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March 23 - April 14, 1987

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WINROCK INTERNATIONAL  
1611 North Kent St.  
Arlington, VA 22209

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Participation in the FAO Mission on Forestry  
Research, Education and Training in India

March 23 - April 14, 1987

Robert L. Youngs

This will provide some personal observations regarding my participation in the FAO Mission on Forestry Research, Education\* and Training in India. A draft report of the Mission has been prepared and was left both with the Government of India and FAO, as well as with the AID staff in Delhi. The final report should be completed at the FAO Headquarters in Rome within a few weeks and will be sent then to all concerned.

Members of the Mission were Dr. Howard Wright, Oxford University; Dr. Dennis Richardson, Forestry Consultant, New Zealand; Mr. Haluk Hilmi, FAO, Rome; Dr. Y. Sedaka Rao, Regional Forestry Officer, FAO, Bangkok; and myself. Our Mission contact in Delhi was Dr. E. Bojadzievski, FAO Representative in India and Bhutan. During the periods of the Mission when I was in Delhi and particularly during preparation of the final report, I was in close contact with David Heesen (AID/ID). In fact, he was most accommodating in helping us with space to work and use of typewriter and word processor, which were a very great help to us in completing our draft report.

The accompanying draft report of the Mission presents highlights of our activity and the recommendations. These personal comments will supplement that.

\*We did not deal with the education question. This was the subject of the Gordon/Mace Mission that just preceded ours.

India is ready to go ahead with reorganization of their forestry research program. They seem to have strong support from Parliament, the Secretary of Environment and Forests, Mr. Seshan, and the Inspector General of Forests, Mr. Jadhav. As far as the current members of the research organization at the various research locations is concerned, I observed that the reaction to the proposals for reorganization ranged from foot dragging to acceptance to enthusiastic support, depending on how one's particular part of the organization would fare under the new arrangement. The most severe foot dragging seems to be at the Forest Research Institute in Dehra Dun, which is the old line forest research establishment in India and which serves really as Headquarters for the forestry research in that country. Funds are available for the reorganization activity and we were assured before we left that the Government of India expects to start implementing these plans by June of this year.

The reorganization would apparently result in rather sweeping changes in policy, delegation of authority, and the degree of independence<sup>ce</sup> of operation of the various units of the research organization. Units operating under the Indian Council of Forestry Research and Education (ICFRE) will apparently have even more authority than the longer-established Indian Council for Agricultural Research (ICAR). Also coming out of the reorganization and the new policies will be a much stronger user-orientation in the research, with a strong focus on determination of researchable problems and their solution.

The Government of India has established ICFRE to coordinate forestry research and education throughout India. It will be promoting and monitoring forestry and forest-related research in India. The presently appointed Director General of ICFRE is Dr. R. V. Singh, who is also

President of the Forest Research Institute in Dehra Dun. The Office of the Director General is officially located in Dehra Dun. This can pose a problem, at least of image if not in reality, depending on how the Government of India generally and how Dr. Singh personally deals with the dual role of FRI President and ICFRE Director General.

Under the new plan there will be a so-called "Center of Excellence" at the Forest Research Institute in Dehra Dun; a Forest Products Research Institute at Bangalore; an Arid Zone Research Institute at Jodhpur; a Genetics and Tree Breeding Institute at Coimbatore; and a Northern Peninsula Deciduous Forest Research Institute at Jabalpur; a Northeast Moist and Wet Evergreen Forest Institute at Jorhat. Also brought into the fold will be the more or less Forest Research Institute of Kerala State (KFRI) at Peechi, to deal with forest problems of the Western Ghats.

The Mission spent about the first two weeks reviewing the plans and visiting most of the institutes as indicated in the draft report. On the basis of this, we prepared a preliminary report which was distributed to and discussed with Government of India Forestry Representatives and the Secretary of Environment and Forests at a National Seminar in Delhi on April 10 and 11. Following this we prepared the draft report in the form in which it now appears. At the Seminar, the points made in the preliminary report were quite generally accepted, but some did need clarification and revision. This has been done in the draft. All in all we found a generally good degree of support for the recommendations that we were able to make.

We recommended strongly that regional economic profiles of the forestry sector in particular be prepared as a basis for research program development. This should get very early emphasis and really serve as a key

foundation for establishing the on-going research program. We also indicated that program development should reflect the growing importance of social forestry in India and suggested some areas in which that could be done.

We recommended that the selection of Directors for the reorganized institutes is a critical early step. We also recommended that the Directors receive training in research management, including visiting developed countries and institutions to learn how established research organizations function and are managed. In this regard, David Heesen expressed interest in supporting travel of some of these key Directors to research institutions in the United States and asked me to send suggestions of institutions that they might visit.

Another key move would be the establishment of what are called Consultative Committees to advise on program priorities. There was a great deal of discussion about who should be members of these committees. The consensus seems to favor selection of relatively few "eminent persons" who are familiar with the situation in the region concerned and have a broad perspective on forestry research needs. This seems to be favored, and was certainly advocated by the Mission, over a more or less formula representation of all possible groups interested in forestry research.

The next few months will be a critical time in establishing ICFRE. The attention expressed strongly by the Government of India and endorsed strongly by the Mission is that ICFRE provide coordination and support, not control over the research function. An important element in its activity will be to create a favorable research climate, which is now plagued by many problems of administration, differences between researchers and Indian

Forest Service foresters assigned to research institutions, and other internal problems.

We urge that ICFRE take a lead in decentralization of the research organization, which is now strongly controlled by Dehra Dun, with the first move to establish regional ICFRE officers. These regional officers would be particularly responsible for providing coordination and funding allocation not only to the research institutes in the region but to state agricultural universities and other related institutions that are now beginning to get into the forestry research business. We also strongly encourage the Government of India, through ICFRE, to give the Directors of the new institutes much more authority over the money, people, and facilities than current institute leaders have.

We strongly advocated that part of the research be developed on a "user pays" principal, partly to generate additional funds for the program, but even more importantly to maintain a strong user orientation in assigning priorities and solving problems that are identified through the system.

About 14 so far of the state agricultural universities are beginning forestry programs and others apparently will be soon. These programs will include teaching and research. We advocated that they give strong attention to extension as well. We provided some specific ideas regarding extension and technology transfer as one of the key elements for developing the effectiveness of the research program.

We developed several suggested areas for donor assistance which are listed in Item 4 (page 40) of the draft report. Secretary Seshan said strongly several times that they do not need money to carry out their reorganized program. However, they probably will need foreign exchange to

purchase some of the equipment that will be necessary, as well as for training to be done outside of India.

Dr. Wright, from Oxford, was supported in his activity on this Mission by ODA of UK just as I was supported by USAID. ODA currently has expressed a strong interest in supporting further activity along this line. Likewise, Dr. Richardson had indication of support for further activity in India by New Zealand. One of the suggestions that seems to be being adopted in regard to the function of ICFRE is that that body act as a coordinating group for support provided by international donor agencies. David Heesen and Charles Hatch of AID in Delhi are apparently in rather close touch with Dr. R. V. Singh and can be expected to stay well attuned to the needs of forestry research in India over the next few months and years.

The India forestry research organization is poised for some rather sweeping changes. It will be worth keeping close touch with developments there as a means of focusing international assistance efforts in productive and coordinated ways to maximize their effectiveness.

DRAFT REPORT

FAO MISSION ON FORESTRY RESEARCH, EDUCATION AND TRAINING IN INDIA

March 16 - April 14  
1987

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## 1.0 BACKGROUND

The previous few years have seen considerable discussion, both internally and externally, on the subject of the reorganisation of forestry research in India. On 31 December 1986 orders were published by the GOI establishing the Indian Council of Forestry Research and Education (ICFRE) and detailing its roles and functions. Foremost amongst these was the creation of Regional Forestry Research Institutes at Jabalpur, Jodhpur, Jorhat, and Coimbatore and an Institute of Wood Science and Technology at Bangalore. The GOI prepared proposals detailing the functions and organisation of each of these Institutes and invited FAO to provide a Mission to examine them in the light of the creation of ICFRE. The Mission was also asked to indicate suitable areas for funding by international/foreign agencies. The terms of reference are given in Annex 1.

This Mission, consisting of five members, visited India from March 16 to April 14. Visits were made to the Forest Research Institute, Dehra Dun (FRI), and the research centres at Bangalore and Coimbatore, to the Kerala Forest Research Institute (KFRI), to the Indian Plywood Industry Research Institute (IPIRI) and to the Central Arid Zone Research Institute (CAZRI) at Jodhpur. Discussions were held with the directors and staff and with senior staff of the State Forest Departments. During the time spent in Delhi meetings were arranged with a number of government agencies such as the Ministry of Environment, Forests and Wildlife, the Indian Council of Agricultural Research (ICAR) and the National Wastelands Development Board, with various donor agencies, and with the FAO and UNDP Representatives. A list of people met is given in Annex 2.

A National Seminar was held on April 10-11 at which the Mission presented a preliminary report. The major issues in research reorganisation were discussed by representatives from the Ministry, Research Institutes and State Forest Departments. The agenda, list of participants and minutes are given in Annex 3.

After the seminar the Mission wrote this report in which the main recommendations are given first followed by a more detailed account of some topics. The aim has been to keep the report brief and to this end little of the background has been given.

