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COMPOSITE REPORT
OF THE WATERSHED ASSESSMENT TEAM

assembled by the Government of Indonesia and USAID
between March 28 and May 7, 1983

WITH TECHNICAL REPORTS IN THE DISCIPLINES OF:
WATERSHED MANAGEMENT, FARMING SYSTEMS, SOIL AND
ATER CONSERVATION, LIVESTOCK, FORESTRY AND TREE CROPS,
ECONOMIC EVALUATION, HUMAN RESOURCES DEVELOPMENT,
and INSTITUTIONAL DEVELOPMENT

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Jakarta, Indonesia
14 May 1983
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D. Muljadi D.M. Ramsay

Joint Team Leaders

Jakarta

14 May, 1983

Composite Report of the Watershed Assessment Team

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GLOSSARY

AAETE	:	Agency for Agricultural Education, Training and Extension (BPLPP: Badan Pendidikan, Latihan dan Penyuluhan Pertanian) Ministry of Agriculture
AARD	:	Agency for Agricultural Research and Development (Badan Penelitian dan Pengembangan Pertanian) Ministry of Agriculture
AIC	:	Agricultural Information Center (BIP: Balai Informasi Pertanian)
ATDC	:	Agricultural Technical Development Center
ATDSC	:	Agricultural Technical Development Sub Center (Both ATDC and ATDSC are found in the Jogjakarta Rural Development Project)
BAPPENAS	:	Badan Perencanaan Pengembangan Nasional (Agency for National Development Planning)
BAPPEDA I	:	Badan Perencanaan Pembangunan Daerah Tingkat I (Agency for Regional Development Planning at Provincial level)
BAPPEDA II	:	Badan Perencanaan Pembangunan Daerah II (Agency for Regional Development Planning at District level)
BIMAS	:	Bimbingan Massal (Mass Guidance)
BKK	:	Badan Kredit Kecamatan (Sub-District Credit Institution) in Central Java.
BKPD	:	Bank Karya Produksi Desa (Rural Production Bank) in West Java
Bank Desa	:	(Village or Rural Bank) in East Java
BPD	:	Bank Pembangunan Daerah (Provincial Development Bank)
BLK	:	Balai Latihan Kehutanan (Forestry In-Service Training)
BLPP	:	Balai Latihan Penyuluh Pertanian (Agricultural In-Service Training)

BPP	:	Balai Penyuluhan Pertanian (Rural Extension Center: REC)
Bupati	:	District Head
Camat	:	Sub-District Head
DINAS	:	Technical Line Agency at Provincial or District Level
GBHN	:	Garis-Garis Besar Haluan Negara (Basic Policy Guidelines)
Gubernur	:	Governor
ISTC	:	In-Service Training Center
Kabupaten	:	District
Kecamatan	:	Sub-District
Kepala Desa	:	Village Head
LKMD	:	Lembaga Ketahanan Mayarakat Desa (Village Self Reliance Group, functioning as Village Council)
PEMDA	:	Pemerintah Daerah (Provincial or District Government)
PKP	:	Pembantu Khusus Penghijauan (Special Assistant of the Bupati for Regreening)
PLP	:	Penyuluh Pertanian Lapangan (Field Extensionist for rice, secondary crops and horticulture of Mass Guidance Program)
PPM	:	Penyuluh Pertanian Madya (Extension Supervisor)
PPS	:	Penyuluh Pertanian Spesialis (Agricultural Extension Specialist)
P3DAS	:	Pusat Pengembangan Pengolahan Daerah Aliran Sungai (Watershed Management and Development Center: WMDC)
P3RPDAS	:	Perencanaan Pembinaan dan Pengembangan Reboisasi dan Penghijauan Daerah Aliran Sungai (Reforestation and Regreening Planning and Supervision for Watershed)
PINLAK	:	Pimpinan Pelaksana (Assistant Implementation Administration)
PINRO	:	Pimpinan Proyek (Implementation Administration)

PUPT	:	Panca Usaha Ternak Potong (Intensification Program for Beef Cattle)
PUSP	:	Pengembangan Usaha Sapi Perah (Dairy Cattle Business Development)
PUSKESWAS	:	Pusat Kesehatan Hewan (Animal Health Center)
PUSPENMAN	:	Pusat Penerangan Masyarakat (Information Office at District Level)
RCP	:	Rural Credit Project
REC	:	Rural Extension Center
SPP	:	Sekolah Pertanian Pembangunan (Agricultural School for Development)
TDC	:	Technical Development Cell (in Jogyakarta Rural Development Project)
UDKP	:	Unit Daerah Kerja Pembangunan (Development Coordinating Unit)
WKPP	:	Wilayah Kerja Penyuluhan Pertanian (Working Unit for Agricultural Extension)

EXECUTIVE SUMMARY
of the
Composite Report of the Watershed Assessment Team

1. Introduction

1.1 General

The Team, composed of 8 Indonesian members and 8 expatriate members, worked together from 28 March to 7 May, 1983 to assess the present state of watershed management in Java through a study of completed and ongoing projects. These projects included: the National Regreening Program, the Brantas River Basin Project, the FAO Solo I and II Projects, the Yogyakarta Rural Development Project, and the Citanduy I (Panawangan) and II Watershed Project. Field visits were paid to all the above areas to assess the content, structure, operation, constraints and impact of the different programmes and projects. As a result of this exposure the team made an objective assessment of the situation on Java and offers the following suggestions to Government to relieve what it considers to be the major weaknesses in the present ambitious effort to reduce soil and water degradation and increase the productivity of upland watersheds, particularly on Java.

1.2 Problem Definition

The basic problem is one of too many people being concentrated on too small a land base, with the situation in Yogyakarta and Central Java being relatively worse than that in East and West Java. As population pressures increase, cultivation has been pushed further up the hillsides thus bringing steep slopes and vulnerable land under sedentary cultivation with consequent massive increases in erosion. Erosion rates in the Solo basin from sedentary rainfed cultivation with no

conservation measures range from 3 to 5 mm/year on land up to 5% slope to 23 to 38 mm/year on steep land of over 50% slope. These rates of soil degradation in Solo are typical of the prevailing conditions found in all of Java's major watersheds. Viewed against the natural rate of soil formation of about 1 mm/year, these rates are alarming.

Land at present under upland rainfed cultivation in Java can be divided into 4 categories:

i) Moderate slopes (up to 50% slope) with good soil depth: This class of land is estimated to cover some 1.8 million hectares. The main components of a technology package for this land class, which will result in increasing productivity and improving ecological stability, already exists and is being extended on a limited basis. Work remains to be done in fine-tuning the package to make it more site-responsive.

ii) Steep slopes (over 50% slope) with moderate to deep soils: This class of land is estimated to cover some 425,500 hectares. At present the technology base is inadequately developed. Some promising technology does exist but requires extensive field testing under Javanese conditions before being widely recommended.

iii) Steep slopes with poor soil: This class of land is estimated to cover some 863,500 hectares on Java and should be under a permanent vegetation cover. This does not necessarily mean forest trees; fruit, spice or fodder trees would be equally suitable and could be combined with grass in a silvi-pasture system. Much more work is required in this area to develop suitable technology packages for widespread use.

iv) Critical land which is so degraded as to be unable to sustain even subsistence farming: This class of land was estimated in 1980 to cover approximately 1.0 million hectares. It is estimated that critical land is increasing by 200,000 hectares per year while the Regreening Program reclaims some 125,000 hectares per year. Even after rehabilitation, steep land should not be returned to annual cultivation.

A considerable amount of technology for dealing with the first two land classes is in place but additional applied field research is needed to adapt it to local conditions, both physical and socio-economic in Java. While additional applied research is necessary and desirable for these land classes, the central problem confronting the government is the need to develop effective institutional structures to facilitate the disemination of available technology.

Steep slopes with poor soil should be under some form of permanent vegetation cover, but this does not necessarily imply a forest tree cover. Silvi-pasture with fruit trees, or a plantation crop (e.g., coffee) initially or permanently under shade trees, are possibilities which should be investigated. A vast area of applied research is open here.

With respect to the fourth class, even though such land can be rehabilitated, it is clear that these steep and highly eroded lands should not be returned to sedentary cultivation after rehabilitation. This poses the problem of what to do with the people presently occupying these lands; it would seem they should be given the highest priority for transmigration.

The long-term solutions to the problem of increasing population pressure and concomitant over-use of land are seen as:

- family planning,
- transmigration,
- the creation of additional off-farm employment,
- increasing the productivity of the land within an ecologically stable system coupled with afforestation or reforestation of sites unsuitable for agriculture.

The government has accorded high priority to both family planning and transmigration and is making excellent progress. Within the framework of the up-coming Fourth Development Plan, much greater attention should be given to developing strategies and programs to promote off-farm employment and to increase the productivity and ecological stability of the nation's upland resources. The Watershed Assessment Team was tasked with assessing present conditions and offering constructive suggestions for improvement in this latter area of priority concern.

1.3 Main Issues

The main issues which the team addressed fell into: technical considerations, human resources development, and institutional aspects, each of which is summarized below.

2. Technical and Economic Considerations

2.1 Farming Systems Approach

The main theme central to the development of upland agriculture in any watershed is the need to adopt a farming system approach. In its application to Java, the farming system approach consists of a package of technology which generally contains five components. These are: soil and water conservation, cropping systems, livestock, forestry and tree

crops, and economic evaluation. Inland fisheries is another important component of the farming system in some areas of Java and should be included wherever the environmental and water resource conditions permit. In turn, each of these components consists of a number of elements. In any given area the appropriate farming system will depend on the local site conditions and the aspirations of individual farmers. While much work remains to be done in fine-tuning the components and elements to make them more site-specific, it is considered that, in general, sufficient knowledge exists on the major components to enable them to be assembled into effective farming systems applicable to conditions on Java and recommended for adoption by farmers.

2.2 Soil and Water Conservation Component

In the soil and water conservation component, the lack of an adequate system of land suitability classification in which the optimum use of land can be based is seen as limiting. The Team also focussed on the different conservation practices which are available to make the point that the present exclusive focus on bench terracing, especially in the Regreening Programme, should be complemented with the introduction of other simpler and hence cheaper measures on some sites. In considering subsidies as an incentive to implementation, the view is endorsed that subsidies for the construction of conservation measures, such as terraces, are fully justified. Information and research results generated through universities and other institutions does not always reach the field, and in the opposite direction, feed-back from the field of problems requiring solution is also slow. Regular seminars are suggested as a way to improve communications. There is also a need for more conservation oriented research, including basic research to compile and analyze data on rainfall, run-off and soil loss, and applied and on-farm research on alternative conservation measures and their effects, and to validate such work under farm conditions.

On the question of the siting of check dams, it is recommended that professional assistance be obtained from engineers of the Public Works line Agencies.

2.3 Cropping Systems Component

In considering the cropping systems component, the Team noted that a considerable technological base has been developed by the Solo I and Panawangan projects and from other work in Java and that this technology can be directly transferred to new target areas thereby enabling these projects to concentrate on implementation and expansion. The Team stressed, however, that field based, site specific applied research support from universities and institutes is insufficient to deal with problems and constraints encountered in adapting the general technology package to specific site conditions. Rather than slow down implementation, it is recommended to accelerate on-site research to fill gaps in the technology. A series of "field-laboratories" where such work can be undertaken should be established on sites which are representative of the main agro-ecological zones in Java. Further it is imperative that a workable scheme for the production and distribution of seeds and planting materials be implemented as soon as possible.

2.4 Livestock Component

Under the livestock component, the Team stressed the important contribution animals can be make to the overall viability of the farming system. In fact, for farmers with minimal land holdings, livestock offers not only supplemental employment opportunities but should be explored as a first source of income, particularly in areas of low soil fertility. The present focus is on sheep and goats; other livestock should be considered in relation to local conditions, as should combinations of different animals. Grass testing should continue, but on a wider base and more emphasis should be placed on trees and shrubs as sources of fodder. Finally, better marketing facilities for livestock should be encouraged; all too frequently local markets are dominated by one or two traders who dictate prices.

2.5 Forestry and Tree Crops Component

The Team's analysis of the forestry component indicates that tree planting programmes on steep slopes can be successfully developed but that the majority of upland farmers who have limited land grow only food crops, regardless of slope conditions. A range of options, suitable to local conditions, should be developed and offered to the farmers. Suggestions emphasize the introduction of fruit trees or spice trees instead of forest species or dual purpose species such as Leucaena for both fodder and wood production. These could be grown in association with grass under a silvi-pasture system. This latter implies the incorporation of a livestock component into the farming system. Another leguminous tree, Glyricidia, can be managed on a 3-year coppice rotation for firewood with an annual return (at 1983 prices) of Rp 200,000 per hectare. More applied research is needed to develop upland farming systems on steep land which incorporate tree crops which are both technically sound and socially acceptable.

2.6 Economic Evaluation Component

An examination of this component shows that the adoption of improved cropping systems on terraced land of less than 50% slope and under demonstration plot conditions significantly increases both employment and returns to labour. Net farm income increased per year from two to six times the pre-development level, depending on the site. By including an animal component in the system the net returns would be further increased. A cautionary note is introduced to underline that all components are interdependent and if one breaks down, the incentive to adopt associated complementary elements will be reduced. The main lesson here for site managers is that the system recommended to any farmer must be in accordance with the ability of that farmer to manage that system. Special training in this area is required by site planners and implementors.

Compared to the lowlands, upland agriculture has received minimal assistance by way of irrigation infrastructure, extension services, credit programmes, road building, and finally research to improve productivity. In consequence, upland farmers have lower yields and are poorer than their lowland counterparts. Beneficiaries of upland development will be not only the farmers directly affected, but include, as well, the downstream farmers who benefit from reduced flooding, improved water quality, and reduced siltation of reservoirs and canals. Just as lowland farmers are not expected to pay the cost of irrigation infrastructure works, equity considerations suggest that the subsidization of upland infratructural development (terraces, etc.) is appropriate and should be considered as an income transfer from urban and rural lowland populations to rural upland populations, who will not in any case capture on-site all the diverse stream of benefits which are generated by the development works.

On the question of credit, poor farmers with limited resources will be unable to adopt the improved technology without the provision of non-collateral credit. The absence of an institutionalized credit program for upland households constitutes a major constraint to broad based diffusion of upland conservation and productivity increasing technology. As the recommended packages are economically attractive, production credit should be made available without subsidization. Repayment schedules should reflect the time period required to obtain the expected income from the investment.

Projects should be designed to facilitate the evaluation of their impact, which will help in modifying and improving delivery systems. Special efforts should be made to monitor early adopters of a technology package (a farming system) and to incorporate the lessons learned into the evolving programme so as to accelerate expansion.

2.7 Main Recommendations to Relieve Constraints

Recommendations are back-referenced to the original section of the Summary in which they were made.

Farming Systems 2.1-1: Fine-tunning of the components and elements to make them more responsive to local site conditions is required. This can be accomplished through the establishment of "field laboratories" in representative agro-climatic zones.

Soil Conservation 2.2-1: No system of Land Suitability Classification has been evolved on which field-level decisions regarding optimum land-use can be based. A suitable classification system should agreed to and made operational.

-2 In the Regreening Program excessive importance appears to have been given to bench terracing at the expense of other simpler treatments which are appropriate to certain classes of land and land-use.

-3 Subsidies for the construction of conservation measures are justified.

-4 The two-way exchange of information between universities and other Research Institutes and the field, and in the opposite direction of problems needing solution from the field, could be improved.

-5 There is a need for more research, both basic and applied; the latter at "field laboratories" and on-farm sites.

Cropping System 2.3-1: The lack of adequate research support to solve problems encountered during the implementation of projects and programmes is emphasized. Rather than slow down implementation, it is recommended that applied research activities in suitable field laboratories should be accelerated.

2.3-2 There is an urgent need to establish a workable system for the production of seeds and planting materials.

Livestock 2.4-1: For owners or tenants with minimal land holdings, livestock should be explored as a first source of income.

-2 The present focus is on sheep and goats but other animals should be considered as well, as should combinations of different animals.

-3 Grass testing should continue and be expanded to include fodder trees and shrubs.

-4 Better marketing facilities for livestock are required.

Forestry 2.5 -1: A range of forest tree species and tree crop species suitable to different conditions should be prepared and offered to the farmer occupying steep land.

-2 Dual-purpose species such as Leucaena for the production of both fodder and wood should be used more widely.

-3 More applied research is needed to develop systems incorporating tree crops on steep land.

Economics 2.6-1: Development works on upland sites (terracing, etc.) should be subsidized in the same way as irrigation structures on lowland sites are subsidized (i.e., in neither case are the beneficiaries required exclusively to bear the cost of the structures).

-2 The absence of a viable credit program to support upland households constitutes a serious constraint to the rapid diffusion of ecologically sound and productivity increasing technologies. Non-collateral credit should be provided to subsistence farmers with limited resources; otherwise they will not be able to avail themselves of improved technology packages. Repayment schedules must reflect the time period required to obtain the expected income from the investment.

-3 Subsistence farmers require the annual provision of production credit, but as the recommended technical packages are economically attractive, no subsidy element is required.

-4 Projects should be designed in such a way that their impact can be measured and any modifications to improve acceptance and delivery systems incorporated.

3. Manpower and Training Requirements

3.1. Introduction

The wide range of social, economic and technical factors involved in the development and implementation of programs for watershed improvement demand that manpower for these programs represent a wide range of knowledge, experience and skills. Not only must disciplines such as soil and water conservation, upland farming systems, forestry, animal science, agriculture economics and rural sociology be represented, but they must be integrated in a coherent plan of action of education, research and extension. The following discussion addresses the training needs for farmers, field technicians and professional staff.

3.2. Potential For Meeting Manpower Needs

In a program expansion such as the one being projected for watershed development, it is important that the potential supply of manpower for program expansion be considered. Studies of educational trends and existing manpower studies indicate that needs for priority programs in agriculture can be met during the coming decade. The following comments are relevant to this point.

3.2.1. Technician level manpower

a. The government of Indonesia and donor agencies are making a concerted effort to improve the output of agricultural high schools. This includes programs to train teachers and to develop facilities.

b. Universities are developing a number of diploma (S_D) program courses "on demand" to meet critical needs. This activity is expected to grow rapidly in the next decade.

c. Revised World Bank estimates show only a 3% demand/supply gap given a total demand of 146,300 middle level technicians by the end of the Fourth Development Plan.

3.2.2 .Professional Level Manpower

a. The student body (S_1) of 52 agro-complex faculties in Indonesia has been expanding at a rate of 23%/annum during the past decade and is projected to continue to grow at rates of 8-10%/annum.

b. The number of graduate (S_2, S_3) students in agriculture and environmental studies has grown from less than 100 in 1975 to approximately 1000 in 1983.

c. World Bank estimates show a positive balance in the supply of professional level graduates by the end of the Fourth Development Plan.

3.2.3. General Comment

World Bank estimates reflect rapid growth in middle level technicians between 1981/82 and 1988/89, as follows:

Forestry	-	320%
Estate Crops	-	240%
Livestock	-	200%
Food Crops	-	166%

These are areas which will play an important role in watershed development.

3.3. Training Needs

In addition to specific subject matter deficiencies, the Team has identified 3 problem areas which relate, at least in part, to manpower and training. They are:

- Too little input of farmers into the technical packages
- Lack of adaptation of technical packages to local needs
- Too little flexibility in the technical package at the field level

Training plans developed by the watershed development projects visited should be adequate to overcome technical deficiencies of the field staff; however, they are not yet achieving the desired results.

The training target groups for the development and implementation of watershed improvement activities are the farm families, key farmers, field level technicians (PPL's and PLP's at the village unit level), middle level extension workers (PPM's at the Rural Extension Center (BPP) level), subject matter specialists (PPSs at District Agricultural Services and watershed sub-centers. Training is also needed for technical staff of related services at sub-district, district and provincial level.

3.3.1. Farm Families

The training need is to increase skills in integrated upland farming systems. The approach of the training should be group learning based on learning by doing. A group of farmers have a greater opportunity to solve their problems by working together on a demonstration farm supervised by field level technicians. In this connection, the role of key farmers who are early adopters and who serve as leaders and organizers is very important. Emphasis should be continued to implement this basic concept of training which involves the farmer in the decision making process needed to select and apply appropriate practices.

3.3.2. Extension Workers

a. Field level technicians

The training need is for increased comprehension and skill in upland farming systems, increased skill in communications, and increased leadership capability. This can be achieved through revision/improvement of curriculum and teaching methodology in SPPs (Agricultural Schools for Development), SMTPs (Secondary Agricultural Vocational Schools), BLPP (Agricultural In-Service Training Centers), and BLK (Forestry Training

Centers). Subject matter on upland farming systems, soil and water conservation, social communication, and agricultural extension should be included in the curriculum. Teaching methodology should place emphasis on adult education. The use of a field laboratory is also very important in reinforcing skills in the technical as well as in the social fields. In order to meet the demand for field level technicians with higher qualifications, diploma programs should be initiated for field personnel. These training programs should be designed to improve technical knowledge and sharpen observational skills of the extension workers.

b. Middle level extension workers

The training need is for developing skills in management (M.B.O., productivity, motivation, leadership), for increasing comprehension and analytical skills needed to incorporate problems of watershed management in agricultural extension programs at the BPP level, and for increasing skills in guidance and supervision techniques. This training need can be fulfilled through in-service and upgrading training in BLPP, BLK, and on-the-job training supervised by the PPS. To meet future demand for higher professional qualifications for the PPM, S_0, S_1 training should be offered.

c. Subject matter specialist

The training need is for developing improved comprehension and skill in watershed development, increased skills in action research, and increased comprehension and skill in extension program development and evaluation. The training need can be fulfilled by BLPP and BLK and by workshops and seminars by P_3RPDAS. Future graduate/post graduate training should be offered through in-country as well as fellowship programs. This training should prepare the PPS to more effectively incorporate appropriate technical packages in extension programs and to provide stronger technical support to field technicians.

3.4. Recommendations

3.4.1. Pre-service Training

1. The curricula of training institutions (agricultural high schools, universities and training centers) should be adjusted to give more attention to the needs of field personnel in watershed development. This would include greater emphasis on:
   a. upland mixed farming systems
   b. basic soil and water conservation practices
   c. agricultural extension methodology

2. Field and classroom contact between P3RPDAS staff and students of training institutions should be increased through class visits to watershed development areas and the use of P3RPDAS staff as guest lecturers for seminars and workshops.

3.4.2. In-service Training

1. A comprehensive training program for field technicians, key farmers, professional staff, managers and policy makers similar to that projected for Citanduy should be developed for each watershed area. However, the following factors should be given stronger emphasis:

   a. Key farmers and field personnel should be involved in a continual learning process through more effective use of demonstration farms and experimental areas as field laboratories for training purposes. This practice would also increase field contact among field staff, specialists and researchers, and should broaden the extension workers' knowledge of improved practices and sharpen observational, practical and analytical skills.

b. As the pre-service curricula are adjusted to include some of the technical subjects presently taught through in-service programs, more attention should be given at the project level to field as opposed to classroom training.

2. A participatory extension approach similar to that used in the Kali Sendang (FAO Solo II) pilot area should be used for farmer training. This includes:

- the use of farmers' meetings to motivate participants
- the use of demonstration plots to provide farmers an opportunity to see and to practice new farming skills
- the use of farmer action groups to decide what practices will be implemented on their individual farms

3.4.3. General

1. The level of formal education for watershed development staff should be improved. As farmers become better educated, there will be a need to increase the quality of formal education at all levels. This will also provide incentives for field staff who may otherwise feel themselves to be in a dead-end situation.

2. A technical committee should be appointed to develop training programs for watershed development personnel and to coordinate training programs at the SPP, Project, Training Center, and University levels.

3. Consideration should be given to broader involvement of training institutions in watershed development projects, especially those institutions providing graduate training for professional staff. Such cooperation would not only promote graduate study and research activities in the area but would also provide a channel for feeding field problems into the program of instruction.

4. Institutional Aspects

4.1 Beneficiary Participation

This concept is clearly implied in the Pancasila State Ideology as well as the Basic Policy Guidelines (GBHN). Experience both in Indonesia and abroad has shown that unless the ultimate beneficiaries are actively involved in the planning and implementation of development projects, the projects are unlikely to achieve their goals. Although the village (desa) remains a viable administrative unit, experience indicates that hamlets (dukuh, kampung) have greater viability as social organizations for effective participation in development activities at the real grassroots level. At village and lower levels, voluntary farmers' organizations are non-existent. As an alternative, the Village Self-Reliance Group (LKMD) seems a viable alternative but should include non-formal leaders and representatives of upland farmers' groups and other farmer interest-groups to facilitate representation of perceived needs and means for their satisfaction.

There is a gap between District Government (Kabupaten) and the beneficiaries. To help bridge this gap it is recommended to activate the UDKPs at the sub-district level (Kecamatan) level and to involve the Rural Extension Centers (BPPs) and Field Extension Workers (PLPs) with the aides (Mantri) of the Camat, not only in planning but also in implementation.

4.2 Institutional Arrangements

To achieve beneficiary participation as suggested above, there are three management principles which should be observed. These are:

i) Decentralized management: Because of the wide variations in agro-climatic zones and social and institutional environments which characterize Java, a structure which places responsibility and authority at the lower levels of government is the only practical way to manage the diverse conditions and specific needs

of upland watersheds. Additionally, the multiple choices which will become available for the development of these areas rule out a monolithic approach as in the BIMAS programme, and makes local decision-making an essential ingredient for success.

ii) Unified Management: The second principle which should govern institutional arrangements for watershed development flows logically from the justification for decentralized management. If the responsibility for watershed development is most appropriately placed at provincial or lower levels of government, officials at those levels need to be vested with sufficient authority, including effective budgetary control, to insure the unified and coordinated management of the various human, technical and financial resources that are required for successful introduction of improved practices. The resources required for watershed development (e.g., research skills, extension, and credit) reside within several technical ministries. All of these resources must be mobilized and allocated in an integrated manner if a sustainable process of upland development and watershed conservation is to be achieved.

iii) Budgetary and Credit System Flexibility: The final principle essential to the successful execution of a watershed development program is the need for budgetary and credit systems that are sufficiently flexible to accommodate the inevitable variations found in any effort to introduce technology in diverse agro-climatic zones and to farmers with varying income levels, sources of employment and attitudes towards risk.

These principles are examined in relation to three ongoing programmes/projects with the following results.

a) National Regreening Programme.

An examination of the organization reveals certain weaknesses.

The separation of the planning-supervision function and the implementation function in very different institutions means that neither the regional government nor the line agency can effectively be held accountable for the results of the program. This institutional separation also disperses limited skilled manpower between units with overlapping and essentially competing jurisdictions.

In sum, planning is overly centralized. The separation of planning and implementation in different institutions and the predominance of one functional ministry are obstacles to unified management. The use of targets set by central government to drive the system and the application of nationally standardized inputs despite tremendous agro-climatic variations even on Java are detrimental to both decentralization and flexible budgeting. Significant institutional and procedural modifications of the present P3RPDAS program are required if the management principles articulated by the Assessment are to be effectively applied.

b) Citanduy II Project

The Citanduy II project is widely expected to demonstrate an improved approach. By decree issued by the Minister of Agriculture, the function of the P3RPDAS was augmented and personnel were seconded from various Directorates General in order to accomplish integrated planning and supervision of all agricultural activities in the watershed. Apparently the seconding of personnel from central agencies, locating them in the basin, and supporting them with a ministerial decree has not yet been accompanied by the transfer of sufficient authority to make this system fully effective. Regional government has been vested with the responsibility for expansion of upper watershed activities and hence coordination between regional government and P3RPDAS

is essential. However, the formal mechanisms created outside the regular government structure to ensure coordination have been ineffective.

Project design gave careful attention to balancing the positions of three implementing ministries. To accomplish this, project activities were funded through multiple budgets and coordinating teams were established at two levels. Experience thus far with the Project indicates that mechanisms established outside the regular government structure, such as the Basin Coordinating Team, are not effective at coordination and integration of operations. Such mechanisms seem to be more effective at the national level for dealing with policy issues and administrative bottlenecks. Further, the funding of Project activities through 24 different budgets has been a major handicap to unified management and timely delivery of inputs and services. For these reasons, Project Citanduy is unlikely to provide a convincing model of institutional arrangements for future replication, but based on experience gained in Citanduy it is possible to propose a better system.

c) Jogyakarta Rural Development Project

Many of the problems mentioned above are less severe in the Jogyakarta Rural Development Project. Management and financial authority are clearly located in the provincial planning board (BAPPEDA); thus decentralization is achieved at the provincial level. By virtue of authority given through Law No. 5/1974 and Presidential Instruction 27/1980, the BAPPEDA effectively coordinates agencies involved in implementation through the Agriculture Technical Development Centers and effectively controls the entire project budget. This financial control is accomplished through a consolidated budget.

While problems are minimal in this project, this is probably a reflection of the small size and tight administrative structure of the special province, and some doubt must remain as to the wider applicability of the organizational arrangements.

4.3 Institutional and Budgetary Recommendations

The experiences to date with the above projects are sufficient bases for the following recommendations:

1. Provinces, districts (kabupaten) and subdistricts (kecamatan) should be re-emphasized as the fundamental units for the organization of upper watershed management in both planning and implementation, in line with the concept of decentralized management advanced by the Assessment Team. An alternative, organizing by watershed, is conceptually attractive, yet there are no functions presently being performed in the National Regreening Program or in the upper watershed component of Project Citanduy that could not be performed equally well on a provincial or district basis.

2. Management of watershed management activities should be strengthened through a Presidential Decree that would establish special supervisory bodies at the national, provincial, district, and subdistrict levels. This is needed to further specify the policy of decentralized but unified management mandated in UU 5/1974 and KEPRES 27/1980 because it would authorize operational management lower than Kabupaten (i.e., Kecamatan) and mandate an inter-agency approach to watershed development at all levels of government. See Figure No. 4.3. The coordinating bodies that now exist at the national and provincial levels under the National Regreening Program might be utilized, provided they are vested with sufficient authority. Such bodies should be established at lower levels as well, and they should be strengthened at all levels through the proposed Presidential Decree (KEPPRES). The proposed Presidential Decree should vest these supervisory bodies, particularly at the provincial and district levels, with sufficient authority to insure unified management of watershed development interventions within their jurisdiction, including control over all budget resources, including those budgetary resources traditionally allocated to technical line agencies.

3. Watershed development programs require financial arrangements different from most of those currently in use. The necessity of a farming systems approach and the nature of the task which involves adaptations to conditions at the lowest operational level imply that a watershed program should not be structured like most INPRES programs. Most of the INPRES programs (DATI-I and DATI-II excepted) give too little discretion and initiative to the local level in allocating funds to particular projects, locations and items within given types of expenditure. Flexible budgetary procedures at the field level are essential to enable local decision-makers to effectively respond to the inevitable variations found in any effort to introduce technology to varying agro-climatic zones and to farmers with varying income levels, sources of employment and attitudes toward risk. To achieve this budgetary flexibility, one possibility would be to combine the special INPRES Penghijauan and Reboisasi funds with INPRES DATI-I funds. By channeling these funds through the "ditetapkan" component, adequate flexibility as well as control could be achieved. If this cannot be done, other ways might be found to increase flexibility such as relaxation of target setting at the national level.

A second point on this structure of financial systems for watershed development which the Team feels should be emphasized is the need for a unified budgetary system. Multiple funding channels as in Project Citanduy have several adverse results. Lack of synchronization in arrival of financial authorizations (DIPs) means late deliveries of inputs or services and occasional postponement of activities for an entire season. Additionally, there is no way of ensuring that the development and operational costs of a function is comprehensively covered and no one is encouraged to feel an overall sense of responsibility for a particular function when so many agencies are contributing to its running. Above all, unified management is ineffective if not impossible without financial control, and financial control can be achieved only with installation of a unified budgetary system under the direct control of a watershed supervisory body.

4. Consideration might be given to reorganizing the P3RPTAS Centers in ways that would attach them firmly to the regional governments, perhaps under the general supervision of the BAPPEDA as exemplified in the Jogya Project or under the new Environmental Bureaus (Biro Lingkungan Hidup) that are to be established within provincial and district governments. The reorganized centers would continue to receive technical guidance from the Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry, as well as from appropriate Directorates General, and the Agency for Agricultural Research and Development (AARD) within the Ministry of Agriculture.

5. Consideration should be given to placing regreening extension workers (PLPs) under the administrative authority of the implementing units, the district level agencies (dinas), with technical guidance from the Research and Development Agency, Department of Agriculture, and the similar agency in the Department of Forestry when it becomes operational.

5.0 Summary

5.1 Planning Considerations

Watershed development is essentially a component element of any regional development and by its nature is an example of integrated rural development. In general a watershed is a well defined physical region with natural physical boundaries.

In order to improve the utilization of the natural resources and the productivity and the stability of the watershed, an integrated development plan must be developed based on the physical and environmental conditions, i.e., the sustained capability of both land and water resources.

In the first phase, an integrated watershed development plan at the macro level must be developed based on primary data and information on the physical and environmental conditions.

It is recognized that socio-economic and political aspects are likely to be the overriding factors in the final decision on macro land utilization in any watershed area. Macro planning should be carried out by the Planning Board (BAPPEDA) at provincial and district levels and must be followed by more detailed planning at the sub-watershed level. This level of planning should be carried out at district and sub-district levels.

Further micro-planning at the operational or village level requires much more detailed and specific information. It must be able to respond to the type and level of management at the field level. This planning should be carried out at sub-district and village levels.

Based on specific guidance from the National Government/BAPPENAS, the planning of any watershed development program should be under the direction of the BAPPEDAs I and II, with the involvement of all line agencies, such as P3RPDAS, Agriculture (Food Crops, Livestock, Estate Crops and Fisheries), Public Works, etc. This planning process should consider the proposals and aspirations generated by sub-district and village institutions.

The implementation of a watershed development program will logically follow the administrative boundaries of province, kabupaten, kecamatan (UDKP) and village, in accordance with Law No. 5 of 1974 (Autonomy of Provincial Government). In many cases the boundaries of the kecamatan coincide with the physical boundaries of sub-watershed units.

The Minister of State for Population and Environment, BAPPENAS, and the Ministry of Home Affairs (including provincial governments) all have very important roles in coordinating the planning, implementation and monitoring/evaluation of watershed development programs and also the maintenance of stable ecosystems and productivity of the upper watershed regions.

The line Ministries directly or indirectly concerned with the watershed development program (that is to say the Ministry of Agriculture, Ministry of Forestry, Ministry of Public Works, Ministry of Finance), as well as all line agencies in the provincial government, must be directly involved in the design and implementation of the program. Improved and better management from the national level through the provincial level to kecamatan and desa levels must be developed and embodied in a Presidential Decree.

5.2 Technical Considerations

The development and application of a farming systems approach is central to the successful execution of upper watershed development programs. The alternative packages of technology must be appropriate to the physical and socio-economic conditions at the micro level. A farming system approach embraces very complex issues because of the subsistence level of farmers and their very limited resources.

The role of research and development by the Agency for Agricultural Research Development (AARD) and other research institutions for the generation of appropriate technology (components or complete packages of technology) at representative field laboratories, and also provision of base line data, is very important. The assembled packages of technology must be further verified by on-farm trials, and finally must be demonstrated under actual field conditions through demonstration farms with active participation of the community and representative farmers.

The active participation of farmers/beneficiaries is very important for the success of any watershed development and management program.

5.3 Human Resources Development

Because of the complexity of training needs for watershed development staff and the need for unified programs of instruction, a technical committee (coordinated by the Agency for Agricultural Education, Training and Extension/AAETE) should be appointed to coordinate training activities in this area.

Institutional arrangements should be made to involve a broader range of university staff and graduate students in watershed development. This would increase research and graduate studies on watershed problems and feed-back field information into educational programs.

The field laboratory proposed under the technical section should be used by extension personnel as a teaching-learning laboratory for field workers.

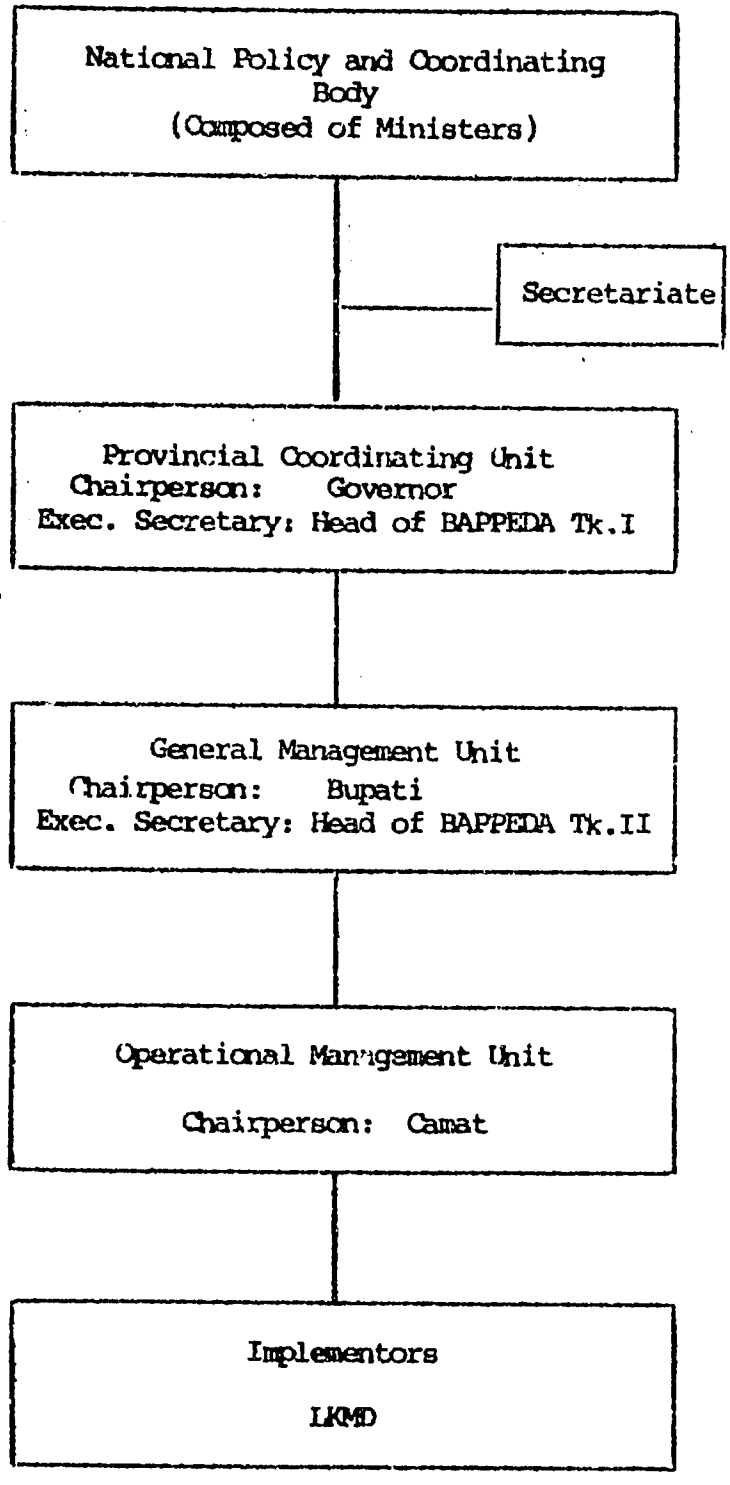
5.4 Institutional Aspects

Since watershed development is a multidisciplinary and cross sectoral process, it is essential that management systems from the national to the provincial, kabupaten and kecamatan levels should be established by Presidential Decree. The administrative Unit (province, kabupaten, kecamatan) should be given the authority and responsibility for management of watershed development, both with respect to planning and implementation.

Figure 4.3

DIAGRAM TO ILLUSTRATE THE
PROPOSED ORGANIZATIONAL STRUCTURE

Bodies for Coordination of
Watershed Development based on Presidential Decree



COMPOSITE REPORT OF THE WATERSHED ASSESSMENT TEAM

Chapter I. INTRODUCTION

1. Purpose

Basically the team was required to assess the present state of watershed management in Java through a study of completed and ongoing projects, which included i.a.,:

- National Regreening Programme
- Brantas Basin Project
- FAO Solo Projects I and II
- Jogyakarta Rural Development Project
- Citanduy I, especially the Panawangan sub-project
- Citanduy II, particularly the upland development programme.

In regard to these projects:

- the institutional structures, management and decision-making systems employed in all the above projects were examined;

- the roles of the National Watershed Steering Committee and the Basin Coordinating Committee in the context of to the Citanduy II project were assessed;

- the various watershed technology packages developed over the past several years were assessed with regard to their technical content and their social, economic and financial implications and viability.

- The budgetary and credit mechanisms for financing the various programmes were examined for adequacy and relevance to the tasks required of them.

- The effectiveness of extension efforts particularly at the grass-roots level in diffusing technology packages and encouraging beneficiary participation in development activities was examined.

- The manpower requirements and the level and type of training necessary were assessed.

The full terms of reference of the team are reproduced in Annex 1.

2. Watershed Assessment Team

The team was composed of 8 Indonesian members and 8 expatriates as follows:

2.1. Team Leaders and Watershed Management Generalists

Dr. D.M. Ramsay and Dr. D. Mulyadi

2.2. Technical Group

a. Soil and Water Conservation:

Professor N. Hudson and Dr. Tedjoyuwono N.

b. Farming Systems:

Dr. J. McIntosh and Dr. Suryatna Effendi

c. Livestock:

Dr. H. Knipscheer and Dr. Bedjo Suwardi

d. Forestry:

Dr. Achmad Sumitro

e. Economics:

Dr. R. Bernsten and Dr. Rudy Sinaga

2.3. Human Resources Group

Dr. J. Murdock and Dr. Samedi Sumintaredja

2.4. Institutions, Management and Farmer Participation Group

Dr. D. King, Dr. D. Korten, and Dr. M.P.S. Tjondronegoro.

3. Programme

On Monday 28 March, 1983 the team assembled in Jakarta where they spent the first week in briefing sessions with senior government officials and USAID staff covering a wide range of topics associated with watershed management.

The subsequent two weeks from 4 to 16 April were spent on a field trip covering all 3 provinces and DI Jogyakarta. Discussions were held with 4 Provincial Planning Boards (BAPPEDA I) and also 4 District Planning Boards (BAPPEDA II), as well as 4 Reforestation Planning and Supervision Units (P3RPDAS) and the National Watershed Management Development Centre (P3DAS). Site visits were paid to all projects listed earlier to assess the content, structure, operation, constraints, and impact of the different programmes and projects.

The itinerary of the field trip is reproduced as Annex 2.

As a result of this exposure the team is in a good position to make an objective assessment of the situation and to offer constructive suggestions to government.

Since returning to Jakarta in mid-April the team has engaged in extensive discussions resulting in the production of the present assessment report.

4. Problem Definition

The basic problem is one of too many people being concentrated on too small a land base. The following table illustrates this point.

Table 1.1.
Population and Agricultural Land Use in Java

Province	Populatn 1983 (mil)	Persons per sq/km	Agric. land by use in '000 ha.					
			Home Garden	Irri-gated	Rainfed dry-land	Estate Crops	Grazing or not used	Wood-land & scrub
W. Java	26.8	580	343	324	1038	366	168	203
Cent. Java	27.3	797	569	225	810	53	13	21
Jogyakarta	3.0	935	91	16	103	-	-	18
E. Java	30.4	635	564	147	1142	156	12	19

Source: Statistik Indonesia, 1980-81
Tables III. 1.2 and V.1.1

In terms of population pressure and land availability per capita of population it can be seen that Jogyakarta and Central Java are relatively much worse than East Java which in turn is worse than West Java. This ranking was borne out by observations during the field trip.

