirely dependent on availability of financial support whether internal or external to the network. A D N NK NA P

5.2.11. Other _____ A D N NK NA P

5.3. Of the factors for sustainability listed above, please indicate the five most important in order of their contribution to research network sustainability.

5.3.1. _____

5.3.2. _____

5.3.3. _____

5.3.4. _____

5.3.5. _____

6. Conclusion

Instructions: This is the end of the questionnaire, per se. Now, we would like to ask for your assistance in providing us with the names of three other individuals who you know participate in forestry research networks. We would like to have their names, addresses, phone, and fax numbers in order to contact them in the future.

6.1._____

6.2._____

6.3._____

I would like to ask you about the issue of confidentiality of your responses to this questionnaire. Would you like for your responses to be maintained as confidential?

6.4. Yes No

Before closing, please feel free to note any additional thoughts about forestry research networking that you would like to include. Use the back of this questionnaire or additional sheets of paper. We would like to follow up on these items insofar as time permits in person or by telephone in the near future.

Thank you for your assistance in this task. We appreciate your time, energy and input on this important topic.

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