The report is based on perceptions and insights gained by the Mission during the field visits and on the information provided by a large number of senior administrators in the forest sector, scientists, practising foresters and even those outside the government. To all of them the Mission members are profoundly grateful for sharing their knowledge, ideas and experience with them. Particular thanks and sincere appreciation go to the following:

- Mr T N Seshan, Secretary, Ministry of Environment, Forests and Wildlife, Government of India.
- Mr Y G Jadhav, Inspector General of Forests, Government of India.
- Dr R V Singh, Director-General, ICFRE and President, FRI.
- Mr Narayan Singh, Deputy Inspector General of Forests, Government of India.

## 2. SUMMARY OF RECOMMENDATIONS

### 2.1 ROLES OF ICFRE

The Mission recognises that

1. the socio-economic contribution of forestry research to the entire forestry sector is well below its sustainable and justifiable potential; this is in part due to inappropriate programmes, a lack of coordination and communication of research results and the ineffective use of inter-disciplinary, problem-oriented research;
2. deficiencies are acknowledged and that the creation of ICFRE provides an opportunity to bring about far-reaching and exciting changes in the research climate and the cost-effectiveness of forestry research;
3. the areas in which change are most needed are:- problem identification, which must be based on recognition of economic development needs and closely related to user demand - rather than the perceptions of researchers; programme preparation - which, within the policy framework established by GOI and ICFRE, is primarily the responsibility of research institute directors; project formulation and implementation which should be left to the researchers; monitoring which is the responsibility of management; evaluation which should involve more independent assessment and dissemination which calls for a new approach to extension and public awareness;
4. the main purpose of ICFRE is to create a favourable research climate - service not control - and that this will be achieved by the decentralisation of powers to the regions;
5. research must be assured of adequate finance to attract high calibre staff; researchers must be assured of objective support from administration; a lessening of the formality, which at present characterises personnel relationships, might enable more concerted (and concentrated) effort.

and recommends that

1. the major role of ICFRE be played in the regions;
2. maximum delegation of powers be given consistent with overall policy and monitoring role;
3. well-defined yet flexible procedures be established for the involvement of all those interested in forest research, government and non-government, industrial and private, in the identification of research needs, in the monitoring of progress and in the evaluation of effectiveness;
4. linkages between institutes - whether inter-departmental, inter-sectoral or inter-institutional, are sine qua non; it must be a primary role of ICFRE to foster such linkages;

5. there is significant potential for task-force and multi-disciplinary approaches to both regional and national problems;
6. ICFRE should have wide powers of research funding through other research institutes and individuals; it should be able to set up projects jointly funded with other agencies to take advantage of existing infrastructure and to make the most of research facilities; the undertaking of contract research on the "user pays" principle should be encouraged;
7. the "Indian Way" is not immutable; where cultural tradition or excessive bureaucracy is perceived to be a constraint on efficiency in research (which is universal in its methodology), it should be modified; if it is perpetuated, there must be honest recognition of its limiting effects;

## 2.2 DECENTRALISATION OF POWERS

Some of the important tasks confronting the Ministry of Environment, Forests and Wildlife are:

- to take a fresh look at the rules and procedures governing research implementation;
- to dismantle the existing structures based on concentration of authority at the higher levels;
- to put in their place a decentralised mechanism which is intended to serve the following objectives:

- to make it impossible for ICFRE and the institutional heads to abdicate responsibility for failure in implementation;
- for higher authorities to retain unfettered freedom to evaluate the performance of research by not becoming a party to the approval of the details of implementation.

The Mission recognises the importance of this and recommends that

1. the guiding principle should be for higher authorities to justify why they should retain certain powers; actively divest themselves of powers for prior approvals; and retain and effectively use the prerogative of "performance appraisal" of implementing agencies;
2. the Ministry's major function is to provide a budget to ICFRE based on proposals from ICFRE and its institutions;
3. ICFRE should allocate the budget to itself and its institutions after reviewing programmes in the light of their potential impact not only on the forestry system but also on the broader socio-economic scene;
4. ICFRE in its turn should delegate its own authority to the Directors of Institutions who should be held primarily responsible for implementation;

5. directors should be vested with the power to incur expenditure within the sanctioned budget on various activities including:
- acquisition of land and sanctioning of expenditure towards civil works; purchase/hire of equipment for laboratory as well as field use;
  - creation, filling, and termination of posts up to the level of S3 scientists;
  - engagement of consultants and commissioning of studies;
  - organisation of conferences/seminars/meetings/training courses of a technical nature;
  - authorisation of travel of researchers; setting up of demonstration plots; carrying out field level training activities;
  - approval and acceptance of payment, engagement of personnel, incurment of expenditure and accountability for delivery of efficient service with regard to contract research;
  - organisation of programmes for interaction between users and researchers incurring any expenditure involved;
  - the disbursement of all or part of the money received for contract research among individual researchers according to their contribution towards the project;

Note

Whereas the above are not exhaustive, they ~~are not exhaustive and do not cover all the aspects of decentralisation of power and authority in the institution.~~

~~The institution is of the view that decentralisation is only one side of the coin. On the other side is the mechanism to ensure that the Director/Division Head accepts the responsibility for efficient implementation. Higher authorities, having delegated powers, should concentrate on:~~

- formulating broad policies under which research will be conducted; monitor conformance to those policies;
- questioning those responsible why certain initiatives were not taken if such were called for to address the problems;
- systematically carry out "performance audit" of research programmes;
- if necessary fix targets for contract research; user interaction; research extension and similar key areas and ensure that targets are achieved.

### 2.3 RESEARCH PROGRAMMES

The Mission recognises that

1. past forestry research programmes have not adequately served the growing needs of the country since they have failed to reflect the changing goals of forestry development;
2. coverage of a wide and dispersed range of activities was attempted, thinly spreading the available resources; the concept of high input/high output projects with maximum priority has been lacking;
3. it is common practice for research projects to be initiated by researchers, rather than through consultation with users to identify problems;
4. in research institutes, the primary objective must be to solve problems that hold back development;

and recommends that

1. the approach to research programme formulation be analogous to medical research in aiming to cure the disease rather than merely to study it;
2. the first stage of programme formulation be the development of regional forest economy profiles, within a national perspective (see Section 3.3 for details);
3. the second step consist of translating the profiles and policy developed therefrom, into a programme; this should be done by the Director and senior scientists;
4. the third stage be the assignment of priorities by a Regional Consultative Committee;
5. the final stage be assignment of programme to researchers with full responsibility and authority for implementation;
6. during programme formulation, guidelines for establishing linkages be established and procedures for review and monitoring be indicated;
7. project workplans follow a standard format stating the problem to be addressed, the target group who will benefit, the reasons why it is important, the approach to problem solution, and refer to related research being done in India;
8. the programme be drawn up for at least three years, with provision for flexibility as justified;
9. research programmes be clearly responsive to regional conditions in the region for which they are conducted.

The Mission expects that implementation of these recommendations will identify ~~selected projects to be accorded the highest priority~~ and pursued vigorously to achieve an impact in the short term. This could include:

1. establishment of a sufficiently large number of field demonstrations in critical areas to provide the basis for optimal land use through multi-purpose forestry, including a positive bias towards introducing pasture, legumes and nitrogen-fixing trees in afforestation; the demonstrations should be highly visible, easily accessible and serve the purpose of extension;
2. development of economic techniques for the vegetative propagation of superior genotypes to increase productivity;
3. an applied research project to establish appropriate seed collection areas and seed orchards within the State Forest Departments, and to encourage and assist States in introducing the use of improved seed.

#### 2.4 MONITORING AND EVALUATION

The Mission recognises that

1. little monitoring and systematic evaluation of research projects and their impact has been carried out in the past;
2. there is a need for instituting appropriate procedures and time schedules for monitoring, evaluation and assessment of impact; as well as obtaining feedback and readjusting and redesigning research programmes;

and recommends that

1. an internal management system for the annual monitoring of the progress of research projects be established;
2. at the time of project formulation the objectives, activities and outputs of the project be clearly defined in quantifiable terms;
3. a procedure for evaluation be established which must involve some measure of independent assessment and take into account the cost-effectiveness of the project;
4. evaluation be carried out periodically (every three years) during the lifetime of the project and at the end;
5. after a lapse of time the impact of the project should be assessed; this will concern such aspects as whether the research findings have been accepted and adopted by the users and if so to what extent, what technologies have been effectively transferred, etc.;

## 2.5 COORDINATION AND LINKAGES

The Mission recognises that

1. a major role of ICFRE is to coordinate and fund research in the entire forestry sector;
2. institutions/organisations concerned with forestry-related research, whether within the forestry system or outside, have shared problems, common concerns and are working to find approaches that may be common;
3. cooperation among those concerned with research will lead to the avoidance of potentially costly duplication of efforts, shorten the time of research, encourage cross-fertilisation of ideas and eventually lead to enhanced collective self reliance;

and recommends that

1. ICFRE establish a National Information Centre at Dehra Dun which will have the objective inter alia of maintaining a database of all forestry and forestry related research in India; there should be branches of this Centre at all Regional Institutes;
2. ICFRE should encourage networking among institutions through organising meetings, seminars, common training courses, etc.;
3. ICFRE should ensure that as far as possible all relevant organisations are represented in the consultative and dissemination mechanisms;
4. the Directors of Regional Forest Research Institutes be made responsible for taking the lead in establishing and maintaining linkages within their region.