Erosion is a function of, among other factors, land use. It is negligible to low from irrigated land, estate crops and home gardens; variable from grazing and unused land, woodland and scrub; and high to very high from rainfed uplands under sedentary cultivation. Soil loss through erosion from rainfed cultivation in the Solo basin (assuming no soil conservation measures are employed) range from 3 to 5mm/year for nearly level land (up to 5% slope) to 23 to 38 mm/year from steep land (over 50% slope). Viewed against the natural rate of soil formation which is around 1mm/year, these rates are alarming.

Upland cultivation sites can be classed as follows:

1. Moderate slopes (up to 50%) with soils over 40 cm deep; for such sites the essentials of a technology package already exist which if systematically applied will result in improving both productivity and ecological stability. Considerable work remains to be done in fine-tuning the components and making these more site specific. The total area of this class of cultivable land in Java at present in agricultural use is estimated at 1.8 million hectares.

2. Steep slopes (over 50%) with deep or moderate soils for which at present there is an inadequate technology base. The dividing line at 50% between land which can be cropped and land which should be under permanent vegetation is arbitrary and in practice is frequently disregarded, often with disastrous results if no conservation treatments are applied. Given proper soil conservation measures, certain types of cropping can be allowed above the 50% limit. However, at present the technology is poorly developed and a considerable amount of applied research on a pilot scale in different agro-ecological zones needs to be done before an ecologically sustainable technology can be made available. The total area of this class of land in Java at present being cultivated is estimated at 425,500 hectares.

3. Steep slopes (over 50%) with poor soil should be under some form of permanent vegetation cover, but this does not necessarily imply a forest cover. Silvipasture, horticultural tree crops, or plantation crops (e.g., coffee) initially or permanently under shade trees are possibilities which should be investigated. An extensive amount of applied research is required. Total area of this class of land in Java under some form of agricultural use at present is estimated at 863,500 hectares.

4. Critical land, irrespective of slope, is defined as land on which erosion has reduced the soil/subsoil to less than 25 cm and which will not yield more than 500 kg/ha/yr of cassava. At this stage the land is generally abandoned for farming but it can be rehabilitated as was seen in the lower Samin watershed (Solo). The techniques for dealing with such land are known and are being applied as was seen in the field. The total area of critical land in Java in 1980 was quoted as 1.05 million ha. It is estimated that 200,000 ha. becomes critical each year and that a somewhat smaller area is rehabilitated annually under the Regreening Programme, so the net position is an increase in the area of critical land on the order of some 75,000 hectares per annum.

From the above it is clear that in relation to the first 3 classes of land, while varying degrees of technology already exist, much remains to be done in the field of appplied research to adapt the technology to the range of agro-ecological conditions encountered in Java. While much additional applied research is needed to perfect and improve the technological base, the central problem confronting the government is the need to develop the supporting institutional structures to secure the dissemination of the improved technology.

In relation to the fourth class, even though such land can be rehabilitated, it is clear that steep land should not be returned to annual cultivation after rehabilitation. This poses the problem of what to do with the people presently occupying these lands. It would seem that they should be given the highest priority for transmigration.

The long-term solutions to the problems of increasing population pressure and concomitant over exploitation of land are seen as:

- family planning
- transmigration
- the creation of additional off-farm employment
- increasing the productivity of the land within an ecologically stable system coupled with afforestation or reforestation of sites unsuitable for agriculture

5. Issues to be Addressed.

These have been identified as follows:

5.1. In the area of technology and economic evaluation the main issues concern:

i. the need for additional applied research into the application of farming systems technology in different agro-ecological zones;

ii. the need for involvement of the ultimate beneficiaries, the upland farmers, in the planning and implementation processes for the development of their land;

iii. an examination of the question of subsidies - their type and level, etc., as necessary mechanisms in any programme of upland development, and

iv. the provision of credit, and its financing, to facilitate the broad-based expansion of the upland development programme.

5.2. The main issues in the development of the human resource base were seen as:

i. the need to improve greatly the coordination of efforts among technical and extension staff from different line agencies of government working at the field level;

ii. the need to improve administrative machinery to enable field staff to do field work and not spend 60 to 80% of their time in administrative work;

iii. the need for a functional career structure to enhance staff morale, and

iv. the improvement of the software components of training facilities, particularly in regard to course content and quality in the fields of soil and water conservation, farming systems technology, and community motivation and development.

5.3. Under institutional arrangements the following topics were seen as important:

i. the separation of planning and implementaton in very different institutions inhibits accountability for results;

ii. the need to decentralize responsibility and authority for planning and management of watershed programmes and to place these programmes in the context of broader regional development strategies being carried out by local government;

iii. the need to improve integrated watershed management coordination at all levels, and

iv. the need to simplify and make more flexible budgetary systems.

Chapter II. TECHNICAL AND ECONOMIC CONSIDERATIONS

1. Farming Systems Methodology: An Overview

The technological packages presently utilized in Indonesia for the development of upland agriculture is based on a farming systems approach. The application of farming systems methodology involves an indisciplinary approach to agricultural development. In relation to Indonesian conditions, and more specifically conditions on Java, the approach to farming systems development contains five components, specifically:

- a soil and water conservation component;
- a cropping systems component;
- a livestock component including a fisheries component if feasible;
- a forestry and tree crops component; and
- an economic evaluation component.

Each of these components can be subdivided into a number of elements. Two examples are given below.

The soil and water conservation component in any given location may include a selection of the following elements:

- contour bunding,
- hillside ditches,
- terraces (bench, orchard, individual basins, etc.),
- waterways,
- gully plugs,
- such other site-specific measures as may be required by local conditions.

The forestry component may include some or all of the following elements:

- forest tree plantations (for fuelwood, poles or construction timber production);
- agroforestry (fruit and spice trees, etc.);
- silvipasture (mixed grass and trees, usually leguminous, for the production fodder),
- other site-specific measures as dictated by local conditions.

Similarly, the cropping systems, livestock and economic evaluation components are each composed of a number of individual elements. The sum total of the individual elements define each component, while the sum total of the components comprises the technology package known as the farming system.

On any given area, the appropriate farming system will depend on local site conditions and farmers' aspirations. As a general rule, however, as many components as possible should be included since their actions are complementary and synergistic. Economic evaluations carried out by the assessment team clearly demonstrate the complementary and synergistic impact generated by the interrelated component elements of the farming system technology.

While much applied research remains to be done in fine-tuning the elements of different components to make them more responsive to local site conditions, i.e., more site-specific, it is considered that sufficient work has already been done on the major components to enable them to be assembled into effective farming systems which are applicable to conditions on Java and appropriate for adoption by farmers.

The farming system appropriate for any given site should not only increase productivity of the farming enterprise, but as well ensure the sustained ecological stability of the site.

Each of the main components is examined below.

2. Soil and Water Conservation Component

This summary highlights the strengths and weaknesses of the soil and water conservation component of watershed development in Java and offers recommendations for refinements and alternatives.

The framework of planning and implementing land use within the concept of using land resources wisely, that is, to achieve the best sustainable production without degradation, must be established. It should be pointed out that there are many unresolved questions which should be addressed by the GOI in formulating a policy on soil conservation. Is the main effort to be directed toward upland loss of productivity or downstream siltation? Should reclaiming the critical areas have priority over preserving better land? Why is the planning separated from implementation with the resulting lack of accountability? How will the cost of soil conservation be allocated between the State and the landowner? These are basic questions which must be addressed in determining a sound land use policy.

It is strongly recommended that a practical land suitability classification scheme, based on measurable physical facts, should be developed as the basis for deciding the optimum use of land at the field level.

In connection with soil conservation, three basic principles must be kept in mind, specifically:

- that soil conservation should be preventive as well as curative
- that soil conservation can only be effective if the land use is sound and should not be thought of as a crutch to prop up exploitative land use
- that soil conservation should be equally concerned with good farming as with the mechanical task of building terraces

Turning to practices, the techniques of reclaiming eroded land are first considered, followed by an account of the alternative practices available for use on arable land, depending on the land slope. Since bench terracing is so important in Java, specific design details are given so that present practice can be based on calculations rather than guesswork.

As to conservation practices on forest and grazing land, the first point is that it is a fallacy that all forests help prevent erosion. The reason is due to the kinetic energy of the through-fall rain when there is no surface litter. The second point is that there are several types of mechanical protection, such as orchard terraces and step terraces, which can be used on land unsuitable for bench terracing, but which will allow productive use of the land for tree crops. It is recommended that these methods should be tested and more widely used.

The planting of roadside embankments by the Highways Department is noted with approval, and improvements in the technique are suggested.

With respect to water conservation, it is pointed out that bench terraces can be structured to promote or to reduce surface run-off according to what is required for optimal crop production. It is recommended that water conservation be considered more specifically in the design of the soil and water conservation component.

There is much strength in the check dam programme, which has a good record of success. A minor weakness is that there appears to be little engineering expertise applied to the decisions of where check dams are sited. The team's recommendation is that engineers from the Directorate of Rivers be given a broader advisory role in the proper siting and design, but not the construction, which is currently managed well by Regreening Programme staff.

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The Technical Report on Economic considerations reviews the existing data on the benefits and costs associated with terracing and check dams. These proforma data demonstrate the overall economic soundness of these investments. However, the analysis assumes the effective maintenance of the infrastructure throughout its useful life. The reality is that in several cases (e.g., in selected areas served by the FAO Solo I project), farmers did not properly maintain their terraces. This reality points to two important conclusions. First, farmers must be actively engaged in the decision-making process leading to the installation of mechanical conservation measures and must, as part of that process, be made aware of the importance of sustained maintenance of the terraces overtime. This implies the need for a great deal of community organization, education and motivation as an integral part of any conservation effort. The Cigaru Pilot Project experience has much to offer in this regard. Second, the poor record of maintenance is probably directly correlated with the fact that upland farmers do not have access to the investment and working capital which is essential to increase productivity and income derived from the terraced land once the terraces have been put in place. In the absence of this required capital there is little incentive for farmers to maintain their terraces. This conclusion leads to two recommendations: 1) an easily accessible credit program should be immediately put in place to serve upland farmers, and 2) the government should not encourage, let alone directly subsidize, terrace construction until participating farmers have access to an appropriate credit system to finance their investment and working capital requirements.

A final observation of the Team with regard to the proper role of subsidizes and credit in promoting adoption of sound soil and water conservation practices is that the direct financial subsidization of terrace and waterway construction is sound, but that subsidizing inputs which are already cost-effective is not constructive and is best handled through a non-subsidized credit program.

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A review of soil and water conservation research, beginning with an examination of the data base, indicates that although data are being collected at many sites, statistics are incomplete, inconsistent and incongruous over time. A single agency, such as AARD, should be charged with the responsibility of compiling and analyzing, including assessing the reliability of, existing data. Recommendations for future research activities should focus on the need to develop more effective soil and water conservation techniques for small farmers. Specifically, it is recommended that future research programmes include:

- more long-term basic research on rainfall, run-off, and soil loss by research institutes and universities
- more applied research on alternative soil conservation methods, and before-and-after studies on the effect of conservation practices
- more on-farm research to validate the conclusions derived in applied research trials and to determine farmer acceptability

The lack of practical knowledge of soil and water conservation at all levels has hindered effective broad scale implementation of programme policies and improved technology in most areas. The remedy proposed is to train the trainers. The weakness is on the practical not the theoretical side, so higher degrees from overseas is rejected as a solution. An immediate boost to the training capability is proposed in the form of specialized in-house short courses run by experienced overseas organizations having particular expertise in this area.

In addition, "experience-widening" study tours to enable policy makers (Directors General and Directors) to study the organization and administration of successful soil conservation programmes, and field workers to study conservation practices in countries with similar agro-climatic and socio-economic conditions have been found to be very educational.

It appears that there is much valuable information which is not being disseminated. Better information exchange between universities and research centres and between researchers and field workers, especially with respect to farmers problems, is definitely needed. The exchange of information could be easily improved by establishing a regular programme of seminars with guest presentations from a variety of disciplines and government agencies.

3. Cropping Systems Component

Cropping systems (and later farming systems) research in Indonesia and other countries in Southeast Asia over the past ten years has developed methodology for evaluating existing farming systems and designing, testing and implementing new technology that is appropriate for specific target areas. Much of the technology has been disseminated through government agencies and implemented to some extent. In this report the field activities that were observed in the upper watershed projects will be assessed with respect to standard development methodologies.

Agriculture has extended into the upper river watershed areas where unsuitable soil, land formation and topography hinder sustainable crop production. Consequently, over time there is a considerable drop in soil fertility and crop yields. Furthermore, the area of land available to each farmer has decreased due to subdivision (among family members) and abandonment as a result of erosion. Farm income is, therefore, very low, and the great majority of people living in the most eroded areas are subsistence farmers.

The farmers understand that erosion reduces yields but also know that the use of fertilizer counterbalances the yield losses. However, on steep slopes where upland farming is practiced, eventually a complete loss of arable soil will occur unless soil conservation measures are taken. Downstream river channels and irrigation canals will be filled

with sediment. The farmers have neither the skill nor the financial resources needed to implement control measures which require considerable amounts of labor and time.

Review of Projects

The development activities being carried out in each of the upper river watershed projects do not substantially differ. The objectives are similar. There are some differences in approach and starting points among the projects. A detailed review is not relevant primarily because projects are short termed and supplementary to the government system. The Indonesian systems for research and extension and production programmes are well developed. Technical assistance through these channels is likely to be most productive. Existing institutional constraints to upper river watershed research and development are legitimate major concerns of this assessment and will be considered in Chapter 4 and Appendix 8, the technical report on institutions.

Each project that was visited, including the Regreening Program (P3RPDAS) activities, really constitutes farming systems research and development but with special emphasis on the implementation phase. In this connection it is important to note that equal emphasis is placed on socio-economic and on biological research. For pioneer research in upper river watersheds such as in the Solo River and Citanduy watershed areas, there was little existing technology that could be obtained from other locations with similar conditions. Consequently, there was very little "technology transfer in" and much initial work was done on soil conservation, applied farming systems development and the development motivational strategies. With experience gained from research and development in these two target areas and cropping systems research carried out in other places in Indonesia, considerable technology has been developed that can now be directly transferred to new target areas. Consequently, new projects are able to concentrate on implementation and extension.

Since most of the activities observed in the field constitute the implementation phase, it is understandable that very little biological and economic research could be seen. This suggests that in the opinions of the project planners ample technology was available to proceed with the implementation phase directly or with some supplementary field trials. In general this conclusion was right. The field work in terracing, cropping systems, forage production, animal husbandry and perennial crops has progressed. There is also evidence, however, that support from the existing research institutions (AARD and universities) is inadequate to deal with problems and constraints in the field. It is necessary to accelerate on-site research by research institutes to fill the technology gap.

Assessment of Constraints

It needs to be emphasized that the upper river watershed projects as well as the institutionalized Regreening Program (P3RPDAS) activities have moved forward in carrying out their assigned tasks. The sequence of activities, such as terracing (soil stabilization), cropping pattern testing, forage production, animal husbandry, tree crops, and check dams are basically appropriate. There are, however managerial, institutional and technical problems that have constrained progress. This assessment deals primarily with constraints that involve methodology and technical matters. The major constraints identified include the following:

1. Due to the scope of the problem, both in scale and micro-level diversity, the demand for inputs exceeds the capacity of implementation staff to deliver, especially in terms of:

   a. steep slope technology
   b. economic evaluation
   c. extension methodologies and strategies
   d. animal husbandry technology
   e. on site decision making.

2. Poor coordination among existing government technical line ministries, supporting institutions, and projects.

3. Timely availability of seeds, planting materials and other major inputs.

4. Inadequately trained field staff especially as related to farm research and development activities.

5. Inadequate flow of appropriate technical information to the field.

Recommendations

1. Based on existing methodology for farming systems research and development, it is important that project personnel understand the sequence of research and development phases and that they carry out their activities accordingly.

2. Research and development activities must be truly inter-disciplinary and integrated with other concerned government agencies, in all phases from site selection to implementation.

3. It is imperative that some form of national and regional (i.e., provincial and district) coordination be established to ensure institutional support and to prevent excessive duplication of effort.

4. Technology coming from existing research institutions may not be directly supportive of the special needs of these projects. On the other hand, on-site farming systems research may be constrained by insufficiently trained personnel and lack of control of resources involved in field research. To provide continued back-up support, it is necessary to fine-tune existing technology and provide a place for more relevant training. Some

type of Field Laboratory is proposed. These facilities would be located in areas representative of the major watersheds in selected agro climatic environments.

5. It is imperative that a workable scheme for seed and plant material production and delivery be implemented as soon as possible.

4. Livestock Component

The usefulness of livestock products is not limited to the production of meat, milk and eggs, but is also expressed in a number of other contributions (see Table 2.1.). Furthermore livestock plays a role in the transfer of income (or purchasing power) from high income urban areas to low income rural areas. Demand projections for livestock products indicate that a substantial increase in domestic supply is warranted.

In most parts of Indonesia, livestock production systems are part of the farming systems that also include crop production systems. Interacting components of livestock production with other farm activities need therefore to be taken into account. Such a farming systems approach does not imply that the research must encompass the whole farm, but it does imply, in many cases, that a final evaluation of a livestock production system is impossible without considering the farm as a unit. Within the scope of the teams' terms of reference observations were limited to the livestock enterprise, while emphasizing the links with other farming activities.

Observations and Conclusions

All the watershed projects visited have a livestock component, based on the assumption that a policy of establishing and maintaining suitable vegetation cover on terrace banks achieves the dual purpose of stabilizing the structures while also providing animal feed. The project

authorities are to be commended for the procurement and distribution of various high yielding grass varieties at the project sites. Increased grass production provides an opportunity for increased livestock production.

The utilization of grasses on slopes and terrace banks, however, is too narrow an approach to the livestock aspects of watershed management. As the fundamental cause of erosion is one of "over-use" of land because of population pressure and lack of alternative labour opportunities, the development of the livestock sector deserves more attention. For farmers with minimal land-holdings, livestock husbandry may offer the best employment opportunity. Rather than solely emphasizing food production in upland areas of low soil fertility, the possibility of livestock development as a first source of income should be seriously explored.

Whatever the management recommendations for livestock holders, these should always be pre-tested. Applied research under conditions similar to those of the farmers' environment is warranted. In this respect the pretesting of Brachiaria species for feed is urgent as this grass species has sometimes undesired secondary effects. The addition of animals to the demonstration plots and the careful monitoring of the performance of these animals is recommended.

It would appear that the cultivation of high yielding grasses has not been adopted spontaneously by farmers surrounding the demonstration areas. This might be due to a lack of concerted extension efforts, the overall economic viability of the package or the inaccesibility of credit to finance the purchase of livestock and supporting inputs. This aspect deserves further research. It should be understood, however, that the success or failure of the introduction of new grass varieties is only partially dependent on their yield production and ability to control erosion. Other important criteria for species selection are palatability and digestibility, aspects which are presently overlooked.

The distribution of the animals (mainly small ruminants) is based on the so-called "gaduhan" system. Under this system, female animals are distributed on credit while part of the offspring is used as payback. Local existing contractual arrangements among livestock owners should be analyzed and documented, including those concerning on livestock management.

The "gaduhan" system offers an excellent opportunity for animal distribution especially when the credit and payback conditions are carefully spelled out. These conditions do not have to be universal but can be adapted to local needs. It is recommended that favourable terms be extended for the purchase of animals as an incentive for farmers to follow recommendations. These recommendations should again be location specific and not be limited to the planting of improved grasses. Recommendations concerning other aspects of livestock management should also be formulated.

At most project sites, the livestock expertise seems to be very limited. As animals are an essential component of the total package, the availability of livestock management expertise at the project site on a day-to-day basis would be useful.

At most sites collaboration with the Livestock Services (Dinas Peternakan) can be further developed. Besides providing technical assistance, coordination with the activities of the Dinas Peternakan provides extra opportunities as project efforts could be linked to existing livestock programmes such as PUSP, PUTP and RCP.

The general focus of projects is on goats and sheep rather than other species. The advantages of small animals are, among others, their divisibility, the rapid turnover of capital, and their marketability. However, other livestock species such as poultry and cattle have their own benefits. Depending on the comparative advantage in each project area in terms of farmer objectives, water, labor and other input

requirements, productivity, marketability, income, and equity considerations, each of the species should be assessed. In some cases a combination of livestock species, rather than one single species might be desired. In view of the importance of soil maintenance, the quantity and quality of the manure produced might be an important criterion for species selection.

Field grasses generally are considered to be public property. Improved grass varieties are owned by the landowner or the person planting them. Attention should be given to making improved grasses available to landless farmers. Arrangements or contracts by which landless farmers are allowed to cut high yielding grasses in return for manure seems one way of fully utilizing rural labor resources. However, the selling of manure by landless livestock holders outside the area should be prevented.

Public land and forest land are areas presently used as feed resources. The planting of high yielding grasses or fodder shrubs in these areas should be considered, provided aspects of ownership and use can be resolved.

The link between fuelwood and fodder requirements deserves further investigation. Although progress has been made in the screening and introduction of grass varieties, at most sites only a few shrubs and trees have been established. The slower growth of this type of vegetation should not prohibit its inclusion at the testing and/or demonstration sites.

Animal disease control can be improved by participating in the routine activities of the Dinas Pertnakan. As more attention to animal health may be required, self-help activities (such as by swadaya) by farmer groups, cooperatives, etc. should be stimulated.

Breeding management recommendations can be formulated by consulting the Dinas Peternakan and Indonesian animal research institutions.

In some instances the profitability of the livestock enterprise can be raised by improving the marketing outlets for the farmers. In particular in isolated project areas or in project areas where the livestock population is still relatively low, markets for animals may be dominated by only a few traders. Better accessibility to markets and market information will improve the chances of expanding the livestock component of the farming system.

Table 2.1. Livestock Contribution to People

Food:	meat, milk, eggs
Fiber and Skins:	wool, hair, hides, and pelts
Traction:	power for crop production, irrigation pumping, threshing, and transport
Animal Wastes:	fertilizer, heating fuel, methane gas production, feed, construction material
Storage/Savings:	storage of food supply or capital and seasonal excess of feed
Weed Control:	biological control of brush, plants, and weeds along roadsides and waterways
Cultural/Religious:	security and self-esteem, revered symbols
Sports/Recreation:	competition, exhibition, hunting, and companion animals

Source: Winrock International

5. Forestry and Tree Crop Component

In upland areas where population pressure is high, and consequently the demand for food and cash crops is intense, small farmers have been unable maintain the forest resource even on the steeper slopes as

permanent vegetation cover has been degraded or destroyed leaving the steep slopes barren or cultivated with a low yielding crops such as cassava. Although there are instances where tree planting alone on the steep slopes has been well developed and maintained, the majority of upland farmers, having limited employment opportunities or alternative cropland, grow only food crops on their land regardless of slope. If no protection measures are applied on steeply sloping land, the farmers are actually depleting their resource base as the fertile top soil is washed away by the heavy tropical rain. A more realistic approach is needed in this situation. Rather than persisting in planting only trees on critical land, a wider range of options more appropriate to local conditions must be developed.

In an attempt to correct the Regreening Programme's nearsightedness, the planting program in the "Bangun Desa Project" in Jogyakarta has been extended to trees which produce fruit and major efforts are concentrated on increasing production of food crops on terraced slopes.

An interesting phenomena has resulted from the first Greening plantation of 1976 near Patuk Gunung Kidul consisting of Acacia auriculiformis and Dalbergia sissoo. P3RPDAS reports than in one area a failing plantation was restored by land owners themselves after they realized the attractive income that could be obtained from selling the trees (a 5 or 6 year-old tree is worth about Rp10,000 to Rp15,000). The self-motivated tree farming operation at this location seems capable of being maintained by the farmers since seedlings naturally germinating underneath the stand provide plenty of new planting material.

The dry, shallow limestone soils prevailing throughout the North and South Kendeng Range and extending from western Central Java to mid-East Java provide severe constraints to agricultural production, thus limiting better land-use alternatives. In such critical upland areas, trees for production of fodder as well as wood are becoming an increasingly important source of farm income. In one village visited, half of the

people are collecting leaves from the legume trees (preferably Leucaena but also other legumes) to be sun dried and ground into meal. This leaf meal can be sold for Rp50 per kg; one person can make approximately 10 kg or Rp500 per day. In Trenggalek, East Java, and other places with "marl" soils, farmers grow Glyricidia maculata, a legume tree which, managed on coppice system, can produce a substantial amount of firewood. Average production after the third year is about 80 m3 of wood per hectare per annum; the price for standing crop is Rp2,500 per m3.

Efforts to rehabilitate critical lands require continuous guidance and credit assistance to promote appropriate technology with a wider combination of food and tree crops on protected soil (terrace) for improved soil stabilization and income generation. Trees providing lumber and firewood are a significant source of cash income being readily marketable at anytime and in any quantity. The area under plantation, currently expanding, can only be developed fully by improving market outlets, access roads, availability and quality of planting materials as well as livestock. Since most legume forage can be used as fodder, a credit system to permit farmers to purchase livestock is clearly required to enable farmers to increase income and land productivity through forage crops. At the same time the high nitrogen content of the leguminous leaf litter plus the manure from livestock can measurably improve the quality of the soil.

The national Regreening Programme (P3RPDAS), especially the tree planting activity, has been widely supported by society as a whole, which has begun to associate trees with amenity benefits as well as environmental protection. Conflicting private and social interests impose a danger of achieving only suboptimal results or a reduced success rate, however, if no other innovative efforts are undertaken. More research is needed to develop technologically as well as socially acceptable solutions to upland degradation which can be adapted to varying physical and socio-economic conditions.

6. Economic Evaluation Component

Introduction

Over the past decade, GOI has become increasingly concerned about the deteriorating condition of upland watersheds, especially in Java. In the early 1970's regreening activities and the Upper Solo River Basin project were initiated, followed by Citanduy I and II, the Jogyakarta Rural Development project and P3RPDAS demonstration farms in the mid-to-late 1970s and early 80s. All of these activities constitute a foundation of experience that should be incorporated in future interventions in the watersheds.

Interventions implemented include check dams to reduce downstream flooding and siltation; improved terracing on slopes of 50% or less to enable farmers to sustain the production of food and fodder crops while minimizing erosion; the introduction of improved cropping patterns, varieties and inputs to increase productivity; the distribution of improved grasses for planting on terrace lips and risers to stabilize the terraces; animals to utilize the increasingly available grass and leguminous forage trees and the planting of cash crops and fuelwood trees on slopes greater than 50% slope. Taken together, the activities represent an ambitious and much needed approach to watershed development.

Economic Viability of the Technology Packages

Common across most of these activities is a interdependent package of technology. Landowners on slopes of 50% or less are expected to construct improved terraces to stablize the soil. This will be attractive because these terraces will enable the farmers to increase yields and cropping intensity by also adopting recommended cropping patterns, varieties and input levels. As terraces will erode if the lips and riser are not protected, improved grasses are introduced to stabilize the terraces. Animals are introduced to utilize these grasses, providing an economic incentive to maintain the forage crop that protects the terraces.

Demonstration farm results from bench terraced farms below 50% slope show that the components of the crop packages have a significant impact on productivity. These packages increased total employment/ha/year and the daily wage the farmer can earn by working for himself. Together, the employment and wage impact increased net farm income/ha/year from two to six times the pre-development level, depending on the site. As livestock are added, the financial attractiveness of the package will increase. While the tehnical package for slopes greater than 50% has not yet been widely implemented, it appears to be economically viable. If adequate attention is given to refining all package components through applied biological research, these interventions can be fine-tuned and made more applicable across a broader range of agro-climatic and socio-economic environments.

Institutional Viability

Of concern is the apparent interdependence of the elements in the technology package. If one or more component breaks down, the incentive to adopt the associated complementary elements will be greatly reduced. In addition, adoption of many elements is dependent on factors beyond the farmer's control, resulting in potential constraints to widespread adoption. In general, the longer the chain of interdependence and the more the farmer depends on external factors, the less likely widespread adoption will occur. In order to achieve success, all support components, both technical and institutional, must be synchronized and coordinated. Wherever possible, efforts should be directed at decentralizing decision making and giving local farmers and project staff maximum input into the design of packages.

Social Viability

In all of these projects, primary attention has been given to technical considerations. Economic analysis has focused primarily on simple costs and returns analysis. In most of these projects, very

little attention has been given to evaluating potential social and institutional factors that may significantly constrain adoption such as absentee land ownership, tenancy, traditional public access to grass, the limited capacity of poor farmers to self-finance terrace construction, and the difficulty of subsistance farmers to recognize and respond to the promise of future financial benefits.

Equity in Development

Compared to the lowlands, the upland watersheds have received minimal development assistance such as irrigation infrastructure, extension services, credit programmes, road building and research to increase the productivity of upland agriculture. As a consequence, it is generally recognized that farmers in these zones have lower yields and are as poor or poorer than their lowland counterparts. The beneficiaries of upland watershed development will be not only the farmers directly affected; downstream inhabitants benefit from reduced flooding, improved water quality, less siltation, and the protection of river estuaries.

Given the history of neglect of the upper watersheds and the diverse stream of benefits that are not captured on-site by the farmers, equity considerations suggest that subsidization of infrastructural development (terracing) may be appropriate as an inter-spacial income transfer from lowland and urban populations to upland rural populations. By comparison, lowland farmers are not expected to pay for irrigation infrastructure costs. In addition, a more rapid realization of program targets are likely to be achieved and the burden of investment cost borne by the farmer who in actuality receives only a portion of the benefits will be reduced.

The target group in most of these activities are land owning farmers. In certain areas, landless labourers and tenants may be a significant portion of the residents. Without specific interventions to increase these groups' incomes, they can be expected to follow practices

that are counter-productive to watershed improvement. In fact, successful introduction of high yielding grass may eliminate traditional public access to forage resources and reduce the income-earning capacity of landless livestock owners. Consequently, programmes to increase non-farm employment opportunities must be strengthened to reduce pressure on the watershed

Facilitating Adoption

Even if the new technology is economically viable, poor farmers with limited resources will be unable to adopt it. Non-collateral credit must be made available to farmers so they can take advantage of the income increasing potential of the new technology. As the recommended packages are economically attractive, production credit should be made available without subsidization. Repayment schedules should reflect the time period required to obtain the expected income from the investment.

Understanding Farmers Strategies

Over many years of trial and error, farmers have developed successful production practices in an attempt to adjust to dynamic ecological and economic circumstances. Considerable insights may be gained by attempting to understand better the rationale for seemingly destructive practices, such as planting crops perpendicular to the contour and planting cassava on the terrace lips. In all instances, new technology must be evaluated against farmers' practices before they are recommended.

In some upland areas, improved terraces have evolved spontaneously apparently without external assistance. Investigation into the reasons for these developments, problems encountered and characteristics of the adopters would provide valuable insights into the dynamics of land improvement and possible lessons that could be applied in the program.

Initial adopters of the technology packages can be expected to modify and, in some instances, abandon recommended practices. Observing and monitoring these changes would also provide valuable insights for program redesign.

Impact Assessment

Ideally, all projects should generate data which makes it possible to evaluate the success of the project in achieving stated goals. Most of the projects observed were planned as implementation projects and were not designed with adequate consideration of the principle of evaluation research. Consequently, numerous cautionary considerations have to be taken into account which reduce our ability to learn from these experiences and use these lessons to improve project implementation. Future projects should take into consideration these deficiences and with minimal additional cost incorporate into projects adequate controls that will make it possible to have greater confidence in assessing impacts.

Recommendations

1) Future projects should be designed to facilitate impact evaluation which will provide guidance as to how programmes can be improved. Particular effort must be made to monitor early adopters of the technology package and incorporate into the evolving programmes lessons learned that will serve to accelerate expansion.

2) While initially tested interventions are promising, greater resources must be allocated to research activities to fine-tune existing packages. To assess the effectiveness of prototype technologies, economic analysis must be applied to measure the impact of the new technology on employment, daily wages and income.

3) A significant effort must be made to develop flexibility in the various components of technology packages which potential adopters are

encouraged to modify to meet their particular needs. This is particularly important in the ecologically diverse upland watersheds where agro-climatic variability makes it impossible to develop prescriptive recommendations that are universally valid.

4) Institutional arrangements such as the degree of subsidization and repayment period for credit must be flexible enough to take into consideration differences in expected productivity and the capability of various types of farmers to adopt the technology package. While a standardized program is easier to administer, it can not meet the diverse needs of the upland watershed population.

7. Conclusions and Recommendations

1. General Assessment

1. There exists an adequate technical base for the implementation of improved land use in the upper watersheds.

2. There is evidence of good progress being made in improved land use in the watersheds visited.

3. Areas can be identified areas where improvements can be suggested. Some of these relate to technical practices, some to materials, and some to availability of inputs.

2. Constraints to the application of improved farming systems

A. Technical Constraints

1. Steep slope technology is inadequate to allow full productive, environmentally sound development of steep lands, and further applied research is required in the area of mixed agroforestry, orchard terraces and tree crops, and silvipasture.

2. The data base is weak. There is insufficient data on rainfall and run-off, on crop performance, on livestock performance, and on the economics of the practices recommended.

3. The potential contribution of livestock development in upland areas justifies a much greater emphasis on livestock within the framework of farming systems technology and research.

4. Extension work needs strengthening primarily in three areas:
   a. the content and methodology, i.e., what the extension worker is trying to put across.
   b. the strategy, i.e., the framework of how to put it across.
   c. continuity, i.e., how the impetus generated by a project is maintained after project completion.

5. Expansion is slowed by the lack of practical experience in developing suitable crops and grasses. There is an inadequate supply of suitable seed, planting material, and to a lesser extent, fertilizer and agrochemicals.

B. Planning Constraints

1. Detailed planning is inhibited by the lack of a nationally accepted set of criteria for evaluating the optimum form of land use. Some framework is essential as a starting point for land use planning at the field level.

2. A recurring theme is lack of flexibility. The standard technology package approach currently ignores variations is soils, rainfall pattern and farmer's wishes. More flexibility is needed in choice of crop species, of the mix

of crops, trees, and livestock, and of physical soil and water conservation structures such as bench terraces and check dams.

C. Soil and Water Conservation

1. Currently soil conservation is limited for the most part to bench terraces, overlooking the possibility of utilizing other forms of terracing, particularly orchard terraces and step terraces. The division of land into forest land and agricultural land at 50% slope is arbitary and does not permit the full potential of the land to be realised in all cases.

2. Bench terracing is presently thought of solely as a soil conservation measure, whereas design and management of the terrace system for moisture management is equally important.

3. The siting and design of check dams could be improved by an engineering input through engineers of Directorate of Rivers. A dam whose primary purpose is to catch silt should not be designed as a dam for storing water for irrigation.

D. Livestock

1. The techniques of animal husbandry (selection of breed, and response to feeding) need applied research.

2. Grass and forage should be selected on the basis of palatability and nutritional value as well as suitability for stabilizing terrace risers.

3. For non-landowners, there is opportunity to raise livestock on feed from roadsides and public land, but questions of ownership and access need clarification.

4. Marketing livestock is more difficult than marketing uniform products, such as milk or eggs, and the present market structure is inadequately developed to handle the complexities involved in livestock marketing.

E. Forestry and Tree Crops

1. Steep slope farming technology should utilize all relevant disciplines to develop a variety of cropping regimes employing perennial crops, such as trees and grasses as well as food crops, in order to be able to offer the farmer a variety of options with the environmental advantages of perennial crops and income advantages of traditional food crops.

2. Research on pasture development (grass and legumes) under tree canopy has been initiated, for instance in the Upper Solo Watershed, but purposeful, rigorous, long-term research in this field has yet to be conducted; in particular, researchers should focus on identifying:
   - fodder tree, grass and legume combinations adapted to specific soil, climatic and topographic conditions
   - appropriate tree, grass and legume species mix and planting densities of different age classes for optimal growth given shaded conditions
   - optimum combination of grass, legumes and fodder trees to provide balanced nutritional intake for various livestock species
   - the livestock carrying capacities and economic feasibility of various grass and legume production systems

3. Inclusion of a credit system to support establishment of perennial tree and grass crops should be promoted. The credit can be used to finance fertilizer, grass cuttings, and tree seedlings.

   As fodder itself may not be a commercial goal in all areas, the credit package should include support for the purchasing of livestock to consume the newly produced forage. This system may entail organization (cooperatives) and marketing systems which should be taken into account in the development program. A pilot project in this activity is necessary to study feasibility.

4. Because of the longer term development horizon associated with the establishment and maturation of environmentally sound agroforestry and silvipastural systems, a continued and dedicated extension effort is essential to help the upland farmers to realize the potential benefits of these production systems. Demplots and model farms should illustrate not only convincing physical performance but also credible economic returns.

F. Economic Evaluation

1. Demonstration farm results show that the components in the technology crop package have a significant impact on productivity, causing major increases in daily wages earned, total employment and farm income. As animals are added, these benefits will increase.

2. Differences between farmers' resources will determine their capacity to adopt the packages. Subsidies and credit support must be flexible to respond to these differences.

3. Since the technology package is highly interdependent, adoption will require significant coordination by delivery agencies to make available technical advice, planting materials, credit and inputs on time.

4. Economic analysis must be designed into all project activities so that at each stage the program components can be evaluated and modified to increase their effectiveness. Particularly important is the need to monitor early adopters to better understand potential constraints to widespread dissemination.

Chapter III. HUMAN RESOURCES DEVELOPMENT

1. Introduction

The wide range of social, economic, and technical factors involved in programs for watershed improvement demand that manpower for these programs represent a wide range of knowledge, experience, and skills. Not only must disciplines such as soil and water conservation, upland farming systems, forestry, animal science, agricultural economics, and rural sociology be represented but they must be integrated in a coherent plan of action through functions of education, research and extension. The complexity of the problems and the urgency for rapid growth in this area present a challenge for manpower development.

2. Manpower for Watershed Development

The work force in the watersheds visited is made up of the rural population and the staff of line agencies and special projects. Those playing key roles in the development and implementation of watershed improvement activities are the farm family, key farmers, village extensionists, extension supervisors, extension specialists, researchers, program planners, administrators and support personnel.

2.1. The Farm Family

The ability of farmers and their families to understand the consequences of present practices on their land and their future livelihood, their willingness to make changes in the face of the

risks involved in the adoption of new practices, and their skills to implement new practices are a major concern of training programs. The farmer is the key to the success of any program aimed at changing agricultural practices. Thus, the farm family must be the focal point of manpower training for watershed development programs in Indonesia.

The average farmer in the watershed areas visited is literate but has only 3 years of formal education. The level of education of his wife is likely to be somewhat lower. However, they are intelligent and have well developed skills in traditional farming systems as evidenced by their well kept farm plots, gardens and homes. The farmers and farmers wives interviewed exhibited positive attitudes toward education and cooperation in community activities and were willing to experiment with new farming practices which they felt would improve their income. Thus, they are receptive to training and have the capacity to learn new skills and to adapt them to existing conditions. Their limited resources, however, makes risk taking difficult and may limit their interest in new practices.

2.2. Key Farmers

In order to deal more effectively with the large number of farm families in a program area, extensionists have established a practice of working with key farmers who, in turn, work with a farm group. The key farmers also facilitate the process of "feed back" of farmers problems into the system.

The criteria for selection of key farmers are as follows:

a. They must be actively engaged in farming,
b. They must have adopted new, recommended practices,
c. They must be willing to disseminate information regarding new practices to other farmers, and
d. They must have a farmer group.

Although these farmers have similar educational background to their neighbors, they have leadership qualities and experience which make them valuable assets in the promotion of new practices.

2.3. The Village Extension Worker (Farm Level)

The village level extension worker is perhaps the most important agent for change in existing and projected programs for watershed development. There are 2 types of extensionists who work on the watershed projects at this level. They are:

a. The PPL-field extensionists for rice, secondary crops and horticulture mass guidance (BIMAS).
b. The PLP-the field worker of the greening project. These workers are usually assigned to extension activities but may also be assigned to other field tasks.

Level of Training - The field extension workers are graduates of agricultural high schools and their background varies only in terms of special training courses taken and their experience. In general the PPL have been in service longer and have had more supplemental training. However, most of their field experience has been with irrigated rice and secondary crops. The training of the PLP, on the other hand, has been oriented toward greening project targets.

Tasks - The basic role of the PPL as defined by AAETE is as follows:

a. To disseminate useful agricultural information,
b. To recommend more profitable farming practices,
c. To teach improved agricultural knowledge and skills,
d. To assist farmers to participate in development programs which will provide credit, supplies, processing, and marketing facilities, and
e. To develop auto-activity of farm families to achieve higher standards of living.

The role of field extension workers for watershed development projects vary from those stated above only in terms of the limits placed on them by their specific assignments.

Constraints - The PPL-PLP face three major problems in fulfilling their roles. The first problem relates to the fact that their training has not adequately prepared them for their tasks in watershed development. Deficiencies in training were identified in the areas of:

a. Extension and adult teaching methods.
b. Upland mixed farming systems.
c. Soil and water conservation technologies.

The second problem, which is related to the first, is the difficulty the field extensionist has in identifying specific factors which limit agricultural productivity and in reporting these factors back into the system to bring about change. There is a tendency to accept a package of practices without question. The third problem which the field extension workers face is their youth. Many of them have been appointed to their tasks within the past 5 years and some of the more experienced ones have moved up in the hierarchy to higher levels. Consequently, as a group, they are young and relatively inexperienced.

2.4. The Extension Supervisor (REC Level)

The Rural Extension Center (REC/BPP) is the primary administrative unit from which field extension services are provided under supervision of the middle level extension worker (PPM). Generally, there are 2 types of middle level extensionists who work at this level in watershed areas. They are:

a. The PPM-extension supervisor for BIMAS.
b. The PMP-extension supervisor for the watershed project.

Level of Training - The PPMs at the REC level are generally appointed from senior field extension workers and are graduates of agricultural high schools. A few are graduates of agricultural academies or universities.

Tasks - Their roles are defined by AAETE as follows:

a. To develop agricultural extension programs at the REC level,
b. To guide and supervise the activities of field extension workers,
c. To manage training and demonstration farms,
d. To evaluate the implementation of extension programs and give recommendations for improvement, and
e. To manage the REC as a whole which comprises the buildings, land, facilities, and agricultural extension activities.

Constraints - The following basic deficiencies are faced by PPM's in carrying out their duties.

a. Basic techniques of management and supervision,
b. Agricultural extension programming,
c. Evaluation of extension programs,
d. Upland farming systems,
e. Watershed management.

2.5. The Extension Specialist (Project Level)

In the hierarchy of the system used for extension activities, this is the first level at which any degree of specialization occurs. The extension specialists (PPS) working in the watershed areas include the following:

a. The PPS-extension specialist for BIMAS and for agricultural services.
b. P3RPDAS-heads of sub-centers.

Level of Training - The extensionist at this level usually has an agricultural university degree (Sarjana) or equivalent and a few have graduate degrees.

Tasks - The basic responsibilities of the PPS are:

a. To bridge research activities and farming practices,
b. To backstop field extensionist by means of material and methodology improvement,
c. To backstop program development, implementation and evaluation at the REC level,
d. Assist the head of the agricultural services in developing agricultural programs.

Constraints - These specialists are relatively well trained in their specific discipline but have some deficiencies in knowledge and skills needed to fulfill their tasks in the watershed programs. They are:

a. Watershed management principles involving integration of disciplines in upland mixed farming systems,
b. Extensions program development and evaluation,
c. Field demonstration or action research.