## 2.6 RESEARCH PERSONNEL

The Mission recognises that

1. low morale amongst scientists, duality of status between IFS and scientists is widespread and has a serious effect on productivity and quality of research;
2. there is a tendency for a single-track and single discipline attitude to problems and a reluctance for multi-disciplinary approaches;
3. flexible complementing will call for substantial changes in the evaluation and promotion of research personnel and flexible complementing, of itself, will not bring about those changes;
4. there is a serious lack of training in research management and methodology, and of opportunities to attend meetings or travel overseas;

5. there is a need for a regular inflow and outflow of staff;
6. promotion to the highest posts demands qualities in addition to purely scientific competence and that the appointment of research directors is critical;
7. skills in communication, research interpretation and recognition of field problems are undervalued by research workers and administrators;
8. the evaluation of personnel must be objective, and seen to be objective, using the sole criterion of research-effectiveness;
9. there is a tendency to overvalue basic studies to the detriment of applied research

and recommends that

1. the appointment of research directors be based on proven experience - whether scientist, IFS or from outside, and that small selection committees be established to actively search out appropriate people;
2. all research workers should be regularly exposed to field forestry or to forest industry or to other areas of application;
3. the use of short-term specialists for specific projects from outside the ICFRE sphere should be possible and encouraged;
4. consideration be given to the creation of a "specialist cadre" within the IFS - comprising researchers, extension officers, state service silviculturists and utilization officers, wildlife personnel, etc. - and that a study be commissioned from a specialist in administration of the feasibility of such a cadre;
5. ICFRE have funds available for overseas, as well as internal, travel of scientists who would gain and contribute the most from such experience;
6. where possible research staff should be involved in teaching and the supervision of students;
7. there should be increased mobility between institutes and other organisations both within ICFRE and outside, including temporary posting to the field;
8. retirement age should be raised to 60 years;
9. a personnel evaluation process be set up which will be independent and objective and work within published guidelines (see Section 3.5 for details);  
- the first step in setting up a mechanism for evaluation be abolition of the CR with respect to research personnel;

the evaluation process not be considered a promotion process, but rather one with options to promote, demote or retain in grade;

the current practice of allowing re-evaluation one year after denial of promotion be reconsidered;

there be no difference in the basis or method of evaluation of research performance between IFS officers on deputation in research and other scientists;

there should be no limit to the time that an IFS officer can work in research after a probationary one or two years - continuation should depend on the regular five year evaluation procedure; he should have no inbuilt advantage over scientists;

promotion to the highest levels must be dependent on proven research administrative experience (such as leader of a multi-disciplinary task force);

initially all appointments to Division Heads and above should be probationary and confirmed only after evaluation;

evaluation of research leadership be carried out on a regular basis by a method that recognises the different qualities demanded of research leaders;

10. an intensive programme of training be set up.

## 2.7 EXTENSION

The mission recognises that

1. the problem of reaching the people on the land continues to defy simple solutions;
2. education alone is not the answer since the subsistence lifestyle of such people necessitates a sustained supply of food and wood regardless of environmental conditions;
3. the regulatory role played by foresters has so far prevented them from acting effectively in an extension capacity;
4. different approaches are being pursued to extend tree cultivation to private and community lands;

and recommends that ICFRE

1. establish an Extension Directorate in each Regional Research Institute to provide liaison with the extension wings of state forest departments or other agencies responsible for forestry extension.
2. use field demonstrations, seminars, workshops, leaflets, and the mass media for disseminating research results and transferring technologies;

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3. ascertain in this context the most efficient and effective ways in which extension messages are transmitted and, more important, received by target groups;
4. promote people-oriented research as well as research into kinds of products to be produced, new benefits expected from trees, new organisational forms to promote people's participation, and legal measures to facilitate new land-use systems;
5. initiate action to prepare extension packages for individual target groups.

## 2.8 TRAINING

Training is indispensable for re-orienting and strengthening forestry research as well as increasing its internal efficiency and external outputs. Reorganization of research along the lines proposed by the Mission will demand more positive scientific direction and a better understanding of research management than has so far been required.

The mission recognises the importance of this and recommends that

1. training put strong emphasis on research methodology and management;
2. training efforts concentrate on tree improvement and clonal propagation methods as well as economic analysis, sociology, chemistry and engineering of forest products, and information and documentation;
3. while training abroad is necessary in some subjects, as much as possible of the training should be done in the work environment of the researchers;
4. foresters on deputation will need training in investigative thinking and research procedures, with a commitment to at least five years in a research field appropriate to their training;
5. scientists will need to be oriented to the discipline of closely problem-oriented research and to the applied aspects of Indian forestry;
6. Directors of the newly organized Institutes should be given intensive training in research management, including early opportunity to travel abroad to become acquainted with management procedures used in established forestry research organizations comparable to those envisaged in the new plan;
7. technical field staff should have training in effective field techniques of plot layout, measurements, data recording, and statistical methods;
8. clerical staff should have training in efficient clerical procedures, data storage and retrieval, and statistics appropriate to their work.

## 2.9 FOREST RESEARCH INSTITUTE - DEHRA DUN

The Mission has examined the proposals put forward by GOI and by the President FRI and recommends that

1. there should not be any immediate expansion of FRI until there has been an evaluation of all existing research schemes and a new research programme has been drawn up; (It is envisaged that this will be radically different from the present programme and reflect national and regional priorities)
2. expansion should be encouraged if it can be justified to solve critical forestry sector problems;
3. overall professional staffing be kept much the same as at present except that some loss on the forest products side be balanced by an increase in expertise in economics, econometrics, information science, extension and sociology;
4. the ratio between research and support staff be balanced;
5. an intensive effort be made to summarise, document in suitable format and if necessary demonstrate the results of relevant past research (this could be in conjunction with 1 above);
6. the proposed divisions be organised as follows:

<u>Division</u>	<u>Approx. no. Research Officers</u>
1. Silviculture	12
2. Forest Management	8
3. Ecology and Conservation	15
4. Social and Community Forestry	8
5. Genetics and Propagation	8
6. Forest Protection	21
7. Forest Botany	19
8. Forest Products	33
9. Harvesting and Logging	8
10. Minor Forest Products	9
11. Economics, Statistics and Operations Research	13
12. Information, Extension and Training	13
13. Himalayan Forestry (Simla)	10
14. Ranchi Centre	6
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7. there should be no sub-division into branches;
8. there should be an administrative unit to deal with financial and other organisational matters;
9. a deputy director of the FRI be appointed with necessary powers to act when the director is occupied with ICFRE business; (possibly combined with the proposed Director/coordination)

10. an attempt be made to separate the routine servicing functions of the FRI from research, if necessary by the employment and training of technical staff.

## 2.10 REGIONAL FORESTRY INSTITUTES (excluding Forest Products Research Institute)

The Mission has examined the proposals put forward by the GOI and agrees with the broad proposals as regards location and their areas of responsibility. It recommends that

1. the research divisions be rationalised within each institute and more emphasis given to social, economic and extension disciplines;
2. this emphasis be reflected in the staffing breakdown for each institute;
3. the research schemes outlined in the proposals are not accepted as given since the research programme and priorities for each institute will emerge after the planning process;
4. maximum effort should be given to a few selected key areas;
5. the equipment lists for each institute be rationalised and should only be taken as a guide at this stage;
6. each institute should have the following divisions with capability in their disciplines and new directions for development (only Jorhat will have Forest Products):
  1. Silviculture and Management  
The selection and establishment of species for intractable sites; economic analysis of silvicultural and management models.
  2. Ecology and Conservation  
Integration of land-use and capability assessment.
  3. Social and Community Forestry  
Optimisation of integrated silvi-pastoral and agro-forestry systems for livestock, crop-production and fuelwood.
  4. Genetics and Propagation  
Selection and clonal propagation of superior genotypes for both industrial plantations and multipurpose trees; provision of selected seed.
  5. Forest Protection  
Economic aspects of pest control; fire research, including socioeconomic studies.
  6. Forest Products  
Application of modern technology to village-scale industry.
  7. Coordination, Information and Extension  
Field demonstration of new techniques; networking with the public; popular science publications.
7. there should be a central administration unit to deal with all financial and other organisational matters.

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8. the present Sandal Research Centre be absorbed into the Regional Forestry Research Institute at Coimbatore;
9. the proposed institute at Jodhpur be developed initially as a Research Association with the ICAR funded Central Arid Zone Research Institute.

## 2.11 FOREST PRODUCTS RESEARCH

The Mission recognises that forest products research has the potential to contribute substantially more to the economic and social development of the nation and the people than is now being realized. This is particularly critical in the face of the many conflicting demands on the forest. Accomplishment of this contribution will require transforming the present efforts into an imaginative and service-oriented mould. The Government's new proposals are aimed at achieving this transformation.

The Mission recommends that

1. Forest products research be organized to enhance:
  - a) the use of wood as fibre to meet the literacy as well as the housing needs of a growing population;
  - b) the use of wood to meet agricultural needs such as implements, poles, posts, etc.;
  - c) the use of non-wood products to enhance rural employment and income opportunities;
  - d) the application of modern technology to village level production; and
  - e) the reduction of waste and improvement of product quality.
2. the proposed institute at Bangalore be named FOREST PRODUCTS RESEARCH INSTITUTE (FPRI);
3. programmes of FPRI include research on properties and uses, seasoning and preservation, timber mechanics and engineering, wood energy, fibre and chemical products, and application of modern technology at the village and small industry level;
4. capability for forest products research at FRI be continued, complementary to that at FPRI;
5. FPRI not duplicate the facilities available at IPIRI, but make use of IPIRI for appropriate parts of FPRI's research programme;
6. FRI not expand its facilities for pulp and paper research, but make use of the Central Pulp and Paper Research Institute;
8. The Director FPRI establish a network of professionals working in forest products research in India and convene an annual meeting to facilitate exchange of research findings and plans;

9. a small, but increasing, portion of forest products research be conducted on a "user pays" basis. To this end USER LIAISON UNITS (ULUs) should be established to maintain user orientation, promote research capabilities, help identify user problems, and seek external financial support from those who could benefit from such research.
10. As a means for achieving quick and effective solution of short-range, specific, critical problems, Directors form multidisciplinary TASK FORCES with definite time horizon and specific terms of reference.

### 3.1 The Roles of ICFRE

ICFRE is intended to become the most powerful agency promoting and monitoring forestry-related research in India. It is important, therefore, that it be enabled to concentrate on research policy (and the climate for research) rather than administration. To this latter end, it has a Management Committee (provided almost entirely from the Ministry Environment, Forests and Wildlife) and may appoint an Executive Committee and a Secretariat.

Despite its Dehra Dun base, it is envisaged that ICFRE's major role will be played in the regions, through its responsibility for the promotion and coordination of regional research - not only that done by agencies of IFS but in State Forest Services and other Organizations, both State and non-governmental. Its responsibilities are such that it must operate - and be seen to operate - at arms length from the Department. The Director-General of ICFRE is to discharge the functions of Scientific Advisor on Forestry to the Government of India; as such, he must represent the needs of the forestry sector as a whole - not merely the governmental part of it.

ICFRE, as well as taking responsibility for research policy, should provide a medium for public discussion of "issues and options" for forestry development and provide a vehicle for integrative sector planning. It must therefore, have wide powers of research funding - through other research institutes and individuals. It should be able to establish "Research Associations" - funded jointly with other agencies - to take advantage of existing infrastructure and to make the most of research facilities. The Central Pulp and Paper Research Institute (CPRI) and the Indian Plywood Industries Research Institute (IPIRI) provide opportunities for the establishment of jointly-funded, private and public sector, research associations, while the development of the Central Arid Zone Research Institute (CAZRI) as a joint ICFRE/ICAR Research Association - instead of the separate establishment of a parallel institute - would enable a precedent for jointly - funded departmental associations. The Zonal Research Stations of SAUs provide other loci for jointly-funded research.

There is a strong case for setting up regional sub-units of ICFRE, with access to broadly representative consultative committees representing public and private forestry and non-forestry interests. These committees would assist in the preparation of regional research programmes and in the over-view of institute linkages and joint projects. They would also serve an informal - but important - extension and public relations function. It is envisaged that they would comprise men and women of stature in the regional community, appointed as individuals, and having regard to:

Personal attributes; and the need for diversity of knowledge and experience in relevant fields.

In many countries at present, there is widespread discussion - even argument - about the application of the "user-pays" principle to research. Often, it is concerned as much with focussing the attention of research on practical, development-limiting, problems as it is with extracting funds from the users of research. The first objective is perhaps the most important in India. The involvement of consultative committees of regional ICFRE units should be viewed in this light.

As well as regional consultative committees, there will be a need for a body to develop national forestry perspectives for research. It might be expected that ICFRE itself would provide such perspectives. ICFRE, however, is dominated by foresters and comprises wholly governmental and quasi-governmental nominees (e.g. the University Grants Commission). There is no representation of wood-using industries, the private sector, planning bodies, economists. Surprisingly, the Economic Intelligence Service of the Centre for Monitoring India's Economy plays no role. ICFRE is simply not constituted to develop perspectives objectively and to evaluate the role of forestry and wood based industries in the national economy. It seems important, therefore, that ICFRE use its powers of co-option to widen the experience and expertise available to it.

A further role for ICFRE may be to serve as a coordinating channel for research components of internationally funded forestry projects accepted by the Government of India. Channelling all proposals through ICFRE should minimise the danger of unnecessary duplication in research. In the Asia-Pacific Region, such duplication has resulted from poor advice, over-aggressive salesmanship on the part of donors, and inadequate dialogue between representatives of donor agencies and, indeed the international agencies themselves. Forestry research is particularly prone to duplication for two reasons. First, it is a collection of very broad fields, touching the interests of many organizations. Within in the UN family in India alone, forestry-related research projects have been sponsored by FAO, UNESCO, ILO, UNEF and UNIDO. Second, it is a side-effect of the revolution in information technology. Nowadays, scientists tend to rely on computerized retrieval systems for references to previous work in their fields. In forestry, few such systems pre-date 1950 and most of them cover only the last ten years. Forestry research in India, however, pre-dates by decades the development of computers. At a recent workshop on forestry research sponsored by the East-West Center, six out of twelve "activities highlighted for immediate action" relate to the improvement of research coordination. The Mission, in its short visit, has found evidence of duplication of research in India. Perhaps the most important role which ICFRE might play would be to monitor and nationalise externally-funded research.

There is considerable scope in India for contract research and, again, a coordinating role may be foreseen for ICFRE and its regional units. Such research could be undertaken for both private sector agencies and other governmental agencies. The National Wasteland Development Board will undoubtedly need research, as may the private-sector afforestation companies. Within policy guidelines established by ICFRE, all the regional research institutes (not merely as at present - the Kerala Forest Research Institute) should be able to undertake contract research. In many countries, the proceeds of contract research are retained by the institute concerned and applied in part to further research, and in part shared between the researcher responsible for undertaking the contract and the staff of the institute in their entirety.

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ICFRE's role in commissioning research could be a powerful one, with a high "tooth to tail" ratio. ICFRE would determine a research programme and offer to fund it at an appropriate institute. It could retain technical direction and control, without the tedium of administration - or a financial commitment to indefinite extension. The Mission recommends that at least 20% of ICFRE's budget be applied to funding defined research. While funding University research might be undertaken for training purposes and the definition and direction of the research left with the University, commissioned research would remain strictly under ICFRE's control.

It is important that decision making be decentralised to the maximum extent compatible with the promotional and monitoring roles of ICFRE. Within a government system there cannot, of course, be financial autonomy but, once programmes have been prepared and budgets accepted, there is no reason why financial authority should not be delegated to Institute Directors to the extent that it rests with ICFRE (and subject to acceptable audit procedures). Present practices of highly centralized financial controls are counter-productive. They may be appropriate in a management situation; there are stultifying in research. Indeed, ICFRE should move, very early in its life, to instal an efficient and forward looking administration at the FRI, Dehra Dun. The ratio of research: support personnel at the FRI is 4 times greater than at the Kerala FRI. The "extra-mural" commitments of Dehra Dun (grounds, health centre, etc.) do not warrant such a difference.

Publication policies are of concern to researchers - particularly in developing countries where outlets are severely restricted. Authority to publish must rest with the Institute Directors and their management committees. But ICFRE should have powers of publication of research results, as well as information and policy papers which it considers merit wide consideration and public debate. ICFRE might also take some responsibility for promotional and public relations literature. Public misconceptions about research and forestry often result from failure in communication. Yet never before have there been so many information media available to scientists and offering semi-captive, thinking, audiences. The last decade has seen a huge increase in e.g. airline magazines, weekend newspaper supplements, hotel and "house" magazines of all kinds. They provide unrivalled opportunities for Popular Science - an art-form no longer disparaged as it once was, provided articles are truthful, easy to read and presented with flair. This is an area of extension - networking with the public - virtually ignored by professional foresters in India; it is a proper concern for ICFRE.

As well as publications which will promote the work of the Institutes among non-specialists, there is a need - particularly at the FRI, Dehra Dun, for a prestigious scientific annual, similar, to the "Annual Review of \_\_\_\_\_" (Plant Physiology, Biochemistry etc.) but concerned with forestry science. The FRI is quite big enough to support such a volume - containing in-depth, "state-of-the-art" reviews of worldwide developments in particular branches of forestry science. Standards of production as well as content would need to be high; but such a publication would do much to establish and enhance the reputation of India's forest scientists.

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An objective of forestry research is to service forest management. This normally involves more than the publication and dissemination of research results. The FRI, for example, is responsible for a national disease and insect survey, a forest soil and vegetation survey and maintenance of the forest inventory data bank. Apart from services traditionally provided by a research organisation, there is a growing need for the central collation and analysis of e.g. operational costings, forest products supply and demand projections, the provision of basic data for integrated sector planning, information on which to base market projections, and other services for management and policy-makers on a scale - and at level of sophistication - beyond the competence of the FRI.

The GOI has decided that ICFRE Headquarters will be at Dehra Dun. It is questionable, however, whether, FRI is an appropriate location for a servicing unit which will need constant contact with management, industries, planning units and other agencies located in the national capital, where communication with Dehra Dun is not always easily available.

Moreover, ICFRE's role in coordinating international aid for forestry research will involve regular contact with embassies and international agency offices - all of which are in Delhi.

The Mission recommends, therefore, that a satellite unit of ICFRE be established in Delhi to provide management, policy, planning and liaison services. ICFRE will also need a voice in Delhi to speak for forestry research in the corridors of power. The Mission considers it to be important that ICFRE be seen to operate at arm's length from the Department of Environment, Forests and Wildlife.

### 3.2 The Formulation of Research Programmes

In forestry research in India and in many other countries the way in which research priorities are set and programmes drawn up is, to say the least, curious. Projects are proposed and prepared by researchers who may be the least experienced and able to relate research needs to real-life problems. They are vetted by other researchers or former researchers and monitored "in-house". Often, projects are only exposed to independent evaluation by practitioners when their results are published. There are a number of ad hoc research committees under the State CCFs, but they seldom initiate research; rather, they react to proposals from researchers.

This system is not, of course, unique to India. However, in research institutes, the prime purpose must be to solve problems which are holding back development. In forestry, such problems are not only those of basic science but require applied and adaptive field research. Moreover, they have to be related to the regional economy and to the resources available for solving them.