Other problems faced by extension specialists are that critical disciplines are frequently not represented on the specialist staff. Thus, support is provided from other programs which demand almost all the specialist's time.

2.6. Planning and Technical Staff (Project level)

The professional staff required to provide analytical, planning and technical support for watershed projects include such areas as watershed planning, conservation engineering, survey and mapping,

and nursery supervisors. Disciplinary support is provided by specialist staff. Most of these staff have an agricultural university degree (Sarjana) degree and a few have graduate level degrees.

Constraints - Indications were that the greatest need in this area is the development of analytical skills needed to adequately evaluate existing resources and to develop integrated plans for watershed development. In some instances, improved technical skills such as soil and water engineering, economic and social sciences, and land survey were limited. The upper Solo watershed had benefited from an intensive training program in these areas under FAO Solo I.

2.7. Researchers (Project level)

Research is being conducted in the watershed areas by ongoing programs of the Agency for Agricultural Research and Development, by AARD staff seconded to watershed development projects and by national and international contractors. The largest research group specifically assigned to carry on watershed research is the P_3DAS in the upper Solo Watershed. However, the group appeared to be underutilized. The major problem with research activities relates to lack of facilities, staff and institutional support to focus research on local problems.

2.8. Administrative Staff

Other important groups relating to the further development of watersheds are policy makers and heads of administrative units. It is essential that the Camat, Bupati, and other officials be given training on watershed development problems to acquaint them with the program, orient them toward development processes and to win their understanding and support.

3. Training Programs

Training programs are being provided for the staff of watershed development project by institutions at all levels. Although deficiencies still exist, especially as related to problems of mixed upland farming systems, significant efforts are being made to improve the quality and relevancy of training programs. A brief description of these programs follow.

3.1. Agricultural High Schools

There are 3 types of high schools which train the majority of field extension workers. They are:

a. SPP-Negeri - National agricultural development high schools under the Ministry of Agriculture.

b. SPP-Daerah - Provincial agricultural high schools with guidance (curriculum approval) by the Ministry of Agriculture.

c. SLTA-P - Vocational agriculture high schools under the Ministry of Education.

Curricula - The curriculum of the SPP, with the exception of the marine fisheries schools (SUPM) and the two forestry schools (SKMA) which have specialized curricula, has been designed to provide a polyvalent (multidisciplinary) type orientation. Twenty eight percent of the teaching time remains flexible for the introduction of a specialized bias. This bias is either directed toward inland fisheries (two schools), animal husbandry (five schools), or crop production (in the remaining schools). Overall the curriculum consists of 34% general education and 66% technical subjects, the proportion of lecture and practical period is 49% and 51%, respectively. The SLTA-P of the Ministry of Education are oriented more toward a specialized job market and do not provide the polyvalent type orientation.

Constraints - In relation to training for watershed development projects, the agricultural high schools are faced with 3 basic constraints:

a. The curriculum is designed along the lines of the agricultural services and too little attention is given to upland mixed farming systems, soil and water conservation technologies and extension methodology,
b. The teaching staff need to be upgraded. Although the qualification of staff of the national schools is relatively high, 35% Sarjana, 43% Sarjana Muda and 22% high school, only 14% of the staff of the Provincial schools have Sarjana degrees,
c. Although physical facilities for agricultural high schools are being improved, there are still considerable deficiencies in classroom, laboratory, dormitory and field practice facilities. In relation to training for watershed development, field facilities for practical work in upland mixed farming systems is lacking.

3.2. Universities

There are 52 agro-complex faculties which provide professional level training in Indonesia. As a group, these faculties offer S_0, S_1, S_2 and S_3 level training in the traditional agro-complex and environmental science areas. These faculties represent a substantial resource for training.

Curricula - At the Diploma (S_0) level a wide range of curricula are being developed to meet specific requirements of the clientele. These curricula may be of 1 to 3 years in duration and include areas such as, teacher training, estate crop management, seed technology, and management of cooperatives. Sarjana(S_1) level training is offered in traditional disciplinary areas of

agriculture, animal sciences, forestry, fisheries, agricultural engineering and technology, and veterinary science. However, the range of curricula being offered within these areas is expanding rapidly. Graduate (S_2, S_3) curricula are also being offered in over 20 disciplinary and multidisciplinary areas.

Constraints - Indonesian universities have been growing rapidly during the past two decades, but because of staff and space limitations they are able to accept only 25% of applicants. This pressure has made it difficult for university staff to become as involved as they should be in field activities. There is a need for greater contact between the university staff and rural development problems. Curricula are needed in subjects which give greater emphasis to areas such as:

a. Upland mixed farming systems.
b. Agricultural and Extension education.
c. Community nutrition and family resources.
d. Soil and water conservation.

3.3. In-Service Training

In-service training is provided primarily by In-Service Training Centers (ISTC/BLPP, BLK, BKPI) and by project level supervisors and specialists at Rural Extension Centers (REC). There are 19 In-Service Training Centers which provide teaching in the following topics:

Topics	%Time 1980/81
Orientation Training	22.7 %
Basic Training	0 %
Skill Upgrading	48.0 %
Refresher Training	17.3 %
Advance Training	0 %
Promotional Training	12.0 %

Curricula - The training program for watershed development projects is quite specific. In Citanduy, for example, the training program to be provided by the centers includes:

a. First year of assignment (PPL)

1. Orientation to job assignment	3 weeks
2. Basic Extension Training	1 month
3. Community development	2 weeks

b. After 1 year on assignment (PPL)

1. Special Extension Technology	2 weeks
2. Integrated farming Technology	2 weeks
3. Special Farming Technologies	2 weeks

c. First year of Assignment (PPM)

1. Extension program development	1 month
2. Supervision training	2 weeks
3. Water management at farm level	2 weeks

d. First year of assignment (PPS)

1. Orientation to job assignment	2 weeks
2. Extention methods	2 weeks
3. Watershed management	3 weeks
4. Special professional training	1 month
5. Trainer training	-

Constraints - Although the programs of the ISTC's are fairly well developed, they suffer from the same type of constraints as other training institutions, i.e., the need for more staff and facilities. The major difficulties observed in relation to the training program were:

a. Too much classroom as opposed to field training. This is in part related to attempts to make up for deficiencies in technical training at the pre-service level.

b. A need to develop and make better use of field laboratories in the watershed area for training purpose.

c. Technical programs are often too short. For example, it is difficult to see how 8 subjects including terrace construction techniques, land survey and mapping, basics of hydrology, etc., could be covered in more than an introductory way in 3 weeks.

3.4. On-the job training

This level of training is provided by supervisory and specialist staff in the field through training programs at the REC and on demplots and model farms. Agricultural Information Centers (AIC's) were set up to assist in training activities as well as to provide support services. There are 11 Regional Agricultural Information Centers and 1 National Agricultural Information Center, covering the 27 provinces, which means that one Regional AIC has to cover more than one province.

Functions - The functions of AIC are:

a. Gather, select, and organize information from various sources such as research institutions, universities, libraries, government and private institutions, farm businesses and the rural people,

b. Prepare extension materials in a form suitable for printing and audiovisual purposes, and suitable to the target audiences,

c. Distribute extension materials as smoothly as possible to all units who are working in extension or who supervise extension activities,

d. To collect, analyze, and interpret data as regards the effectiveness and efficiency of the information materials that have been distributed,

e. Assist in the training activities and work together with the extension in developing on-farm demonstrations and field trials and in developing extension methods.

Constraints - The primary constraints on the AIC's are:

a. The AIC's are required to cover large areas with limited staff and facilities,
b. The centers are new and are not yet fully integrated into the system,
c. They have not yet developed as much experience and expertise in upland mixed farming systems as is needed.

4. Organizational Constraints to Effective Use of Manpower

Although other members of the team were responsible for studying institutional arrangements, the sub-team for human resources considered some problems which relate to effective manpower use.

4.1. Distribution of Effort

During the past 2 decades government policy has determined that major emphasis be given to the development of lowland agricuture, primarily rice. As a consequence, programs, staff, and facilities have concentrated in the lowland areas. The fruits of these efforts are evident in the increased productivity of rice. In spite of the great progress which has been made in these areas, a large agricultural support system is still needed. Thus, it is unlikely that emphasis will be shifted from these areas but it should be expanded to include the upland areas. Improved management of these areas is important not only to the upland farmer but also to the lowland farmer who shares in the consequences of upland degradation.

In order to show the present imbalance in personnel assigned to upland and lowland areas the following data from the Citanduy Watershed will serve as an example.

Distribution of Technician Level Staff in the Citanduy Watershed Area by Location and Program.

KABUPATEN	BIMAS PPM	P_3RPD PPM	BIMAS PPL	P_3RPDAS PLP
Tasikmalaya	20	2	96	9
Majalengka	20	-	117	-
Kuningan	12	1	75	5
Cilacap	20	4	80	20
Ciamis	32	5	145	25
TOTAL	104	12	513	59

These data show a ratio of BIMAS to P3RPDAS staff of approximately 9:1. Although some of the BIMAS staff are working on upland agriculture, it is estimated that at least 90% of them work in lowland agriculture.

Another related problem is that the REC's are most frequently located in areas where they serve lowland agriculture more effectively than they do upland agriculture. This problem was raised in every watershed area visited by the team.

4.2. Coordination of Extension at the REC Level

Coordination of extension programs at the REC level is extremely important. This is the level at which programs directed toward the farm community are either integrated in a unified system of mutually supporting activities or are presented to the community as a bewildering array of separate activities. The fact that personnel

working at this level represent a wide range of agricultural services and projects, different sources of funding and different lines of command, would indicate that coordination at this level will be difficult.

The distribution of field level personnel among agricultural services and P_3RPDAS in Citanduy indicate a large and diverse effort on the part of government in this area. The distribution is as follows:

Agencies	Number of PPL
Food Crops	222
Forestry	117
Small Holders	64
Livestock	13
Fisheries	16
P_3RPDAS	59

The problem of coordination is further complicated by the fact that 3 coordinating bodies with supervisory responsibilities exist at this level. They are the REC with PPM supervisory staff, the P_3RDAS sub-center with PINLAK, and the UDKP under the Camat. There is a possibility that this problem will be accentuated when the P_3RPDAS falls under a separate Ministry from the agricultural services.

In practice, coordination of extension activities by the REC appears to be strongest but the degree of coordination is quite variable. The REC's visited in Gunung Kidal and Citanduy seemed to be functioning quite well. In other areas they seemed to play a limited role. Since only a few Rural Extention Centers were visited, this observation may be subject to considerable error. However, one thing is certain, coordination of project

implementation at this level is extremely important. Since this is the level which involves the largest number of people and is the level at which the farmer and projects interact, a strong, well organized coordinating unit which can backstop the staff in the center is needed.

The Agency for Agricultural Education, Training and Extension (AAETE) of the Ministry of Agriculture was established under Presidential Decree No. 44/45 in 1974. The Agency is charged with the formulation of policies and plans for coordination of agricultural education, training, and extension and to implement programs in liaison with the various Directorates General of the Ministry of Agriculture. According to this decree, AAETE should exercise a coordinating role between the existing services and special projects at the Rural Extension Centers. The fact that AAETE also has a strong base for supporting extension activities through training (ISTC) and information services (AIC) would support this approach.

Effective use of personnel and mutual support of programs would be strengthened by a unified program of extension which would be effective across service and project lines.

In order for such a system to function effectively there is also a need to establish a functional career program in extension.

In spite of the important role that extension plays in the implementation of agricultural programs, there is no formal career program for extension. As a result, it is more difficult to get qualified persons to enter this activity, and there is a significant drain of extensionists into other services. A strong career program which provides improved uniformity, professional identity, and stability would do much to improve the effectiveness of extension work.

4.3. Field Support to the PPL

Most PPLs have, or will have, general or polyvalent training. In view of the fact that they must deal with farmers on a wide range of subjects, this type of training is most useful. However, it means that he must depend on others to backstop him on special problems. The present structure places specialized help at the kabupaten level where each specialist has to backstop up to 50 PPL spread over a large area (based on the ratio of 1 PPS/10 PPM and 1 PPM/5 PPL). Actually, if there were 5 PPS representing 5 disciplines, then each PPS would have to respond to problems in his discipline experienced by 250 PPL. This represents a weak link in the chain.

4.4. Organization of Training Programs

Several institutions and agencies are involved in training technical and professional manpower. These include national agricultural high schools, provincial agricultural high schools, the ISTC's, the AIC's, project staff, and universities. Although each institution fills a defined slot in the training program, there is a need to plan a unified curriculum for training watershed personnel.

5. Manpower Requirements

Development programs and educational institutions in Indonesia are growing rapidly, thus the data base for projecting manpower demand and supply is constantly shifting. Past experience has shown that manpower projections are often outdated before they are published. However, it is important to establish estimates of needs and potential supplies of manpower for programs which are to expand as rapidly as is upper watershed development.

5.1. Manpower Demand

Based on assumptions outlined in the technical report (Appendix 7), the human resource team made the following estimates for technical and

professional staff for the development of watershed programs between 1983-1988/89.

a. Technicial SPP Level:	PPL-Field extensions	-	17,500
	PPM-Extension Supervisor	-	3,500
	PPL-Technicians	-	3,500
	Total		24,500

b. Professional Ir. Level:	PPS-Extension specialists	-	350
	Research workers	-	175
	Headquarters Professionals	-	200
	Total	-	805

The ratio of PPL to farm families used in these estimates are lower than those used for BIMAS rice projects because of the greater complexity of upland mixed cropping systems. However the ratio is still a very high 1/1000. Actually it is more practical to think in terms of 1 PPL to 200 farm families who participate in the farm groups. This provides direct contact with 20% of the total population. Others would be reached primarily through mass media and through contact with progressive farmers.

5.2. Qualification and Training Requirements

This subject has been covered in some detail in an earlier section but is reviewed in relation to type of training and numbers.

Following is a listing of numbers by position and level of training.

Position	Polyvalent + ISTC	Diploma + ISTC	Sarjana + ISTC	Graduate Degree
Field Ext. Worker	17,500	3,500	---	---
Field Technician	3,500	1,000	---	---
Ext. Supervisor	2,500	2,500	1,000	---
Ext. Specialist	---	---	350	100
Headquarters Professional	---	---	280	100
Researcher	---	---	175	100
TOTAL	23,500	7,000	905	300

5.3. Potential Supply of Staff

Technical - A recent report *)indicates that middle-level technical manpower will be in short supply through the mid-1980s and that standards of agricultural technicians need to be raised. The report has stimulated the government to undertake efforts to strengthen agricultural high schools. Actions being taken are outlined in the Technical Report (Appendix 7). Based on projected improvements, revised World Bank estimates show only a 3% gap on a total demand for 146,300 middle level technicians by the end of Pelita IV. These projections included large increases for several agricultural service areas which will play a major role in future watershed development. Data are as follows:

Service	1980/81	1988/84	% increase
Forestry	9,900	31,760	320%
Estate Crops	16,200	39,470	240%
Livestock	6,900	14,030	200%
Food Crops	22,500	37,440	166%

The total increase projected for these areas between 80/81 and 88/89 is 39,200 compared with the calculation of 17,000 additional middle level technicians needed for the watershed development program.

Diploma programs were initiated in 1980 and have already grown to an estimated number of 2000 in training at the present time. Since these programs are developed largely "on demand", it is likely that the annual output of these programs will approach 5000 per year by 1988/89, provided demand is high enough and planned facilities and teacher training support is provided.

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*) Indonesia: Technical and Professional Manpower in Agriculture, Report 3249-IND, IBRD, August 1981

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In summary, it appears that the supply of a middle level and upper middle level technicians will be tight by the end of Pelita IV but that the needs of high priority programs can be met.

Professional - The 52 agrocomplex faculties in Indonesia have been growing at an accelerated rate. The Sarjana level (S_1) student body has been growing at a rate of 23%/year over the past decade and universities are projecting continuing growth rates of 8-10%/annum.

The output by 1988/89 could easily exceed 10,000/year. Graduate Programs are also growing rapidly, expanding from fewer than 100 students in 1975 to over 1000 in 1982/83. World Bank estimates show a positive balance in the supply of professional level graduates. However, these projections do not reflect the substantial level of upgrading of positions which is likely to take place in the next decade.

The conclusion is that emphasis must continue to be given to higher agricultural education if demands for professional level manpower are to be met.

In-Service Training - There are 19 ISTC's (BLPPs) covering agricultural in-service training. In addition there are 5 centers specializing in fisheries (BKPIs), 6 centers for forestry (BLKs), and 2 centers for animal husbandry. The capacity of the existing centers is as follows:

BLPP	1,500	(including Ciawi and two animal husbandry ISTCs)
BLK	540	
BKPI	360	
	2,400 places	

The Agricultural Information Centers are also valuable in-service training units. As was pointed out earlier, they not only assist in

preparing extension information and materials for use in teaching and mass media activities, but also assist in training at the REC and in field demonstrations.

The total number of participants in in-service training during 1980/81 was 8155 against an estimated total staff of 74,600, or in broad terms 1 person out of 9 received some form of in-service training during the year with an average course duration of 52 days. The capacity of the training system is thus sufficient to provide each member of the Ministry of Agriculture with 6 days training per annum with planned improvements. These units should be able to handle in-service training needs.

6. Recommendations

In order to meet the demand for manpower for watershed development programs, the following recommendations are made.

6.1. Technical Level Manpower

a. The government's three point strategy to accelerate teacher training, strengthen and consolidate agricultural high schools, and develop post secondary diploma programs should be implemented.

b. The curricula for the agricultural high schools should be adjusted to give more attention to the needs of field personnel in watershed development. This should place greater emphasis on:
   1) Upland mixed farming systems.
   2) Basic soil and water conservation.
   3) Agricultural extension methodology.

c. Field and classroom contact between P3RPDAS staff and agricultural high school students should be increased through class visits to watershed areas and the use of P3RPDAS staff as guest lecturers.

d. Diploma (S_0) curricula should be developed to meet the needs for upgrading polyvalent extensionists in such areas as:
   1) Upland mixed farming systems.
   2) Rural communications.
   3) Extension methodology.

6.2. Professional Level Manpower

a. The Ministry of Education's efforts to expand and improve the system of higher agricultural education in Indonesia which places emphasis on staff and facility improvement, the development of a unified curricula, improved internal efficiency and increased enrollment should be continued.

b. Curricula of Sarjana (S_1) level programs should be strengthened in such areas as soil and water conservation, agricultural and extension education, rural communications, upland farming systems, and community nutrition and family resources, in addition to traditional disciplinary areas.

c. The graduate (S_2, S_3) level programs should be more directly involved in training staff of watershed development projects and in broader participation in research and public service activities through Centers for Environmental Services, Community Development, Economic Research, and Farming Systems.

6.3. In-Service Training

a. Plans to strengthen Agricultural Training Centers and to expand Agricultural Information Centers to put at least 1 AIC in each Province should be implemented.

b. Detailed training plans, similar to those developed for Citanduy, should be developed for staff in each watershed area.

c. Field laboratories, farmers fields, and demonstration farms should be used more effectively in training programs designed to promote day to day learning through:

1) increased contact between farmers, extensionists, and research staff,
2) frequent visits to field experiments developed to do research on local problems and to provide an interface between extension and research,
3) field trials on model farms and farmers fields under the guidance of specialist and research staff,
4) greater use of simple analytical tools such as routine soil testing.

d. A participatory extension approach, similar to that used in the Kali Sendang (FAO Solo II) pilot area, should be used for farmer training, this includes:

1) the use of farmers meetings to motivate participants,
2) the use of demonstration plots to provide farmers an opportunity to see and to practice new farming skills,
3) the use of farmer action groups to decide what practices will be implemented on their individual farms.

6.4. Organizational Considerations

a. A coordinated effort should be made to expand programs of watershed development. This would include not only the expansion of P3RPDAS activities but also expansion of activities of the agricultural services such as the secondary crop improvement program of the Directorate General for Food Crops.

b. An effective means for developing and implementing unified extension programs at the "working community" level should be developed. The team recommends that strong consideration be given to using the Rural Extension Center as the point of coordination and that AAETE's role in coordinating activities at this level be strengthened.

c. Consideration should be given to providing technical staff with specialized training to assist extension specialists in improving support to PPL-PLP.

d. A technical coordinating committee, made up of representatives of high schools, projects or services, training centers, and universities, chaired by AAETE, should be appointed to develop an effective unified system of instruction for field personnel.

Chapter IV. INSTITUTIONAL ASPECTS

I. Beneficiary Participation

Assumptions made in the following assessment and recommendations:

- That the Pancasila state ideology as well as the Basic Policy Guidelines (GBHN)undeniably imply an important role for beneficiaries in the execution of the national development program.
- Experience in Indonesia and abroad over the past three decades has demonstrated that unless development efforts actively involve the poor majority in the planning processes, implementation and evaluation of development programs and projects, these programs are unlikely to achieve their goals. In the absence of direct participation the poor majority are less likely to benefit from development initiatives sponsored by government.
  Beneficiary participation is not an option but a necessity in the struggle of the poor for more favourable terms of development and for improvement in their lives.

1. Hamlets as Units of Social Organization

The approach by the GOI in many rural development programs in Indonesia has been based on the assumption that the village is the most effective administrative and social unit. From past research findings, and more recent observations during the field trip, this assumption appears questionable. Alhough the village is still the most viable administrative unit, in sociological terms the village has frequently come to be divided along class lines and even exploitative of its poorest residents.

The experience of the PSL-ITB pilot watershed project in Cigaru and of the FAO 2 Project in the Solo watershed indicate that hamlets (i.e. dukuhs, kampongs) have greater viability as the basis of social organization for effective participation in soil and water conservation.

Rural projects which attempt to reach beneficiaries at the grass roots level have primarily utilized bureaucratic mechanisms. Although not ideal, this approach is understandable, since voluntary farmers associations of some size and viability at the village or lower levels have been non-existent for the past 15 years. Under these circumstances, the team sees the LKMD (i.e., Village Council) as a possible alternative model around which to foster greater community participation. However, if the LKMD is to function as a democratic institution at the village level, it should include more non-formal leaders so as to enable more accurate and constructive community dialogue about farmers' needs as well as to facilitate subsequent program execution with as much direct village participation as possible. Upland farmers groups should be given formal representation in the LKMD.

2. Bridging the Gap between Kabupaten and Beneficiaries

There appears to be a "gap" in the communication between kabupaten (district) government and beneficiaries residing in rural communities; the slow moving bureaucratic mills are often a great handicap to quick problem solving at the local level where the actual operations of a watershed management program take place on a day to day basis.

To bridge the gap between the higher level planning boards (BAPPEDAs) and the Regreening Centers (P3RPDAS) and the beneficiaries in local communities, consideration should be given to activating subdistrict (kecamatan) level coordinating agencies such as the UDKP (Unit Daerah Kerja Pembangunan/Development Coordinating Unit). These UDKPs have been dormant since their inception because they suffer from lack of technically trained personnel, funds and the necessary extent of autonomy. Bridging the gap calls for a greater and more responsible role

for both sub-districts (kecamatans) and UOKPs. It is at this level where the UOKP, Balai Penyuluhan Pertanian (BPP) or Rural Extension Center (REC) and extension workers (PLPs) should work closely together and where they should share responsibilities with the aides of the sub-district head (Camat), not only for planning but also for supervision.

In order to enhance public awareness and understanding of soil and water conservation, a promotion and awareness program should be launched nation-wide similar in scale and intensity to the National Family Planning Program. The LKMD should play a major role in such a program, with supporting roles by the UOKP and district (kabupaten) information offices (PUSPENMAS - Pusat Penerangan Masyarakat).

3. Toward Self-Sustaining Projects

Past rural development project implementation has included considerable inputs and subsidies from government institutions that have left the impression among beneficiaries of an open-handed "father state". In addition to the fact that these practices may exacerbate mismanagement in the bureaucratic apparatus, a more serious consequence is that operations also cease with the termination of a project. In other words, project management does not become institutionalized and operations and funding are not routinized by the bureaucratic apparatus in the post-project period.

Speedy institutionalization of a program by beneficiaries and at their level is the best alternative to bureaucratic management. External subsidies should be kept flexible, taking into account differences in quality of land, probable increase in productive capacity, and farmers' initial response to a modest level of subsidization (see section on Economic Considerations). Care should be taken to give subsidies in forms that will minimize the formation of dependency relations and attitudes.

II. Institutional Arrangements

There are three means of achieving beneficiary participation: through decentralization, through unified, interagency management; and through flexible budgetary and credit systems. A maximum degree of institutional (both governmental and non-governmental) decentralization is necessary for effective watershed management because of the widely varying agro-climatic, social, and institutional environments which characterize the Indonesian archipelago. A decentralized management structure which places responsibility and authority at the appropriate lower levels of government is the only practical way of managing the diverse conditions and specific needs of the upland areas in each watershed. A second compelling justification for decentralized management of watershed development programs is related to the multiple interventions needed to assure adoption of productivity increasing, but ecologically stable, upland agriculture technology. Unlike monoculture cropping systems, such as rice, where the range of input choices is limited, the range of technical packages and associated input choices for upland agriculture farming systems are much broader and must be tailored to fit the particular agro-climatic, social, and institutional environment in which they are being introduced. Given the range of choices involved, it is simply not feasible to manage upland agriculture programs in a centralized manner.

The second principle which should govern institutional arrangements for watershed development concerns the need for unified management of watershed development interventions. If the responsibility for watershed development is appropriately placed at provincial or lower levels of government, officials at those levels must be vested with sufficient authority, including effective budgetary control, to ensure the unified and coordinated management of the various human, technical and financial resources that are required for successful introduction of improved practices. The resources required for watershed development (e.g., research skills, extension, and credit) reside within several technical,

line ministries. All of these resources must be mobilized and allocated in an integrated manner if a sustainable process of upland development and watershed conservation is to be achieved. The magnitude and severity of upland degradation, together with the pressing need for effective unified management for conservation interventions in the uplands, requires that the government give serious attention to both strengthening the management capacity and authority of local governments, so they can effectively coordinate and control the specialized inputs and skills which reside within the technical line ministries of government.

The final principle essential to successful execution of a watershed development program concerns the need for budgetary and credit systems to be sufficiently flexible to accommodate the inevitable variation found in any effort to introduce technology in diverse agro-climatic zones and to farmers with varying income levels, sources of employment and attitudes toward risks.

Decentralization, unified, interagency management and flexible budgetary and credit systems are thus desirable goals in and of themselves, and they can also be viewed as dimensions of variation on which three existing projects can be assessed.

1. <u>The National Regreening and Reforestation Program (INPRES) Penghijauan/P3RPDAS</u>.

The National Regreening Program has, within only a few years, developed competent managers with an impressive capacity to plan and execute certain activities nation-wide. According to the official organization chart (See Figure 4.1), the line of command for the planning function runs from the Ministry of Agriculture (MOA) (now the Ministry of Forestry) to P3RPDAS (i.e., the National Regreening Program), but responsibility for implementation resides with local government. Therefore, the P3RPDAS only has a technical assistance-guidance function with respect to local government (PKP, Pimpro, Pinlak) and field extension workers (PLP).

In actuality, however, the relationship of the P3RPDAS Centers to the supervisory committee of the regional government is unclear. In actual practice the P3RPDAS exercises not only a technical function toward the Regreening extension workers (PLPs), but exercises administrative control over them as well. This reality was brought to the Team's attention during a field briefing in which the Team was provided the organization chart (see Figure 4.2) which clearly shows the direct line of authority and control running from P3RPDAS to field personnel.

Thus, certain weaknesses in the management structure are apparent.

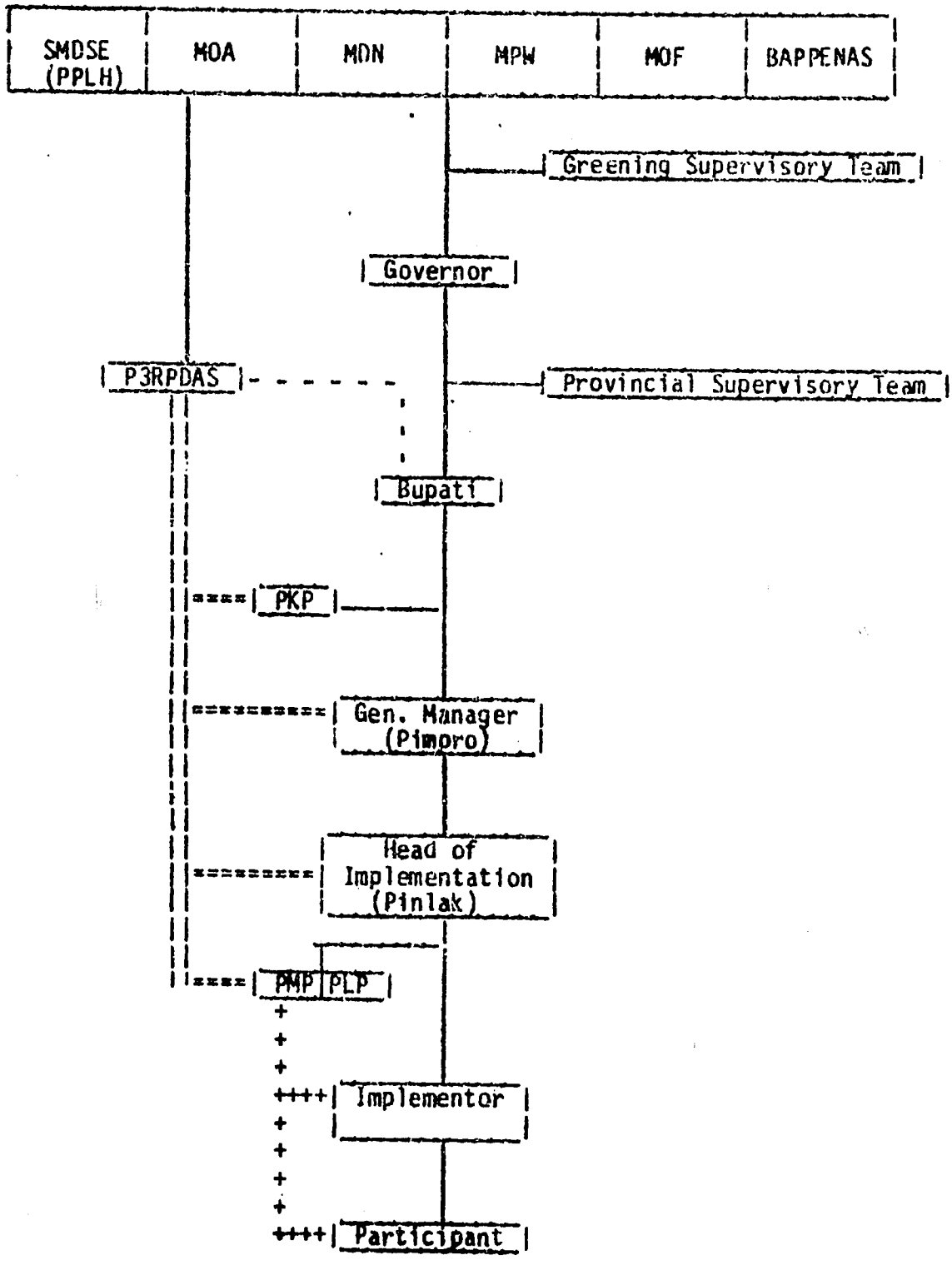
a. The separation of the planning-supervision function and the implementation function in very different institutions means that neither provincial and district governments nor the line agency can effectively be held accountable for the results of the program.

b. This institutional separation also disperses limited skilled manpower between units with overlapping and essentially competing jurisdictions. Furthermore because of its watershed based planning jurisdiction, the P3RPDAS Centers fall midway between provincial and district jurisdictions, thereby complicating coordination. Some officials have suggested that there is no problem because provincial and district governments (BAPPEDA) are responsible for macro-planning while the P3RPDAS Centers are responsible for operational planning. Yet most P3RPDAS Centers which cover several districts and sometimes two provinces, appear, in fact, to perceive themselves as having the superior role and are accountable to Jakarta rather than provincial and district governments.

The P3RPDAS Centers are not appropriate for integrated planning and unified management of watershed development. They, after all, are instruments of a functional, line ministry. Efforts by one functional ministry to coordinate, let alone manage, the inputs from another ministry are seldom effective anywhere. Now the relocation of the Centers under the new Ministry of Forestry will likely further weaken their integrative capacity, since they no longer will have direct call on critical resources needed for watershed development that are controlled

FIGURE NO. 4.1

OFFICIAL ORGANIZATIONAL CHART OF NATIONAL (INPRES) REGREENING PROJECT DURING REPELITA III

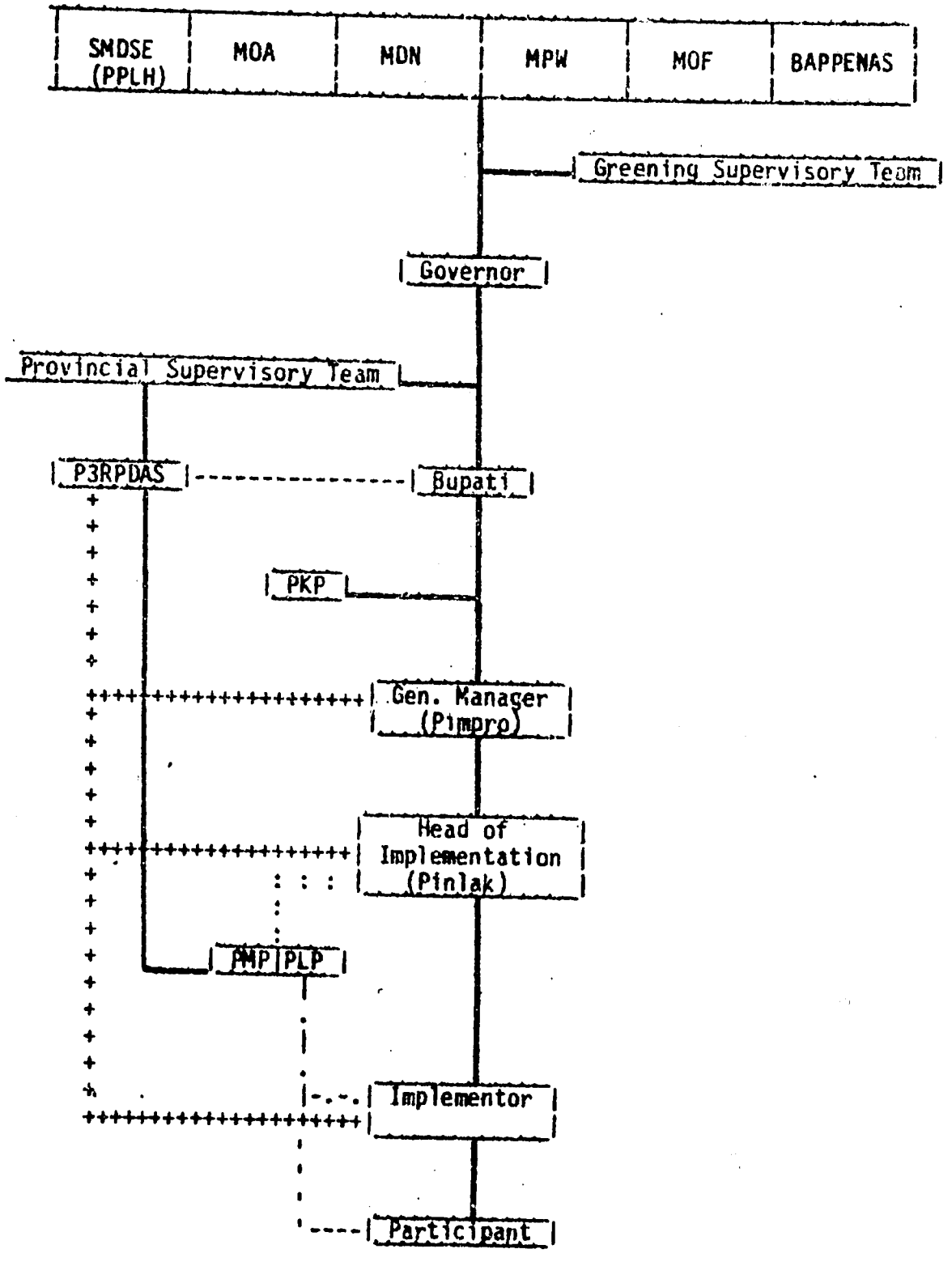


———	Command
========	Technical Assistance and Guidance
- - - -	Consultation
+++++++	Technical Assistance and Extension

Source: Bantuan Penghijauan dan Reboasasi, Tahun 1981/1982

FIGURE NO. 4.2

ORGANIZATIONAL CHART OF NATIONAL REGREENING AS VIEWED BY A P3RPDAS



———	Command
++++++++	Technical Assistance and Guidance
- - - -	Consultation
-.-.-.-	Technical Assistance and Extension
: : :	Coordination

by the Ministry of Agriculture. These weaknesses detected in the Regreening Program are structural. For this reason, simply trying harder to improve planning and management within present institutional arrangements is not the preferred solution.

In sum, planning for the Regreening Program is overly centralized. The separation of planning and implementation in different institutions and the predominance of one functional ministry are obstacles to unified management. The use of targets set by central government to drive the system and the application of nationally standardized inputs, despite tremendous agro-climatic variation even on Java, are detrimental to both decentralization and flexible budgeting.

2. The Citanduy Project

The Citanduy II project is widely expected to demonstrate an improved approach. By decree issued by the Minister of Agriculture, the function of the P3RPDAS management unit in the watershed was augmented and personnel were seconded from various Directorates General (D.G.'s) in order to accomplish integrated planning and supervision of all agricultural activities in the watershed. In actuality, however, the staff at the P3RPDAS Center continues to feel that their responsibilities are limited to the Regreening program and the operation of five subcenters. Apparently the seconding of personnel from central agencies, locating them in the basin, and supporting them with a ministerial decree has not yet been accompanied by the transfer of enough authority. As can be seen through a comparison of Figures 4.3, the management structure created by MOA (Ministerial degree), and Figure 4.4 (an organizational chart which reflects the present field operating arrangements), the P3RPDAS Center in the basin stands independent from and has no operational control over the technical agencies of the Ministry of Agriculture operating within the watershed.

FIGURE NO. 4.3

ORGANIZATIONAL CHART FOR UPPER WATERSHED DEVELOPMENT OF DAS-CITANDUY

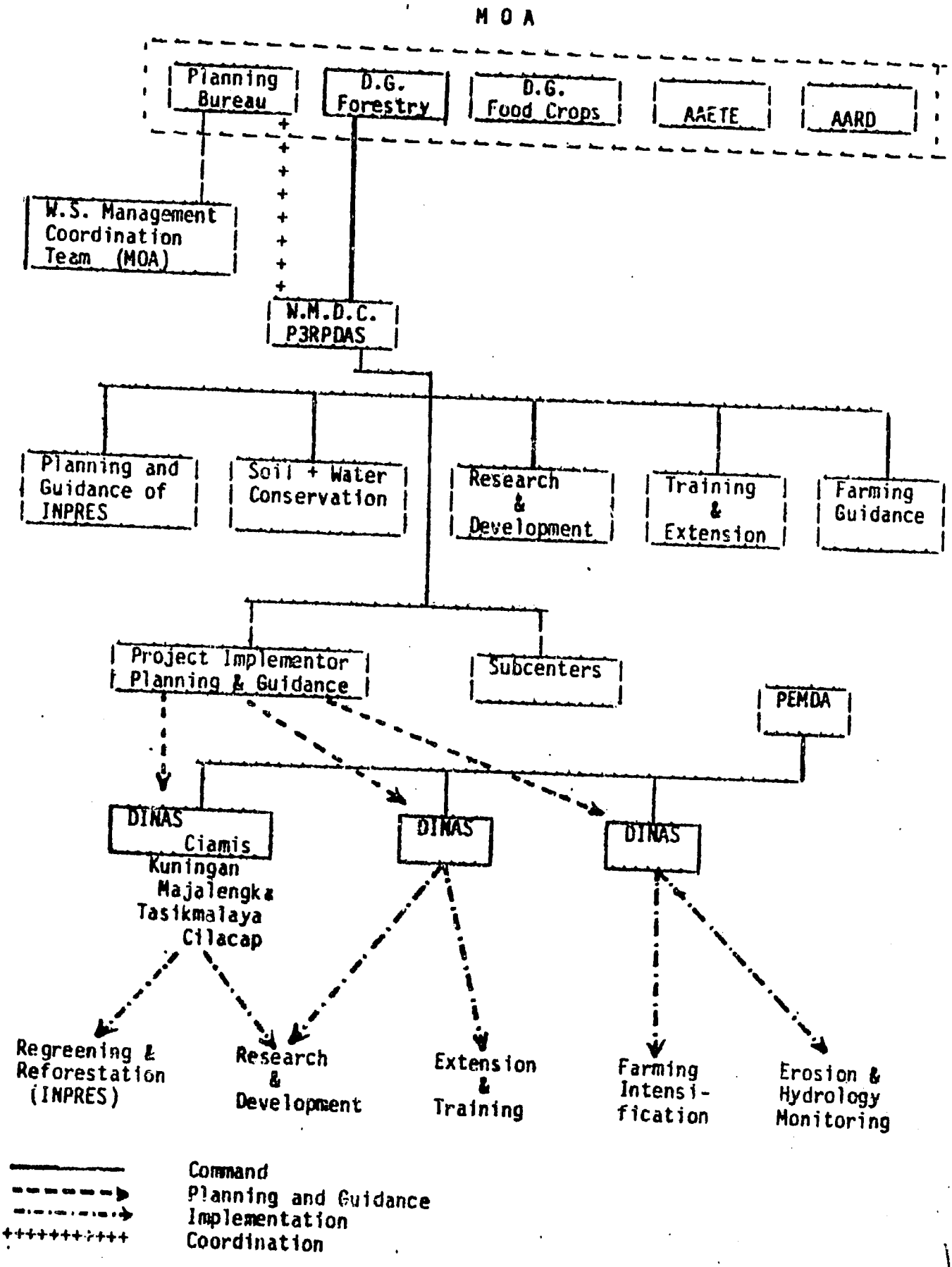
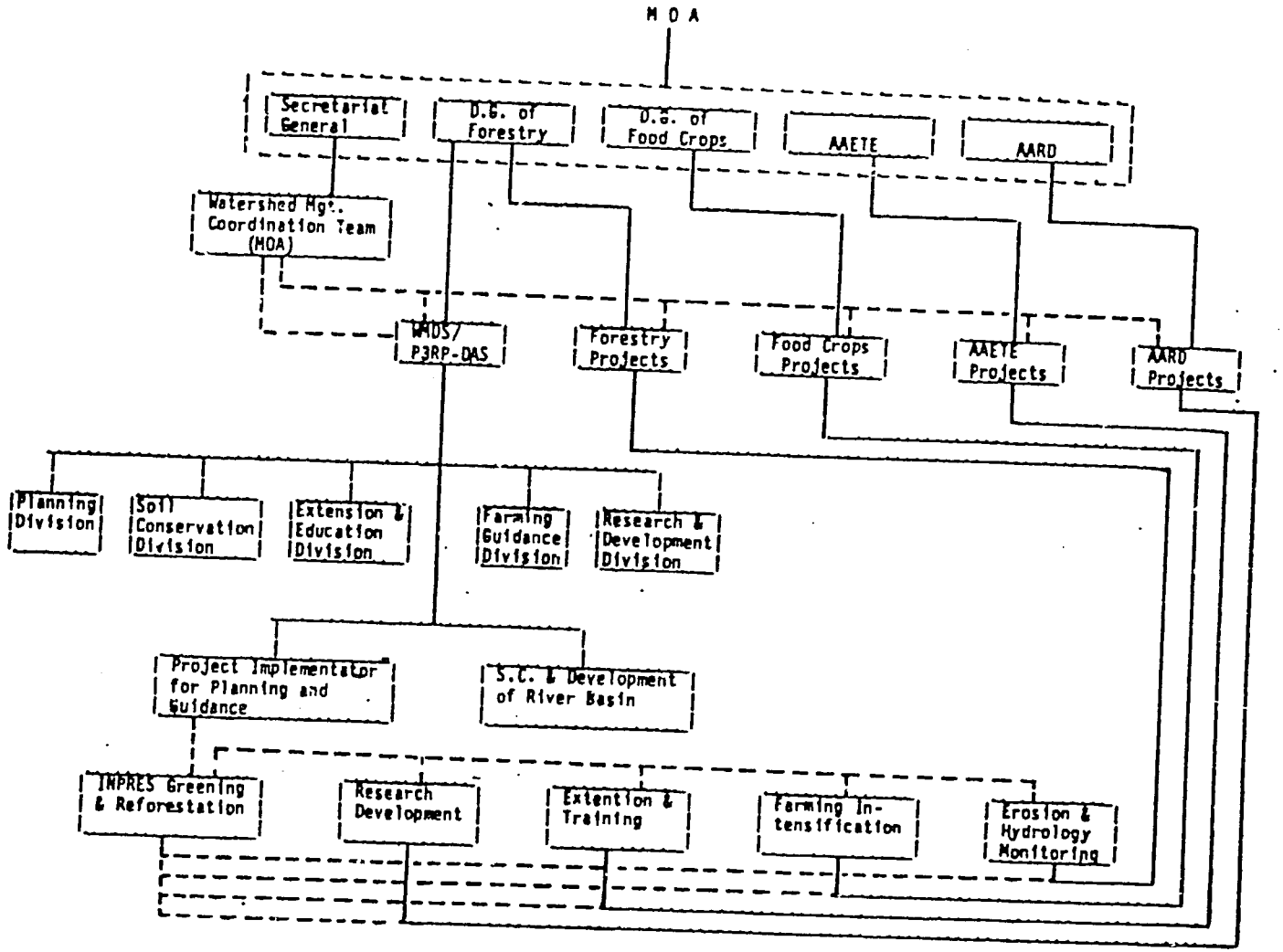


FIGURE NO.4.4
STRUCTURE & ORGANIZATION
OF THE DEVELOPMENT OF CITANDUY RIVER BASIN



Command
Technical Assistance and Guidance

Source: P3RPDAS Citanduy-Cisanggarung

On another point, provincial and district government have been vested with the responsibility for expansion of upper watershed activities. Therefore, coordination between them and the P3RPDAS Center is essential. Yet the formal mechanisms created outside the regular government structure to ensure coordination have been ineffective. To the extent that coordination occurs, it occurs informally.