#### THE MISSION RECOMMENDS THAT:

1. The approach to forestry research be analogous to medical - rather than pure science - research. Applied medical research begins by identifying disease problems. This is done not by researchers, but by experienced practitioners and diagnosticians. And the objective of research is not to study the disease but to cure it. This may, of course, require study of the disease mechanisms, but not inevitably. The resources which can be devoted to research (including clinical trials) are decided not by the researchers but by the community at large.
2. Programme be formulated in three stages, the first being preparation, within a national perspective of regional forest economy profiles. In these, demographic and economic data are reviewed, and forestry sector statistics summarized. The objects are to evaluate the role of forestry in the regional economy, to identify opportunities for forestry to contribute to development, to present a strategy based on "issues and options", and, finally, to analyse the research needed to achieve the stated objectives. Foresters, of course, have a role to play in the preparation of the profiles, but it is subordinate to that of economists, planners, and policy specialists. The profile provides a basis for resesearch policy.
3. The second step consist of the Regional Research Director, aided by senior scientists, translating the policy into a programme of research to which pricities can be assigned by his consultative committee (a committee dominated by users rather than producers of research). It is suggested that three levels of urgency be set:
  - a) a programme of high priority to be undertaken with no increase in resources (financial or technical);
  - b) programmes which are deemed necessary but which require additional inputs; and
  - c) research areas considered interesting and perhaps desirable but which would only be investigated at the expense of items under (a) or (b) and on the representations of the consultative committee.

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4. The final step is assignment of programme to researchers, with full responsibility and authority for implementation. The research programme is the starting point for staff allocations, budgeting, equipment acquisitions, etc., first identifying where the needed research might best be done. Only when the programme is agreed do the researchers become involved. Thus, the final stage sees the researchers - with the help of the Director - translate the programme into specific projects for the implementation of which they take total responsibility, and on the success of which they will be judged.

5. During programme preparation, guidelines be provided for establishing linkages with other institutions and individuals, and procedures for monitoring progress be indicated. At the project preparation stage, time-frames should be set, a network established (perhaps with a rudimentary critical path), the costs of the project precisely determined, and an attempt made to quantify benefits. It is envisaged that most projects will to some extent be multi-disciplinary and, in view of a perceived suspicion among some forestry scientists in India of multi-disciplinary co-operation, the responsibilities of collaboration may need to be set out in greater detail than would be the case elsewhere.

6. Project workplans state the practical problem being addressed - and the reasons why it is important - and should refer to related research being done elsewhere in India, as well as the traditional "literature review."

7. The research programme be drawn up for at least 3 years (in view of India's apparent predilection for 5-year modules, a 5-year programme may be more appropriate), but it should be revised and updated annually. It is considered essential that the Institute programmes be published and circulated widely among practitioners and other researchers.

Research programmes must not, of course, become rigid. There must always be flexibility and the facility to respond to unforeseen but important problems (such as disease epidemics) and there will be continuing needs - at all Institutes - for routine servicing from facilities which are best located regionally (e.g. local species identification, simple routine testing - standards control, etc.). The effectiveness of the Institute in responding rapidly to ad hoc demands is a measure of the competence of the Director and the system.

8. Research programmes be responsive to regional conditions. If research programmes are to be relevant to practical needs, they will vary from region to region. In 1978 the Asian Development Bank prepared a working paper on Forestry and Forest Industries, acknowledging the disparities which exist with respect to resources, population and development levels between its member countries. It proposed a classification of "forest economies" to provide a basis for the consideration of appropriate development strategies. The parameters which determine forest policies (and research strategies) are the extent of forest resources (per capita) and the level of industrialisation. The following categories were recognised:

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1. Deficient in per capita forest resources and at a low level of industrial development (e.g. Pakistan)
2. Deficient in forest resources but, industrially, relatively advanced (e.g. Korea)
3. Possessed of significant forest resources at a low level of industrial development (e.g. Burma)
4. Having significant forest resources and at a high level of industrialisation (e.g. Philippines)
5. Abundant forest resources, at low industrial levels (e.g. Papua New Guinea)
6. Restricted-size economies ("highlands and islands") with inadequate forest resources (e.g. Kiribati)
7. Restricted economies with abundant forest resources (e.g. Solomon Islands)
8. Highly industrialised, with inadequate raw material resources (e.g. Japan)
9. High industrialised, with abundant resources (e.g. New Zealand)

The Mission believes there would be merit in classifying India's regional economies in a similar (not necessarily identical) fashion, as a basis for developing regional research policies. It is important that the boundaries of regional responsibility for research be economic as well as eco-geographical. Only when research can be related to regional development needs, can the "core" programmes for the institutes be decided.

What should emerge from the regional profiles is a set of problems which may be seen to be national - and best tackled centrally at the appropriate "specialised" institute - and a series of "core" research strategies for the regions which relate to specific regional problems. Some areas such as "social forestry" and "tree improvement" may be considered as core projects in every region and there could be merit in further subdivision with respect to regions. For example, social forestry to help solve tribal problems in reserved forest areas (a matter of concern for many decades) involves community-based forest industry rather than tree planting; in some regions, agro-forestry components will be more important than fuelwood forestry and so on. Similarly, with respect to tree improvement, different regions will be concerned with different species groups - all of them involving multi-disciplinary, ad hoc, research. There could be merit in assigning species groups to the regional institutes but confining research on techniques of tree improvement (including tissue culture) to a single specialist institute. ICFRE will ultimately be responsible for approving all research programmes and it will need to ensure that duplication is prevented. As noted earlier, the criterion for allocating national research projects must be "comparative advantage", whether resulting from geography or the possibility for establishing productive linkages with other scientists.

### 3.3 Forest Economy Profiles

During the late 1970s, forest economy profiles were prepared for some 15 of the ADB developing member countries. They followed the publication of a staff working paper on forestry lending policy and were intended to provide background data for the development of specific national loan proposals. They attempted to assess the socio-economic roles of forestry in the country as well as its commercial functions, identifying "opportunities and constraints" on development. Profiles were issued for inter-alia, several Pacific Islands, as well as Nepal, Thailand and the Philippines.

The Mission believes that the preparation of regional profiles for India would facilitate the identification of research needs relevant to the regions and "affordable". The following outline is proposed:

1. Introduction:

Definition and location of the region. Objectives and purpose of the profile.

2. The Economic Background

Demographic and socio-economic features of the region; agricultural and industrial contribution to GNP; regional features and implications of national planning.

3. The Forestry Sector:

Summary data on forest resources; state and private forests; ecological features of natural and man-made forests, forest industries; inter-and-intra-regional trade in forest products; employment; inter-relationships of the forestry sector with agriculture, secondary industry, etc., forestry-related institutions, state and private.

4. Opportunities and Constraints on Forestry and Forest Industries Development:

Issues and options.

5. The Role of Research:

Needs and priorities; investment and manpower implications; putative costs and benefits.

6. A Forestry Sector Research Strategy:

Conclusions; linkages; inter-regional and national implications.

Based on ADB experience, a team of 3 consultants (1 generalist forest, 1 economist, 1 forest industries specialist) together with experienced counterparts, should be able to prepare a regional profile in 3-5 weeks - depending on data availability (including private sector and non-forestry data). It would be important that counterparts be appointed in the disciplines of the consultants and desirable that the Director-designate of the respective Regional Institute be closely associated with the preparation of the profile.

### 3.4 A Specialist Cadre

Poor morale among forestry researchers in India, especially at Dehra Dun, is acknowledged to be widespread. In part it seems from differences in terms and conditions of employment between members of the IFS on deputation and scientists recruited directly into research. It is exacerbated by differences in promotion prospects between the two cadres and, in both by excessive reverence afforded seniority in matters relating to status and advancement.

Nor is the devastating effect of low morale on research productivity and quality, appreciated. By any standards, the recent record of forestry researchers in India is unimpressive (there are, of course, exceptions). In overseas forestry research institutions, a publication record of at least one paper - research or extension - per year is an accepted norm. It is achieved by many Indian research institutes - but not in forestry. There are of course contributory factors other than morale. But of all the constraints on effective research, poor morale is the most pervasive. When it derives from discrimination (real or imagined) it should be addressed with urgency.

In science, effectiveness can be the only criterion for advancement in a mature society. And, unlike management - where effectiveness may be in part related to seniority - scientific achievement is often the product of young and lively minds. But forestry research in India also needs the experience and expertise of the practising field forester. To staff the research institutes only with non-forestry scientists would heighten the already excessive tendency to over-value basic studies to the detriment of applied research. The problem is to enable transfers between research and IFS field posts, without perpetuating the present duality of status (and the stigma of second-class citizenship which non-IFS scientists feel attaches to them).

If forestry research is to obtain the maximum benefit from such movement, it must be 2-way. There have to be opportunities for all researchers, not just forest scientists, to become exposed to field forestry; similarly, there need to be outlets for "failed researchers" to be given opportunities to achieve effectiveness in another field. Motivation of researchers is complex and mistakes in personnel selection can be costly. The facility to transfer out of research is an important safeguard.

There is a more immediate consideration. The reorganisation of forestry research in India involves the appointment of 5 Research Institute Directors as well as several senior research administrators. In the present climate, with a shortage of senior research scientists within the system (and apparent reluctance to appoint outsiders), there is a danger that these posts may be filled as an interim measure, by IFS officers, without a long-term commitment to research. There is a further danger that because of the slow promotion of pure scientists in the past, there will be pressure to use the flexible complementing system to redress grievances, and that the number of promotions available will be used up before the new institutes have had an opportunity to show their mettle. The same grievances will then re-appear and any improvement in morale and research effectiveness will be temporary only.

A possible solution to these problems considered by the Mission involves the creation, within the IFS of a "Specialist" cadre - comprising researchers, extension officers, forest service silviculturists and utilization officers. There is already a need in several States for EDF specialists and economists. With the development of forestry plantations, there will be a call for entomologists and pathologists to serve in field posts, outside the research organizations. The probable increase in State Forest Department research capability will need experienced personnel. It is envisaged too that the forest services (including research institutes) may need to recruit from time to time short-term specialists for specific projects from outside the ICFRE sphere - from universities, other departments, and - most importantly - from the private sector. The need for interaction between forestry research and the private sector has yet to be seriously, acknowledged in India. ICFRE has an opportunity to grasp an initiative which will have far-reaching consequences.

The creation of a specialist cadre within the IFS could accommodate the various disciplines and backgrounds required in these posts, without disrupting the existing terms and conditions for IFS officers. The main justification for reviving the all-India Service was (reportedly) the need for personnel mobility. The same argument applies to the specialists envisaged here.

Two further benefits to research might result from the creation of a specialised cadre: the first relates to multi-disciplinary cooperation, and the second to in-service perception of extension.

A strong impression gained by the Mission from discussions with researchers is of a single track approach to problems. This is not limited to forestry researchers. At CAZRI, for example, animal management researchers were unwilling to discuss optimal tree spacing in silvipastoral systems, referring the Mission to the silviculturists. Similarly, the foresters were unwilling to discuss livestock densities under the same systems. This single mindedness does not auger well for multi-disciplinary projects and calls for stronger technical direction, which may be easier within a specialist cadre - in which scientists and extension specialists confer on equal terms.

The status of extension in forestry is also a cause for concern. In advertisements for staff of a new forestry department of an agricultural university, extension specialists rate only half the salaries of junior teachers. At the research institutes, also, formal extension tends to be assigned to the least experienced in field practice; while the military-type discipline which characterises the forest services is counter-productive in the kind of informal relationships needed for effective extension among, for example, peasant farmers.

The Mission believes that skill in communication, outreach activities, effectiveness in research interpretation and, equally important, the feedback from field practices to research, should be valued and rewarded equally with research. The establishment of a specialist cadre within the IFS would enable more than lip-service to be paid to extension.

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The Mission had insufficient time in India to examine the implication of the proposal to establish a specialist cadre with the IFS vis-a-vis terms and conditions in parallel fields of e.g. CSIR, ICAR, State Forest Services, etc. It proposes, therefore, that a study be commissioned from a specialist in Administration of the feasibility of the proposed cadre. It is suggested that relationships between research and management in State Corporations as well as in GOI Departments of Mines and Railways, be examined for possible precedents.

### 3.5 The Evaluation of Researchers

Major changes in the organisation and administration of forestry-related research in India - and the introduction of flexible complementing-call for substantial changes in the evaluation and promotion of research personnel. Unfortunately, the issues are clouded by the co-existence of IFS officers on deputation to the FRI (and, presumably not subject to flexible complementing) and non-IFS scientists. It seems to be tacitly assumed that flexible complementing will bring about parity in "terms and conditions" and equality of opportunity for promotion between the two categories.

It should be made clear to all research personnel at the outset that flexible complementing of itself will do nothing of the sort. Grievances will remain or re-emerge. As noted earlier, there is a danger that flexible complementing may be used, not to reward research effectiveness but to redress imbalances. Until a system of evaluating research effectiveness, applicable to all researchers - whether IFS or not - is introduced, flexible complementing will only paper over the cracks.

#### THE MISSION RECOMMENDS THAT:

1. Caution be exercised in the use of flexible complementing in its initial stages of reform. The quota for promotion is said to be 30; since there must be a 5-year interval between promotions (accelerated promotion appears not to be contemplated), it would be unwise to "use up" a substantial part of quota until such time as a mechanism is in place for independent, objective, evaluation of research personnel.
2. The first step in setting up such a mechanism should be the abolition of routine confidential reporting with respect to research personnel. (in the case of IFS officers on deputation this would involve the suspension of C.R. during the period of deputation). Regular reporting on performance in research is of course necessary, but there can be no justification for secrecy. Personnel evaluation must be objective, and seen to be objective, using the sole criterion of research effectiveness.
3. In the process of reorganisation, before any research staff appointments are confirmed, and as a regular procedure thereafter, all researchers should be evaluated by an independent panel. Moreover, the factors to be considered in the panel evaluation (and the weight attaching to them) should be publicised.

One arrangement of the factors to be considered that is used widely is the following:

<u>Factor</u>	<u>Weight</u>
1. The nature of the assignment; complicating factors, complexity.	1
2. Supervision received; degree of independence of action	1
3. Creativity and originality required in the assignment	1
4. What does the person bring to the assignment. Contributions that advance the field and important	2

Demands by scientists to be evaluated only by their "peers" (and carrying the assumption that only graduates in their particular discipline have any claim to peerage) should be firmly rejected. The assessment panel should be the same for all researchers in each Institute. It could comprise three individuals - one from field forestry, one senior researcher from a CSIR or ICAR Institute (or similar) and one with experience of personnel appraisal from a university or the private corporate sector. It could also be made up primarily of scientists.

The Researcher would be required to present material to the panel before-hand in a written format, describing the four factors as they apply to his/her assignment. He or she would appear before the panel to be questioned, in the presence (or absence, if he so wishes) of his supervisor. The Institute Director would not be present; in fact he would play an informal role in the evaluation, but his written comments would be invited on the research competence of each member of staff (and shown to each individual).

The panel would work within self-imposed (and published) guidelines and would design its own procedures. It should be able to call for evidence to support submissions - from colleagues as well as supervisors. The terms of reference would emphasise its role in the evaluation of performance, not personality. Membership would be rotational and for a period covering not more than two assessment periods (presently envisaged as 5 years, but possibly reducing to 3 years - in which case each member would serve for 6 years, with one member retiring after each assessment). The details of membership of the Panels remain to be worked out - what is important is their independence and integrity.

--- An evaluation panel could be expected to review about 100 researchers over a period of 3 weeks, taking from 15 minutes to 2 hours over each candidate. Alternatively, it could meet for a few days to evaluate perhaps 4 to 6 researchers per day. It is obviously important that researchers feel they have been fairly treated in relation to their colleagues - even though they may disagree with the system (and make-up of the panel) initially.

4. The evaluation process not be considered a promotion process, with panels free to recommend promotion, retention in grade, or demotion, as appropriate.

5. The current practice of allowing re-evaluation one year after any failure to be promoted be examined. The mission considers that a minimum of 3 years is necessary.

6. There be no difference in the basis or method of evaluation between IFS officers on deputation in research and other scientists. In both cases they should be expected to work to a programme given to them by their Institute Director. There can be no room in a problem-oriented research organisation for intellectual snobbery.

7. Evaluation of research leadership be carried out on a regular basis. Research leadership demands qualities in addition to scientific competence. This may be considered in future. Initially, all such posts should be probationary. Research leaders (including Institute Directors) who do not perform competently as leaders should be reassigned.

### 3.6 Forestry Extension

In India, as in many other parts of the world, the problems of reaching the people on the land in forested areas continues to defy simple solutions. Education alone is not the answer, since the subsistence lifestyle of such people necessitates a sustained supply of food and wood regardless of environmental considerations.

The traditional regulatory role played by foresters has so far prevented them from acting effectively in a more educational or advisory capacity. This is rapidly changing, however, as social and multi-purpose forestry becomes more widespread and, in consequence, public demand for information about tree planting on private and community lands increases.

Pressure on forest land in India is expected to grow in the future. Because of this, foresters must build up a carefully-designed system or systems of extension, education and information to the public, not in order to persuade or manipulate but to establish a basis for dialogue and understanding of the fact that responsible forest and tree-crop management is built upon scientific research and with sustained yield as a goal.

At present, many different approaches are being pursued in India to extend tree cultivation to private and community lands, depending on the local situation and based mainly on the initiative and creativity of foresters responsible for social forestry. The Mission is of the opinion that the time has come to improve forestry extension practices and make them more efficient throughout India by establishing appropriate structures and organisations at both Central and State levels. It also suggests that a study be conducted to ascertain the most effective ways in which extension messages may be sent to and, more important, effectively received by target groups, in particular, those at the grassroots level in rural areas. ICFRE is in a good position to give direction to such a study.

The most effective pattern of forestry extension requires a functional approach. This means that designers must, in cooperation with the people concerned, define goals which are of importance to the people and decide on the steps that must be taken to achieve these goals. The goals themselves must be clearly defined if the process of achieving them is to operate effectively. The goals are often related in some way to national policy. This may be based on broad studies which have been carried out of overall national needs, followed by the establishment of priorities in both tasks and areas requiring attention. For instance, the supply of fuelwood may be considered a national priority. Certain areas in which the shortage is acute may be designated for priority attention and within these areas certain groups of people may be in greater need than others. It is these groups which should be considered high priority target groups for extension.

A study can be undertaken to define the needs and to devise a suitable means of reaching the groups which have the greatest need for fuelwood. Assessments can be made of suitable communication techniques to help the people to become aware of their situation and to offer possible solutions to the problem. When this has been done the people can be assisted to choose a course of action to meet their needs and to determine if any outside assistance is necessary to make this possible. Assistance can be given in training some of the community members to take a leading role in the communication, the discussion or the execution phases of the process.