Project design gave careful attention to balancing the positions of three implementing ministries. To accomplish this, project activities were funded through multiple budgets and coordinating teams were established at two levels. Experience thus far with the Project indicates that mechanisms established outside the regular government structure such as the Basin Coordinating Team are not very effective at coordination and integration of operations. Such mechanisms seem to be more effective at the national level for dealing with policy issues and administrative bottlenecks. Further, the funding of Project activities through 24 different budgets has been a major handicap to unified management and timely delivery of inputs and services. For these reasons, Project Citanduy may not provide a convincing model of institutional arrangements for future replication.

3. The Jogyakarta Rural Development Project

Many of the problems mentioned above are less severe in the Jogyakarta Rural Development Project. Management and financial authority are clearly vested with the provincial planning board (BAPPEDA), thus becoming decentralized to the provincial level. There is no special organizational chart of the project. By virtue of authority given through Law No.5/1974 and Presidential Instruction 27/1980, the BAPPEDA effectively coordinates agencies involved in implementation through specially created Agriculture Technical Development Centers (ATDC) and effectively controls the entire project budget. This financial control is accomplished through a consolidated budget, although problems have been experienced with two different disbursement channels,

necessitated by the requirements of the IDA loan under which the Project was financed, and with the limited prefinancing capacity of the provincial treasury. However, because of the heavy use of expatriate consultants in designing the project, and the special characteristics and size of the province, doubts remain about the generalizability of the Project's institutional arrangements.

4. Credit Support for Financing Watershed Development

With the exception of the Citanduy Watershed Project no institutionalized credit system for financing conservation and productivity increasing upland technologies is presently envisioned or in place. The absence of an institutionalized credit program for upland farmers constitutes a major constraint to successful diffusion of upland conservation and productivity increasing technology.

In the absence of an institutionally decentralized credit system, it is difficult to envision how the technology, now being demonstrated (through direct subsidization) by the National Regreening Program on over 700 sites, can be systematically disseminated to surrounding farmers. The investment and working capital requirements for adopting improved conservation and productivity increasing technologies are well beyond the means of the vast majority of upland farmers (see Technical Report on Economic Considerations). Accordingly, the government should give high priority to supporting development of financially viable rural finance institutions to serve, among others, upland farmers.

In establishing a credit program to serve upland farmers, every effort should be made to utilize existing rural credit institutions such as the Badan Kredit Kecamatan in Central Java, the Bank Karya Produksi Desa in West Java and the Bank Desa in East Java. These decentralized, local financial institutions, supervised by the respective Provincial Development Banks (BPD), represent appropriate institutional mechanisms for the delivery of credit to upland farm communities. These rural

financial institutions are considered appropriate because they fall under the direct supervision of the provincial government and the provincial development banks and, therefore, should be more capable than national banking institutions in developing flexible credit programs responsive to specific agro-climatic, social and environmental conditions unique to each watershed.

Whatever the institutional delivery mechanism, the credit package should not be standardized but should be offered in the form of a general line of credit, leaving it to the farmer to determine both the size of the loan and the specific inputs to be financed. Eligibility for borrowing would be determined, in part, by the recommendation of the local extension worker and the village head that the prospective borrower has been made aware of the upland technology package appropriate to his area and that he is prepared to test all, or appropriate elements of, the technology package.

Finally, interest rates should be established at a sufficiently high level to ensure that the rural lending institutions can cover all costs, including generation of adequate reserves to write off bad debts. The credit program now being put in place to support the Citanduy Watershed Project should be carefully examined as a possible model for broader replication.

5. Recommendations

The experiences to date with the above projects provide a sufficient base for five recommendations, as follows. Through implementation of these recommendations greater adherence to the three management principles herein articulated (i.e., decentralization, unified management, and flexible and decentralized budgetary and credit mechanisms) could be achieved.

a. The province, district (kabupaten) and subdistrict (kecamatan) should be re-emphasized as the fundamental units for the organization of

upper watershed management in both planning and implementation. An alternative, organizing by watershed, is conceptually attractive. Yet there are no functions presently being performed in the National Regreening Program or in the upper watershed component of Project Citanduy that could not be performed equally well on a provincial or district basis as is now the case with the Yogyakarta Rural Development Project. The assignment of responsibility for planning to a separate unit based on the watershed is unlikely to improve the quality of planning and management, at least for the foreseeable future.

b. Management of watershed development activities should be strengthened through a Presidential Decree that would establish special supervision bodies at the national, provincial, district, and subdistrict levels. The coordinating bodies that now exist at the national and provincial levels under the National Regreening Program might be utilized. Such bodies should be established at lower levels as well, and their supervisory authorities should be strengthened at all levels through a Presidential Decree (KEPPRES). See Figure 4.5 for a suggested organizational framework.

c. Watershed development programs require financial arrangements different from most of those currently in use. The necessity of a farming system approach and the nature of the task which involves adaptations to conditions at the lowest operational level imply that a watershed program should neither be structured like most INPRES programs nor utilize multiple funding sources such as in Project Citanduy. Most of the INPRES program designs (DATI-I and DATI-II excepted) give too little discretion and initiative to the local level in allocating funds to particular projects, locations and items within given types of expenditure.

More budgetary flexibility would be achieved by combining the special INPRES Penghijauan and Reboisasi funds with INPRES DATI-I funds. By channeling these funds through the "ditetapkan" (determined) component, greater budgetary flexibility as well as adequate control could be achieved. If this cannot be done, other ways might be found to increase

flexibility of Inpres Penghijauan such as relaxation of target setting at the national level.

Multiple funding channels as in Project Citanduy have several adverse results: lack of synchronization in arrival of financial authorizations (DIPs) means late deliveries of inputs/services and occasional postponement of activities for an entire season; there is no way of ensuring that the development and operational costs of a function are comprehensively covered; no one is encouraged to feel an overall sense of responsibility for a particular function when so many agencies are contributing to its running, and, above all, unified management is ineffective if not impossible without financial control.

d. Before making the following recommendation concerning changes in the National Regreening Program, a disclaimer is necessary. Presidential Decree No. 20/1983 officially established the new Ministry of Forestry including its Directorate General of Reforestation and Land Rehabilitation, Directorate of Soil Conservation and Directorate of Regreening and Shifting Cultivation Control. In most other countries of the world soil conservation and regreening functions are attached to the Ministry of Agriculture rather than the Ministry of Forestry. As far as was known at the time of writing this report, the organization of the new Directorate of Soil Conservation and Directorate of Regreening and Shifting Cultivation Control had not yet been specified. Thus the Team was neither aware of, nor did it intend any conflict between the following suggestions and official government policies.

Consideration should be given to reorganizing the P3RPDAS Centers in ways that would attach them firmly to the provincial and district governments, perhaps under the general supervision of the BAPPEDA as exemplified in the Jogya Project or under the new Environment Bureaus (Biro Lingkungan Hidup) that are to be established within provincial and district governments. The reorganized centers would continue to receive

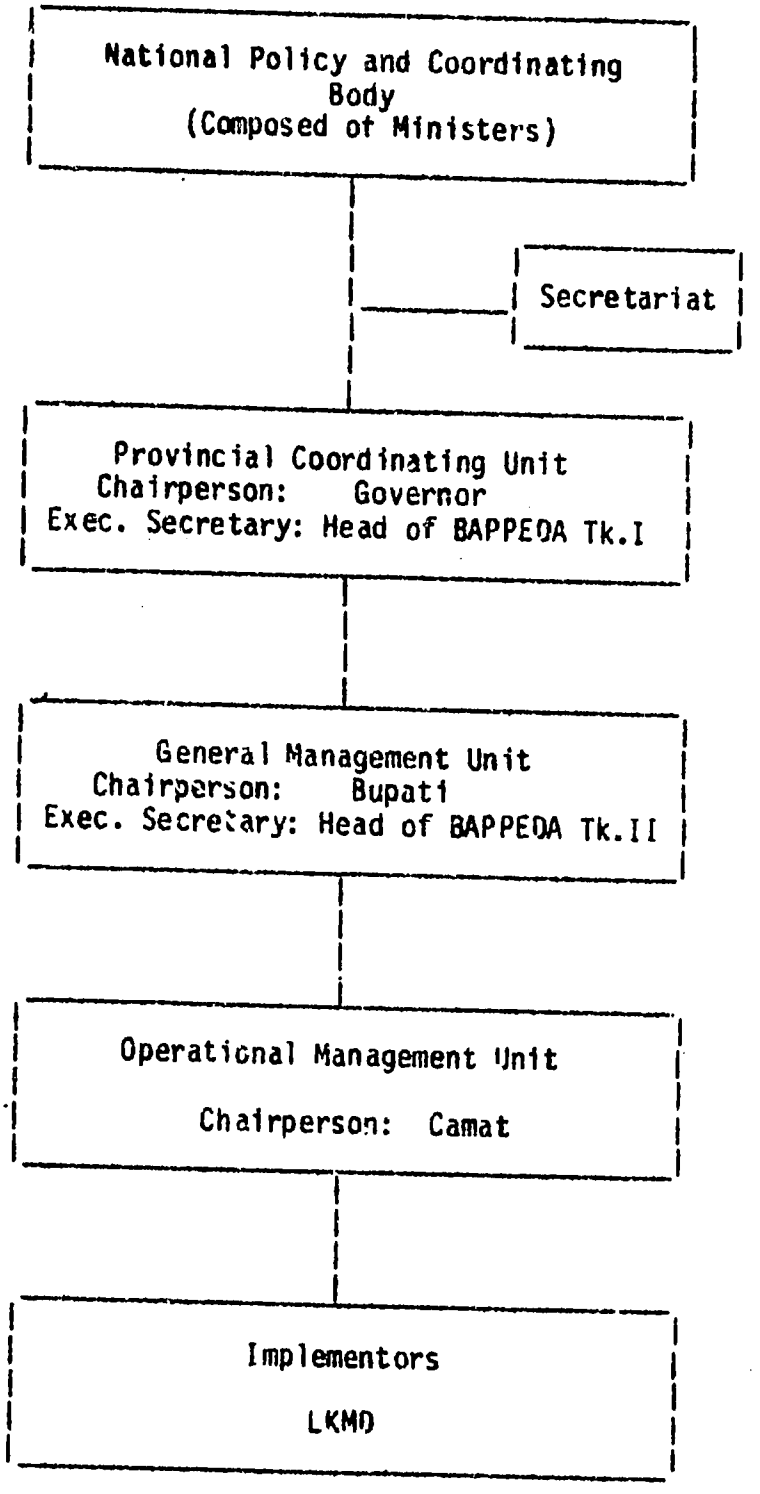
technical guidance from the Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry, as well as from appropriate Directorates General of the Ministry of Agriculture.

Regreening extension workers (PLP) would be placed under the administrative authority of the implementing units, the district level agencies (dinas), with technical guidance from the Research and Development Agency, Ministry of Agriculture, and the similar agency in the Department of Forestry when it becomes operational.

e. Finally, as outlined in Section 4, the government should give priority attention to the establishment of a decentralized system of rural financial institutions to support the investment and working capital requirements of upland farmers.

Figure No. 4.5.

Bodies for Coordination of
Watershed Development based on Presidential Decree



Chapter V. Strategy Considerations

1. Technical Aspects

1.1. Development of a farming system approach is seen as the key solution to improving ecological stability, farm productivity, and hence income of the farmers.

The packages of technology should be appropriate to the ecological and socio-economic conditions at different micro levels. A farming system approach embraces very complex issues because of the subsistence level of farmers and their very limited resources.

The components of a farming system are as follows:

- Soil and water conservation,
- Food crops component,
- Grass, tree, tree crops and industrial crops component,
- Livestock component, and
- Fishery Component.

The socio-economic aspects integrate all the components.

Of the different components, the grass, tree, tree crops and industrial crops component has a very important role in the stabilization of fragile ecosystems, for the production of forage for livestock, fruits and crops, fuel wood and sawn timber. Because the fundamental cause of erosion is one of "over-use" of land due to population pressure and lack of alternative employment opportunities, the development of the livestock sector as a component of farming systems in the upland areas deserves attention as a substitute for land. Development of improved fodder trees and suitable high

yielding grass-legume pastures also offer promising ways for the farmers to earn money from selling fresh forage, dried fodder or hay.

Livestock has an important role in the farming system of the small farmer because of synergistic interaction with food crops, cash crops and tree crops. Livestock produce manure to maintain the fertility of cropland and are also a source of traction for cultivation. By increasing these synergistic interactions, farming efficiency can be increased, as well as the fulfilment of the farmer's needs.

The watershed development strategy must differentiate between improved management on good land (food crops on terraces) and reclamation of critical eroded land. Both require investment but the pay-back in the first case is quick and high, whereas in reclamation activities the pay-back is low or marginal and occurs over a longer period of time.

1.2. Research and development through field laboratories based on agro-ecological considerations.

The role of AARD and other institutions for the generation of appropriate technology (components or complete packages of technology) at representative field laboratories and also provision of baseline data is very important. The development of field laboratories in representative watershed regions based on agro-ecological considerations is essential for speeding up the transfer of appropriate technology to similar agro-ecological zones. The appropriate packages of agro-technology generated by field laboratories will be further fine-tuned by on-farm verification trials, demonstrated in the model farms with the participation of farmer/beneficiaries, and finally disseminated to farmers.

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1.3. Land Use Planning Considerations.

Watershed development is essentially a component element of regional development and by its nature is an example of integrated rural development. In general, a watershed is a well defined physical region with natural physical boundaries.

In order to improve the utilization of the natural resources, the productivity and the stability of the watershed, an integrated development plan must be developed based on the physical and environmental conditions, i.e., the sustained capability of both land and water resources.

In the first phase, an integrated watershed development plan at the macro level must be developed based on primary data and information on the physical and environmental conditions.

It is recognized that socio-economic and political aspects are likely to be the overriding factors in the final decision in macro land utilization in any watershed area. Macro planning should be carried out by the planning boards (BAPPEDA) at provincial and district levels and must be followed by more detailed planning at the sub-watershed level. This level of planning should be carried out at district and sub-district levels.

Further, micro-planning at the operational or village level requires much more detailed and specific information. It must be able to respond to the type and level of management at field level. This planning should be carried out at sub-district and village levels.

Based on specific guidance from the National Government/BAPPENAS, the planning of any watershed development program should be under the direction of the

BAPPEDAs I and II, with the involvement of all line agencies, such as P3RPDAs, Agriculture (Food Crops, Livestock, Estate Crops and Fishery), Public Works, etc. This planning process should consider the proposals and aspirations generated by sub-district and village institutions.

The implementation of a watershed development program will logically follow the administrative boundaries of Province, Kabupaten, Kecamatan (UDKP) and village in accordance with Law No. 5 of 1974 (Autonomy of Provincial Government). In many cases the boundaries of Kecamatans coincide with the physical boundaries of sub-watershed units.

2. Human Resources Development

2.1. Unified extension program at REC (BPP) level. Formulation is needed of an effective means for developing and implementing unified extension programs at the REC (BPP) working level. The REC should be the point of coordination and the role of AAETE in coordinating activities at this level must be strengthened. This is the level at which programs directed toward the farm community are either integrated in a unified system of mutually supporting activities or are presented to the community as a bewildering array of separate activities. The fact that personnel working at this level represent a wide range of agricultural services and that projects have different sources of funding and different lines of command imposes constraints.

Most PPLs/PLPs (field extension workers) will have general or polyvalent training which is useful for dealing with farmers and a wide range of subjects. Therefore, PPLs/PLPs must depend on others (PPMs and PPSs) to backstop them on special problems.

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2.2. Unified training programs including the improvement of curricula in soil and water conservation for upland agriculture.

a. Technical Level Manpower.

(i) Improvement of the technical level manpower by the acceleration of teacher training, strengthening and consolidating agricultural high schools, and developing post secondary diploma programs (S_o).

(ii) Improvement and adjustment in the curricula of the agricultural high schools to give more attention to the needs of field personnel in watershed development. The curricula should place greater emphasis on:

- Upland mixed farming systems;
- Basic soil and water conservation;
- Agricultural extension methodology.

(iii) Development of post secondary diploma (S_o) curricula in order to meet the need for upgrading polyvalent extensionists in the following areas:

- Upland mixed farming systems;
- Rural communications;
- Extension Methodology.

b. Professional Level Manpower.

(i) Continuing the efforts of the Ministry of Education to expand and improve the system of higher education, while placing emphasis on the improvement of staff

and facilities, the development of a unified curricula, improved internal efficiency and increased enrollment.

(ii) Strengthening of curricula of agricultural university degree (S1) level programs in such areas as:

- Soil and water conservation,
- Agricultural and extension education,
- Rural communications,
- Upland farming systems, and
- Community nutrition and family resources, in addition to traditional disciplinary areas.

(iii) More direct involvement of graduate (S2, S3) level programs in training staff of watershed development projects, and in broader participation in research and graduate studies on watershed problems and in the feed-back of field information into the educational programs.

c. In-service Training.

(i) Strengthening of the existing Agricultural Training Centers and expanding the Agricultural Information Centers (AIC) to at least one AIC in each province.

(ii) Development of detailed training programs for staff in each watershed area.

(iii) Efficient utilization of Field Laboratories, field trials on farmers fields, and demonstration farms in training programs to provide teaching-learning through:

- increased contact between farmers, extensionists, and research staff,
- frequent visits to field experimental sites to undertake research on local problems and to provide an interface between extension and research,
- field trials on model farms and farmers fields under the guidance of specialist and research staff,
- greater use of simple analytical tools, such as soil testing kits.

d. Development of a Participatory Extension Approach, including:

- the use of farmers meeting to motivate participants;
- the use of demonstration plots to provide farmers the opportunity to see and to practice new farming skills;
- the use of farmer action groups to decide on practices to be implemented on their individual farms.

e. Technical Coordinating Committee.

The creation of a technical coordinating committee is recommended. This would consist of representatives of agricultural high schools, projects or services, training centers and universities, and be chaired by AMETE. The purpose would be to develop an effective unified system of instruction for field personnel in the light of the complexity of training needs for watershed development staff.

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3. Institutional Aspects

3.1. Application of 4 Principles.

a. The four principles for achieving the objectives of watershed development and management are:

- decentralization of authority for management,
- unified interagency management,
- development of flexible budgetary and credit systems,
- active participation of beneficiaries.

The decentralization of authority and responsibility is necessary for effective watershed management because of the complex nature of development and of the widely varying degree of physical (agro-ecology), and social environments in Indonesia. A decentralized management structure which places authority and responsibility at the appropriate lower levels of government is the only logical and practical way of managing the diverse conditions and specific needs of the upland areas in each watershed.

Further justification for decentralized management of watershed development program is to facilitate the smooth and orderly execution of activities, encompassing the multiple actions needed to assure adoption of appropriate farming systems for sustained productivity and the maintenance of ecological stability.

The second principle which governs institutional arrangements is the need for unified management of watershed development programs. Since the responsibility for watershed development would be appropriately placed at the lower levels of government (provincial, district and sub-district), the officials at those levels must be vested with sufficient authority, including effective budgetary control, to ensure the unified and coordinated management of scarce resources (both human and natural). The resources required for watershed development (e.g., training, research, extension and credit) are supplied by several technical line ministries. These resources must be efficiently mobilized and utilized in an integrated manner, if a sustainable process of upland development and watershed conservation is to be achieved. Serious consideration must be given to both strengthening the management capacity and authority of local governments, so that they can effectively coordinate and control the specialized inputs and skills which reside within the different technical line ministries.

The third principle essential to the successful execution of a watershed development program is the need for budgetary and credit systems which are sufficiently flexible to accommodate the variation of packages of technology appropriate to the ecological and socio-economic conditions at different micro levels.

The fourth principle is the active participation of upland farmers (the beneficiaries) to ensure the successful implementation of any development program.

b. The Creation of Bodies for Coordination of Watershed Development Based on Presidential Decree.

The Province, Kabupaten and Kecamatan administrative units should be given authority and responsibility for management of watershed development and be re-emphasized as the fundamental units for the organization of these activities at the both planning and implementation stages.

Coordination of watershed management activities should be strengthened through a Presidential Decree that would establish special coordinating and supervisory bodies at the national, provincial, district and sub-district levels.

3.2. Necessity for Development of Upland Credit System.

The development of an institutionalized credit system for upland farmers is an absolute necessity to successful diffusion of appropriate technology for improving productivity and stability in upper watershed regions. In the absence of an institutionally decentralized credit system, it is difficult to see how the appropriate technology can be systematically disseminated to upland subsistence farmers.

In developing a credit system to serve upland farmers, every effort should be made to utilize existing rural credit institutions such as the Badan Kredit Kecamatan (BKK), the Bank Karya Produksi Desa (BKPD) and the Bank Desa. These decentralized, local financial institutions, supported by the respective Provincial Development Banks (BPD), represent appropriate institutional mechanisms for the delivery of

credit to upland farm communities. These rural financial institutions are considered appropriate and should be more capable than national banking institutions in developing flexible credit programs responsive to specific social and environmental conditions unique to each watershed. The credit package should not be standardized but should be flexible and offered in the form of a general line of credit, leaving it to individual farmers to determine the size of the loan and the specific inputs to be financed.

3.3. Subsidization in the Form of Capital Investment for Physical Conservation Measures.

Since the investment requirements for adopting improved conservation and productivity technologies are well beyond the means of the vast majority of upland farmers, it is appropriate that subsidies for capital investment, such as physical conservation measures, be provided to farmers.

ANNEX 1

WATERSHED ASSESSMENT TEAM
TERMS OF REFERENCE

- Assess the role, function and adequacy of the Citanduy National Watershed Steering Committee and its Secretariat and define steps for; (1) improving its policy and budgetary oversight functions; and (2) broadening its scope beyond the Citanduy River Basin;

- Assess the institutional structures, and management and decision-making systems, employed by the National Regreening Program (P3RPDAS and P3DAS), the Jogyakarta Rural Development Project, the Provincial Development Project, and the Citanduy II and Solo Watershed Projects and make recommendations for improving the organization and management of GOI watershed management programs based on the experience and insights gained from these various programs. Specific attention should be focused on responsibility/ authority that can and should be delegated to provincial and lower levels of government, and the mechanisms/processes for improving coordination among involved government agencies;

- Assess alternative budgetary/credit mechanisms available for financing watershed/upland agricultural programs and make recommendations for increasing the flexibility and appropriateness of these systems to watershed program administrators as well as beneficiaries;

- Assess the technical, social, economic and financial viability of the various watershed technology packages developed by the FAO Solo project which have been applied/further refined in the context of the Jogyakarta and Citanduy Watershed Projects and the National Regreening Program. Specifically, emphasis should be given to level, type, and duration of subsidies required to secure adoption of the various technology packages. Analyze the present constraints which preclude large scale farmer adoption of a given technology package;

- To the extent possible, assess the impact of on-going watershed programs in terms of their economic and financial impact on participating farmers as well as their impact on stemming soil erosion;

- Assess the effectiveness of various government and non-government extension efforts in diffusing farming system and soil conservation technology and in encouraging community and farmer participation in watershed conservation development activities. Particular attention should be directed to the role formal and non-formal institutions at the village level (such as the LKMD, RTs and farmer groups) could play in mobilizing and sustaining community support for watershed conservation/development activities;

- Assess the medium and long term professional and technical manpower requirements in the fields of upland agriculture and watershed management and recommend professional and technical training programs that should be initiated or strengthened. In this context, examine the role of selected universities and the GOI's Environmental Centers (PSLs) in providing relevant professional technical and short course training related to upland agriculture, watershed management. Also examine the possibilities for these institution to assume a more activist role through the execution of pilot action programs and policy and field research with the goal of reinforcing formal training programs as well as providing alternative methods/models for developing and diffusing watershed technology to upland communities;

- Identify and assess alternative policies or programatic initiatives capable of addressing the principal cause of upland degredation (i.e. population pressure) and recommend policy or program initiatives that could complement soil and water conservations programs in critical watersheds;

- Make recommendations on the scope and content of future GOI policy and program initiatives generally focused on reducing population pressures on marginal upland areas as well as specific recommendations with respect to direct support for upland soil and water conservation policy and program initiatives in the field of watershed development.

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ANNEX 2

WATERSHED ASSESSMENT: WEEK ONE

Sunday, March 27 : Assemble in Jakarta

Monday, March 28 : Team members meet at USAID

a. Meet first with RD/STE/AGR: 0830 - 1130 Conference Room
b. 1130 - 1230 lunch
c. 1230 - 1400 logistics (e.g., ID card, advances)
d. 1400 - 1530 meet Mission Director/Deputy/Program (USAID conference room)

Tuesday, March 29 :

1000 hrs : Meeting with GOI at Dr. Herman Haeruman's office, Ministry of Population and Environment (Jl. Medan Merdeka Barat 15, Jakarta)

Wednesday, March 30:

A.M. Technical team members meet in Bogor to go over questions to be sent to field in arranging meetings

1000 hrs : Ir. Mardjono, Chief of Planning, Public Works, and Ir. Putra Duarsa, Assistant Director General for Rivers Development

P.M. Institutional/manpower team meet at USAID

Thursday, March 31 :

0900 hrs : Bapak Salmon, head of the MOA Agency for Agricultural Education, Training and Extension (in Indonesian, BPLPP)

1100 hrs : Meeting with Dr. Ibrahim Manwan, Director of the Center for Agricultural Research Programming of the Agency for Agricultural Research and Development, MOA

Friday, April 1 : Indonesian holiday (Good Friday)

Saturday, April 2 : Visit to Bogor:
- Center for Soil Research, AARD, and other AARD offices
- Meeting with Dr. Sadikin S.W., Head of AARD, MOA

WEEK TWO:

Sunday, April 3 : Easter Sunday

Monday, April 4 : begin field trips

Team A	Team B
Ramsay/Mulyadi	Bernsten/Sinaga, McIntosh/Effendi, Sumitro
King/Tjondronegoro,	Knipscheer/Bedjo,
Murdock/Samedi	Hudson/Tedjoyuwono
Jim Mullen, IBRD	Sid Draper, IBRD
Ric Machmer, USAID	Enrique Barrau, USAID
Ketut, USAID	Van K. Haderlie, USAID

(other members of USAID and GOI officers are expected to join in at different intervals in the teams' trips, such as Pak Nyoman Ardha, MOA, and Pak Bambang Sukartiko and Pak Engkah Sutadipradja, Ministry of Forestry.)

Monday, April 4 :

0730-0805: Fly from Jakarta to Bandung

0830-1100: Meeting with BAPPEDA
Ramsay/Mulyadi
King/Tjondronegoro
Machmer
- request Kanwil/Pertanian , Head/ P3RPDAS, to be present

1000-1115: Fly from Jakarta to Cilacap (Mike Hauben joins)
- USAID vehicles to meet

1115-1145: drive to Cilacap

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0830-1100: ITB, School of Environmental Studies (Bill Knowland arranging appointments and will meet and accompany)

Murdock/Samedi

1100-1200: Lunch

Murdock/Samedi have program in Bandung. Fly straight to Surabaya (Bouraq Airlines ETD 1640 - ETA 1840)

1200: Leave for airport

1345-1420: fly Bandung-Jakarta

1540-1640: fly Jakarta-Semarang

1715-1900: Meeting with BAPPEDA
Ramsay/Mulyadi
Korten/King/Tjondronegoro
Ric Machmer
- request Kanwil Pertanian, Head/ P3RPDAS, to be present

Overnight, Siranda Hotel, Semarang

1145-1300: lunch in Cilacap

1300-1530: drive to Ciamis

1530-evening: program in Ciamis
At P3RPDAS Office, briefing by P3RPDAS Chief. Discussion with P3RPDAS staff; BAPPEDA II Ciamis, Tasikmalaya, Kuningan staff; Dinas Pertanian Ciamis, consultants.

<u>Tuesday, April 5</u> :

0850-0935: Fly from Semarang to Surabaya (GA 300)

Citanduy site visit - Model farms, Expansion areas and Regreening (Cisanggarung)

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- Ketut, USAID, flies from Jakarta
  to join at airport in Surabaya
  at 1000 hrs
- Jim Mullen, IBRD, to fly from
  Jakarta and join (1500-1615)
  - taxi to meet

Team splits in two, one going directly to Brantas and the other meeting with the BAPPEDA in Surabaya

- Sid Draper arrives Cilacap,
  1115 from Jakarta
  - will be met by project vehicle
    and brought to Ciamis

Team A/1:

1000-1800: Drive to Brantas
- USAID vehicle
- see Dutch project en route (in Malang)
  Ramsay/Mulyadi
  Murdock/Samedi
  Ketut

Surabaya - Malang: 2 hours (1000-1200)

Noon : lunch in Malang

1300 : go to PU Office in Malang
(Jl. Surabaya # 2A) to meet PU staff.
Representatives from P3RPDAS will be
present. Get briefing and begin
field trips.

1400-1800 tour:
- Kali Konto (Dutch)
- Pujon (Dinas Pertanian)
- Tokol Check Dam

Team A/2:

1030-1300: Meet with BAPPEDA
Korten/King/Tjondronegoro
Machmer

1300-1400: Lunch in Surabaya

1515-1630: Korten and King fly back to Jakarta. Dr. Tjondronegoro stays in Surabaya overnight

1400-1600: Machmer drives to Malang and Solorejo to meet Ramsay and group

Overnight: Solorejo Guest House

Wednesday, April 6 :

Dr. Tjondronegoro flies from Surabaya to Solo GA 601 (0945-1030)
- met by Bapak Nurdin, head of P3RPDAS, Wiroko & taken on tour of three experimental villages. To spend the night in Solo, joining team on Thursday.

From Solorejo to Sarangan
- visit northern sub-basin pilot projects
- also visit Sumber Brantas
- opportunity meet School of Environmental Studies, University of Brawijaya, Malang.

A.M.: Citanduy site visits
Rachlan's Office - visit Cigaru

1300-1800: travel by car to Jogyakarta (Hauben returns to Jakarta)

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Overnight Silver Wind Hotel in Sarangan

Overnight Puri Artha Hotel in Jogya

Thursday, April 7 :

Tumavick flies to Solo 1310-1410

Sarangan to Solo, visiting field on the way. Representative of Ministry of Forestry and P3RPDAS arranging schedule

Schedule in Jogyakarta arranged by Bapak Samirin, Bagian Evaluasi, Office of BAPPEDA

0800: Briefing in BAPPEDA's Office

0900: to field, accompanied by Bapak Samirin, IBRD project concentration

1930-sampai selesai: Steering Committee Meeting

- overnight at Sahid Prince Hotel

Friday, April 8 :

0830: David Korten leaves Jakarta for Manila (PR 538)

Complete activities in Solo

Deanna Donovan and Dwight King (USAID) arrive last flight from Jakarta (1310-1410)

A.M.: Schedule in Jogyakarta area, arranged by BAPPEDA's Office. Field visits.

1600-1800: Travel to Solo

Saturday, April 9 :

Visit Jratunseluna
- see John Ihalauw at Satya Wacana University in Salatiga

Activities in Solo
- P3DAS
- P3RPDAS
- FAO project

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- Dinas Pertanian, Salatiga
- BAPPEDA visit
- P3RPDAS

(from Solo to Jratunseluna (Salatiga) is approximately 1 1/2 - 2 hours; from Salatiga to project field site is approximately 30 minutes)

WEEK THREE:

Sunday, April 10 :

Professor Hudson arrives Jakarta GA 891 at 1540 hours

Team A

In Solo (Team A/B discussion)

- Tumavick returns to Jakarta, (0840-0940)
- Jim Mullen, and Deanna Donovan return to Jakarta, last flight (1450-1550)

Team B

in Solo (Team B/A discussion)

Monday, April 11 :

0730-0900: to Jogyakarta

0900-1200: BAPPEDA
request Kanwil Pertanian, and Head, P3RPDAS, to be present

1200-1300: lunch

1300-1800:
- Ramsay and group in field. Concentration on IBRD project

in Solo (Hudson joins/leaves Jakarta at 1310; arrives Solo 1410)

- Murdock and Samedi to Gadjah Mada University

Overnight at Puri Artha Hotel in Jogya

Tuesday, April 12 :

Jogyakarta
- to field to see second site for IBRD integrated development project

visit Jratunseluna
- DG/WRD
- DG/Food Crops

Wednesday, April 13:

Machmer returns to Jakarta (1145-1245 at Halim)

leave Solo for Malang (6-hour trip)

0800-1230: Travel from Jogyakarta to Citanduy (Hauben flies to Cilacap: 1000-1115): meet at Grand Hotel

to Brantas by car; visit regreening programs on the way

1230-1330: lunch

P.M. see Citanduy

1400 meeting with Bupati and BAPPEDA II, Cilacap. Time permitting, see Karangpucung enroute to Ciamis

Overnight in Ciamis

Overnight in Karang Kates (PU arranging accommodations)

Thursday, April 14 :

Visit Citanduy area
Model farms, expansion areas, Regreening (Cisanggarung)

Overnight in Ciamis

Brantas
- P3RPDAS
- Dutch Project
- DG/WRD

Overnight in Pujon

Friday, April 15 :

Citanduy

0800 P3RPDAS Office. Briefing by Chief of P3RPDAS. Discussion with P3RPDAS staff; BAPPEDA staff of Tasikmalaya, Ciamis and Kuningan; Dinas Pertanian Ciamis; and consultants

1300 Rachlan's office. Visit Cigaru

vernight in Ciamis

Drive from Pujon to Surabaya (2 1/2 hour drive) and fly to Jakarta 1015-1145 (leave Pujon approximately 0630)

However, Enrique Barrau and Dr. Tedjoyuwono will take Professor Hudson to Citanduy until Monday, April 18 (fly from Surabaya to Jogyakarta and drive to Ciamis/Citanduy)

Saturday, April 16 :

To Cilacap and fly back to Jakarta
(1145-1300 flight times)

WEEK FOUR:

Sunday, April 17 : Free day

Monday, April 18 - Saturday, April 23:

This week in Jakarta and Bogor.

Monday, April 18:

Tedjoyuwono, Barrau and Hudson fly from Cilacap to Jakarta (1145-1300)

Thursday, April 21

1900: Reception at Director Fuller's Residence

WEEK FIVE:

Sunday, April 24 : Free day

Monday, April 25 - Thursday, April 28:

Final drafting of reports.

Saturday, April 30 :

1000: Team Oral Presentation to Steering Committee, chaired by Minister Emil Salim, Ministry of Population and Environment.

WEEK SIX:

Sunday, May 1 - Saturday, May 7 :

Team Leaders and remnants of team members stay on to complete drafting of Report.

Sunday, May 8 - Saturday, May 14:

1000: Team Leaders present Report to Steering Committee.

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PN-AAT-809

COMPOSITE REPORT
OF THE WATERSHED ASSESSMENT TEAM

assembled by the Government of Indonesia and USAID
between March 28 and 7 May, 1983

WITH TECHNICAL REPORTS IN THE DISCIPLINES OF:
WATERSHED MANAGEMENT, FARMING SYSTEMS, SOIL AND
WATER CONSERVATION, LIVESTOCK, FORESTRY AND TREE CROPS,
ECONOMIC EVALUATION, HUMAN RESOURCES DEVELOPMENT,
and INSTITUTIONAL DEVELOPMENT

V O L U M E II
(Appendix I - IV)

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TECHNICAL APPENDIX I

WATERSHED MANAGEMENT

by

D.M. RAMSAY & D. MULJADI

Doc. # 2701A

TECHNICAL REPORT ON WATERSHED MANAGEMENT

by D.M. Ramsay and D Muljadi

Chapter 1. Identification of soil and water degradation by causative factors.

Chapter 2. Analysis of government policies for improving upland land and water management, and the institutions for the delivery of these policies.

Chapter 3. Assessment of previous and ongoing programmes in watershed management.

Chapter 4. Incorporation of results from pilot projects into the national programme.

Chapter 5. Evaluation of research and demonstration activities

Chapter 6. Improvement of the present system with particular reference to policy formulation and implementation and the institutional arrangements for management and coordination.

Chapter 1. Identification of Soil and Water Degradation by Causative Factors

Definitions:

- soil degradation is taken to mean the removal through erosion of the intrinsically fertile top soil (the 'A' horizon) and its replacement, as a plant-growing medium, by the relatively infertile subsoil (the 'B' horizon);

- water degradation is taken to mean the:

  * massive and largely unpredictable variations in the actual amounts of water delivered to a particular site at a given time as a result of increased hydrological instability in the catchment area, and
  * decrease in the quality as a result of increased sediment transport resulting from accelerated erosion.

In itself, soil erosion is a natural process which merely reflects the removal of water and soil from upland sites where both are, at best, indifferently used and their redeployment on lowland sites where both can be utilized more efficiently. This natural process is related to a geological time scale which, in the case of Java, has been disrupted and compressed by a rapidly increasing human pressure on the land. This results in increasingly higher slope-categories of land having, of necessity, to be brought under annual cultivation with increasing dangers of accelerated soil erosion.

In many areas, of which the Solo basin is an example, the rural population pressure exceeds 775 persons per square kilometre. Given the subsistence nature of the present agricultural practices, this represents about the maximum carrying capacity of the land in terms of its present food output.

It is postulated that erosion on dryland (tegalan) farming sites will result in yields diminishing at 5% per annum so that unless positive action is taken now to redress the situation, by the year 2000, many sites will be so degraded as to be unable to sustain annual cultivation and would then be classed as critical land. Examples of this can already be seen in the Upper Solo Watershed.

Erosion rates depend on a combination of site factors (soil type, rainfall amount and intensity, steepness and length of slopes) and land use factors (type of cultivation, degree of vegetation cover, soil conservation measures employed, if any).

An indication of the amount of soil lost per annum from rainfed cultivated land in the Solo basin, assuming no soil conservation measures are applied, is given below:

Table 1

Soil loss in mm per annum

Elevation	Slope Class			
	0-5%	5-30%	30-50%	Over 50%
Over 1000 m	3	13	15	23
750 - 1000 m	4	15	19	30
500 - 750 m	5	19	25	38
Below 500 m	4	14	20	31

Source: FAO Upper Solo Project

Data as above are of use in relation to a particular land-use in a given agro-ecological area. However, to appreciate the problem as it relates to Java as a whole, it is necessary to consider data specific to Java, and place it in relation to the situation in all of Indonesia.

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Tables 2 to 6 following present data on the major physical, human and land-use aspects of Java which are relevant to an understanding of the agriculture of the island, while tables 7 to 11 relate specifically to various aspects of soil erosion and rehabilitation in both Java and all-Indonesia.

Table 7 introduces the concept of 'critical' land which is defined locally as land which is unable to:

- produce more than 500 kg/ha/yr of cassava (at which level of yield it is uninteresting even to the subsistence farmer),
- act as a regulator in the water system, and
- fulfill any protection function (i.e., absorb run off).

Typically, in critical areas all the topsoil has long been removed through erosion as well as a varying depth of subsoil until in general not more than 25 cm. of subsoil remains in place over the parent material. In most cases it is a compacted and virtually sterile growing medium for most forms of plant life.

PHYSICAL DATA

Table 2

Area

Province	Sq. Km.	% of All Indonesia
DKI Jakarta	590	0.03
West Java	46,300	2.41
Central Java	34,206	1.78
D.I. Jogyakarta	3,169	0.17
East Java	47,922	2.50
Total Java & Madura	132,187	6.89

Source: Statistik Indonesia, 1980-81 (S.I.); Biro Pusat Statistik, Jakarta, 1982. Table I.1.

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Table 3
Population (Projection for 1983)

Province	Population	Per Sq. Km.
DKI Jakarta	6,874,800	11,652
West Java	26,841,400	580
Central Java	27,268,300	797
D.I. Jogyakarta	2,963,200	935
East Java	30,408,000	635
Total Java & Madura	94,355,800	714

(Of whom: 46,522,600 males)
47,833,200 females)

Source: S.I. Table III.1.2.

Table 4
Administrative Units

Province (Capital)	Number of		
	Kabupaten (Districts)	Kotamadya (Municipalities)	Kecamatan (Sub District)
DKI Jakarta (Jakarta)	-	5	30
West Java (Bandung)	20	4	390
Central Java (Semarang)	29	6	492
DI Jogyakarta (Jogyakarta)	4	1	73
East Java (Surabaya)	29	8	546
Total Java & Madura	82	24	1531

Source: S.I. Table I.2.