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Joint monitoring by the people and the organisation supplying assistance can be established to determine effectiveness of the procedures adopted. The approach to be adopted can be characterised as an approach through the community, as it is only through community action that progress can be made. ICFRE must establish a mechanism for the dissemination of research results and transfer of technologies to individual farmers; State Forest Departments; other Government Departments such as Railways, Public Works and Mining; State Forest Development Corporations and companies. This may be done through:

- (a) setting-up a specialist district level forestry extension service;
- (b) giving the responsibility to the existing district forest office;
- (c) utilising an extension service covering general rural development;
- (d) using an extension service in one of the sectors of agriculture; or
- (e) establishing a project organisation.

The Mission recommends that ICFRE investigate the options in the order given above. However, even if a specialist forestry extension service is usually the best alternative for any district, provided resources are available, it should be noted that a uniform type of district organisation does not have to be chosen for the whole country. For example, in areas where most of the land is agricultural and no significant forests exist, the resources of another extension service may have to be utilised for forestry extension, while special units formed for forestry extension may be more appropriate for mountainous or mainly forested areas.

The Mission also recommends that an Extension Directorate be established in each Institute to liaise with the Extension wings of State Forest Departments or other agencies responsible for foresting extension. For the transfer of technologies field demonstrations, seminars, workshops, leaflets and the mass media should be used, as appropriate.

Because its goals and methods are very different from large-scale commercial forestry, forestry extension programmes require new kinds of research. The State Forest Departments and other institutions which fund forestry research must re-adjust their priorities in order to bring about this re-orientation. Research institutes and universities must begin new types of forestry projects, and research students should be encouraged to concentrate on problems related to forestry extension projects. The following is an indicative list of areas in which research efforts are needed for forestry extension:

- kinds of products to be produced;
- new benefits expected from trees;
- new organisational forms to promote people's participation;
- legal measures to facilitate new land-use systems; and
- socio-cultural aspects

Most of these are problems of applied research, where it is important to ask questions which are relevant to practical situations. The research must be jointly undertaken by foresters and researchers, to avoid asking the wrong questions, and to prevent misinterpretation of research results by field personnel.

It is clear from the above list that extension-oriented forestry research must be inter-disciplinary, encompassing the social and behavioural as well as the agricultural sciences. However, experience elsewhere has shown that multi-disciplinary research is difficult to achieve. The best way to implement this kind of research appears to be to assign qualified researchers in the different disciplines to work in a loosely coordinated network or in ad hoc projects.

### 3.7 Training

Training is indispensable for re-orienting and strengthening forestry research as well as increasing its internal efficiency and external outputs. The Mission recommends strong emphasis on research methodology and management training. It also urges concentration of effort on tree improvement and clonal propagation methods as well as economic/econometrics/economic analysis, sociology, social forestry, chemistry of forest products and information and documentation including forestry extension.

While the Mission sees much value in training abroad in areas for which there are no adequate local training facilities, it also believes that there is much advantage in providing as much training as possible in the work environment of the researchers. This applies particularly to such areas as research methodology and management training through short courses. Indeed, ICFRE should establish a time-frame for training, both in-service and institutional, as soon as possible. A training matrix is given in Annex 4.

IFS Officers on deputation and scientists recruited directly into FRI usually have different training backgrounds. The former may have had no formal training in research methodology, while the latter come from a range of university disciplines and (most probably) with a bias towards basic research. To become effective researchers, foresters need to be introduced to investigative thinking and research procedures while university-trained scientists will have to be orientated to the discipline of applied and more closely directed research than they are accustomed to.

Given the rather rigid teaching methods which characterise in-service training, forest officers drafted into research need early exposure to the atmosphere of intellectual curiosity which should exist in a university, as well as formal training in research methods, (problem analysis, literature search, experimental design and methodology, data logging and analysis, deductive reasoning, <sup>the</sup> impact analysis, cost benefit evaluation-even the art of writing-and in/use of particular research tools (equipment, computers, etc.) such training may often best be provided away from the ~~fore~~ service environment, in an overseas institution (university or research institute). Because of the costs involved, it is important that the training provided be utilised in the service of Indian forestry; all too often, foresters - expensively trained in particular fields-are posted to jobs which provide no opportunity to exercise their particular skills. The Mission is of the opinion that a research training programme for forest officers should be structured and be followed by a commitment to at least 5 years in a research field appropriate to the training prevailed.

On the other hand, scientists with post-graduate qualifications at recruitment will need induction into areas specific to forestry; and this is best done in India. Given the duality of present "terms and conditions" of IFS officers and scientists in research, it will be important to ensure that overseas training does not become a perquisite of foresters. The sooner that "dual citizenship" is abolished, the better.

The reorganisation of research along the lines proposed by the Mission will demand more positive scientific direction than hitherto. Institute Directors and division chiefs will need to understand the management of research and the ways in which it differs from other kinds of personnel management. The Mission proposed that, when research directors are designated, they attend a course in "research management".

The Mission also recommends that courses be organised for technical field staff in such areas as experimental plot lay-out, field measurements, data recording and statistical methods and for research clerical staff in data storage and retrieval as well as the statistics appropriate to their work.

### 3.8 FOREST PRODUCTS RESEARCH

Recommendations relating to forest products research are considered here separately because of the unique channels of implementation and the unique professional skills and facilities in the physical sciences and engineering called upon in this broad field. Unique also are the associations and working relationships with industry, universities, non-governmental organizations, and others working in this sector. It is particularly important, however, that the essential tie to the forest not be lost. Forest products research must continue to be an integral part of the overall forestry research effort. Interaction among researchers and users of research results in forest products and those in others areas of forestry must be kept strong and effective, so that all problems will be solved most effectively.

Overexploitation of forest resources has resulted in increasing shortages of wood raw material for industries. This is particularly true of saw logs and veneer logs, which have been imported in considerable quantities in recent years. From the national viewpoint, comparative advantage lies in substituting both sawn wood and plywood with reconstituted boards (e.g. particleboard, flakeboard, fiberboard) which use plantation grown wood.

#### THE MISSION RECOGNIZES THAT:

India's forest resource has the potential to contribute substantially more to the economic and social development of the nation and its people than is now being realized. This is of particular concern during this time when forest resources are under severe pressure to meet the many needs of fuel, timber, food, fodder, and others required by an increasing population and a growing economy. However, accomplishment of this contribution will require creative new approaches to using that resource effectively and economically, as well as to producing and managing it. Accomplishment will require transforming the present efforts into an imaginative and service-oriented mould. The Government's new proposals are aimed at achieving this transformation.

#### THE MISSION RECOMMENDS THAT:

1. The following areas of concentration and need be given particular attention in developing programmes of forest products research:
  - a) identifying and solving the problems and introducing new technology to the existing forest industries;
  - b) providing sound technical and economic assistance to entrepreneurs for establishing new forest based industries;
  - c) encouraging the processing and use of forest products from social forestry projects in order to create new employment and income opportunities for local communities.

These are designed to encourage focus on the new possibilities for effective use of forest resources that are emerging from current efforts in social and community forestry while not detracting from the increasing needs of the on-going forest industries.

2. To give specific attention to emerging needs, forest products research be organized to promote:

- a) the use of wood as fibre to meet the literacy as well as the housing needs of a growing population;
- b) the use of wood to meet agricultural needs such as implements, poles, posts, etc.;
- c) the use of non-wood products to enhance rural employment and income opportunities.
- d) the application of modern technology to village level production; and
- e) the reduction of waste and improvement of product quality.

Programme Structure

3. The proposed institute at Bangalore be named FOREST PRODUCTS RESEARCH INSTITUTE (FPRI).

The term "forest products research" is more accurately descriptive of the broad range of research to be undertaken in the new institute. It is anticipated that this will include studies of chemical derivatives from wood, forest products other than wood, and related subjects.

4. Programmes of FPRI should be structured to include:

- Wood properties and uses.....8 scientists  
Wood structure and anatomy, evaluation of properties for non-structural uses, wood substitution, silvicultural and tree improvement effects on wood properties.
- Wood seasoning and preservation.....9 "  
Seasoning methodology and schedules, preservatives and their use, natural durability, biological deterioration and its control.
- Panel products manufacture and engineering.....9 "  
Physical and mechanical properties of panel materials and factors that affect them, structural grading of panel materials (including non-destructive testing), structural design, construction methods.
- Wood energy.....4 "  
Gasification, charcoal manufacture, efficient use of wood-based fuels for domestic and industrial energy.
- Fibre and chemical products.....6 "  
Chemical products of wood and bark, gums, oleoresins, non-wood products and their processing.
- Wood use in village industry and farming....6 "  
Application of modern technology to small scale industry, integration of wood into the socio-economic structure of rural communities.

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-Information, documentation, and extension...2

Packaging information for use at the local and industrial levels. Demonstrations, workshops, field days, films, TV spots, and other means of transmitting applicable technology to those who need it.

These are intended only as general indications of the research areas to be taken up and the number of scientists to be assigned. Final designation of research programme and personnel details should be based on identification and analysis of the problems to be solved, their priority, and the research skills needed to solve the most urgent ones.

5. Capability for forest products research at FRI be continued, complementary to that at FPRI, to meet the special needs of utilization of north Indian species. That capability will also be essential to maintain national forest products research capability while the FPRI is becoming established. Experience gained and data bases developed over years of research at FRI will be critical to the effective operation of future research efforts.

6. FPRI should not duplicate the facilities available at IPIRI and should make use of IPIRI for appropriate parts of FPRI's research programme. The concept of a formal research association should be explored as a means of strengthening and using most efficiently the research capabilities of the two institutions.

7. In view of the urgent need to conserve and provide for effective use of a timber resource that is limited in size, quality, and volume, it is particularly important that an effort be mounted by both FPRI and IPIRI to expand use possibilities for fibre- and particle-based panel materials. This will involve determining application potential in the market and devising ways to process panel materials to meet the needs of those potential applications. It means identifying the market and the performance and economic requirements to enter that market, then learning how to make panel materials to meet those requirements.

8. FRI should not expand its facilities for pulp and paper research, but should make use of the Central Pulp and Paper Research Institute (CPPRI) on a contract/cooperative basis. Facilities for research in pulping and papermaking are specialized and expensive. Research in this area at FRI should concentrate on relating it to characteristics of the resource and to special problems that are not in the programme of CPPRI. Effective coordination of this effort will require FRI/CPPRI/user consultation on a regular basis.

### Research Coordination

8. The Director FPRI should establish a network of professionals working in forest products research in India and convene an annual meeting to facilitate exchange of research findings and plans. This would provide an effective mechanism for coordinating research among FPRI, FRI, KFRI, and Jorhat, as well as among researchers at universities and other research institutions. It would also foster the informal contact that is ultimately most effective.

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9. Regular, at least annual, meetings should be convened by the Director FPRI to bring together researchers of FPRI with those working in related fields in the Indian Institute of Science and the State Agricultural University of Karnataka as a means of facilitating cooperative research, particularly in the physical sciences and engineering.

#### User Orientation

10. A substantial portion of forest products research should be conducted on a "user pays" basis. Initially this could be about 10% of the total budget and it could increase to about 40% within 10 years. This would have the valuable function of maintaining the user orientation of the research program. To this end USER LIAISON UNITS (ULU's) should be established, especially at FPRI and FRI, to promote research capabilities, help identify user problems, and seek external financial support from industries, state and central government departments, rural development agencies, and others who could benefit from such research.

11. As a means for achieving quick and effective solution of short-range, specific, critical problems, Directors of FPRI and FRI form multidisciplinary TASK FORCES with definite time horizon and specific terms of reference. These would typically be composed of 2 to 4 scientists with leadership by the scientist most involved in the problem, regardless of seniority.

12. Specific provision be made for planning and carrying out routine testing of forest products with minimum disruption of ongoing research when this is needed for research at other centers.

#### Recruiting and Staffing

13. In meeting the critical need for key research staff for units in forest products research, especially for the new institute to be established at Bangalore, it will be important to extend the search more broadly than is usually the case. In addition to the usual sources of wood scientists and technologists, industries, universities, and other scientific and technical bodies should be searched. The search should seek outstanding physical scientists and engineers (chemical, structural, mechanical, and industrial), as well as outstanding biological scientists and economists whose skills are needed to contribute to these programmes.

#### Teaching and Training

14. Scientists in forest products research units take advantage of unique opportunities to teach in institutes and universities and guide graduate students in fields related to their research. This should be particularly possible at Bangalore, in conjunction with the Indian Institute of Science and the State Agricultural University of Karnataka. Teaching and the supervision of students will keep researchers abreast of latest developments in the field, require them to meet the mental challenges of alert, inquiring, doubting students, and assist in attracting into forest products research university faculty and graduates who have unique interests and qualifications for such work. (See earlier section dealing with Research Personnel).

15. These scientists also participate in training of state utilization officers. This would increase the capability of such officers to serve as effective partners in both transferring new research-based technology to those who need it and identifying research problems. It would also assist the researcher to maintain user orientation in planning and carrying out his work.

### 3.9 NATIONAL INFORMATION CENTRE

The role of ICFRE in coordinating forestry-related research throughout the country means that it will need to be aware of all on-going research projects in both the private and public sector. This could best be achieved by setting up a computer database which could be accessed by all those concerned with research particularly in the setting up of new research programmes and projects. Once such a database exists it would be possible to produce regular lists of projects in progress, or recently completed, by various subjects, regions, forest types, species, etc. Some thought would need to be given to exactly what information was to be included in each project record. This should not be too detailed but must include details on where further information on the project can be obtained. It goes without saying that the utility of such a system depends on regular updating.

A logical extension of such a database is a more comprehensive system in which the actual results of research are available for retrieval. This could allow, for example, retrieval of all available information on a particular species from seed characteristics to end use properties, or all economic analyses for a specific agro-forestry system.

Another role of ICFRE is to ensure that those carrying out research have access to published literature both from within India and from outside. The scope, coverage and emphases of a forestry bibliographic information service must be dictated by its clients. In this case 'forestry' must be broadly defined and include 'non-forestry' work relevant to forestry. The service should also take a liberal attitude to the inclusion of 'unconventional' or 'grey' (semi-published) literature, but should try to avoid 'low-grade' popular, ephemeral or trade publications, that contain no new information.

A bibliographic information service has an interest in all of the closely related complex of activities that include: primary publishing; essential 'library' work (meaning especially the acquisition and storage of literature); classification and indexing; cataloguing and abstracting; 'alerting' and 'selective dissemination of information'; retrieval and document delivery; state-of-the-art reviews and special bibliographies; and expert information and enquiry answering services. For this reason the service has to use a battery of techniques to achieve its aims. The management problem is to keep these various activities in balance, and related to the changing needs of the users. The concept is of an active information service, that seeks out potential users, and takes the initiative in supplying, or at least offering, useful information. Details of an Indian Forestry Information Service were given in the report prepared by CDA(UK) and given to the GOI in 1984.

New technology is available that can greatly facilitate the transfer of information. In particular a combination of computers and microforms would answer many of the present needs in India. Some constraints are imposed by the current state of telecommunications, but the effects of this can be minimized.

Various approaches to the computer-based supply of information for both researchers and management are currently being considered or implemented in the forestry sector in India. The establishment of any new Centre would need to liaise and cooperate with all such ventures.

The Mission recommends that a National Information Centre be set up at Dehra Dun with remote sub-centres in the Regional Forest Research Institutes and Kerala Forest Research Institute. Linkages should be established with all potential users of the services such as SAUs, State Forest Research organisations, the Indian Institute of Forest Management, ICAR institutes, etc.

The objectives of this Centre should be twofold:

1. the establishment of a computer-based storage and retrieval system for all current forest and forestry-related research projects; and
2. the development of a bibliographic information service, culminating in an Indian Forest and Forest Products Abstracts.

#### 4. AREAS OF POTENTIAL DONOR ACTIVITY

The mission discussed potential donor activity with various agencies. There was general expression of interest and some specific suggestions. The Mission puts high priority on 1, 2, and 3 and on all training suggestions and reemphasizes the recommendation that ICFRE should coordinate all donor activity.

1. Preparation of regional forest economy profiles to facilitate the identification of research needs relevant to the regions.

2. Establishment of linkages between ICFRE and overseas research institutes/universities to enable regular exchange visits and cooperative research programs to be undertaken.

3. Assistance in setting up a National Information Centre at Dehra Dun with regional sub-centres; assistance with library organization and book/periodical acquisition.

4. Purchase of research equipment, particularly that requiring foreign exchange and especially for equipping the new FPR at Bangalore. For the most part, this should be delayed until research programs and related equipment needs have been more thoroughly developed.

5. Survey of the market potential and performance requirements for panel materials based on veneer, particles (including flakes or strands), and fibre. Forest products supply and demand prospects in various regions.

6. Assistance to ICFRE in training personnel at all levels (Director through technician) for the reorganised research institutions. Two such proposals are already under preparation by FAO and ODA.

7. Support for short term visits by scientists and research administrators from research institutions in the developed world. These would be to consult on programme development and implementation, as well as on specifics of research in specialised areas.

8. Support for short term visits by Indian Directors and scientists to research institutions in the developed world and in other developing nations that face problems similar to those of India.

9. Support for exchange of scientists between Indian research institutes, as well as between those in India and those in other countries. To be effective, this should allow a high proportion of exchanges of sufficient duration to allow full participation in conducting research at the host institution.

10. Survey of the performance of preservative-treated wood in service and determination of performance requirements for economical application of treated wood.

## TRAINING FOR RESEARCH, PLANNING, MANAGEMENT AND IMPLEMENTATION

## TRAINING MATRIX

## AREAS TO COVER AND TRAINEES

(1 = awareness 2 = understanding 3 = skill)

Trainee Subject-matter Area	Director- General	Institute or Centre Director	Programme Leaders or Directors	Other Researchers and Ancillary Staff
Programme Ident- ification and Planning	3	3	3	2 for Research Officers 1 for Ancillary Staff
Financial Management	3	2	2	3 for Finance Officers 1 for others
Personnel Management	3	3	2	3 for Personnel Officers 1 for others
Communications	2	3	3	3 Research Officers 3 for staff responsible for public relations
Documentation and Information	1	2	3	3 for Research Officers 1 for others
Operational Management	1	2	2	3 for Transport and auxiliary service
Monitoring and Evaluation	2	3	3	3 for Research Economists
Extension	2	3	3	3 for Extension specialists
Leadership and Team work	3	3	3	3 for Research Officers and Support Staff
Research Methodology	2	3	3	3 for Research Officers 2 for Research Support Staff
Specialisation/ Research Training	1	2	3	3 for Research Scientists

11. Survey of the trends in plantation establishment and their effects on wood properties and use characteristics.

12. Survey of the work being done at other institutions in India on improving the efficiency of use of wood for fuel. This would include derivatives of wood (charcoal, gas, etc.) and the processes through which they are derived.

13. Support for assistance in developing standards and grading procedures for panel products to improve product quality and dependability for particular uses.

14. Support for professors and graduate students in departments of engineering and science at Indian universities to conduct research in fields related to forestry and forest products. This could be a rich source of potential researchers and research cooperators for the ICFRE research institutions.