Table 5.
Agricultural Land Use (1979) in ha by Provinces

Province	House & Home Garden	Rainfed Cultivatn	Shifting Cultivatn	Upland Grazing	Swamp (not cult.)	Dykes	Water Surfaces	Land not in use at present	Scrub & wood and lots	State Forest	Estate Crops	Irrigated land	Other	Total
DKI Jakarta	15,673	7858	335	3	1326	536	936	485	5	-	15	813	1849	29834
West Java	343241	268680	769596	64933	24700	11689	30202	103291	202821	642195	365847	324023	350601	3501819
Central Java	568604	797963	11720	6385	3741	24968	942	7200	21031	531105	52824	224797	120045	2371305
DI Yogyakarta	91398	103319	-	37	30	-	36	239	17998	13971	9	16354	22065	265454
East Java	564353	1127272	14678	7368	6463	43654	361	4868	18570	916843	155977	146609	129001	3136017
Total Java Madura	1583269	2806006	295413	78726	36260	80827	32477	116083	260425	2104114	574672	712596	623561	9304429
As % total for Java	17.02	30.16	3.17	0.85	0.39	0.87	0.35	1.25	2.80	22.68	6.18	7.66	6.70	100.00
Total Indonesia	4873105	7226890	249 155	2625873	6423303	148805	154702	5975654	8155305	43180599	6114257	3972570	9976812	101894659

Source: S.I. Table V.1.1.

Note: Data refer to land in agricultural use only and not to other uses, such as industrial sites, infrastructural emplacements, etc., hence the total given above does not agree with that given in table 1.

Table 6

Forest Area by Type/Province ('000 ha) (1980)

Province	Protection Forest	Production Forest	Nature Conser-vation	Reserved Forest	TOTAL
DKI Jakarta	-	1	-	-	1
West Java	299	422	213	-	934
Central Java	21	600	3	-	624
DI Jogyakarta	-	15	-	3	18
East Java	259	807	178	70	1,314
Total Java and Madura	579	1,845	394	73	2,891
TOTAL INDONESIA	12,933	69,235	10,150	29,909	122,227*

Source: S.I. Table V.3.3.

Note: * Total State Forest in Table 4 is 2,104,114 ha in Java which is some 787,000 ha less than given above.

Table 7

Area of Critical Land (up to 1980)

(in ha)

Region	On Land classed as Forest	Outside Forest *	Total
J a v a	281,238	903,092	1,184,330
Total Indonesia	3,417,046	5,095,241	8,512,287

Source: Directorate General of Forestry (1980)

* taken to mean on agricultural land

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Table 8
Critical Land
(in million ha)

Type of Land	Situation		Total
	Critical	Not yet critical	
. Rainfed cultivation	3	0	3
. Bareland, grass fallows & other neglected land	13	3	16
. Forest land	4	19	23
T o t a l	20	22	42

Source: "Statistical Information on Indonesian Agriculture" by Manfred Woelke; FRG Agency for Technical Cooperation, 1978. Data from D-G Forestry, "Statistik Kehutanan Indonesia, 1975".

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Table 9
Areas covered by the Reforestation and Regreening Programmes 1971/72 - 1980/81 (ha) (all Indonesia)

Year	Reforestation (1)	Regreening (2)	Total
1971/72	23,053	54,881	77,934
1972/73	26,133	69,599	95,732
1973/74	20,791	85,402	106,193
1974/75	35,287	51,396	86,683
1975/76	39,113	90,653	129,766
SubTotal	144,377	351,931	496,308
Average/yr	28,875	70,386	99,262
1976/77	116,729	273,107	389,836
1977/78	169,205	578,812	748,077
1978/79	274,544	665,991	940,535
1979/80	207,480	536,430	743,910
1980/81	146,046	472,094	618,140
SubTotal	914,004	2,526,434	3,440,498
Average/yr	182,801	505,267	688,100

Source: Personal communication from Directorate-General of Reforestation and Land Rehabilitation (April, 1983).

Notes: (1) carried out on State-owned land, usually forest land of some type (cf. table 6), and typically on steep slopes.
(2) on privately-owned land which has generally been used for farming and is often on steep slopes.
(3) most Reforestation activities take place in the outer islands (in which are located nearly 98% of the total forest estate), while Regreening activities are almost totally confined to Java.

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Estimate of the Distribution of Critical Land in Java

Taking the distribution of critical land and land at risk by land-use class given in table 8, and applying the same proportions to the land in Java classed as critical given in table 7 (1980 data) gives the following results (all areas in ha):

Table 10

Land Use	Total area in Java	Area of Critical	As % of total	Area at risk	As % of total
Rainfed & shifting cultivation land	3,101,419	199,600	6	) 1,000,000	19
Bare land, fallow and other neglected land	2,062,664	850,900	41	)	
Forest	2,104,114	166,930	8	950,000	45
	(7,268,197)	1,217,430	17	1,950,000	27

One interpretation of these figures is that up to 6% (approx. 200,000 ha) of the land under annual, rainfed cultivation reaches the critical stage in any year and is taken out of cultivation and increases the size of the class next below, "Bare land, fallow and other neglected". Against this wastage must be set the land rehabilitated each year under the Regreening programme, which over the 5-year period 1976/77 to 80/81 has been averaging about 500,000 ha per annum (table 9). However, the success rate has been variously estimated at from 6% to 50%. A success rate of about 50% (measured by number of trees surviving) at 2 years after establishment is claimed, but after the 3rd year this may drop to 35% and to 25% after the 4th year. At the rate of 6 and 50%, the area of

land rehabilitated for agricultural use can range from 30,000 ha to 250,000 ha per annum, against a wastage of some 200,000 ha per annum. At a success rate of 25%, assuming the other factors remain constant, the system has a negative balance of 75,000 ha per annum, i.e., the total area of critical land in Java is increasing by this amount each year.

However, there are other factors bearing on the situation which will change, of which the most important is population growth. Between the censuses of 1961 and 1971, the population growth rate in Central Java was 1.76% per annum. At this latter rate, the population will double in approximately 44 years, bringing the 1982/83 density of 775 persons per sq. km. to 1550 by the year 2026.

Work by the first FAO Solo Project indicated that after implementing rehabilitation and development activities in a watershed of 27,800 ha in the Solo basin, the human carrying capacity of the land would be as below:

Table 11

Level	Criterion: Caloric intake per input	Carrying capacity: persons per sq. km.
Subsistence	Food intake in 1976 (1,790 cal/day)	1,348
Security	Standard requirement (1,920 cal/day)	1,258
Optimum	10% over standard* (2,112 cal/day)	1,144

Note: * To allow for adverse climatic conditions on average 2 years out of 10.

Source: Termination Report, AG:DP/INS/72/006; FAO, Rome, 1976.

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As a general comment, it should be noted that data even from the same source, for example "Statistik Indonesia", is not always internally consistent; see footnote to Table 6 as a case in point.

From the data presented it can be argued that increasing population pressure will accelerate land deterioration unless a massive and effective programme to increase upland productivity under ecologically stable conditions can be put in place. Allowing that this is, or will become technologically possible in the foreseeable future, an indication of the maximum human carrying capacity of the land at full benefit is given in Table 11. Study of these figures in relation to present population and growth rate suggests that any programme of upland development while maintaining ecological stability can only succeed when integrated with other national programmes such as family planning, transmigration and a considerable increase in off-farm employment opportunities.

Chapter 2. Policies for Improving Upland Land and Water Management and the Institutions for their Delivery

In the early 1950s it was recognized that soil erosion was a problem in Java and interventions on a small scale and at a local level were initiated in an attempt to redress the situation.

In 1961, a Regreening Programme was started by the late Ir. Hatin Soedarma. Initially this was confined to tree planting on privately-occupied land on steep slopes. Typically, such land was over 50% slope and, in many cases, had been abandoned for cultivation because of the loss of topsoil through erosion. A parallel programme to reafforest state land which had been denuded of its natural vegetation cover was also initiated. Nurseries were established to raise the necessary tree seedlings and both programmes of reafforestation on state land and regreening on private land were operated on a "food-for-work" basis supported by the UN World Food Programme. In 1967, these programmes were officially recognised as the National Reforestation and Regreening Movement and a special Directorate of Reforestation and Land Rehabilitation was established under the Directorate General of Forestry in the Department of Agriculture to be the responsible government agency.

At central government level an awareness of the problem of soil erosion and its magnitude had been developed and between 1969 and June 1973 three advisors were supplied by FAO under the UNDP Technical Assistance programme to study the problem and suggest solutions. The resulting dialogue between GOI and FAO led in 1972 to the formulation of a UNDP-financed, FAO executed project entitled the "Upper Solo Watershed Management and Upland Development" project which was to address the problems of soil erosion and consequent reduction in productivity in the Upper Solo Basin. This was a large-scale, multi-disciplinary project which sought to establish an integrated, multi-disciplinary approach to the problems of watershed management. The project became operational in

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July, 1973 and was intended to run for 3 years 9 months but was terminated after 3 years because of the UNDP financial crisis in 1976.

Significant outputs were achieved and a number of technical packages were developed and demonstrated in 7 pilot sub-watersheds ranging in size from 185 to 340 ha. The total development of all land in these sub-watersheds was undertaken by the local farmers and village labourers who were "paid" under the UNDP food-for-work programme. The package of conservation and agronomic measures developed for rainfed cultivable land up to 50% slope has been proven viable and remains the basis of all subsequent work undertaken in this field. The trees/grass/animals package developed for land over 50% slope has been less succesful, but to date no viable alternative has been developed and demonstrated. A serious attempt was made to involve the farmers in planning the development of their land by using a bottom-up technique, but there is little evidence (apart from one operation at Cigaru) that this approach has been continued, although the establishment of Demonstration Plots (under the Regreening programme) and their expansion into the surrounding area does contain implicitly an element of farmer participation.

One of the main recommendations of the original FAO Solo project was that the counterpart team of professional officers trained on the project should be retained as a group and employed in planning the integrated development of further watersheds. To a certain extent, this has been observed in that at the time the project was terminated the FAO-GOI team had completed the development planning of only one of the 4 watersheds; the planning for the remaining 3 was subsequently undertaken by the GOI team on their own.

At present the remains of the team, plus additional new staff, is based in Solo at the Watershed Management and Development Centre (P3DAS). The broad objectives of this unit, as defined in the Ministerial Decree of 1979 under which the centre was established, are in line with the FAO recommendation quoted earlier. However, in practice

the centre is concerned mainly with applied research on problems encountered in watershed management and the collection of data, both physical and socio-econonomic, relating to watersheds. As far as can be ascertained no work is being undertaken on resolving the problems associated with the trees/grass/animals package for steep land mentioned earlier. This is an area in which continuing research and demonstration is required.

Development planning of watersheds has been made the responsibility of a separate organization, the Reafforestation Planning and Supervision (P3RPDAS) units*, one of which is established for each catchment basin in which work is being undertaken. These are large areas - the Solo unit covers an area of 1,731,767 ha spread over 14 regencies (districts, kabupaten) although staff are shown as deployed in only 13 of these. Total staff of the Solo unit is 91, of whom 43 are in the Solo headquarters office and 48 are deployed in the different kabupaten work areas.

The organization of the Solo unit is shown in figure 2.1 and may be taken as the basic model. The structure of the organizations in place in Jogyakarta and Citanduy follow a similar pattern with minor variations to accommodate the requirements of, respectively, the IBRD and USAID projects operating in these localities.

The responsibilities of P3RPDAS in the catchment areas for which it is responsible are:

- to prepare the development plan,
- to provide technical guidance during the implementation of the plan, and
- to monitor the work carried out under the plan.

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* In the organizational chart of the Ministry of Forestry (1983) these units are called "Soil Conservation Agencies" and are on Level III (Sub-Directorates) but report directly to the D.G. Reforestation and Land Rehabilitation and not through the Director of Soil Conservation.

The plan is prepared in consultation with individual village "Community Self-Reliance Associations" (LKMDs) which in theory provide the local level inputs on farmer aspirations, etc. The plan is channeled through the Planning Centres (BAPPEDAs II and I) at, respectively, the kabupaten and provincial levels where adjustments are made, if necessary, to conform to the regional plans of the district and province before going to the Ministry of Agriculture for approval and submission to the National Development Planning Board (BAPPENAS) and finally to the Cabinet for approval of the funds required. The planning mechanism is shown diagramatically in Figure 2.2. It should be noted that the above description was given verbally by P3RPDAS Solo. According to the official handbook, "Regreening and Reforestation Assistance" (for 1981/82), there is no mandatory requirement to channel the plans through BAPPEDA II or I; all that is required is that they be approved by the Bupati and Governor.

When approved, funds in the form of an INPRES budget are channeled through the Ministry of Home Affairs to the Provincial Governor and down to the kabupaten at which level the actual implementation work is organized.

It will be noted that implementation of the plan is undertaken through the existing administrative units of local government, namely: kabupaten (district), kecamatan (sub-district) and kepala desa (village) and ultimately it is the responsibility of these units to ensure that the work is carried out. The function of P3RPDAS during implementation is to give technical guidance and extension services through PLPs. They are not held accountable for the outcome of actual implementation.

It should be recognized that the organization responsible for preparing a development plan should also be responsible for its execution, thereby making that organization accountable for the overall result.

The role of P3RPDAS and its relationship to the implementing machinery is shown diagramatically in Figure 2.3.

The importance ascribed by the GOI to Reforestation and Regreening can be seen from the budgetary provisions made for them which for 1982/83 were, in round figures, as:

		Rp. (million)
Total budget for field operations (excluding staff salaries and administrative costs)		68,000
Of which:		
Reforestation in State land accounts for approx. 40%	27,200	
Regreening on private land accounts for approx. 60%	40,800	
		68,000

Within the Regreening component about 10% is for the Demplot programme which totalled 700 new sites in 82/83.

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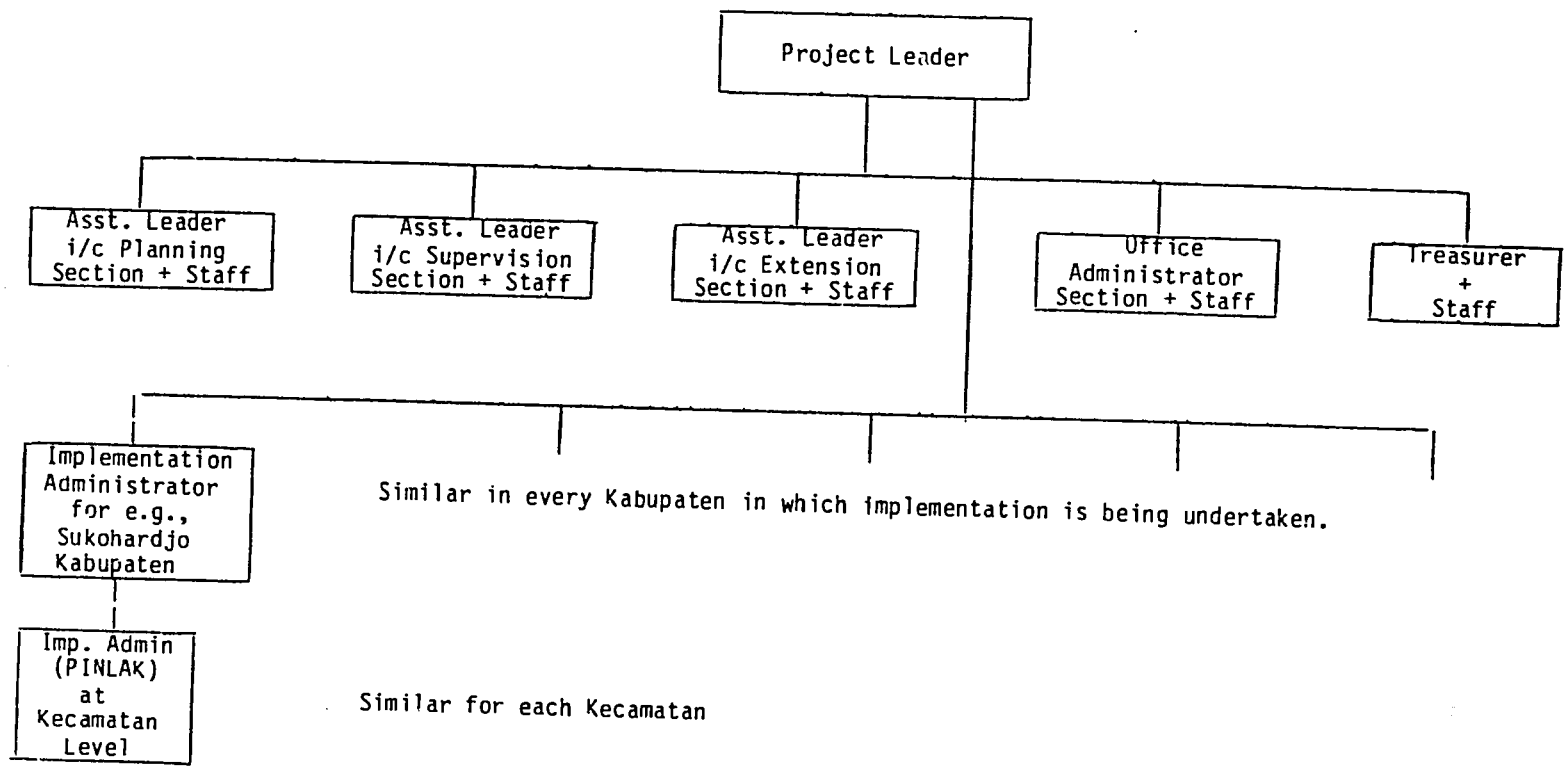
Figure 2.1

Organizational Structure of the Solo Watershed Reforestation Planning & Supervision Unit (P3RPDAS, SOLO)



Note: As this chart covers Reforestation activities which by definition are on State land, the live from Project Leader to Pimpro at the kabupaten level is a line implementing function.

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Figure 2.2

Planning Mechanism for Regreening Operations

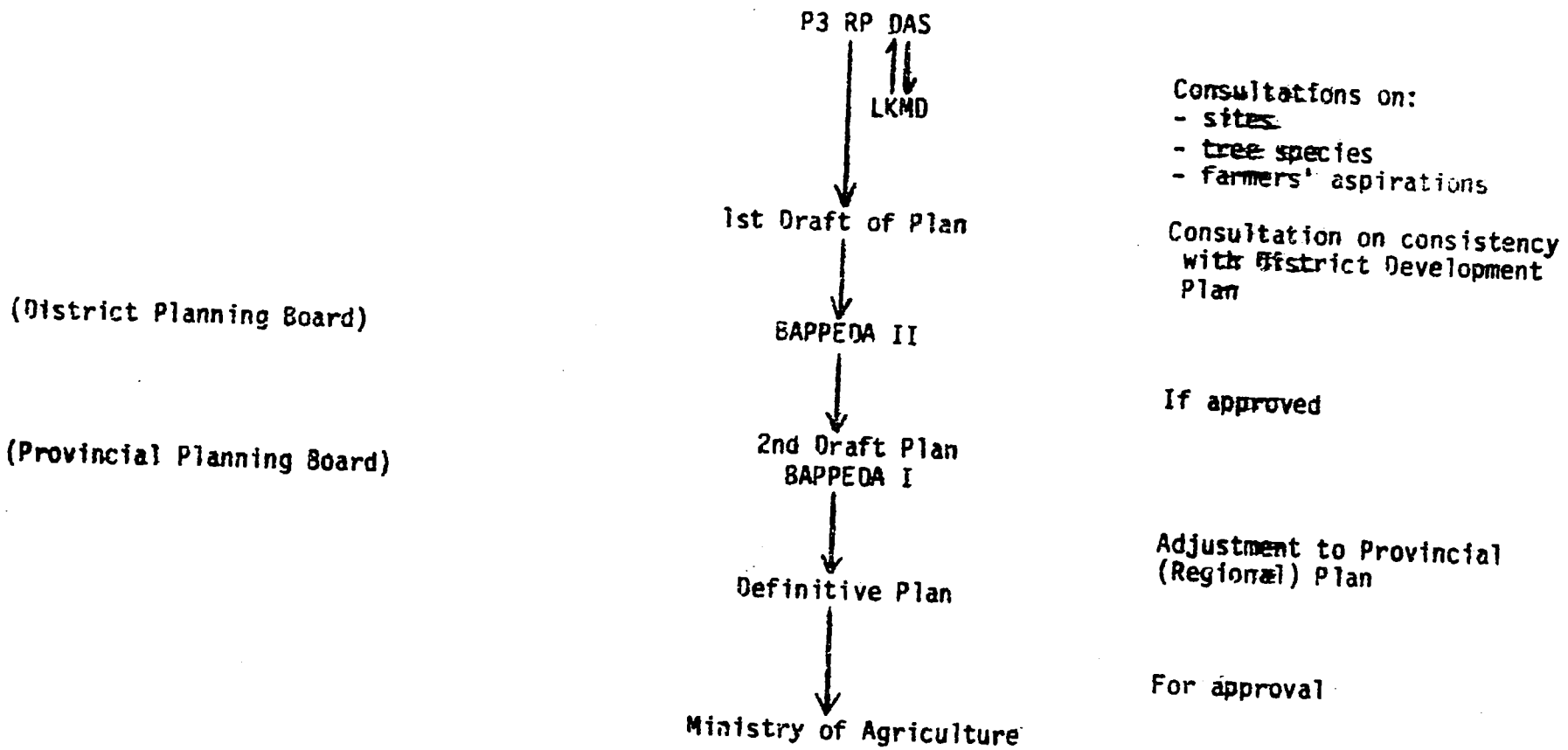

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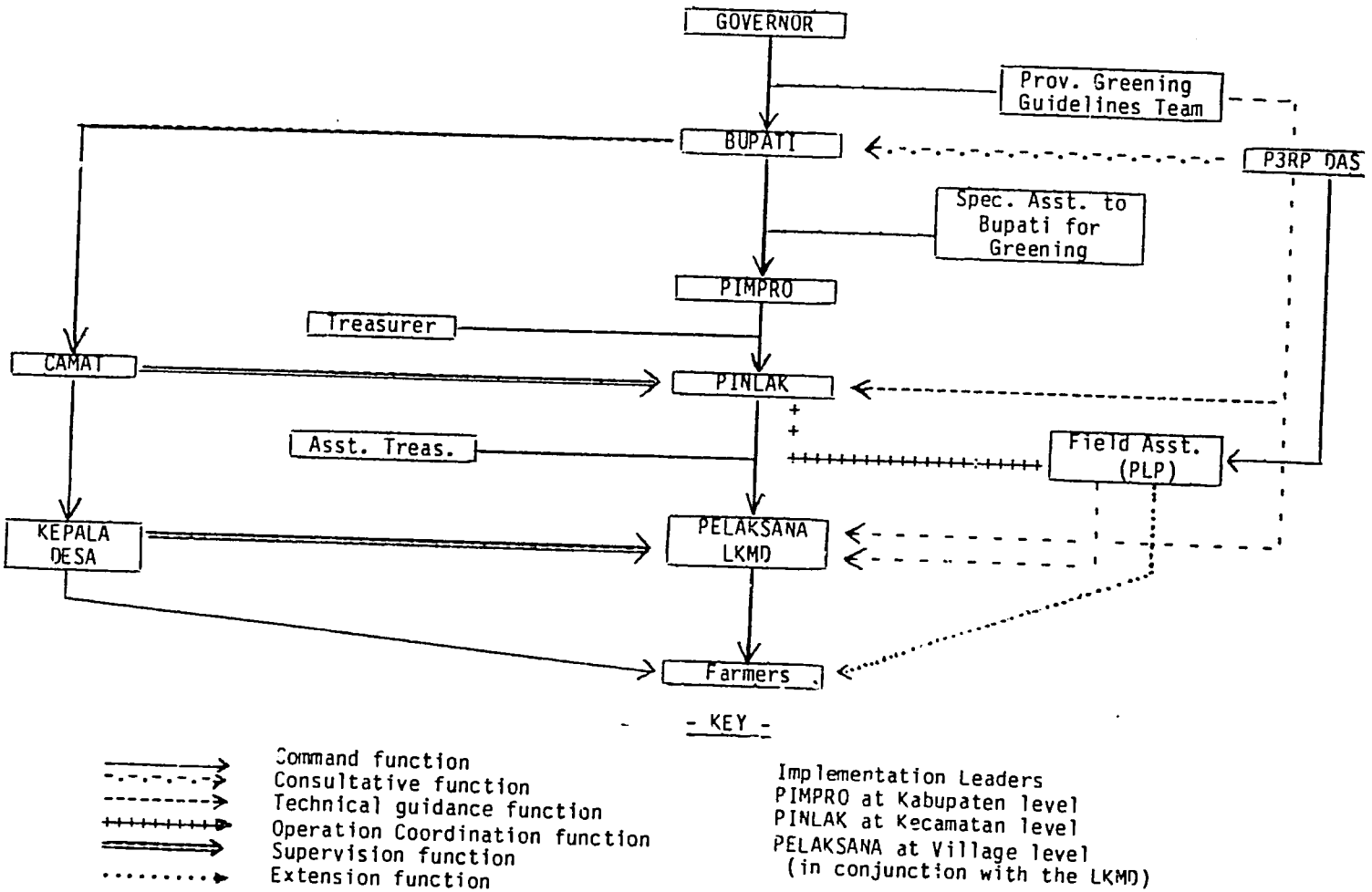
Figure 2.3

Structure of a Kabupaten Regreening Project and the Role of P3RP DAS



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Chapter 3. Assessment of Previous and Ongoing Programmes in Watershed Management

3.1. Reafforestation and Regreening Programmes

These are ongoing government programmes, the distinction between them being that Reafforestation is confined to State land, while rRgreening is undertaken on private land. The programmes started in 1961 in a small way and initially Regreening was concerned solely with planting trees (at 400 per ha.) on steep or badly degraded private land. Originally, payment was made on a food-for-work basis, but in 1976 an Inpres budget was introduced through which cash payments were made and the programme became Inpres Penghijauan. In 1977/78 the scope of the programme was considerably broadened by the inclusion of terracing on private land and one year later the construction of check-dams was added thereby increasing the scope still further. Finally in 1981, Demonstration Plots (Demplots) were added to the package of works.

Demonstration Plots are about 10 ha. in size, involving some 15 to 20 farmers who undertake to work as a group in improving cultivation practices over the whole plot. The co-operation and approval of the Kepala Desa is secured in plot selection. Plots are commonly 1 to 2 km from the village. A small, inexpensive meeting hut is erected within each plot which serves as a focal point and shelter for the extension worker, PLP, assigned to develop the plot, to interface with the group. Upgrading operations include renovation of terraces, construction of waterways, stabilization of earthworks with grass planting, some tree planting, and the introduction of improved agronomic practices. Incentive payments for the field work, seedlings and fertilizers are currently of the order of Rp. 291,000/ha in year 1, Rp. 113,000/ha in year 2, and Rp. 25,000/ha in year 3. After year 3, the improved level of management is expected to be self sustainable. The objective of the programme is to establish one demonstration plot to serve 200 ha of

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relatively contiguous land with the intention that the improved practices will be adopted by farmers in the remaining 190 ha. Incentive payments to farmers outside the Demonstration Plot are not, at present, included in the programme other than payments (estimated at Rp. 50,000/ha) through Inpres Regreening for the construction of waterways and drop structures in the Demplot expansion area (Dampak area). Some field staff consider this is a weakness and are recommending small incentives for fertilizer costs, seed and other planting materials.

In relation to the Dampak areas of Citanduy II, in addition to payments for waterways from Inpres Regreening, farmers also receive assistance in kind (seeds, fertilizers and insecticides) through Dinas Pertanian which are funded from Inpres Dati I and valued at some Rp. 90.000/ha. These are being made available in the first year only since it is hoped credit will fulfill the farmer's needs after his subsidized, initial year as a replicator.

In the Jratunseluna watershed, the number of Demonstration Plots has increased from 15 in 1980/81 to 43 in 1982/83. In Solo, the 1982/83 target is 67, increasing to 80 in 1983/84. This part of the field programme presently accounts for about 10% of the direct INPRES expenditure and is expected to become an increasing proportion.

In the early years the standard of work was poor and few examples of work undertaken at that time can be seen today. The earliest example of tree planting under this programmeme known to the writer (in Tawangmangu) dates from 1974/75 and is not particularly impressive. The present stocking is very ragged and apart from replacing dead trees in the year after planting (which is known to have been done) it would seem that no further attention has been given to this site.

Later examples of work undertaken by Inpres Penghijauan dating from the late 70s to the present day are much more impressive although in some cases the standard, particularly of terracing, is not as good as it could

be. Examples of this were seen in the outreach area from a Demplot (Lemahireng) in Jratunseluna, and elsewhere. Despite these remarks, however, it is encouraging to see that expansion around Demplots is in general taking place and in most places the standard is reasonably good.

Regarding the Demplots themselves, the standard of these seen varied considerably. Probably the best was that at Sumber Sawit in Magetan district, East Java. The terracing and other work were of a high standard; the farmers gave the impression of feeling involved, and it was clear that the Bupati himself had a considerable interest in and exercised leadership of the project.

Still in East Java, the 20 ha Demplot at Gabes in the upper reaches of the Kali Konto watershed which is operated by PSL of the University of Brawijaya under grant from the Brantas project of Public Works did not have much to offer. There were virtually no crops in the ground, despite the fact that private land in the vicinity was under intensive cultivation for vegetables. The majority of this land is not owner-operated but rented-out to entrepreneurs from Malang and elsewhere at rents around Rp. 150,000 per ha per year, who make a gross return of up to Rp. 1,6 million per ha per year from vegetables (mainly onions, potatoes, carrots, cabbage, etc). Labour and other inputs are at a high level, but soil conservation measures in general are not of a high standard. It would not take much extension effort to put simple measures in place and potentially would pay high dividends in reducing the rate of siltation of the Solorejo reservoir. This hydro-electric installation (which supplies Surabaya i.a.) has a design-life of 100 years but measurements of the current siltation rate indicate an actual life of around 33 years. In the same drainage basin, a check-dam 23 m high constructed across a long but not very wide valley at Tokol was completely filled with sediment in 3 years.

In Central Java, the Demplot at Bulu in Karanganyar district was visited. Good results are claimed for this demonstration, but at the time of our visit the land was between crops.

In Jratunseluna watershed (Salatiga) an impressive Demplot at Lemahireng was visited. This had a good outreach, but as already mentioned the standard of terracing was irregular and not always good.

In the Special District of Jogyakarta, an extensive area of Regreening at Selopamisro was visited. The differences between before and after treatment were highlighted by leaving a small part of the area in its original degraded condition. In the same area, a check-dam, the construction of which was begun in December 1982, was visited. The work was of a very high standard - probably higher than really needed, and the design incorporated an irrigation facility for a downstream benefit area of 2 ha and the dam has a design-life of 5 years to complete fill. The structure was designed by P3RPDAS, Gunung Kidul, and constructed by direct labourers under the Inpres budget. The cost was quoted as Rp. 32 million, which figure, when considered in conjunction with the design features given above, must call into question the cost-effectiveness of such structures.

A 10 ha Demplot at Jatimulyo was visited. The stone-faced terraces were of some age but had been rehabilitated in 1981 and some trees planted on them in mixture with the farmers' crops. There did not appear to be much outreach from this demonstration into the surrounding area.

In West Java, in the sub-watershed of Ciseel, Desa Margajaya was visited. This is being operated as a model farm by the Citanduy project. The standard of terracing and utilization was good but the terrace risers had still to be grassed. It is interesting to note that development in this area was initiated by the farmers themselves as a result of exposure to the Panawangan project. Also in Citanduy area is the Cigaru applied research area in which farmers' participation is being stimulated. Although not visited by the writer, in the course of discussion, the results, in terms of farmer participation, were described as very encouraging and were being obtained at minimum cost.

The overall impression of Regreening and Demplots is that the standard varies from site to site. The better examples appear to be associated with staff who have a high degree of personal involvement and interest in the projects.

3.2. FAO First Solo Project (INS/72/006)

This section is concerned only with the two demonstration sub-watersheds which were visited by the team. These are: Kali Tapan near Tawangmangu in the upper reaches of the Samin watershed, and Kali Dumpul at Ngunut in the lower reaches of the same watershed.

The Kali Tapan has a high proportion of steep land on which the project initiated the forestry package of trees/grass/animals. This package was unattractive and while some of the trees have been left, all the underplanted grass has either died or been removed and replaced by annual crops - typically cassava. This is not good land-use on these steep slopes but, given that the farmer must make a living from his land, and given that the present information is that the forestry package as originally devised is not viable, the reintroduction of food crops is understandable. The obvious answer here is to rework the forestry package to make it both technically viable and financially attractive and when both conditions have been met and demonstrated, an extension campaign should be mounted to launch the revised package. The villagers gave the impression of being more prosperous now than they were 9 years ago when the project started work in the SWS.

In the Kali Dumpul, additional work had been undertaken by the farmers after the departure of the project to increase the area of irrigated land. Land was being used effectively and the terraces and other works were being maintained in a satisfactory condition. Some poor cropping practices were observed - growing cassava on the outer lip of the terraces, which will lead to damage to the riser at harvest and hence increased (and unnecessary) maintenance. A simple extension message

seems indicated. Here too, the village of Ngunut gave the impression of somewhat increased prosperity over its pre-project condition.

3.3. FAO Ongoing Solo Project (INS/78/011)

The title "Watershed Management through People's Participation and Income Generation" describes the main aims of this project. One pilot area in the Kali Sendang was visited and the methods used to obtain participation in the development processes at the grass-roots level were explained. At present, as being appplied in a pilot area, the methods are very staff-intensive but were described as successful. If they can be adapted to a less intensive routine, consideration should be given to adopting them as a standard extension approach since, clearly, beneficiary particiation makes for more meaningful development.

On the same project, a number of small, simple workshops were visited in which craft items in bamboo are manufactured. Provided quality control can be maintained and reliable marketing outlets established, this seems a useful way of generating off-farm employment and income and should be encouraged.

3.4. Jogyakarta Rural Development Project (Watershed Sub-project)

The World Bank assisted Jogyakarta Rural Development Project (Credit 946-IND) aims to strengthen the capacity of the provincial Government to implement effective area development programmes in "critical poverty" areas. Its main components are to test the economic and social viability of new, appropriate, agricultural technologies and soil conservation measures for upland farming and then expand these on a wider scale; expand low-cost income generating activities in fisheries, livestock, and small-scale industries; support the Kabupaten Works Department in developing low-cost, technologies for rural road construction; expand and improve preventive and primary health care and health education; and, provide drinking water in areas of critical need. The project, which

became effective in December 1979, has, after some unexpected delays, picked up momentum and is now substantially meeting targets. The upland farming activities, which are being implemented in three ecologically separate sub-watersheds of about 1,000 ha each, have reached the stage where they are producing encouraging results in promoting water/soil conservation techniques, improved crop agronomy, fodder and tree crops. Before these results can be applied on a wider scale, more effort is still needed, however, to firm up the preliminary results so far achieved, improve and broaden the technical basis for hillside farm improvement, and assess the levels of subsidies/grants required to secure the widescale adoption of these improved technologies by farmers.

3.5. Citanduy Projects I and II

Introduction and History

The Citanduy River Basin lies on the south side of Java about 300 km southeast of Jakarta. Originating on Cakrabuana Mountain, the Citanduy River skirts the north and west slopes of Sawal volcano and travels 175 km to the southeast to discharge in the Indian Ocean at Segara Anakan, a brackish lagoon. The 446,000 hectare project area includes parts of five districts (kabupaten) in West and Central Java.

About 2.85 million people live in the basin, an average of 640 people per square kilometre. Since the turn of the century, increasing population pressures have resulted in serious deterioration of the watershed. Removal of permanent vegetation for crops and roads has subjected large areas to soil erosion and reduced the capacity of the soil to absorb heavy rainfall. As a consequence, the upland areas are threatened with decreasing productivity, while in the lower basin cycles of flood and drought are becoming more severe; heavy siltation increases problems of maintaining irrigation systems and is destroying the mangrove swamps.

Most of the Basin's inhabitants are farmers with an average farm size of around 0.5 hectares. Such small holdings and low productivity, especially in the uplands, severely limit the farmers' resources to undertake either soil conservation practices or improved cropping systems.

The Government of Indonesia established the Citanduy River Basin Project in 1969. Since then, the project has undertaken two phases. The first, 1969-76, included reconnaisance studies, preparation of a Basin Master Plan and feasibility studies/design of priority development activities.

The next phase, Citanduy I, 1976-81, continued studies for future project activity while beginning implementation of priority flood control and irrigation rehabilitation in the lower basin.

Citanduy I

Purpose

The three-fold purpose of Citanduy I is the reduction in flood damage, increased production of rice and other food crops, and studies for further integrated basin development.

Principle Outputs

The principle outputs of the project include 189 km of improved river levees and a number of major flood control structure; seven rehabilitated irrigation systems serving a total 10,500 ha and one new 600 ha system; and four feasibility studies for further irrigation development, related irrigation design work, and a feasibility study and work plan for upper watershed development. The Panawangan Pilot Project was undertaken as part of this study. This project was implemented on a 300 hectare sub-watershed area which included a demonstration or model farm of some 6.1 hectares. Both a model farm and the Watershed Management Development

Subcentre for the Cimuntur Subbasin, financed under the USAID Citanduy II Upper Watershed Project, are located within the Panawangan area.

Beneficiaries

The principal beneficiaries of this first Citanduy loan are about 355,000 inhabitants of the lower basin, most of them farmers who will enjoy better protection from floods, improved irrigation systems, or both. The rest of the population of the lowland plain and of the entire basin will benefit indirectly from increased food supply, an expanded economy, and from future implementation of the activities studied and found feasible.

Other donors

To the present USAID is the sole donor involved in the work of Citanduy I. USAID's funding of the feasibility and design studies for the Sideraja Cihaur irrigation systems in the basin, however, has led to a major loan by the Asian Development Bank for the construction of this system.

Citanduy II

Building on the completed studies and experience to date, the GOI's Phase III (second implementation phase) continues the transition from planning to implementation. The early focus on problems of water resources in the lower basin will expand to include comprehensive basin-wide development of soil and water resources involving broader participation of GOI agencies and other donors. The Asian Development Bank is financing major capital costs for new irrigation development, while USAID's Citanduy II emphasizes upper watershed development and management; operations and maintenance and agriculture support for irrigation, including rehabilitation of ten small systems; and increasing local human resource capabilities and participation through training and local institution building.

Purpose

The purpose of Citanduy II is to establish and catalyse local and national capacity to design and implement a comprehensive watershed management programme in selected areas; to achieve and sustain irrigated food production at levels projected in the feasibility studies in all basin technical irrigation systems; and to improve local government capacity in the basin to plan and manage integrated rural development.

Principle Outputs

Principle outputs of the Citanduy II Upper Watershed Development component will include an expanded upland extension service; introduction of improved upland conservation/production technology on some 5,000 ha, through research, a series of 50 "model farms" and an upland credit programme; plans for long-term watershed management; and other soil conservation measures. Outputs of the Development of Irrigation Systems component include rehabilitation of 10 small systems serving 3850 ha, improved local capability for operation and maintenance of all irrigation systems, and the development of effective water users associations with introduction of on-farm water management and high-yield production technology. A feasibility study of one new, 3,200 ha irrigation system will be completed. The third component, Local Development Planning and Management, will enhance the capability of the local governments to plan and manage development activities, provide financing for a number of small-scale local initiative projects, update the Basin Master Plan, and provide for socio-economic research for project management and evaluation.

Beneficiaries

Principle beneficiaries of Citanduy II will include some 100,000 members of upland farm families adopting the improved technology and 365,000 lowland inhabitants benefiting from improved irrigation facilities and/or better farm management and irrigation system operation

and maintenance. All 2.85 million basin residents will benefit at least indirectly from protection of soil and water resources and increased food availability.

Operation

Project Agreements for Citanduy II were signed in September 1980 and all conditions precedent to first disbursement were met by June 1981. A contract was signed with the consultant firm, Resources Management International, Inc. (RMI) in December 1981 and a consultant team was fielded starting early 1982. The GOI support system at the basin level, the Watershed Management Development Centre, was established by Decree of the Minister of Agriculture in June 1981.

Project activities in the agricultural sector, mainly the establishment of pilot farms (Demplots) and their expansion into the surrounding areas has been ahead of targets since the establishment of the WMD Centre. Training activities are being undertaken and a start is being made to research activities and putting in place a farmers' credit system.

Activities have also started in socio-economic research and strengthening the local government capacity in planning and management.

The institutional aspects of the project are covered in the relevant technical report (Institutions).

3.6. Recommendations

Technical and institutional experience gained from previous and ongoing projects constitutes valuable information for designing future programmes or modifying existing ones. Every effort should be made to solve constraints and to utilize the positive outputs from projects.

Chapter 4. Incorporation of Results from Pilot Projects into the National Programme

In the area of watershed management, there are at least two historical cases involving the transfer of technology from the project in which it was developed and its incorporation into a national programme.

The first concerns the development package for rainfed cultivation land on slopes of under 50% which was developed and demonstrated by the first FAO Solo Project between 1973 and 1976. This package comprised:

- bench terracing with waterways and gully plugs (where necessary);
- stabilization of the risers between terraces with grass (which was to be cut and fed to stalled animals - zero grazing);
- improved agronomic practices on the terraced land (improved cultivars, use of fertilizers and pesticides, improved crop rotations, etc); and the
- integration of small animals into the farming system.

This package was standard throughout the areas (subwatersheds) in which the project worked. Elements within the soil conservation component were varied according to site conditions. These included width and height of terraces (dictated by slope class), spacing and size of waterways (governed by rainfall and slope class), type of waterway (determined by local availability of construction materials), treatment of gullies (according to size and grade - which determines spacing and height of plugs), etc. These elements are site specific.

Over a period of years this soil conservation component was adopted by the regreening programme as the standard treatment for the rehabilitation of degraded agricultural land (with the inclusion of tree planting at 400/ha from the earlier regreening programme).

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Other components of the Solo package were not apparently adapted as standard except by the Panawangan project of Citanduy I. Here an integrated approach involving the inclusion of all components - soil conservation, cropping systems, animals, trees for fodder, fishponds, beekeeping - was initiated on a 6 ha model farm.

The model farm acted as a catalyst in generating enthusiasm among surrounding farmers to participate in similar development activities. This became the basic model for the greening programme's Demplot and its extension area which became part of the programme in 1981.

The second package developed by the FAO Solo project for slopes of over 50% was a trees/grass/animals combination which was shown to be viable but which required injections of subsidy in the early years before full benefit was achieved. Because of the difficulties inherent in obtaining a subsidy in cash (or kind) at that time, this package was not introduced as part of the Regreening programme. Additionally, field trials had not been carried out for a sufficiently long period to identify and eliminate all the technical problems. In particular the grass species being used (Pennisetum purpureum) proved unsuitable and further experimental work using other species and as well grass/legume mixtures was, and still is, required.

Another proposal made by the FAO Solo project was for government to adopt a bottom-up approach similar to that latter employed by the project to enable the ultimate beneficiaries - the farmers - to participate meaningfully in determining the development option most appropriate to his particular parcel of land. For various reasons connected with the difficulties of: i) preparing an operation budget for a range of options, and ii) imposing a time frame on the development period in any given sub-watershed, the proposal was never implemented. In hindsight it would appear that the project was too rigid in its requirements; a more flexible position may have resulted in the recognition of the need for farmer participation, but within a controlled framework.

The GOI is and has been prepared to accept techniques developed by projects, provided these can be shown to work, and to incorporate these into its ongoing programmes even if this results in radical changes to these programmes. (See Chapter 2 for the evolution of the Regreening programme from purely tree planting up to 1976, then the inclusion of terracing and later check-dams, and finally the Demplots concept in 1981.) This constitutes an impressive record of assimilating new (but proven) techniques to change the thrust from a simple theme to integrated development which can produce a "snowball" effect.

On the other side of the coin, it should be noted that the Solo model, and in particular the soil conservation component, appears to have been applied without full regard being taken in every case of the individual site conditions. It would appear that the approach is too rigid to allow the local implementor flexibility to take into account micro site conditions. This of course could be a function of the level of training and degree of skill of the local implementor. If either is in question, it is clearly better to be rigid and over prescribe than to allow discretion and probable underprescription. If the assumption regarding level of skill is correct, the solution is to improve the level through in-service training courses. The Watershed Management Development Centre (P3DAS) in Surakarta has the necessary skills to mount such courses.

In the case of institutional support systems which were initially developed for projects, it appears that some elements have been incorporated within the government apparatus.

The National Watershed Development Coordination Committee comprising the Chairman of BAPPENAS and the Ministers of Finance, of State for Environment and Development Supervision (now Population and Environment), Home Affairs, Public Works and Agriculture, is established by Joint Ministerial Decree. In the light of recent (March 1983) government changes, the Committee will presumably be increased by the addition of

the Minister of Forestry. This committee is charged with the coordination of the INPRES Regreening programme at the national level and ensuring that the policies of the individual ministries concerned are directed to a common goal. A separate National Steering Committee for the Citanduy II project, as required under the loan agreement, was established in June 1981 by joint decree of the Ministers of Agriculture, Home Affairs and Public Works. The chairman is from BAPPENAS and members are drawn from staff (at the Director level) from the Ministries of Public Works, Home Affairs, Agriculture (food crops, extension), Finance, Health, BAPPENAS and Environment.

The UNDP/FAO Solo I project had a Central Coordinating Committee (CCC) which can be considered roughly analagous to the above in terms of Ministries involved but representation was not at the level of Minister. Clearly the present National Committee is a much higher body.

The Citanduy II loan agreement also calls for the formation of a Basin Coordinating Committee to coordinate project operations which are located in 5 Districts of two provinces (West and Central Java). Chairmanship of this committee alternates on a yearly basis between the chairman of the BAPPEDA in of the two provinces involved. It was stated openly to the team that this Committee does not fulfill the functions with which it is charged, namely the coordination of activities at the basin level. It was subsequently explained that linkages at the kabupaten level are more effective in ensuring coordination of effort.

A parallel exists with the Solo I project for which Local Coordinating Committees(LCCs) were established at the Residency level in Surakarta (Central Java) and Madiun (East Java), being the two administrative units in which the project operated. These LCCs were very effective in coordinating assistance and inputs required from the different provincial agencies (Dinas). Every agency with direct or even peripheral involvement in project activities and objectives was represented on the LCC under the chairmanship of the Resident.

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These two contrasting, in fact opposite, experiences at the local level appear to suggest that effective coordination is more easily achieved at levels lower than the province. In terms of present administrative units, this would be the kabupaten. This satisfies the principle of decentralization of management down to a level at which it can be effectively exercised. This refers both to coordination of different agencies within the kabupaten and to coordination between adjacent kabupatens.

Continuing within the framework of institutional support systems, the Technical Development Cell (TDC) established within the Jogyakarta Rural Development project must be examined. This has a role in rural development in its widest sense in that it embraces a wide spectrum of rural activities, of which agricultural development is only one sector. This multi-sectoral approach can do much in broadening the base of development and improving the social and living conditions of rural families.

In the agricultural sector, the establishment of an Agricultural Technical Development Centre (ATDC) and sub-centres provides a focal point for locally applied research and, of at least equal importance, of training and extension activities. It is considered that these outreach centres at or near the grass-roots level are performing an extremely useful function and consideration should be given to their replication at the kecamatan level (or at least initially the kabupaten level). The present centres and sub-centres are staffed by personnel hired by the IBRD project who have no guarantee of employment after the project terminates. This is a very worrying issue to the staff concerned, which is bound to have implications on their professional performance. It is recommended that government assess the impact of this centre and its sub-centres and, assuming the outcome is positive, make such arrangements as are necessary to incorporate the present, and similar, units at, at least, the kabupaten level in every watershed area in which development activities are taking place. Assuming the recommendation made in the

Team Report regarding deployment of Soil Conservation Agency staff is accepted, some of these staff could be employed, at least part-time, in the ATD sub-centres.

At an even lower level, it is recognized that there is a very real need to involve the ultimate beneficiaries - the upland farmers - in constructing the development package appropriate to their land and aspirations. In this regard two projects must be considered; these are: the FAO Solo II project and the Cigaru project of the Centre for Environmental Studies of the Bandung Institute of Technology (ITB), both of which seek to identify with the land-holder and to integrate his aspirations into the development process. At present both methods are still under test and therefore it is impossible to make an absolute comparison. Both are impressive. The results claimed for the Cigaru experiment as against the Panawangan prototype are given in table 4.1., but it should be recognized that this comparison is biased towards its progenitor (Cigaru).

In comparison with the Solo II experience (which is staff-intensive), the Cigaru methods would appear to offer considerable advantages. Whatever the method, it is clearly essential that the ultimate beneficiaries - the upland farmers - actually identify in a participatory sense with the development measures being proposed for their land.

It is strongly recommended that government pursue measures to involve the participation of all farmers (implicitly in the context of this report, all upland watershed farmers) in the decision-making processes regarding the development of their land. This implies a bottom-up rather than a top-down approach - however inconvenient this may be to traditional planning.

Table 4.1.
DIFFERENCES IN METHODS
USED IN PANAWANGAN AND CIGARU

REMARKS	PANAWANGAN	CIGARU
1. Assumption	The introduction of technology towards modernization and development will result in a change in the structure, value adherence, and attitude of the target group.	The change in attitude and behaviour should precede the introduction of technology in order to guarantee continuous self-generated development.
2. Approach	Partial participation of the target group at tne implementation and utilization stages.	Total participation of the target group from the time of problem identification, feasibility study, planning, operation, monitoring down to the evaluation of the program and the initial results.
3. Kind of intervention	- urgent problems - maintaining	- urgent problem - maintaining - developing - analysis of system.
4. Outputs	Permanent demonstration of conservation of soil and water to support productivity of dry land agriculture.	Permanent demonstration of community development: - environmental development - economic development - social development based on the written law, tradition, and religious belief.
5. Inputs/Incentives	Rp. 225,000 / ha.	Rp. 20,000 / ha.
6. Lessons learned	Knowledge about techniques of soil and water conservation as related to cropping systems.	Knowledge about: - total farming systems: * land based * non-land based - integrated rural development - appropriate technology including complementaries, sequence, implementation periods. - organization, management, leadership. - improving the environment.

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Chapter 5. Evaluation of Research and Demonstration Packages for Appropriateness and Effectiveness

On the research side, it is clear that a considerable amount of applied research at the local level must be undertaken if the watershed programme is to become responsive to local conditions.

The need for "Field Laboratories" in which applied research in both the technological and human fields can be undertaken has been adequately made in the general report and will not be reiterated here.

The demonstration package as at present applied is a general package which will result in the reduction of erosion and an increase in the productivity of the land. These two goals are central to the present programme, and to any programme in the development of watershed management.

However, as noted above, and earlier in Chapter 4, it is desirable to fine-tune the development package so that it is more site-specific to local micro conditions and responsive to farmer aspirations. The present package seems too general and rigid in application and would obviously benefit in terms of cost-effectiveness by site-specific fine tuning. However, if - as postulated earlier in Chapter 4 - the limitations to the adoption of a site specific policy are:

i. limitations in the technical capacity of on-site personnel at the implementing end, and
ii. lack of site specific recommendations for a given micro environment,

then the answer becomes:

i. upgrading training for in-service staff, and
ii. determination of site specific recommendations regarding soil conservation measures required, farming systems, etc.

Application of the above will result in a more meaningful integrated watershed management package (soil conservation + increased productivity) being delivered to the individual farmer.

BIMAS Approach

The suggestion has been made to base the watershed management structure on the BIMAS/INMAS model, and title it BIMAS PENGHIJAUAN. This is appealing in its simplicity, but in our view the two situations are not similar.

As the name implies, BIMAS was a mass guidance programme designed to increase rice production. The end-product was known - increased rice production. The technical package to secure this end was known - high-yielding varieties, water control, fertiliser rates, pesticides. The programme was a massive exercise to make known the components, and to make them available at the farmer level, and was successful in achieving the desired end-product.

In the case of watershed management, the end-product is known - a stable farming system which increases productivity from the land while at the same time reducing soil erosion to the minimum. However, under any given situation, the prescriptions to achieve this end are specific and site-dependent. This implies that watershed managers must be trained to recognize site-factors and to relate their technical prescriptions to these factors. In other words, unlike the intensification of rice production, in watershed management there is no single set of prescriptions applicable to all situations.

In relation to any given site all prescriptions given below must be considered, and those relevant to the situation prescribed.

Prescriptions for private land:

- agronomic conservation measures on low-slope areas;

- terracing for intensive annual cultivation on slopes under 50%, plus grass for animals;
- waterways;
- agro-forestry or silvi-pasture on slopes greater than 50%;
- check dams or gully plugs;
- farm access roads;
- rationalization and intensification of home-garden cultivation;
- community forest plantations (for fuel and other wood, or charcoal production);
- protection forest (plantation or natural) on very steep land.

The watershed manager (planner) must be trained to recognize the site conditions and to prescribe the relevant measures appropriate to each situation.

This implies areas of training for the above managers.

Chapter 6. Improvement of the Present System with Particular Reference to Policy Formulation and Implementation and the Institutional Arrangements for Management and Coordination.

1. General

In considering the organization and management structure of the different groups at present engaged in watershed management activities, and their performance record in the field in terms of being able effectively to discharge the responsibilities with which each is charged, the following principles have been central to our thinking.

a. We have not envisaged the setting-up of a new organizational structure, purely for the sake of setting-up something new.

b. We have always considered that what already exists in terms of structure and organization should be adapted, if necessary, to enable it efficiently to discharge its responsibilities.

c. This requires an analysis of the present situation, identification of limiting features, and the minimal adjustments required for efficient operation. In effect, it requires the removal of bottlenecks which obstruct management.

d. We think we have identified the main constraints in the present management structures, and have further identified methods by which these can be reduced in impact if not eliminated entirely.

2. Management Principles

There are 4 management principles which should be met if the institutional structure to support a complex and multi-disciplinary subject field such as watershed management is to function efficiently and successfully.

These are:

a. Inter and intra agency (MOA, MOF, MHA, etc.) cooperation at both the national and local levels is essential to the successful execution of watershed development programmes;

b. Decentralization of responsibility and authority for both the design and execution of watershed management programmes to provincial government and lower levels is essential for the successful execution of such programmes;

c. Flexibility in budgetary and credit systems is required to enable local decision-makers to respond to the inevitable variations found in any effort to introduce technology to varying agro-climatic zones and to farmers with varying income levels and attitudes toward risk;

d. Identification and active participation of project beneficiaries in program design and execution is central to the successful introduction of new technology.

In short, the above four working principles should be incorporated in the design of all projects and programmes in this field. To reiterate, these are: unified interagency project management; decentralization of decision-making; flexible, locally determined budgetary and credit systems; and a main thrust on obtaining farmer support for and involvement in the processes of technological innovation.

Four important lessons can be drawn from the experience acquired from examining the various watershed projects which bear directly on the type of institutional structure and its authorities that should be established to manage any proposed project or programme. First, one key to success is that responsibility for planning and management must be vested in local government institutions and decision makers at the provincial and

district levels, appropriately supported and assisted by national level technical institutions which operate in the respective watersheds.

The present machinery for planning, technical guidance and monitoring activities under the Regreening Programme - the office of P3RPDAS - is centrally directed and financed out of the Ministry of Forestry (formerly D.G. of Forestry). Attachment to a narrowly specialized parent body was shown by the first FAO Solo project to be limiting to the maneuverability required of a multi-disciplinary operation such as watershed management in which, because of the variation in conditions, many decisions have to be taken at the operational site. The present structure appears to impose a considerable rigidity in prescription which precludes necessary changes in the standard package of treatments in response to variations in local circumstances. In contrast, an organization which was controlled at the local level, say province and district levels, could be expected to identify more closely with, and be more responsive to local conditions and aspirations.

The second principle which should govern the institutional arrangements for watershed development flows directly from the first principle of decentralization. Once given authority for providing overall management of watershed activities within the province, the Governor (assuming that primary control is to be vested at provincial level) would:

1. appoint a full time manager for each major watershed;

2. provide the manager with authority to create an interdisciplinary professional staff drawn from the staffs of the various technical agencies (e.g., Forestry, Agriculture, Livestock, Extension, Agraria, Public Works, etc.); and

3. provide the project manager with authority to manage field execution of the program in conjunction with district governments and the

technical personnel, representing all participating technical agencies, who work under the direct responsibility of the District Head (Bupati).

The above management arrangements are not presently standard government operating procedures. However, the GOI, in both the Citanduy and Jogyakarta projects, has demonstrated its interest in developing and testing decentralized and integrated management structures appropriate to each of the above watersheds. Both institutional arrangements represent interesting variations which in theory accomplish the objective of decentralizating responsibility and integrating line agencies into one overall watershed management programme. In practice, in one of the watersheds cited, results have been less than expected - largely because of poor coordination within and between line Ministries.

A third management principle essential to the successful execution of a decentralized, area specific watershed development project, such as the Regreening Programme, is the need for budget and credit systems that are sufficiently flexible to allow for the inevitable variations found in any effort to introduce technology to varying agro-climatic zones, and to farmers with varying income levels, sources of employment and attitudes toward risk. A universal criticism of the Regreening Program and the BIMAS credit program is that they offer a single, rigidly defined package with no flexibility to modify the package to a farmer's specific needs or the particular agro-climatic conditions prevailing in a given area.

Given the shortage of trained administrative personnel and government's desire to set in place broadly based national programmes this position is understandable as a starting point in launching nationwide programmes. However, as second generation programmes, such as the Citanduy and Jogyakarta projects, come on stream with more intensive, decentralized management structures, it follows that, in theory at least, both budgetary and credit systems designed for these projects should allow local decision makers a considerable degree of flexibility in the execution of area specific projects.

To build in this budgetary flexibility one possibility is that the Inpres Dati I (Presidential Instruction Provincial Level) program be utilized rather than the Regreening Program Inpres account, because it is unlikely that this latter can easily be modified for the simple reason that six ministers would have to agree to the proposed modifications. The Inpres Dati I program is, however, highly suited to a decentralized initiative such as outlined earlier. Basically, the Inpres Dati I is a "block grant" to provincial governments. A simple "earmarking" of funds channeled through this Inpres account for the Regreening programme effort would be sufficient to get funds to the local level where they would then be allocated against locally, rather than nationally developed programmes.

The same need for flexibility holds with respect to managing the credit component of a project, which is key to sustaining and spreading the use of the technology packages introduced through the project. Rather than channeling credit resources to the watersheds through national programmes such as BIMAS, to mention one, the credit funds should be administered by the provincially owned Development Bank (BPD) and would in turn be allocated to the various sub-District Credit Boards (BKK) participating in the program, either as capitalization grants or long term loans from the BPD to the BKKs.

The fourth, and perhaps most important, principle essential for the success of a program that attempts to introduce a new technology to low income farmers, particularly upland farmers who literally scratch a living out of marginal land, is the need to secure the active participation of project beneficiaries in the process of introducing and accepting the new technology.

The difficulties of the first FAO assisted Solo Watershed project in gaining farmer acceptance of the proposed innovations, attests to the importance of devising appropriate strategies to secure such acceptance, as does the Panawangan Pilot Watershed Project, which succeeded due largely to local leadership which effectively mobilized community support for the pilot project.

3. Proposed Structure

Based on the considerations outlined in the preceeding sections, the following recommendations for reorganizing watershed management are offered.

A. to ensure inter and intra agency coordination at both the national and local levels, and

B. to decentralize management to the lowest levels at which it can effectively be administered.

The following steps are proposed under the authority of a Presidential Decree.

1. The establishment of a National Policy and Coordinating Body for Watershed Management. This body is envisaged at Ministerial level and would be charged with determining policy directions and ensuring effective collaboration between all the Ministries concerned regarding provision of the necessary technical inputs required for watershed management and development.

   This would comprise the seven Ministries (in alphabetical order): Agriculture, BAPPENAS, Finance, Forestry, Home Affairs, Population and Environment, and Public Works. This body is similar in composition to the National Steering Committee established for the Citanduy project, the functions of which committee should be incorporated in the new body when it is established. A small secretariate would be established to act as a clearing house only.

2. The establishment of Provincial Coordinating Units in each province, under the chairmanship of the Governor, and charged with the same coordinating functions as the National Body, but at the province level. Inputs from the various line Ministries through

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their respective Dinas' would be coordinated at this level by BAPPEDA I. Planning inputs are required at this level from the relevant Reforestation Planning and Supervision Unit (P3RPDAS). The suggestion has been made that these units be attached to either BAPPEDA I or to the new Bureau of Environment to be established within the Governor's office. Such attachment is necessary if decentralization of management is to be achieved.

3. The establishment of Management Units at the District (Kabupaten) level, under the chairmanship of the Bupati and with the active involvement of the BAPPEDA IIs.

   This unit would plan watershed management activities, coordinate the supply of inputs from the different Dinas', and supervise the implementation works being carried out at subordinate levels. This will involve active participation of staff of the P3RPDAS Centre (assuming this is attached at the province level as recommended earlier).

   The Implementation Administrator (PIMPRO) would be responsible to the Management Unit for the performance of his duties.

   Funds for implementation activities would be channeled through Inpres Dati II for disbursement at the kabupaten level.

4. The establishment of an Operational Management Unit at the sub-district (kecamatan) level under the chairmanship of the Camat.

This unit would be responsible for physical implementation activities being undertaken at villages within the kecamatan. The Asst. Implementation Administrator (PINLAK) would be responsible to the Operational Management Unit for the performance of his duties under the general supervision of the PIMPRO at the kabupaten level. At this level close liaison must be maintained with the lewel Rural Extension Centre

(BPP) and the Area Development Coordinating Agency (UDKP) whose activities are regarded as complementary.

At the village level, implementation would be carried out by local implementors (Pelaksana) in association with the Village Self-Reliance Groups (LKMD). It is envisaged that the Presidential Decree would establish the above units at the four levels mentioned. From work already in progress in Java, bodies at the provincial level would be required in East, Central and West Java and in Jogyakarta. Units at the kabupaten and kecamatan levels would be required only as and when implementation activities were being undertaken in their respective areas.

C. Budgetary flexibility would be achieved by channelling funds to the kecamatans under Inpres Dati II arrangements, which are considerably less rigid then the present Inpres Penghijauan instructions.

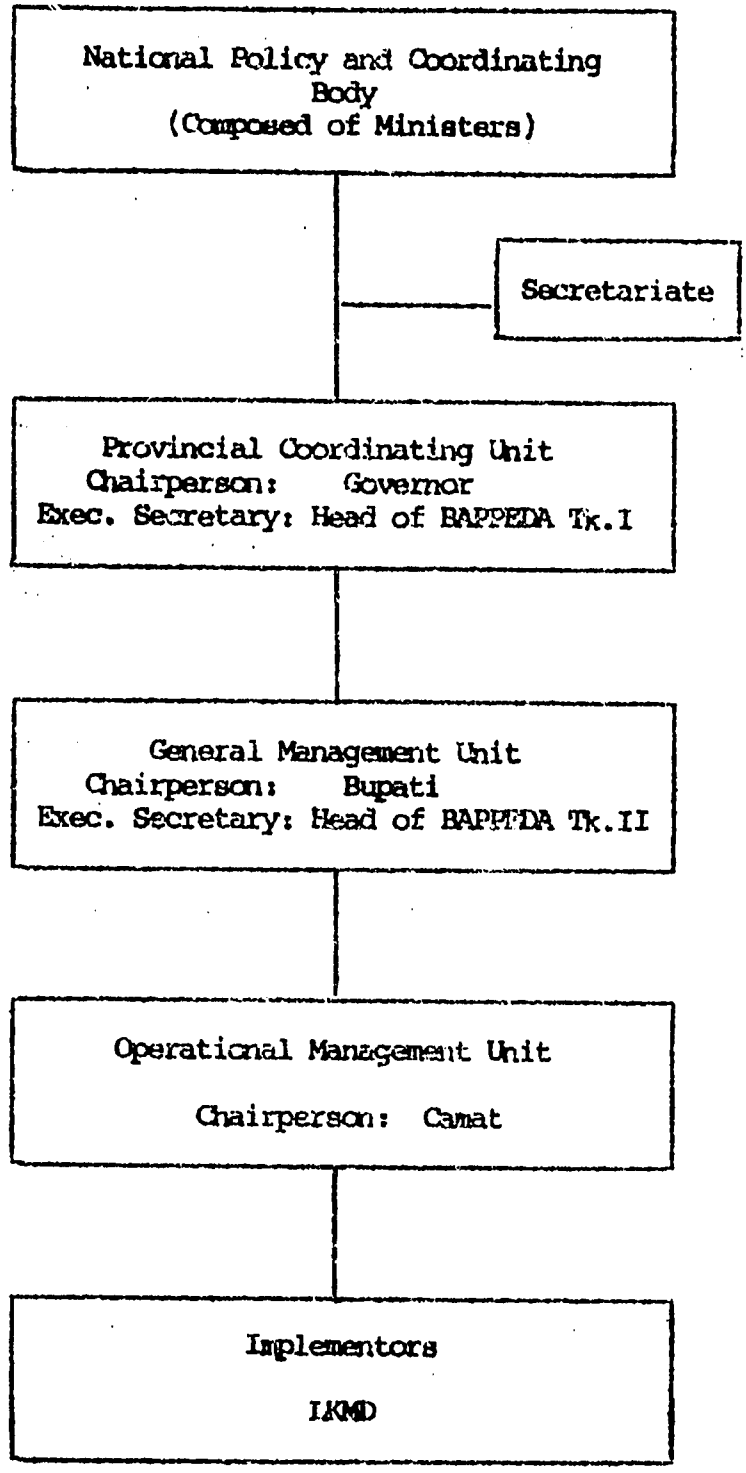
D. Beneficiary involvement at the village and sub-village levels (dukuh and kampung) should be coordinated through the LKMDs and may be further strengthened by the formation of informal farmers groups on the Cigaru or FAO Solo II models.

Items C and D above are discussed in greater detail in Appendix 8, Technical Report on Institutions.

Figure 6.1 following outlines the organizational structure envisaged.

Figure No. 6.1.

Bodies for Coordination of
Watershed Development based on Presidential Decree



TECHNICAL APPENDIX II

FARMING SYSTEMS RESEARCH AND DEVELOPMENT

by

J. MCINTOSH & SURYATNA EFFENDI

Doc. # 2033A

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TECHNICAL REPORT:
FARMING SYSTEMS RESEARCH AND DEVELOPMENT
WATERSHED ASSESSMENT

Introduction

Integrated upper watershed management and resource systems (especially on Java) should be developed with the understanding that problems that exist are really "people problems" that are exacerbated by physical and technical constraints. Consequently, the well being of people must be the central consideration for watershed management and resource development programs. Any programs to be successful should emphasize the improvement of the economic and social condition of the people as well as land treatment practices and improvement of agricultural production and stability.

Conservation practices are connected to agricultural production in two important respects. First, they are physically bound because ground cover and soil management in agriculture or forestry (or in combination) affect both the degree of soil erosion and the maintenance of installed conservation works. Secondly, they are economically bound because the primary justification for conservation of agricultural or forested lands is that these lands, either now or in the future, will be more productive than they would have been without the conservation effort.

In essence, upper watershed development is really an integration of the human element with a system of land management through viable Farming Systems to increase production and economic well being as well as protection of the natural resource.

Farming systems are usually comprised of many different agricultural enterprises that are interrelated. This report however will assess the

farming systems in the upper watershed project areas from a holistic point of view while keeping in mind the major objectives of soil conservation and the need to increase crop production. In each case, however, it is understood that farmer acceptability (socio-economic) and biological stability and sustainability of the farming systems must be a part of any assessment. Cost to the general public must be another consideration.

Cropping systems and later farming systems research in Indonesia and other countries in Southeast Asia over the past ten years has developed methodology for evaluating existing farming systems and designing, testing and implementing new technology has been disseminated through government agencies and implemented to some extent. In this report, the field activities that were observed in the upper watershed projects will be assessed with respect to standard development methodologies.

The soil and water conservation program in the upper watershed should focus on developing technology for erosion control in these critical areas and provide support mechanisms to help upland farmers adopt the control measures and improved farming practices so they might increase their productivity and income. Concurrently, adoption of these techniques will induce farmers, individually and collectively, to maintain and improve their terraces and waterways. Moreover, the impact should be the greatest for the poorest farmers. In their efforts to survive on marginally productive land, these farmers are slowly but surely destroying the land and their source of livelihood.

Background

The soil erosion problems in the upper watersheds are quite evident. So is the high sediment load of all the main tributaries. The natural ecosystems of the watersheds have been disrupted by deforestation, uncontrolled agricultural development, and many other unwise practices.

Agriculture has extended into the upper watershed areas where unsuitable soil, land formations and topography hinder stable crop production. Consequently, over time this has brought about a considerable loss in soil fertility and a drop in crop yield. Furthermore, the area of land available to each farmer has decreased due to subdivision (among family members) and abandonment as a result of erosion. Farm income is therefore very low, and the great majority of people living in the most eroded areas are subsistence farmers.

The farmers understand that erosion reduces yields but also know that the use of fertilizer may counterbalance yield losses. However, on steep slopes where upland farming is practiced, eventually a complete loss of arable soil will occur unless soil conservation measures are taken. Downstream river channels and irrigation canals will be filled with sediment. The farmers themselves have neither the skill nor the financial resources needed to implement control measures which require considerable amounts of labor and time. It seems most likely that any significant development program for these areas will require substantial financial and technical support.

The technical solutions to these problems require erosion and flood control through good watershed management practices. This must be accompanied by an improvement in the productivity of the depleted soil to increase farm production and income. Alternative farm enterprises must be developed that require less soil disturbance, particularly for the steeper areas.

Another point which must be stressed is that although terracing will halt erosion, it will not in itself increase the productivity of the land. Similarly, fertilizers will increase production but by themselves will not control erosion. Both are necessary and complementary inputs to improved soil and water conservation and increased crop production.

Finally, the population and judicious land and water use must attain a dynamic equilibrium.

Farming Systems Concepts

Figure 1 diagrams the scheme used for farming systems research and development in Indonesia. This approach is being used in a similar fashion in many other countries in South and Southeast Asia. The approach represents an attempt by agricultural research scientists to develop, through a process of understanding and redesigning farm systems in specific target areas, technology that will be more directly relevant to small farmers. This approach is not critical of existing agricultural research that has more discipline and commodity orientation but is intended to identify and remove constraints to farmer adoption of new technology in a more responsive and direct manner. The feedback to the existing research and extension agencies from farming systems research can be especially valuable. It helps create an awareness of farmers' problems and stimulates scientists to design research projects that are problem oriented.

Unfortunately, farming systems research may imply more than can be actually accomplished. There are practical considerations that must be taken into account and rational judgments made. For example, many scientists are not farmer oriented. They may prefer indepth studies of a particular commodity or subject within a discipline. There are funding, managerial and logistical problems. Finally, there are so many different agro-climatical environments that it is impossible to work on all with the number of scientific staff that may be interested in this approach. Consequently, major policy decisions are needed to decide where and when on site farming systems research may take place. These decisions may be based on rational scientific reasoning but usually a more pragmatic approach is taken. A combination of funding and technical considerations usually prevail.

Consequently, at any one time in Indonesia only a limited number of target areas and research sites can be tackled. But through adequate site descriptions (socio economic and biological), transfer of technology

Figure 1

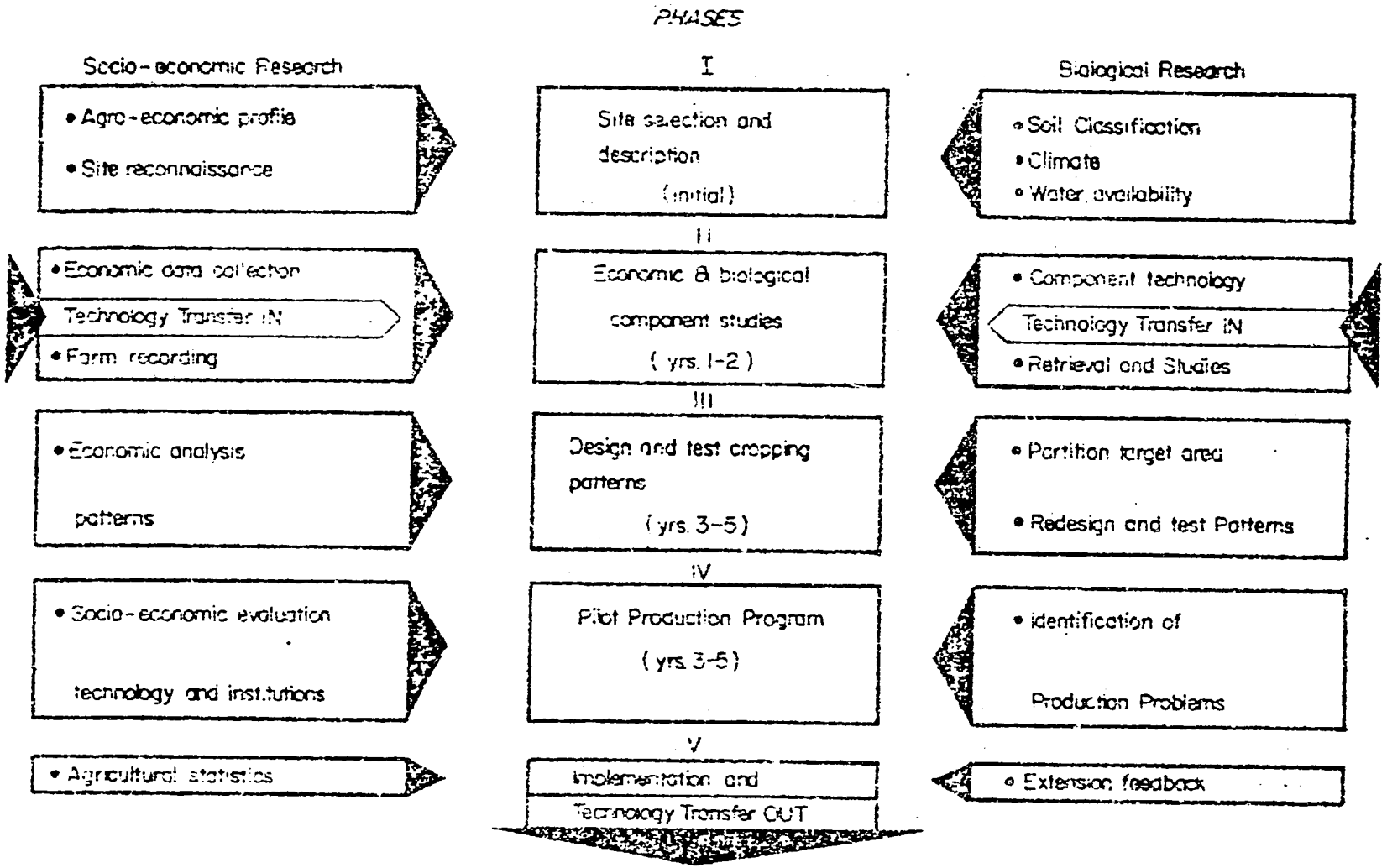

Fig. 1. Parallel biological and socio-economic activities required for the five distinct research and implementation phases of a farming systems program with little inflow of technology.

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from one place to another place with a similar site description can occur quite successfully (Figure 2). This is basically the process that has taken place in the upper watershed projects. There has been a considerable inflow of technology from other projects. This has been supplemented by a limited amount of onsite research - for example, in the early stages of the Panawangan pilot project in the Citanduy watershed. But implementation of technology that has been transferred always uncovers the constraints to adoption and the need for more research. This should not be considered a problem but progress toward problem identification. A viable research organization will respond to these identified problems. Implementation also uncovers institutional constraints. Interdisciplinary research that is integrated with other government agencies is necessary but may not always happen smoothly (Figures 3 and 4). But again, this may be viewed as progress if positive steps are taken to resolve the identified problems. But solutions to these technical and institutional problems will not solve themselves. Coordination is needed. It is our feeling that two kinds of coordination are needed - administrative and technical. Administrative coordination can solve the institutional problems and provide the environment in which the scientists can carry out their responsibilities. But at the national level there must also exist technical coordination to insure that appropriate technologies are transferred and that duplication of effort is minimized. The technical coordinator may need support through a Working Group of appropriate colleagues and authority through some control of funding (Figure 5). Specific research issues that arise may require in depth study on site or within the selected target area. It is our feeling that field laboratories are needed to provide the environment for technology to supplement on site farming systems research activities and bring together scientists from different research centers, universities and institutes (Figure 6). This may be the most suitable approach to foster interdisciplinary research that cuts across the different crop commodities and kinds of farm enterprises. These should not be considered permanent research facilities but simply locations for study of specific problems or research issues that have been identified

Figure 2

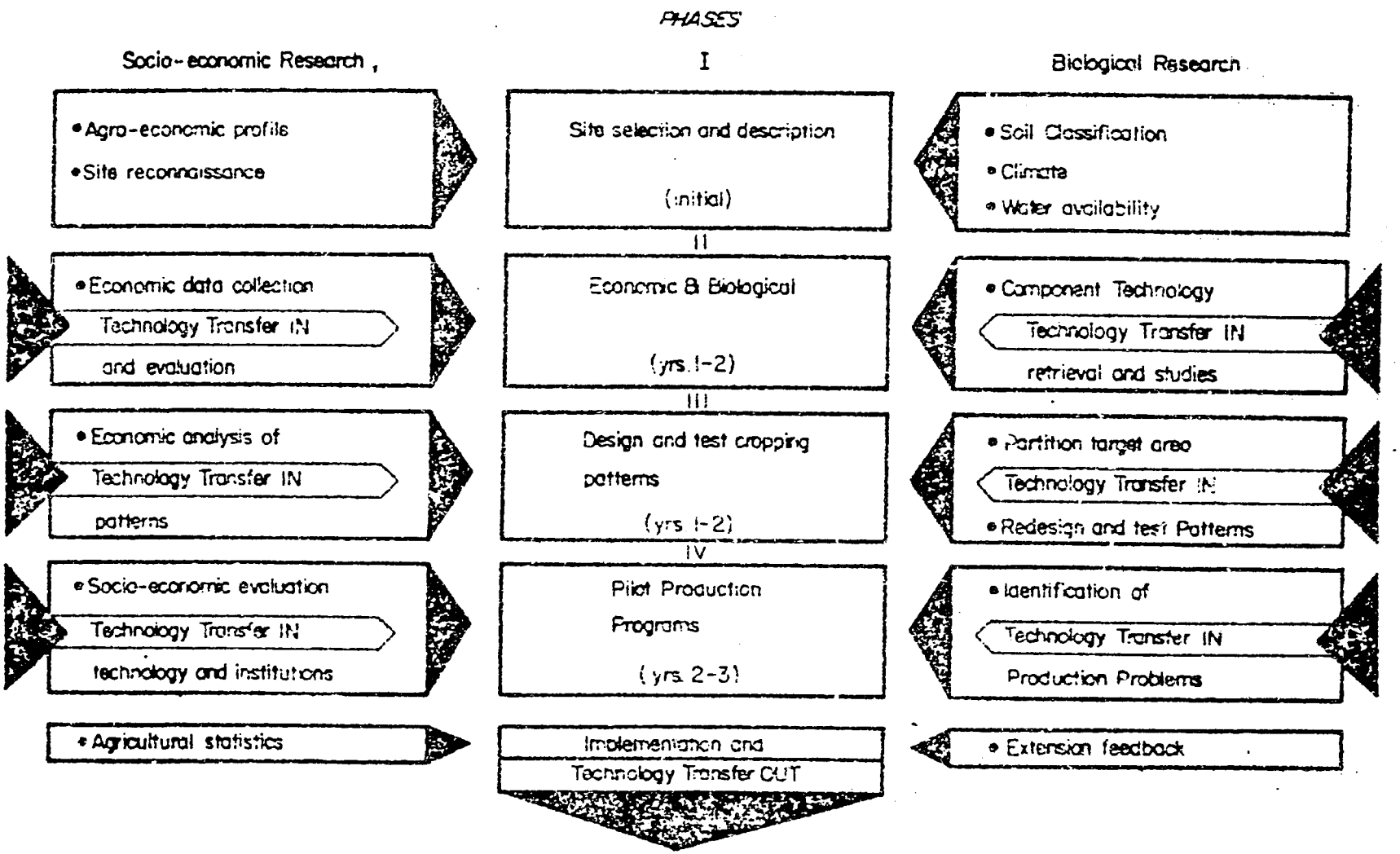
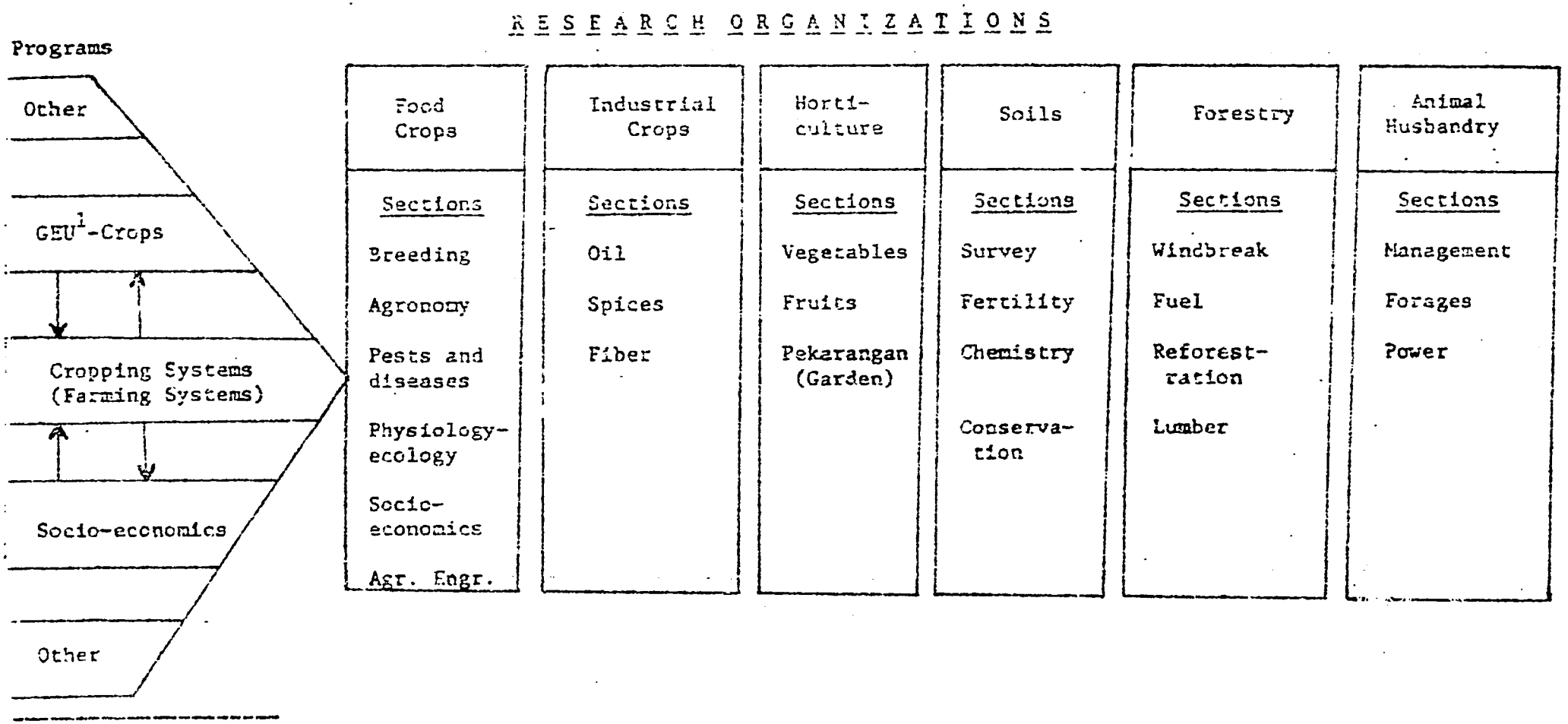


Fig. 2. Time frame for research and implementation phases of a farming systems program with significant inflow of technology from research in areas with similar site descriptions. This technology transfer may reduce the research time in a target area by two or more years.

Figure 3

Framework for integrated Farming Systems Research



[1]GEU - Genetic Evaluation and Utilization refers to systematic varietal improvement studies for food crops such as: rice, corn, legumes, etc.

Fig. 3 This diagram illustrates how research in a Farming systems program (FSP) interacts with other systems, programs and traditional commodity and discipline-oriented research activities.

Figure 4

Research-extension interface over different phases of a farming systems program

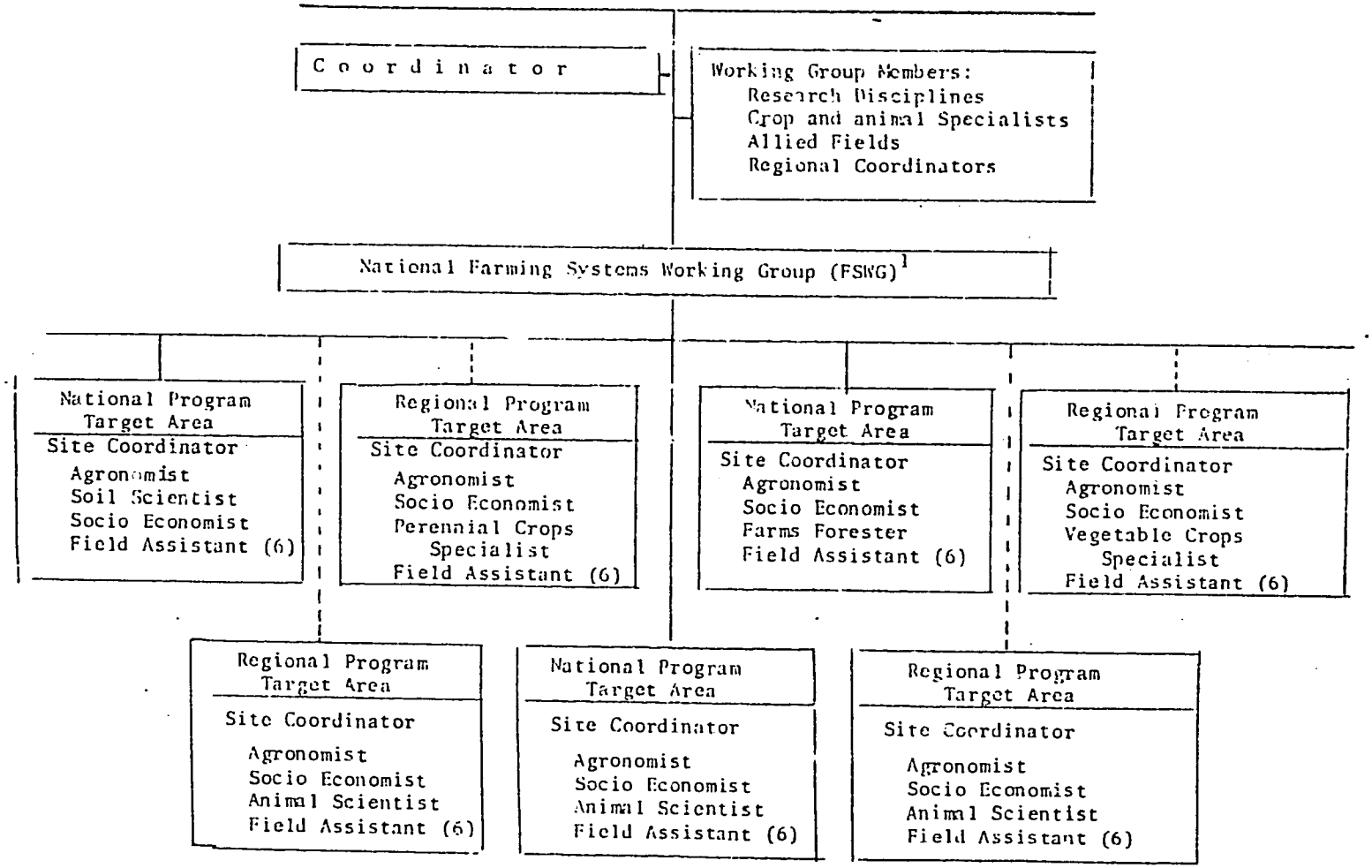
Target Area Selection	RESEARCH AND IMPLEMENTATION PHASES					Technology transfer
	I Site description	II Econ & Biol.Pot'l	III Design & Test	IV Pilot Prod. Prog.	V Implementation	
FSWG[1]	FSWG	FSWG	FSWG	FSWG	FSWG	FSWG
Extension Local Gov't. Nat'l Gov't.	Extension Local Gov't.	Extension Farmer Local Gov't. Bureau Stat.	Extension Farmer Local Gov't.	Extension Farmer Dir. Prod. Local Gov't.	Extension Farmer Nat'l Prod Prog Local Gov't.	Extension Other Nat'l. Gov't. Agen.

[1]FSWG - abbreviation for farming systems working group which is the multi-disciplinary research group that coordinates and carries out the research plans of farming systems programs in a target area.

Fig. 4. This is a schematic representation of the research-extension workload distribution and interaction with farmers and other government agencies in different phases of farming systems research and implementation.

Figure 5

NATIONAL FARMING SYSTEMS PROGRAM



[1] Regional Programs would be the administrative responsibility of the Regional Research Institute, but hopefully in collaboration with the National Program. There would likely be more than one site within a target area, and different technical expertise may be needed for different areas.

Figure 5. Possible organizational chart and staffing requirements for a Farming Systems Program.

Figure 6

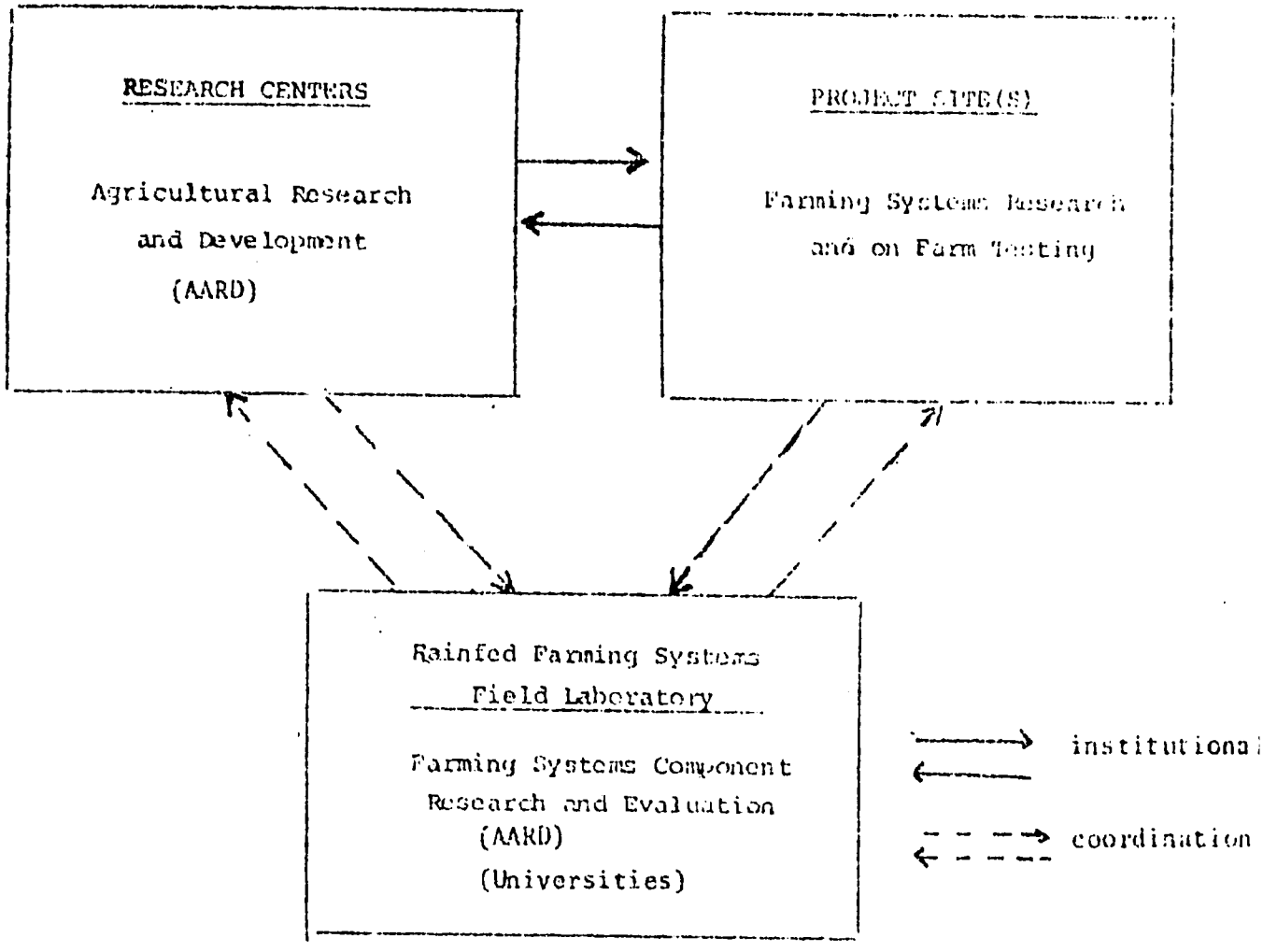


Fig 6

Development, evaluation, testing and flow of technology for Rainfed Farming Systems Research.

in specific target areas. One or two of the three centers visited in the Jogyakarta project would be ideal for field laboratories. Land and building exist that could be quickly used. It is important that longer term research on adapted varieties, soil conservation and combinations of different farm systems need more in depth study. Ultimately, these facilities would be returned to the local government for extention centers or other uses.

Upper Watershed Projects

A major policy decision has been made to tackle problems associated with the upper watershed areas on Java. In order to move quickly, special funds and projects have been put into effect. This implies that the existing government agencies needed additional support to solve the problems within the watersheds with respect to:

1. Soil and water conservation.
2. Increasing production in a way that is technically sound and economically viable.

There have been obvious results from this policy. The numbers of staff and activities of the P3RPDAS are indicators of action. Terracing, reforestation, check dams and more intensive food crops production through the various special projects are also indicators of results. Becuase of the focus on implementation, many times the positive results are obscured or diminished by problems with inadequately trained personnel, insufficient technology, logistics and institutional support. All of these aspects will be covered by the various team members. Specifically for the Farming System Assessment, we feel that the decision to implement existing technology was timely and stimulative to existing research and extension agencies in Indonesia. However, we also feel that existing agencies and universities should begin to play their legitimate role in research and in implementation. This is particularly true for research and extension in agriculture. It is imperative that people have

access to food or food production. Populations of 1000 people per square kilometer living in mountainous and remove places must be largely self sufficient in food. Consequently, food crops production for basic food self sufficienccy will always be a major component of any farming system. The Agency for Agricultural Research and Development (AARD) and the various Directorates General within the Ministry of Agriculture must play a major role in technology development and transfer to farmers. Except for the National Forest Lands and for lands excluded from food production because of steepness, farming systems research activities from AARD and appropriate universities will likely generate the technology base while the agricultural services of the Ministry of Agriculture will execute the extension. The institutions exist to do this. The soil conservation and farm forestry technologies may be supported by the newly formed Ministry of Forestry. The activities of these two Ministries can be complementary and stimulative. This all falls within the line agencies and requires no special projects. However, there must be flexibility within each Ministry to provide for coordination, hopefully through programs that have special funds to facilitate interdisciplinary research and implementation.

Soil Conservation

Farming systems strategies can be developed for all land areas. This can be done in a way that is consistent with the major objectives of the upper watershed. Specific guidelines simplify the tactics used but may not facilitate accomplishments. For example, slopes steeper than 50 percent may be successfully used for food crop production while slopes less than 50 percent may be better used for perennial crops or pasture. Extension agents need to be experienced to help farmers make these kinds of decisions. Hopefully the government regulations can accommodate this kind of flexibility. Of course, soil conservation is understood to be a basic prerequisite.

It should be understood that Indonesian farmers are familiar with level bench terraces. The terraces of rice paddies in the mountains of Java testify to this. The same kind of commitment to terracing can be made to dryland agriculture if the benefits are as obvious. Many farmers are convinced and even after they transmigrate from Java to Sumatra and other places with much less favorable soil proceed to stabilize their soil through bench terraces. There usually remains a problem of how to drop the water from one level to the next. This needs more study. But basically, for the deep volcanic soils on Java, the bench terrace remains a viable model.

The next question considers the alternative to bench terraces. It is said that there are alternatives that require less labor and are more effective. This needs to be demonstrated, if possible under field conditions. Usually the alternatives use slope cropping and alley cropping strategies. For gentle and longer slopes where the fields may be larger these appear to be viable options. The latter can be especially useful on shallow soils with relatively high pH's in drier climates such as are found in Eastern Indonesia. Between the extremes of Panawangan and Flores, there must be viable options. The criteria for differentiating among strategies may be developed in field laboratory studies.

Specific Sites

For ease of presentation, rainfall distribution and cropping patterns for three of the four site areas visited are summarized in Figures 7, 8 and 9. The descriptions that follow for all four watersheds are given to show differences among the locations and need for additional research and testing. These descriptions are based on the limited data available. The incompleteness of the existing data indicate the need for systematic and coordinated research and development.

Figure 7

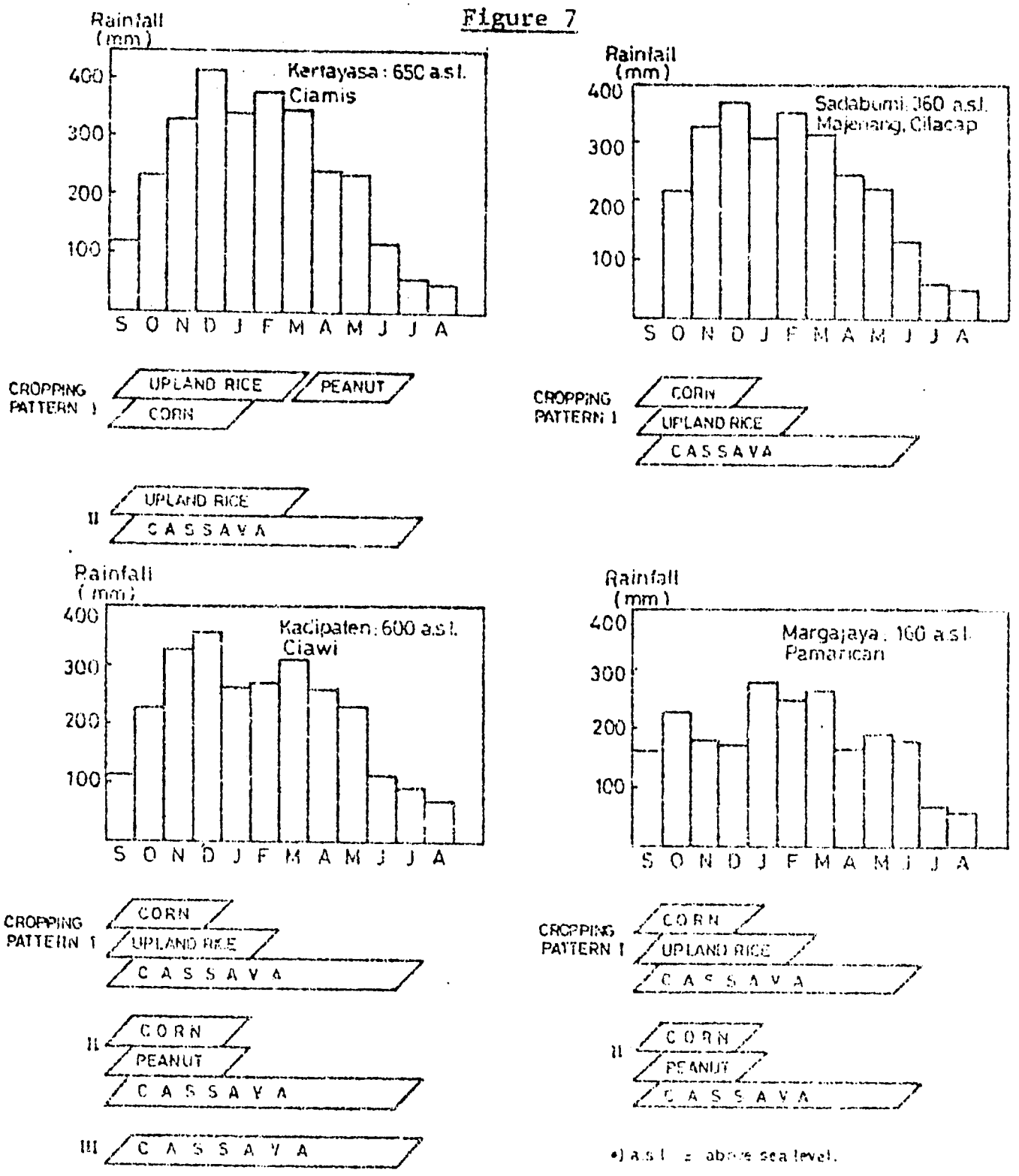


Fig. 7 : Monthly rainfall distribution and existing cropping patterns in four locations in Citanduy Sub watershed (upper watershed).

Figure 8

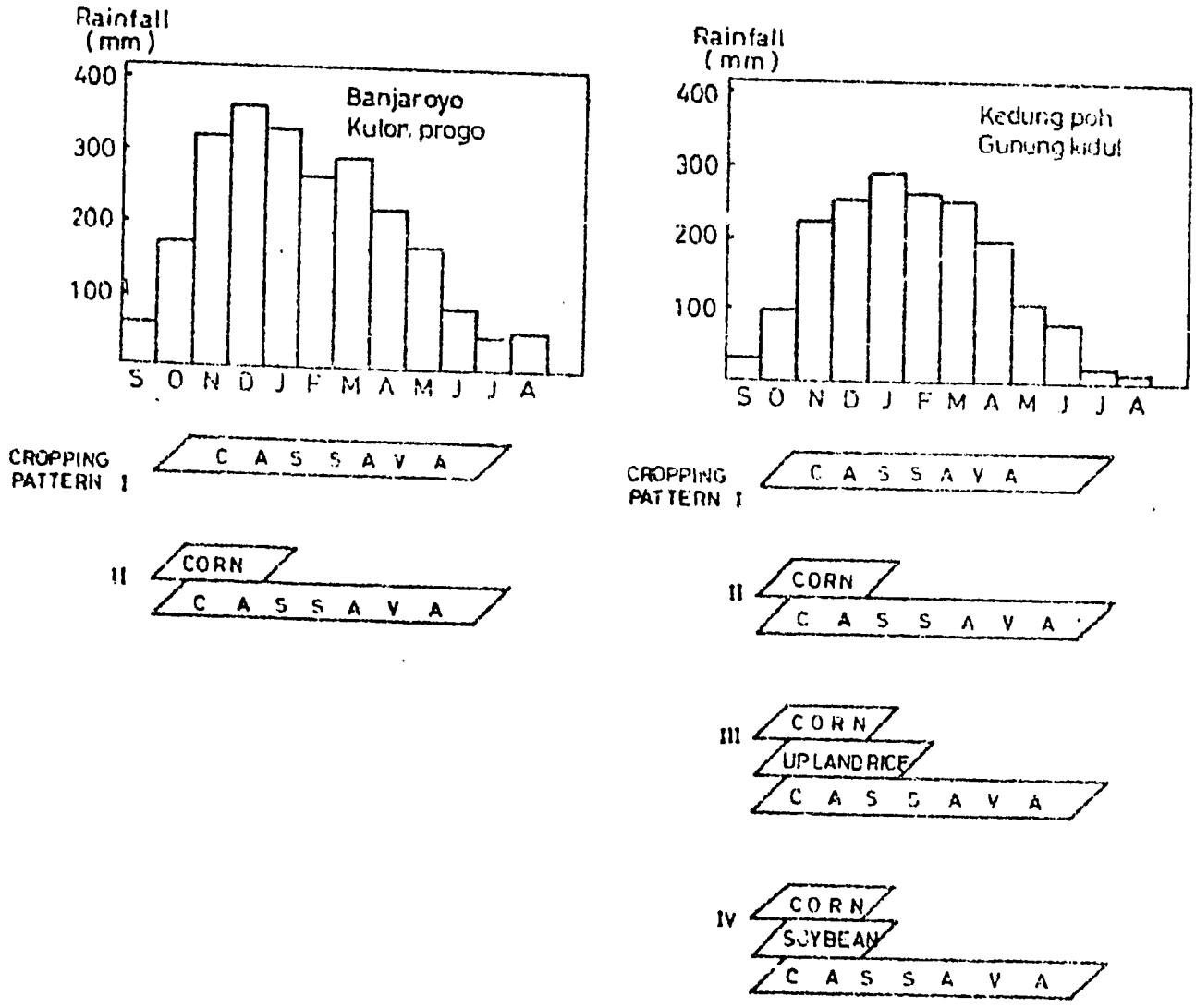


Fig. 8 : Rainfall distribution and existing cropping patterns in Kulon progo and Gunung kidul area of Yogyakarta.

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Figure 9

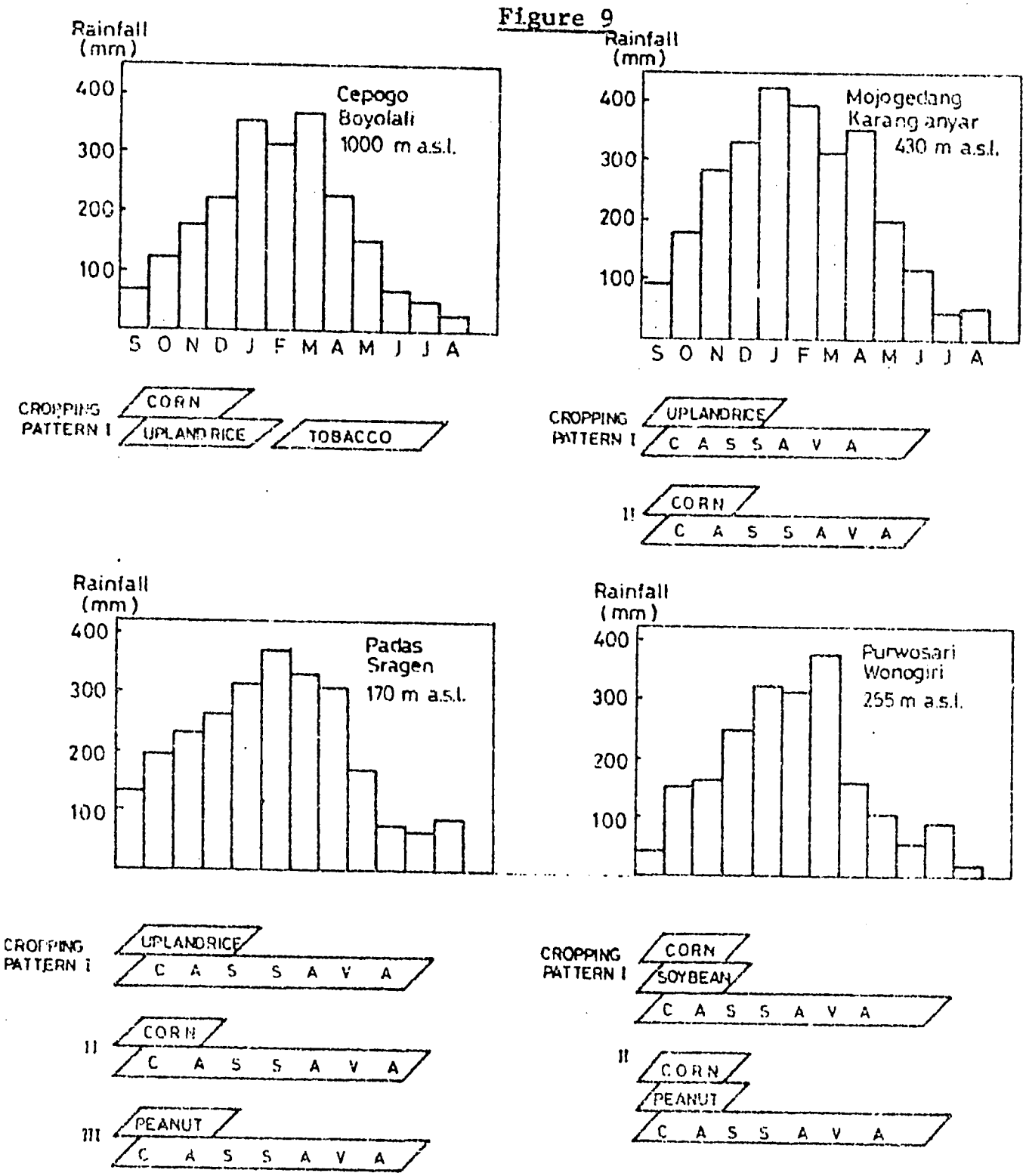

Fig. 9: Rainfall distribution and existing cropping patterns in upland watershed Solo : Cepogo, Mojogedang, Padas and Purwosari.

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Citanduy Upper Watershed. The Citanduy River Basin is mostly in West Java. The upper river portion has a humid climate with at least eight continuous months with more than 200 mm of rainfall. Usually, only the months of July and August have less than 100 mm of rainfall. The soil in the upper watershed is of volcanic origin and immature in development. In general, the soils are deep and relatively fertile, but respond dramatically to phosphate and nitrogen fertilizers.

1. Cropping patterns. Figure 7 shows the rainfall distribution and farmers' cropping patterns as observed in the field and reported in various publications. A composite cropping pattern that is common for much of the area consists of the following crops in the sequence of C + ULR ≠ Cv. In areas where the soil has been seriously eroded, the sequence consists of C + PNT ≠ Cv. In this case, cassava is the main crop. In extreme cases, sometimes only cassava is grown. Generally some fertilizers are used for rice but not for the other crop.

2. Varieties of food crops. Local Bulu varieties are most commonly used for upland rice. These high quality (good tasting) varieties have some resistance to blast disease but are relatively late maturing. They have little or no brown planthopper resistance. Metro is a commonly grown corn variety. Varieties of peanuts, mungbean and cassava that are commonly grown have usually originated from improved varieties. In most instances, the legumes are degenerated and virus infected.

3. Perennial crops. Perennial crops, especially cloves, are the most important source of cash income in Panawangan and farmers plan to plant more. In Majenang, however, a combination of coffee, jengkol, clove and coconut are usually grown in the home garden. There is a need for identification and selection of more shade tolerant secondary crops that have market potential and for home consumption. Fruit tree species especially appear to offer potential for increased production. Already in Kadipaten, citrus, avocado and guava are widely grown in addition to clove.

4. Livestock. The main livestock raised by village residents are chickens (for home consumption), goats and sheep.

5. Crop yields. Table 1 shows yields from cropping patterns tested in Panawangan in the 1981-82 crop season. These are representative of crop yields under farmer and improved management in other places in the watershed. These data show potential for increased yields and income.

If soil and water conservation measures are to be developed further, there are some specific research and production issues that must be addressed.

- Develop or identify forage crops and food crops than can be grown under partial perennial crops canopy.
- Further develop forage production and animal systems strategies in combination with perennial crops.
- Develop systems for record keeping and farming systems evaluation.

From field experiences and research, it is felt that the cropping pattern UlR + C ≠ Cv ≠ SB or PNT, planted at the beginning of the rainy season can give yields that are at least twice those of existing patterns, provided that 200 kg/ha or urea and 150 kg/ha of TSP are used. We would expect yields of 1.8 - 2 ton/ha of rice, 1.5 ton/ha of corn grain and 10 ton/ha of wet cassava roots. The expected yields of soybean or peanut would be around 1 ton/ha.

Jogyakarta Project Area. Agricultural based community development is the central focus of the Bangun Desa Project in Jogyakarta. The development activities are concentrated in:

1. Desa Hargotirto, Kecamatan Kokap, Kabupaten Kulon Progo.
2. Desa Banjar Oyo, Kecamatan Kali Bawang, Kabupaten Kulon Progo.
3. Desa Kedung Poh in Kecamatan Nglipar, Kabupaten Gunung Kidul.

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Table 1. Cropping patterns tested in the Citanduy Upper Watershed 1981-82.

Cropping Patterns	Varieties	Location				
		Kadi-paten	Pana-wangan	Guna-sari	Marga-jaya	Karang Pucung
		Yield (ton/ha)				
Introduced C.P.						
A. Corn +	Arjuna	1.64	1.91	1.93	1.51	1.83
Upland rice -	C-22	1.03	.60	1.00	2.70	1.26
Peanut /	Gajah	.28	.52	.36	.51	.34
Cassava	Local	10.25	9.36	9.00	11.00	0.25
B. Corn +	Arjuna	1.64	1.86	1.82	1.51	1.09
Upland rice -	C-22	1.05	.72	1.00	2.75	1.26
Corn +	Arjuna	1.72	1.97	1.10	1.92	1.50
Peanut	Gajah	.34	.60	.36	.81	.45
C. Corn +	Arjuna	1.68	1.93	1.86	1.60	1.09
Peanut -	Gajah	.48	.41	.32	.72	.66
Corn +	Arjuna	1.60	1.81	1.83	1.51	1.25
Soybean	Galunggung	.98	.70	.95	.91	.67
Farmers' C.P.						
D. Corn +	Local	0.75	.69	-	-	-
Upland rice /	Local	1.85	.97	-	-	-
Cassava	Local	1.85	.97	-	-	-

Source: Annual Reports, Citanduy/AARD Research Project.

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Almost all farm activities in Desa Hargotirto, Kulon Progo, are devoted to upland agriculture. The area has an altitude of between 500 to 1500 meters above sea level. The topography ranges from almost level to steep land. The soil is of volcanic origin and productive if not seriously eroded. The depth of soil varies but in many places is too shallow for constructing bench terraces. Most of the home gardens are planted to coconut as well as fruit trees with cassava interplanted as a main food crop. Sweet potato and corn are usually grown as monoculture or terraced lands. The yields of cassava are still very low - ranging from 2 to 4 ton/ha of wet roots when planted as monoculture, but only 0.9 to 1.2 ton/ha if intercropped with corn. Corn may yield only 0.2 ton/ha of dry grain.

In Banjar Oyo, Kali Bawang, Kulon Progo, the topography ranges from level to hilly. The total amount of rainfall exceeds 2484 mm per year as shown in Figure 8. Rainfall exceeds 200 for at least 6 months per year. There are four dry months with less than 100 mm rainfall. Two types of cropping patterns are dominate in these areas:

- Solid cassava - planted as monoculture and
- Cassava intercropped with corn.

Corn and cassava are usually planted at the same time at the beginning of the rainy season in October or November. Corn is usually harvested in January while cassava is harvested as needed for home consumption. The production of cassava is still very low, only 2 - 3 ton/ha of wet root. Corn yields are low also, with only 0.2 - 0.3 ton/ha of dry grain. Very little fertilizer has been used for these crops, usually not more than 50 kg of urea as well as TSP/ha.

Desa Kedung Poh has an average elevation of about 500 m above sea level and slopes ranging from 15 - 40%. The soil is very shallow. The rainy season lasts about six months from November to April, while the dry

season lasts from May to August. The total amount of rainfall is around 1849 mm per year. The monthly distribution of rainfall is shown in Figure 8. There are four main cropping patterns used by farmers. These are:

- Cassava planted alone;
- Cassava intercropped with corn;
- Upland rice + corn intercropped with cassava;
- Corn + soybean intercropped with cassava.

1. Land Use. The land in the Jogyakarta project area is hilly and eroded. But there remain pockets of soil that are productive and which sustain high populations. The soils are in great need of stabilization through intensive soil conservation and reforestration efforts. Table 2 shows the distribution of land use in the project areas. It is interesting to note the large area of land in home gardens compared to the amount in upland fields. Since the Jogya area tends to be subject to a long and extremely dry season, the farmers have compensated by making better use of perennial crops as a means of livelihood and food.

2. Cropping Patterns. Upland rice + corn / cassava is a dominant cropping pattern used by farmers as well as the project. Improved varieties, planted in the early wet season, can at least double the yield of the existing pattern. Better arrangement of the crops in rows permits the planting of either soybean or peanut between the cassava rows after rice harvest.

3. Varieties. Improved varieties of upland rice (C-22, Cipunegara, and IR-36), corn (Bromo, Arjuna and Genjah Kertas), as well as cassava (Adhira I and Gading) have been introduced. These varieties grow well in these locations. Blast disease attacks IR-36 if it is grown under upland conditions. Unfortunately, other varieties that are specifically adapted to upland are not resistant to brown plant hoppers and cannot be grown (Table 3).

Table 2. Land categories based on agricultural use in 3 locations in Gunung Kidul and Kulon Progo.

Location	Area of lowland rice	Area of Home gardens	Area of Upland fields	Total Land Areas	Average land area per farm family
	ha				
Banjar Oyo	112	651	739	1,502	0.93
Hargotirto	27	1,200	133	1,360	0.97
Kedung Poh	98	292	484	874	0.90

Source: Annual Reports, Bangun Desa Project.

Table 3. Yields of upland rice grown in intercropped combination with corn and cassava.

Location	Rice variety used			
	IR-36	C-22	Cipunegara	G-H-185
	Yield (ton/ha)			
Kedung Poh	3.6	4.01	-	-
Banjar Oyo	3.2	-	4.4	-
Hargotirto	-	-	-	4.4

Source: Annual Report, Bangun Desa Project

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Cassava planted in intercrop combination with corn and rice yielded 8 ton/ha of wet root, while corn in the combination yielded 2 -2.5 ton/ha of dry grain.

Davros soybean grew well in the project area and yielded 1.2 ton/ha of dry grain while grown in combination with cassava. Gajah peanut produced 1.2 ton /ha of dry pods in the same combination.

4. Perennial Crops. In contrast to the Citanduy watershed, drier conditions prevail in the Jogyakarta area, especially during the dry season. The availability of shrubs and tree leaves for animal feed during the dry months becomes very important. Also, the soils tend to be shallow and have less water holding capacity. Under these conditions, trees play a major role not only for animal feed but also for human food and soil conservation. For the badly eroded areas, especially on steep lands, permanent tree and grass cover appears to offer the best solution for a combination of soil conservation and production of useful commodities.

5. Livestock. Table 4 shows the importance of livestock among these farm families. The farmers are making the best use of agricultural by-products and grasses for livestock feed. They are returning the stable manure to their farm land. The small ruminants appear to fill an especially important role in the farm economy.

6. Crop Yields. Research trials conducted on farmers' fields at three locations indicate that the introduced cropping pattern (ULR + C + Cv + legume) could increase the yield of food crops substantially as shown in Table 5.

Upland rice as well as corn and cassava in the Introduced Cropping Patterns A and C gave higher yields than the Farmers' Cropping Pattern. Cropping Pattern A is quite stable under upland conditions. It is expected that yields and profitability can be further increased as more adapted varieties and management practices are developed.

Table 4. Livestock distribution in Banjar Oyo, Hargotirto and Kedung Poh.

Location	Cattle	Small Ruminants	Chicken
	----------number of animals----------		
Banjar Oyo	848	3,372	10,812
Hargotirto	248	2,774	18,028
Kedung Poh	529	1,158	10,083

Source: Annual Reports, Bangun Desa Project

Table 5. Average yields of upland rice, corn, cassava and legumes in cropping pattern studies at Kedung Poh, Banjar Oyo and Hargotirto, Jogyakarta. 1981-82.

Cropping Pattern	Yield (ton/ha)		
	Kedung Poh	Banjar Oyo	Hargo-tirto
Farmers Cropping Pattern			
Corn +	1.2	1.1	0.9
Upland rice +	2.0	no rice crop	no rice crop
Cassava -	6.0	5.2	5.1
Peanut	0.7	0.4	0.4
Cropping Pattern A			
Corn +	2.4	1.9	1.4
Upland rice +	3.4	4.3	2.6
Cassava -	8.5	9.0	7.5
Peanut	0.8	0.7	0.6
Cropping Pattern C			
Corn +	2.5	1.8	1.3
Peanut +	1.8	1.5	1.4
Cassava +	8.0	9.0	7.2
Soybean	0.8	0.4	0.4

Source: Annual Report, Bangun Desa Project

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Upper Solo River Watershed. In the Upper Solo basin, erosion and flooding are widespread. Some 250,000 ha (24.4%) are seriously eroded, while on half of this land erosion has reached such a critical stage that the land has been virtually abandoned for agriculture.

The basic problems in the Upper Solo River Watershed is the intense population pressure on the land (estimated 690 inhabitants/km2). As a result, agriculture has been extended into areas unsuitable for cultivation because of land formation and topography. Crop production and farm incomes are, therefore, very low and the great majority of people living in these areas are subsistence farmers. In most areas, unless soil conservation practices are adopted, complete loss of arable soil will inevitably take place.

1. Cropping Patterns. The existing cropping patterns in this upland watershed under farmers' conditions are shown in Figure 7. Most of the cropping patterns are basically similar to others we have observed in Citanduy and Jogyakarta. The patterns are intercrop combinations. In Boyolali, corn and cassava (and sometime upland rice) are the main commodities. At higher elevations, some vegetable crops are grown. Tobacco is also grown in these areas, especially for cash income.

In Mojogedang and Padas, the main cropping patterns consist of upland rice, corn and peanuts intercropped between cassava rows. Sesame is also grown, but on a limited scale.

In Wonosari soybeans are also planted between cassava rows and sorghum is usually planted on the ridges of the terraces.

The results of research trials carried out in 7 locations are shown in Table 6. It seems that the use of organic matter as compost as well as stable manures are a must to increase the productivity of the soil. Data in Table 6 show that without applying stable manure, the yield of upland rice, corn, cassava and other crops are very low, even with the use of chemical fertilizers as recommended.

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Table 6. Yields of Cropping Patterns tested in 6 locations in the Upper Solo Watershed. 1981-82.

Locations	Upland rice	Crops grown in pattern			
		Corn	Peanut (dry pod)	Soybean	Cassava
		----------Ton/ha----------			
Mojogedang	1.2	1.8	1.2	0.35	9.8
Purworsari	-	1.2	1.25	-	7.2
Bulu	1.4	2.1	1.4	-	9.4
Gendah	-	1.4	0.72	-	5.6
Kr. Tengah	-	1.6	2.25	0.62	-
Padas	1.24	0.8	-	0.300	-

Source: Annual Report Solo River/AARD Project.

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In Desa Lemahireng demonstration plots have been carried out. Land terracing as well as introduction of improved cropping patterns brought about considerable improvement in their farming systems. Yields and income, calculated in rupiah, are shown in Table 7. Yield and income of introduced cropping pattern are compared to the existing farmer's cropping pattern.

It appears that the cropping pattern of upland rice plus corn intercropped with cassava and followed by legumes (soybean, mungbean or peanut) gives a good performance in most agroclimatical conditions, provided the amount of rainfall is well distributed and exceeds 1500 mm/year.

Upper Brantas River Watershed. The total area of the Brantas River Watershed is about 11,800 km2, which may be broken down to 27.3 percent irrigated land, 23.4 percent forest land, 20.9 percent upland (dryland), 16.0 percent home yard, 5.2 percent estates, and 7.2 percent divided among others.

Only small amounts of phosphate and nitrogen fertilizers are used by farmers. Stable manure when available is carefully utilized, especially for high valued crops like tobacco.

2. Varieties of Food Crops. As in most upland crop areas, local varieties are used. Generally, introduction of new and viable seed can increase yields by 100 percent. But these increases in yields must be accompanied by an increase in fertilizer use and management.

3. Perennial Crops. These areas tend to have long dry seasons and occasionally dry wet seasons. The soils tend to be shallow and infertile. Perennial fruit and forest tree crops appear to offer good possibilities for the special conditions in this watershed. They offer food, erosion control, animal feed and fire wood. They can supplement the food and animal crop production programs underway.

Table 7. Yields and economic data from cropping patterns tested in Lemahireng Demplot, Upper Solo Watershed. 1981-82.

Cropping Patterns	Yields	Gross Returns	Cost of Production	Net Returns
	Ton/ha	----------Rp/ha----------		
Farmers C.P.				
Corn +	2	200,000		
Peanut +	1	300,000		
Cassava	13	260,000		
Introduced C.P.				
Upland rice +	3.5	350,000		
Corn +	1.8	180,000		
Stringbean -	250 bunches	12,500		
Peanut +	1.5	450,000		
Corn +	1.0	100,000		
Cassava	5.0	100,000		
		1,192,500	313,600	778,900

Source: Annual Report, Solo River/AARD Project.

4. Livestock. Inadequate supplies of forages and water during the dry season hinders large ruminant production. The numbers of goats and sheep can be increased significantly in the project area. Combinations of forage grasses and tree legume offer a palatable and nutritious diet.

5. Crop Yields. The yields of upland rice, corn and cassava, as well as peanut and soybean are very low. The yields of these crops can be increased at least two times if improved cultivation practices are put into effect.

The total area which is in need of rehabilitation consists of about 151,700 ha located in Malang, Blitar, Tulungagung, Trenggalek, Kediri, Nganjuk, Jombang, Mojokerto and Pasuruan. The population density of these subwatersheds is around 916 people per km2.

The average annual rainfall is 2050 mm/year, of which about 80 percent occurs during the rainy season between the months of December to May. Consequently, only 20 percent occurs during the dry season period between June-November. The soils derived from limestone are shallow and are especially subject to erosion during the rainy season.

1. Cropping Patterns. In the lower elevations (less than 600 m above sea level), farmers usually grow upland rice or corn intercropped with cassava. Some farmers grow peanuts and soybean intercropped with corn at the beginning of the rainy season. Sugarcane is grown in the southern part of Malang and corn is usually intercropped with young sugarcane. At higher elevations, vegetable crops like garlic, leaf-onion potato, cabbages and sweet potato are grown. Corn may be intercropped with onions and carrots or sometimes with sweet potatoes.

2. Varieties of Food Crops. Local varieties are used almost exclusively for upland rice, cassava and legumes. Improved varieties of corn that are resistant to downy mildew are used except were early maturity is required.

3. Perennial Crops. These crops are especially important in this watershed especially to provide food stability for man and animal.

4. Livestock. Large ruminant as well as small ruminants are important.

5. Crop Yields. The demonstration plot of 20 hectares located in Desa Purworejo, Kecamatan Donomulyo, Malang, had a good impact on neighbouring areas. During the second and third years, the area bench terraced covered around 75 hectares. The farmers' cropping pattern before the demonstration plot was in existence consisted of corn intercropped with cassava. Rice was not grown because the farmers were not able to get good yields. Table 8 shows the cropping patterns and the yields for crops before and after the project started. Fertilizer had been applied on the demplot at the rate of 200 kg urea, 100 kg TSP and 4 ton of stable manure/ha. The farmers' plots usually received only about 4 tons of stable manure and 50 kg urea and 75 kg TSP/ha.

The yield performances from these plots are not yet up to potential. Yet the farmers are happy and indicate they will continue to follow the introduced cropping pattern.

General Discussion

Rainfall. The rainfall data in Figures 7, 8 and 9 show differences in total and distribution of rainfall from collection stations near or in the target areas. It would be useful to have some data on rainfall intensities. It would also be useful to have data for a shorter time interval (daily or every five days) so that some rainfall probabilities could be developed, particularly for the beginning and ending of the rainy season. This would be useful for planning purposes but probably not so useful to farmers. The events in any one year that the farmer (or researcher) observes taking place at the appropriate time of the year gives a better guide for time to plant (or not to plant) than long term weather data. Farmers through their collective wisdom can do this quite well.

Table 8. Average yields of corn, rice peanuts and cassava before and after establishment of the demplot.

Cropping Pattern	Before Demplot Ton/ha	After Demplot Ton/ha
Upland rice +	no rice crop	1.72
Corn /	1.27	1.70
Cassava /	2.01	5.10
Peanut	no peanut	0.73

Source: Brantas River Project.

Cropping Patterns. The cropping patterns that accompany the rainfall distribution data are considered to be reasonable approximations of existing farmers' cropping patterns in the areas visited. Contrary to commonly expressed opinion, new cropping patterns are not usually imposed on farmers from some bureaucratic body in Bogor but are simply modifications (hopefully improvements) of existing patterns. Usually the options for crops are not as great as one would suspect. There are certain basic food crops that predominate - rice (upland and lowland), corn, cassava and legumes (mungbean, peanut, soybean and cowpea). Farmers prefer rice if they can perceive any reasonable likelihood of success. Corn is usually a crop that is intercropped into upland rice. Cassava is added to insure food production and more efficient use of turn-around time and the dry season. Legumes for the most part are grown after the rice but are also grown for seed for the main season (dry season) at the beginning of the rainy season. There are additions and exceptions depending on farmers' preference and experience. Farmers on Java are basically food crop oriented and will grow food crops where other commodities, perhaps, should be grown. If tree crops or other nonfood crops are grown exclusively, we are usually dealing with an absentee land owner or a relatively wealthy farmer.

Land Resources. The soils vary considerably among the sites visited. There is a need to better understand the soils, not from an intellectual but from a practical point of view. We need to delineate among areas that can only be preserved for perpetuity by forests and those that may be stabilized and used for other kinds of agricultural enterprises including food crop production. Depth and nature of the soil and steepness of slope are major determinants for selecting agricultural enterprises within a site area. These combined with rainfall characteristics are the major determining factors that must be assessed and quantified to varying degrees. Fortunately, we usually have the farmers' experiences to fall back upon. What he is doing provides a good example of what can be done. The slope of 50 percent above which only perennial crops should be grown may be an arbitrary figure, but it

represents a base around which more precision may be developed. Even in areas where the average slope exceeds 50 percent, there are places (top of hill) where the land may be stable and suitable for food crops production.

Detailed land use and soil maps are not really very useful for on site decision making even if they become available within the next ten years. Like weather maps, they may be used for broad scale description purposes. Air photos and on site evaluations of soil texture (the feel method), structure and fertility are most important. These evaluations which can be made by competent soil scientists coupled with on site evidence represent information that can be most useful for determining soil conservation strategies and farming systems. These evaluation can be usefully inscribed on aereal photos for on site use. Until more complete soil surveys are completed, systematic but simple procedures need to be developed to provide guidance.

Socio Economic. Biological scientists have been criticized, perhaps rightfully, of ignoring the need for simple economic evaluations of their technology. This results from the emphasis in colleges and universities and even research institutes on discipline and commodity research. In small farm situations, this problem is exacerbated by farmers' decisions and practices which do not lend themselves to standard economic evaluations. Mixed farming systems that include animals are especially difficult to evaluate from a strict commodity point of view. Consequently, it is important to know why farmers do what they do. But there can be a tendency to over-emphasize this while not fully appreciating the need for the studies in the first place. For the most part, simple agro-economic profiles on the site areas will tell us the kinds of information needed for farming systems design and evaluation.

These can be followed by more in depth studies on special issues that arise. Broad based and detailed socio economic studies in farming systems research need to be avoided because the mass of data collected

precludes rapid summary and write-up. Consequently, the report may be published after the on-site biological research is finished. The in depth studies represent ideal theses projects for university students and should be encouraged.

In practice, most of the production economics data have been collected by the biological scientists because most agricultural economists find this activity routine. But with mixed farming systems research and evaluation, the job is much more complex and requires the services of experienced and technically sound economists. Since the decision making processes are not simply economic, the term socio-economist is used to describe what is needed. We must be able to understand better the farmer's decision making processes, especially if major changes are contemplated for existing farming systems.

Farming Systems Research and Development

Farming systems are location and farmer specific. This is a warning to all who may wish to make general recommendations for new farming systems technology or even describe existing systems. But it is incumbent upon governments to develop agricultural production, to improve the well being of farmers and the general public and to conserve natural resources of future use. It is necessary to develop national programs that many times appear autocratic and "top down". The technology may not help many farmers and even groups of farmers. But generally, these programs are evolutionary in their development and application. Specificity and applicability increase with experience and time and with feedback from farmers and program officers in the field. Consequently, constructive criticism can be useful if it is given through appropriate channels.

The implementation programs for upper watersheds are still in the developmental stages. Even the research base for technology is in the developmental phases and is subject to continued testing and

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reevaluation. The process is never complete even though the returns from further research becomes less and less. With these reservations in mind, we would like to offer the following suggestions for farming systems research and development for upper watershed areas as a first approximation. Where relevant, we will use existing criteria for description.

Farming Systems Research Approach

Farming systems research in Indonesia is carried out by a coordinated group of scientists from various disciplines. It is interdisciplinary and integrated with other government agencies and activities (extension local government, irrigation and national production programs). It is focused upon specific target areas and limited in scope to make more efficient use of research staff and funds. Indonesia has developed methodology and staff sufficiently strong to continue this research. But special efforts are needed to stabilize the gains that have been made through longer term research projects, particularly in the upper watershed areas. Although production of food crops sufficient for subsistance has been and will continue to be the first step in the development of farming systems for Indonesian small farm operations, greater effort will be made to study and improve all production aspects of the operation from soil conservation to marketing.

Partitioning of the Target Area*. A watershed is not a homogenous area. For research and development purpose some delineation of relevant climatic and physical features must be made. The following is an example of factors to be considered that affect land management.

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* From a national point of view, we would look on the upper watersheds collectively as a target area and each watershed as a site. But for those working only on watersheds, each specific watershed may be considered a target area.

Humid areas (9 months > 200 mm and 3 months ± 100 mm)

> 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

< 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

Drought prone areas (6 months > 200 mm and 3 months ± 100 mm)

> 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

< 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

Dry areas (3-4 months > 200 mm and 3 months ± 100 mm)

> 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

< 50% slope
Deep soil (volcanic origin)
Shallow soil (rock and parent material exposed on terracing)

Each of the above vary according to other easily delineated criteria which directly effect cropping patterns such as soil texture and pH and length of slope. For a socio-economic delineation, the most important criteria relate to:

- Land ownership
- Distance from market facilities
- Farm size
- Population pressure

Farming Systems Component Technology. Technology coming from existing research institutions may not be directly supportive for the special needs of farming systems development in upper watershed areas. On the other hand, on site farming systems research may be constrained by insufficiently trained personnel and lack of control of land for field research. To provide continued back up support, it is necessary to fine tune existing technology and provide a place for more relevant training. A Field Laboratory is needed to facilitate these activities. These facilities would be located in areas representative of the major watersheds in selected agro climatic environments. Three such laboratories should be sufficient for Java conditions. There must be a careful balance among availability of staff and funds and research need. The primary objective would be as follows:

- to provide a central location for more efficient collection, evaluation and transfer of appropriate component technology;
- to provide an opportunity to conduct long term experiments for food crops, perennial crops, animal husbandry, water control, fertilizer efficiency, crop residue management and stability and sustainability of different farming systems and land management;
- to provide an environment for conducting interdisciplinary farming systems research before technology is transferred to farmers;
- to provide a facility and staff for training of extension and research personnel.

On Site Farming Systems Research. There is a need to continue and intensify on-farm research. The technology coming from existing research centers and institutes provides a technology base. But this base needs

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modifications and application not only in the Field Laboratory but under farmers' conditions. The Agency for Agricultural Research and Development (AARD), through the Central Research Institute for Food Crops, has developed methodology for doing this. Cropping and Farming Systems Research has been carried out under farmers' conditions in more than 20 locations on Sumatra, Java, Sulawesi and Nusa Tenggara Timur (see references).

Recommendations

1. Based on existing methodology for farming systems research and development, it is important that project personnel understand the sequence of research and development phases and that they carry out their activities accordingly. Figures 1 and 2.

2. Research and development activities must be truly interdisciplinary and integrated with other appropriate government agencies - this includes everything from site selection to implementation. Figures 3 and 4.

3. It is imperative that some form of national coordination be established to insure institutional support and prevent excessive duplication of effort. Figure 5.

4. Develop Farming Systems Field Laboratories for representative agro-climatic and socio-economic regions within the upper watersheds in Java in which longer term and more comprehensive interdisciplinary component technologies may be developed. These facilities would also serve as training centers for extension specialists and farming systems site researchers. Figure 6.

5. Expand and strengthen on-site farming systems research. Figure 6.

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TECHNICAL APPENDIX III

SOIL AND WATER CONSERVATION

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(Doc. No. 2727A)

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Chapter 1. The Framework for "Conservation - Style" Land Use

1.1. The strategies of planning conservation

1.1.1. Using limited resources

There are never enough resources or manpower and finance to do as much as one would wish, and this applies to soil and water conservation. To deploy the limited resources to best advantage requires a careful definition of the target-problem. Is erosion a problem of upstream loss or crop production? Or is the main problem downstream delivery of silt?

This issue must be resolved, because the two problems call for different solutions. Loss of productivity requires a program directed towards preserving or improving the best land. To reduce sedimentation into reservoirs calls for reclamation of the worst land.

1.1.2. Treating critical areas

Similarly, if the Regreening program is to be directed towards "critical" areas, these should be defined accurately. Is an area critical because of present on-site upstream erosion? Or because of off-site downstream siltation ? Or because previous erosion has lec to degradation of the soil and poverty among the people ? Again, this issue needs to be thought through because it determines the strategy of the conservation plan. Impoverished areas call for a program with social benefits and an investment which will show poor economic returns, whereas the program of bench terracing plus improved production will show a much better return.

1.1.3. Planning and Land ownership

The duties and responsibilities of the Ministries of Agriculture and of Forestry are heavily influenced by the legal status of

the land, i.e., Government forests are soleiy the responsibility of Forestry. However, this is not a sound basis for separating the planning of watershed improvements, even if the land use corresponded with the legal status. In fact this is not the case. What is notionally forest land has been, with varying degrees of legality, invaded and taken over for agricultural use. Planning soil and water conservation must be based on what is happening, not on what is supposed to happen.

1.1.4. The scale of planning

At the watershed level, planning calls for the integration of many disciplines and departments. At the sub-watershed level, it is likely that some aspects will not be relevant, for instance large storage reservoirs or major flood control works. But down at the level where soil and water conservation practices are put on the ground, what is required is less concern about plans and planning, and more concern with the capacity to make things happen, which means more emphasis on delivering services and line departments, with less emphasis on planning agencies.

1.1.5. Planning, Implementation, Monitoring

It seems to be an article of faith that planning must be kept separate from implementation and monitoring separate from both. I see no justification for this and suggest the opposite. Planners should also have responsibility for making their plans work, otherwise there is no real accountability and no opportunity to modify the plan during implementation. My definition of planning is that it consists of 5 steps, which are:

1. Collecting the necessary facts
2. Analysing the facts
3. Making decisions
4. Carrying out decisions
5. Assessing the results

In planning agricultural development, the first step of collecting the information about the land is to carry out surveys and measure the soil properties. Next the data is sorted and analyzed into soil codes and capability classes which are like a filing system for the data. When the land has been investigated and classified, the alternatives can be weighed up and the decisions made. Then comes the fourth step of carrying out the plan, and finally assessing the result to see if the objective has in fact been achieved. Governments seem particularly liable to forget that carrying out the plan does not automatically mean achieving the objective. The last stage of evaluation is as vital as any other, for there may have been some unknown factor which has prevented the plan from working.

1.1.6. The time-scale and who pays ?

The time-scale of soil conservation is longer than that of the peasant farmer. The man with a hungry family is so concerned with the problems of this week, this month, or at the most until the next harvest, that he has no time to worry about how much soil will be left in five years' time. Also it is unreasonable to expect the peasant farmer to pay now for preserving the land for posterity. It is a luxury he cannot afford.

The question of who should pay for soil conservation is difficult. One argument is that it is in the interests of the whole State or Nation to conserve the land resource; therefore the State should pay the cost. The counter argument is that it is unjust to make the city dweller or industrialist pay for improving the lot of the farmer. A compromise between these extremes is required.

1.2. Land suitability classification as a base for planning

1.2.1. Purpose of land classification

Land classification is a technique which makes it possible to determine the most appropriate use for any area of land. There is no

such thing as an all-purpose land-classification system. Land classification only makes sense when it is directed towards a particular purpose, and the more accurately that purpose is defined the more useful will the classification be. For example, land could be classified according to its suitability for irrigation, or its suitability for a particular crop.

1.2.2. Specification of Land Classification systems

The test of a good system is that it must be able to start with the measured facts and from this tell us which class to put it in. This requires clear rules, and any person using the system should get the same result. Too often, a classification consists of a list of the properties found in each class without explaining what to do with a set of data which does not fit exactly into any of the categories. Personal interpretation may be admissible for surveys when all the field surveyors are highly trained and experienced and would all arrive at the same answer. But in countries looking for rapid agricultural development, what is needed is to cut out all personal or subjective judgements and provide a set of clear rules that anybody can understand and follow and get the same answer.

1.2.3. Land Suitability Classification

In most developing countries, the purpose of land classification is influenced by two factors. First, the desired objective is to achieve the maximum possible agricultural production, and this means using the land as intensively as possible. Second, most developing countries are in geographical and climatic situations where soil erosion is a major problem, and development has to be achieved without increasing the risk of erosion. Classifications have been developed for this situation and are called Land Capability Classification. The name is not the most appropriate because "capability" is often confused with "suitability" and the name does not explain the very clear objective, which is to <u>classify land according to its capability for intensive agriculture without increasing the risk of erosion.</u>

There is no single universal Land Suitability Classification system, for in every country or region there are different factors which should be allowed for. The soils and climate will vary and so will social customs, land tenure, economics, and all of these may affect the choice of the best land use.

Land Suitability Classification is a tremendously valuable tool in land use planning for it ensures the logical and systematic collection of data about the soil, and presents the results in a form most useful to the planner. Of course it is not the whole story of land use - there are the economics, political and social spheres which must also be investigated, but it does provide what has been so badly needed in the past - a logical method for deciding the most appropriate agricultural use of land.

1.2.4. Review of classification systems in Indonesia

There are at least nine classification systems proposed or in use in Indonesia, including:

1. Guidelines for land use in Transmigration areas. The criteria are:

   - Land with a slope of less than 8% (flat to gently sloping) for cultivation of food crops. (Little or no erosion.)
   - Land with a slope between 8% and 15% (gently sloping to sloping) for perennial crops. (Erosion already exists here, particularly on land with a long slope, but conservation practices can prevent erosion.)
   - Land with a slope of more than 15% (steep) for forestry, watershed, and wildlife reserves. (Erosion is already serious, requiring permanent plant covers.)

This is extensively used for semi-detailed mapping at 1:25,000 and 1:50,000.

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2. The Regreening program uses 50% as the dividing line between land suitable for food cropping with bench terracing, and steep land suitable only for forestry.

3. The system proposed by Ross for identifying forest land which could be released for agriculture, and that which should be preserved forest, takes 30% as the dividing line.

4. A system which has 6 classes of agricultural land up to 40% and a minimum soil depth of 30 cm is proposed by the Provincial Service of Land Use at Bandung.

5. A system which considers land tenure and available services and is based on land value is also used by the Directorate of Land Use, Ministry of Home Affairs.

6. A suitability classification based on the FAO Framework of Land Evaluation was used for the detailed reconnaissance study at 1:100,000 of the Sekampung watershed in a joint study by the Centre for Soil Research and the FAO project based at that Centre.

7. The University of Gadjah Mada is presently developing a suitability classification for working with the Ministry of Public Works. (See Annex 2.)

8. The following system is proposed for use in the pilot watershed of the Jogyakarta RD Project.

Table

Present land use	Elevation (m)	Ground Slope (%)	Soil Depth (cm)	Treatment
Dryland (tegal)	all	40	all	Reforestation/ Silvi-pasture
Dryland (tegal)	500	15-40	all	Reforestation/ Silvi-pasture
Dryland (tegal)	500	15-40	30	Reforestation/ Silvi-pasture
Dryland	500	15-40	40	Bench terracing (possibly irrigated)
Dryland	500	15	all	Bench terracing (possibly irrigated)
Home gardens (pekarangan)	all	all	all	Tree farming improvement

9. Two other systems based on computerized data are the proposed "Land Resource Data Base for Indonesia" which will map at 1:1 million for macro-planning, and LECS (Land Evaluation Computer System) for semi-detailed and detailed reconnaissance surveys at 1:25,000 to 1:100,000, which are being developed by the Centre for Soil Research in collaboration with FAO. A standard land capability classification at reconnaissance level (1:250,000) based on the modified eight classes system of the U..S. Soil Conservation Service (U.S. SCS) is being refined using the FAO Framework of Land Evaluation.

1.2.5. Other systems used world-wide

For dryland farming on moderate slopes, the eight-class system originally developed by the United States Department of Agriculture Soil Conservation Service will serve in most situations with some modification for local conditions. It meets all the requirements in that it is simple, reliable, objective (i.e., based on measured factual data) and it is easy to teach field staff how to use. Regretably, it

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has one feature which makes it unsuitable for Indonesia. It assumes that there is sufficient gently sloping land available for crop production, so that all land steeper than about 12 or 15% is set aside for non-arable use. It is not possible to extend this system to steeper land because the conservation practices which it recommends are only usable on gentle slopes.

When there is plenty of gently sloping land available for agriculture, it is practical to impose this restriction on the maximum slopes which are considered suitable for cultivation. This is the situation in the United States and in other countries where it has been successfully applied - in Africa, Australia, and South America. But in Java there is a different combination of circumstances - high population pressures so that every hectare has to produce food for a hungry person, no more undeveloped land, and plenty of labour. In this case, arable farming can and should be extended to much steeper slopes by the use of various forms of terracing. A capability classification for this situation has been developed. This is usually known as the Sheng classification after the FAO expert who developed it after many years of experience of practical soil conservation in the humid tropics. The system has been successfully used in Taiwan, Thailand and Jamaica under conditions very similar to those of Java.

1.2.6. Recommended system for Indonesia

I suggest that the Sheng system shown in the following table should be used as the starting point for discussions among appropriate Indonesian specialists to determine whether it needs any modifications in order to be suitable for Indonesia.

Table 2. The Sheng classification system

Land Class	Range of Degrees	Slope %	Minimum soil depth (mm)	Conservation Treatment	Maximum intensity of Land-use
1	0- 7	0-12	Any	0-2° Contour cultivation	Any
				2-7° Channel Terraces	Any
2	7-15	12-27	1000	Bench terraces	Any
3	15-20	27-36	500	Step terraces or hillside ditches	Close-cover crops & semi-perennials
4	20-25	36-47	500	Step terraces or hillside ditches	Tree crops with ground cover
5	25-33	47-65	250	Orchard terraces or platforms	Tree crops with ground cover (no cultivation)
6	33	65	Any	None	Forest only

The objectives are the same as those of the American system, that is, to recommend the most intensive and productive form of land use, together with the appropriate conservation methods necessary to avoid undue erosion. It suggests using non-food crops and tree crops on land too steep for arable farming of food crops. The two main considerations which determine what type of terracing is most suitable are the slope of the land and the depth of the soil, which are inter-related.

In this capability classification scheme, all of the four classes of arable land of the SCS system are included together in Class 1, with the assumption that it will be possible to control erosion by the application of conventional conservation measures such as diversion drains, graded channel terraces, and grassed waterways.

1.3. Strategies for putting soil conservation on the ground

1.3.1. The alternatives

The development of technical solutions is only part of solving the erosion problem. It is also necessary to apply the solutions on the ground. There are several approaches to achieving this objective:

a. The concept that soil conservation is such a 'good thing' that it is only necessary to show the people what to do and they will start to do it. In this scenario, once the technical knowledge is available, all that is required is education and extension.

b. Another approach is to use financial incentives to encourage the implementation of conservation works by the government paying a substantial part of the cost of the works and the rest being a charge to the landowner.

c. The third possibility is to use coercion. This may range from low-key pressure, a kind of moral blackmail to make people feel bad if they do not conform, to the outright enforcement of legislation.

Various combinations of these three elements are possible. In the U.S. it is common to refer to "the green ticket strategy", which is a combination of the first two approaches, and the "red ticket strategy" which is the third approach, possibly with an element of financial assistance to make the pressure more acceptable.

1.3.2. Legislation

The question is 'should government try to enforce its policies for land use by legislation?' It is a tempting thought. After all, surely the expert must know best what is best for the country. However, the record suggests that legislation cannot provide the solution for two reasons. First, it is morally wrong to force on the populace theories and practices unless their validity has been established beyond question. But more importantly, the fact is that legislation does not work.

In the old days of colonialism the approach 'the Government knows what's best for you' worked to some extent. In British territories in Africa, a great deal of practical field conservation work was carried out, two examples being Kenya and Malawi. With independence, two possibilities arose. One was that the newly-independent government would discard conservation control as part of the process of throwing off colonial impositions. Alternatively, the government might say 'now that the land is really ours we will look after it', and increase the conservation effort. In practice, neither has happened - the concept of regulation and control remains, but it has no truth.

Some countries have quite sweeping powers to control land use and enforce soil conservation practices, but in every case it has been possible to pass the legislation because there is a widespread acceptance that the misuse of land is an offence against society and socially unacceptable. When this approach to land use has been accepted by the community as a whole it is not necessary to invoke the legislation because incurring the displeasure of the rest of the community is a more effective regulator of behaviour.

Soil conservation programmes can only be effective when they are 'moved from below', i.e., by full involvement of the rural population. Programmes which are imposed 'from above' will not succeed even if they are technically correct.

Chapter 2. Soil Conservation Practices

This chapter concentrates on reviewing the alternatives, since details and design procedures are fully documented in text books and in-service design manuals.

2.1. Principles

2.1.1. The attitude to soil conservation in Indonesia is focussed too strongly on repairing the damage caused by erosion, instead of being part of a constructive plan of improved land and water management. To use an analogy - medical practice is concerned with both curative and preventive medicine. Soil and water management should do the same. Preventing the deterioration of good land is just as important as reclaiming eroded land - indeed with only limited manpower available it could be argued that reclamation should only be tackled when there is a problem of sediment in the rivers, and that most of the effort should go towards preventive care of good land.

To pursue the medical analogy, the accepted wisdom on soil conservation has locked into one particular cure, the major surgery of bench terracing, with little or no regard for the large range of less dramatic alternatives outlined in this chapter.

2.1.2. Soil conservation can only be effective when it is part of a sensible approach to land use, i.e., using the land appropriately as discussed in Chapter 1. It is unrealistic to see it as a crutch to prop up a form of land use which is inherently unstable, such as trying to grow annual crops on steep slopes with shallow soils.

2.1.3. The over-emphasis on the mechanical side of building terraces and check dams increases the difficulty of getting across to field advisers and farmers the idea of controlling erosion through good farming practice.

2.2. Reclamation of eroded land

Unfortunately, during my field visit this trip, I did not see any examples of the reclamation of badly eroded land. On previous visits, the impression was that there was more emphasis on mechanical measures, dams and earth-moving, than on achieving control through vegetation. Land which is badly eroded goes into a downward spiral of poor soil moisture, leads to poor vegetation, leads to poor moisture and so on. The trick is to discover a point at which the cycle can be broken. It might be to improve the infiltration by scarifying the surface, or improving the vegetation by fertiliser or introducing a new species or variety.

2.3. Conservation practices on arable land

2.3.1. Biological methods

There is a strong correlation between erosion control and profitable crop production. The essence of crop management for erosion control is to minimize splash erosion by providing as full protective vegetative cover as possible. This means high plant density, vigorous, healthy plants, and possibly surface mulching, interplanting of mixed crops and the whole array of practices for maximizing yield. The research now being undertaken on these subjects must be seen as being directly relevant to soil conservation.

2.3.2. Mechanical protection methods

The range of alternative mechanical protection measures extends way beyond bench terracing, which is most suitable only for a fairly narrow range of slopes. Relating them to categories of slope which correspond with those of the proposed capability classification we have:

Slope range 0-2%. It should be possible to contain erosion without earth-moving works, with only contour planting and strip cropping.

Slope 2-15%. The classical 3 prong approach:

a. Diversion drains to interupt run-off from non-arable land above the arable;
b. Graded channel terraces to handle run-off from the arable land;
c. Water disposal channels, either grass-lined, or paved.

Detailed design specifications are available for all conditions of soil and climate. This type of conservation practice is not used or needed much in Java, but it will be very important in the transmigration areas in the other islands. The technology must therefore be understood. It is thoroughly documented.

Slope 15%-35%. Bench terraces are the preferred solution for this range. Since they are presently put in on a rather casual basis, some design details are given later in this chapter (2.3.3.).

Slope 35%-40%. Bench terraces are often used on these slopes, but experience in FAO projects in Thailand, Jamaica and Indonesia suggests that they are not economically viable and that annual cultivation should be avoided if possible. The preferred solution is to use individual terraces for tree crops. Where subsistence farming requires some food crops, it should be on discontinuous terraces and combined with establishing perennial crops which can eventually become sufficiently productive to move away from annual cultivation on the terraces.

Slope 40%-50%. Bench terracing should not be used. Alternatives are step-terraces, intermittant terraces (orchard terraces), or interrupted terraces (plat forms). These should be used for close-cover perennial crops (tea, coffee, etc.) or tree crops (fruit, nuts, spices).

Slope 50%-60%. The same physical treatment as the previous group, but only tree crops on the terraces plus a planted cover crop on the land between (i.e., there is no cultivation).

Above 60% (about 30°) the land should be used only for commerical forest plantations or production forest.

Note that the above slope ranges will vary in different situations of soil and rainfall. The slopes are shown in percentages, not degrees, because that practice seems to be most common in Indonesia.

2.3.3. Design details of bench terracing

The accepted design for bench terracing derives almost entirely from the FAO Solo experience - nothing important has been added since, nor taken away. Fortunately that base is very sound, but there is a problem. Because it was so successful, it has been applied everywhere without any serious attempt to look for local variations. On deep, well-structured soils with high infiltration rates and large moisture storage capacity in the profile, it may be better to have no back-slope, and no lateral slope so that run-off is reduced to the point where waterways are not required.

Waterways are an expensive part of the system which need regular maintenance. Farmers usually prefer to do without them. The experience at CIGARU, where waterways are not used and not missed, proves this point. I do not think that there would have been a problem if waterways had been left out of the Panawangan demonstration area.

Conversely, on soils of shallow depth in high rainfall areas, the run-off from bench terraces may be greater than the standard system can handle. In such cases, if the land cannot be put under a better form of land use (such as tree crops), then a more sophisticated and expensive type of drop structure will be required in the waterways. Possibilities would include the use of cemented masonry or pre-fabricated concrete panels.

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The main point is that the possibilities have not been adequately explored. It is a great disappointment that the excellent foundation established at Solo has not been improved on.

The spacing of bench terraces appears to be rather hit and miss or trial and error, when there is a simple formula available:

The vertical interval is calculated from

$$VI \text{ (meters)} = \frac{S \times W}{100-SU}$$

where S is the land slope (%)
W is the bench width (meters)
U is the slope of the riser, expressed as the ratio of horizontal distance to vertical rise.

A rough and ready approach used in Yogya is VI = 0.25 m up to 5%, 0.75 m up to 17% and 1.25 m up to 40%.

Even if the risers are planted to grass which can be utilized for livestock, the farmer still sees them as an undesirable loss of cultivated land. Tests should therefore be made on how steep risers can remain stable under different conditions of soil type, rainfall, and height of the riser. This kind of work is very suitable for graduate students' theses.

The cross-sectional area of the excavation is an important element of the cost of constructing bench terraces and is calculated from

$$C = \frac{W \times Hr}{8}$$

Where C is the cross-sectional area (m^2)
W is the bench width (m)
Hr is the height of the riser (m) and is the vertical interval plus the change in elevation across the terrace if there is a reverse slope.

The maximum width of terrace is rather more complicated since it depends on the land slope, the depth of soil, and the slope of the riser.

The equation is

$$W = 2d \frac{100^2 + S^2}{100} \frac{100 \cdot SU}{S}$$

Where W is the width of terrace

d is the soil depth (measured at right-angles to the slopes)

S&U as before.

A graphical solution of this equation is shown on page 18.

A commonly expressed fallacy is that the constructon of bench terraces will always reduce fertility because the top soil is buried during the excavation process, and stockpiling the topsoil to put back later is too laborious. This can be largely eliminated by making the terraces from the bottom up. The lowest is built first (some topsoil is buried) then the top soil from the next one up is thrown down, and so on sequentially up the slope. The lowest terrace, gets a double ration of topsoil, and the highest loses all the topsoil, but all those in between should be as fertile as before.

2.4. Conservation on forest and grazing land

There are two technical points to be made on this topic. First there is a widespread fallacy that forests always reduce or prevent erosion. There is ample experimental evidence to prove that this is not the case, and one only has to look at the severe erosion under Pinus mercusii in Kali Tapan in the Solo watershed to understand that Indonesia is no exception. Of course, a forest with crown cover, understory, and forest litter on the surface will have little run-off and negligible erosion. But a pure-stand plantation with no understory and no surface litter can be more damaging than if the forest were not there. The reason is that once the canopy is saturated, the throughfall hits the ground surface in the form of large drops which, if the canopy is high, will be travelling at terminal velocity. The kinetic energy and hence the erosive power of the rain at the soil surface can be greater than outside the forest.

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for diagram

The all important factor in reducing erosion is to achieve a good protective cover, and there are sometimes more effective or more remunerative ways of achieving this than by planting trees.

There may occasionally be a place for some mechanical protection, such as contour furrows, during the establishment of forest, but the result can usually be achieved in the humid tropics by biological practices.

2.5. Conservation on non-agricultural land

In Java, by far the most serious cause of erosion from non-agricultural land is roads. Rural roads are usually steep and unpaved. Highways leave large areas of steep enbankments. It is encouraging that the highways department is aware of the problem and is taking some action. But the technique used on the Jakarta-Bogor highway could be greatly improved. The present system is to plant in square blocks with open drains downslope every few meters, using only one species. It would be no more trouble to plant a mixture of grasses and creeping legúmes such as Centrosema, Pueraria, and Calopogonium. Also planting on the contour without the down drains would reduce the risk of rill erosion taking place before the cover is established. Again, it is just a question of making use of well-known and tested practices.

Chapter 3. Water Conservation Practices

3.1. Soil moisture management

The tendency is for bench terraces in P3RPDAS projects to be seen only as soil conservation measures, whereas they should be considered also as tools for water management. If rainfall is likely to be greater than the crop needs and the soil can store, than we can use the terraces to encourage run-off (as in the present scheme of 1% back slope and 0.1% longitudinal slope leading to waterways). In other situations it is possible to go for maximizing the infiltration in order to maximize the stored moisture available for cropping. This would mean flat terraces with an outer lip, and probably the use of mulching to promote infiltration. This method was seen to be working at the CIGARU site, and should be investigated in other situations.

The other aspect of water management is when we want to improve infiltration as part of the reclamation of eroded land. Getting more moisture into the soil profile is often the best way to crack this problem. Some good work was done in Kali Wader in the early days of the Solo project using surface scarifying and surface bonding to help establish vegetation. More studies of that nature are required.

3.2. Management of run-off

The Citanduy II Erosion Control Measures Planning Report (October 1982) correctly identifies upland irrigation channels as a problem area because at times of heavy rain they become the main route for surface run-off. Within the project, the plan is to put in suitable drop structures, but outside the project this is likely to fall into the no-man's land between the various line ministries.

3.3. Check dams

On the whole, good progress in constructing check dams was seen in all the projects visited. The use of standardised designs has made it possible to build them quickly and in large numbers. The disadvantage is that there is no flexibility; or perhaps it is the lack of people with sufficient experience and authority to make technical decisions. The result is that the dams are sometimes overdesigned and not always in the best place. The long term answer to this is to improve the technical competence of the men in the field who decide where the dam should go and how big it should be. (I was never able to discover exactly who has this responsibility.) In the short term, the solution is for the watershed projects to make use of the country-wide network of engineers of the Ministry of Public Works, linking either with their subdistrict offices under the Regional Public Works Engineer, or with the sub-project offices of the line structure down from the Directorate of Rivers. It should be possible to arrive at an arrangement where these engineers provide advice at the stage of site selection, then leave the construction to the P3RPDAS as at present.

In general, the check dam program must be rated as one of the more successful components of the Regreening programme.

Chapter 4. Economics and Sustainability of Conservation Practices

The Terms of Reference for the Soil and Water Specialist include "In conjunction with the Team's agricultural economist, to assess the costs of soil and water conservation technology as presently applied ---". I share the view of the economist that this would be a fruitless exercise because cost/benefit analysis is not an appropriate tool to apply to soil conservation, any more than it can be applied to education programs or health improvement programs.

It is fairly easy to calculate the costs of soil conservation, more difficult to define the benefits, even more difficult to define the benefits in cash terms. With some subjective guesswork one can make an estimate of the cash value of increased production. With more dubious calculations one can arrive at a value for not losing the soil. Secondary benefits like job creation can be included, but at the end there is no way of putting a cash value on improved quality of life which comes from better health, a more balanced diet, or reduced drudgery.

This chapter will therefore list the available information but not attempt to assess it.

4.1. Cost/benefit of terracing

4.1.1 The Solo project put considerable effort into analyzing the costs and benefits of its activities. For terracing, the project Termination Report No.7 came up with the following:

Slope		Profitability Range
gentle	0 - 5%	25% to 70%
medium	5% - 30%	12% to 40%
steep	30% - 50%	5% to 26%
steep critically eroded land		0%

Bench terracing Kali Samin 19%

This data was reworked by Vincent in the World Bank pre-appraisal Mission of 1978. His conclusion was that the break-even point between accumulated project costs and accumulated post-development returns would occur at year 11 in a 10-year programme, and at year 9 in an accumulated 5-year programme. However this analysis included all the components, not just terracing.

4.1.2 The Citanduy II project working paper C-5 gives the proposed costs of new terracing as Rp 222,000/ha, and rehabilitation of terraces Rp 120,000/ha. The implicit assumption is that initially the increased benefits will not exceed the cost, so an element of subsidization is essential, preferably in kind, e.g., provision of fertilizer.

4.1.3. A detailed analysis of cost and return for selected watershed demonstration farms was carried out in 1983 by Lucas & Barrau. This suggests an average (from four one-ha farms) of a net profit of 2[illegible]5%, with an average investment cost of Rp.328,803. The suggestion is that while an initial investment has to be injected, the investment is well worthwhile, and the question is how best to make the initial injection. This is considered in the technical report of the agricultural economist.

4.2. Cost/benefit of check dams

One would expect this to be a subject of equal concern, but the only data on the subject which was located is the Solo termination report No.7 which suggests that for proposed dams in Kali Samin which could be used for irrigation, the internal rate of return ranged from 13% to 48% with a mean of 26%. Since the life of most check dams is limited by the sedimentation rate, there seems little point in trying to justify them on the basis of increased returns from irrigation.

4.3. Sustainability and Maintenance

The inherent disadvantage of all development through projects is that there is a powerful thrust during the life of the project which is difficult to sustain after the project has finished. This is discussed again in the following chapter.

In terms of improved crop production, the essential assumption is that the improvement, once generated, will continue because it provides a better income. However it still requires that there must be a continued supply of both the physical requirements like seed and fertilizer, and the continued supply of extension advice.

Where physical works have been installed, the question is will they be adequately maintained. The projects visited suggest that only those items will be maintained which can be seen by the farmers to have a direct benefit. He is maintaining the terrace risers because when they collapse he loses land, but I have still to see drop structures which have been adequately maintained by the farmer's own direct effort. This illustrates and emphasizes the point that it is only sensible to put into practice those things which the farmers can really identify with.

The comparison between Panawangan and Cigaru is relevant. Cigaru is totally bottom-up development and things only happen when there is a real felt need. They did not feel a need for waterways in the bench terrace system so they are not used. Panawangan decided that waterways were necessary and paid for them to be built. But the farmers were not convinced so they are not maintained. In this case it does not matter much because the waterways do not seem to be important, but this illustrates the point that maintenance has nothing to do with the actual structure - it depends on attitude.

The discussion on whether bamboo drops in waterways will last is irrelevant. If the farmers were convinced they were absolutely necessary they would rebuild them every week if that was what was required. Using masonry or concrete only extends the time before they will fail if not maintained.

My personal opinion is that Citanduy and Solo have a lot to learn from Cigaru.

Chapter 5 Delivery Systems

5.1. Delivery through line departments or projects

From the view of field staff, operating within a project structure was clearly seen to be a disadvantage. We were impressed by the enthusiastic young men in both P3DAS and P3RPDAS, but they certainly have anxieties about long term career prospects.

From the view of the farmers, there appeared to be a sense of having been abandoned in the only case I saw where a busy project had diminished, which is the FAO Solo project. One farmer contrasted sadly the supply of fertilizer in those days with the present. He may have been completely non-typical, but that is the kind of situation likely to occur. Apart from delivery of physical inputs, there is the question of advice.

The concentration of effort into Panawangan was enormous - two full time expatriate specialists for two years plus strong local supporting staff. That level of care and attention can never be provided on a long term basis by a line Department.

If projects are seen as short-term concentrated attacks on a problem to be solved by a one-shot solution like building a storage dam for irrigation, then the job can probably be better done as a Project. Alternatively if a Project is seen as a one-shot demonstration for the line departments to follow, that also makes sense.

The weakness of the present system is that projects are being used as a substitute for efficient line departments. P3DAS and P3RPDAS are examples of this, and they tend to become institutionalized as substitutes for a line department of soil and water management. Although some projects may be seen as institution building (Yogya R-D is an example), others can be counter-productive by reducing the need for the departments to improve their efficiency.

I think it is significant that of all the watersheds we visited, every single one either has now, or has had, outside technical aid assistance - Citanduy, Cimanuk, Solo, Brantas, Jratunseluna, and Yogyakarta. The question for which I am still seeking an answer is how much progress is being made in those which do not have this head start?

5.2. Management on the basis of watershed or administrative region

Ideally, administrative regions would be based on topography so the difference would disappear, but that seldom happens in real life. The present system is planning and coordination on the basis of watersheds, "one watershed - one plan", while the implementation is done through districts and subdistricts, and this seems to work reasonably well. I felt that most of the problems of missing or non-effective cooperation were more due to people problems than to the system.

5.3. Subsidies and Incentives

The general principle of how to make soil conservation work was discussed in section 1.3. Subsidies and incentives are an essential part of the package. They are discussed in detail in the economists' technical report, but in connection with the mechanics of soil and water conservation, I feel a different approach is needed for construction and improved farming.

To stimulate the construction of bench-terraces, a one-shot incentive payment is necessary to achieve the desired rate of adoptation. The Panawangan experience shows that payment in kind (free or cheap seed, grass, fertilizers) is better than direct payment.

The inputs for improved farming are different because they have to be sustained until the new farming system is financially viable and self-generating. This suggests a suitable mix of price support for the products and subsidy on the inputs.

Another option is 'cross-compliance', which means only giving a particular type of support if there is compliance with unrelated recommendations. In this case, it could be price support only when bench terracing is built and maintained. This sounds like a good bet, but it is currently losing favour in the U.S. Soil Conservation Service so there must be problem. Certainly it would provide a fertile field for graft, and so should probably be ruled out on that score alone.

5.4. Delivery of materials

One fact which came through very clearly is that the machinery for supplying the materials for improved farming is inadequate for the job. There were constant stories of no seed, grass planting material missing or too late, inadequate nurseries (even for trees). It was suggested that this has arisen because of the unexpected rate of adoption, but only a very small percentage of ground has been brought in, so the machinery for delivering certainly needs major overhaul.

Chapter 6. Information Diffusion and Linkages

My base for writing this chapter is regrettably inadequate. There was little opportunity to explore this topic during the field trip, and no time to do it later.

6.1. Information exchange between Projects and P3DAS

Naturally there are close ties and good exchange of ideas and information between P3DAS and the projects close to it. But P3DAS is supposed to have a national role, and I saw little evidence of exchange of information with more distant projects. I must confess that I found P3DAS a great disappointment. I said in 1978 that they were coasting on the momentum of the FAO project and I think that is still the case. Considering the large pool of highly trained specialists, the output of information seems very small. I would have expected a flood of technical reports, guidelines, and research notes to help and guide the projects. If they exist, I did not see them.

6.2. Information exchange between Projects

Again, either I missed it or it is not there. There is a one- way flow from Solo into all the other projects, but I felt that Jratunseluna was not very interested in what Citanduy was doing, and that Brantas also had poor information exchange.

6.3. Exchange with Universities and Research Institutes

There are plenty of personal links, and some local institutional links such as C.S.R. with Cimanuk, and Brawijaya University with the Brantas project. Within Universities, the multi-disciplinary Environment Centers play a useful role. But there is still room for better exchange of ideas and information. An annual national 3-day seminar would improve the information flow enormously.

6.4. Information exchange with Government Agencies

The projects we visited were forced by the structure of project management to be in contact with the relevant line departments. But the line departments are in the not uncommon situation of totally inadequate cross links at the level of middle management. At senior level, Ministers and DG's seem to coordinate, and down at the field level the men on the ground are in contact. At the middle level, I felt that sometimes when we met representatives of several line departments they were seeing other for the first time in months, or years.

Chapter 7. Research Needs

7.1. The present data-base

A comprehensive list of all the past, present, and planned research in the field of soil and water conservation in Indonesia would surprise most people. A first attempt at such a listing is shown as Annex I and contains thirteen entries. There are certainly many more.

However the effort is widely dispersed at many sites and among many agencies. Few of the people operating run-off plots knew who else was doing similar work elsewhere. It would be very useful to have an annual national seminar managed jointly by CSR in Bogor and DPMA in Bandung. Having brought together the people who are active in this field of research, one could then start filling another gap by setting up a working party (preferably consisting of only one member) to analyse the data-base, assess its reliability, and hence identify what needs to be done. The writer carried out such an exercise in southern Africa many years ago, and it was felt to have been very constructive.

One reason why it is necessary to apply an independent critical analysis to the presently available data is that there are good grounds for questioning the reliability and accuracy. To give one example, the original FAO Solo project produced data on the effect of terracing, and published conclusions. The data was extensively reworked by Vincent during the 1978 Bank mission, by the present author later in 1978, and P3DAS have been manipulating it ever since. There is no doubt that there was a reduction of run-off and sediment after the terracing programme, but we still cannot determine how much this was the direct result of the programme, and how much due to variations in the rainfall.

Another difficulty is that of maintaining gauging stations in remote locations. We saw many stations which were silted up, or in need of maintenance, and the reliability of the data must be in doubt. The data from the Panawangan gauging weirs is a case in point. Having seen the

weirs I would very much like to be able to analyse the results published in Indonesia by OPMA.

The inadequacy of the present data-base is reflected by the fact that nearly all the present and proposed projects contain an element of research to fill the missing gap. Citanduy II is an example. I believe this is helpful, but a poor option compared with a programme planned and operated by professionals.

At the moment, the lack of a reliable data base is forcing the use of very second-best techniques, as illustrated by the following example from Citanduy II.

The Citanduy II Erosion Control Measures Planning Report (October 1982) attempts to predict peak rate of discharge, and volume of run-off, for two hypothetical watersheds of 250 ha, one in the Upper Cimuntur subwatershed, and one in the Upper Cikawung subwatershed, using the USDA SCS run-off curve method.

The prediction for case one is that a 24-hour rainfall of 239 mm will produce a maximum rate of discharge corresponding to 132 mm/hr, and a total volume corresponding to 152mm.

The prediction for case two is that a 24-hour rain of 204 mm will produce a peak discharge corresponding to 150 mm/hr and a total volume corresponding to 144 mm.

The USSCS is most careful to emphazise that these design procedures for estimating run-off are applicable only to the United States, Puerto Rico, and the Virgin Islands. I suggest firstly that it is most unwise to base any planning on the above estimates, and secondly that they are likely to be in error by factors of the order of 100%.

7.2. Basic long-term research

Rainfall data is only adequate in terms of total amount. Except where more detailed records have been collected as part of erosion research, e.g., by SRI, there is not enough data on intensity to predict run-off and erosion.

Similarly, we need much more reliable data on run-off and soil loss. Present methods for sediment sampling are crude and unreliable. The programme of technical assistance in this subject currently offered by the Hydraulics Research Station should lead to improvements.

We also need some sound research on the effect of changes in land use at the subwatershed scale. This is time consuming and expensive but will have to be done, and done properly. Simple before and after trials are of little value, although that was what was done in Solo, and is now being repeated at Jratunseluna. The problem is that if a change is recorded there is no way of telling how much of the change is due to variations in rainfall. Vincent points out that in the case of the Solo data, the monthly run-off coefficients show greater variation within treatments than between treatments. Modern experimental hydrology is a highly developed science, and there is really no need to continue to use the methods and concepts of twenty years ago.

7.3. Applied short-term adaptive research

There are two aspects to this. First, when a good piece of technology emerges, such as the Solo bench terracing, it needs to be tested in different conditions to see whether it should be adapted for use in a different soil, or in a different rainfall.

The second aspect is that things like bench terracing are not applied in isolation. They are combined with other things like better varieties with fertiliser, so they need to be tested in that situation.

Elsewhere in the report, the team strongly recommends that this problem should be overcome by multi-disciplinary adaptive research on field experimental stations set up for this purpose.

7.4. Field trials

The field station still cannot research what will happen when the individual peasant farmer applies the proposed research, so there has to be another testing process actually on the farmer's land. Only then can we determine whether he is able and willing to carry out the work, and maintain the drop structures in the waterways. To some extent this is being done now in the Demplots and Trial Areas, but the middle stage of adaptive research has been left out, so what is being tested in the demplots is not necessarily the best method or the best variety of crop for that particular field.

Chapter 8. Training Needs and Opportunities

Training will be covered more fully in the report of the Human Resources group of the team, but some brief comments on technical training in soil and water conservation are appropriate.

The training programme set out for the Yogyakarta RD project is a good model (Working Paper C-10). However, the plan proposes that the training courses in soil conservation should be run by the Forestry D/G for Regreening. I was not able to visit their training centres for discussion with the field staff who have been trained. Having in 1978 taken part in a training course for the top managers of each of the 35 DAS's, I think there is a shortage of sound practical experience and that the first requirement is to train the trainers.

The experience of P3DAS at Solo suggests to me that sending officers to obtain higher degrees at overseas universities increases their knowledge of theory and principles but has little impact on their technical competence.

To increase the body of experience in soil and water conservation I suggest two additional training activities.

8.1. Overseas visits

Indonesia needs to absorb more of the experience available in other countries, and this could be achieved at two levels.

8.1.1 Policy makers (i.e., at the level of Director-General and Director) should go and study good operational soil conservation services. Countries I would suggest are the USA and New South Wales to study the organization and Malawi in Africa to see technology appropriate to Indonesia.

8.1.2 Graduate technical officers, should study terracing and land use systems in Jamaica, Thailand, the Philippines, and Malaysia, and if possible, one of the Latin America countries such as Brazil, Venezuela, or Mexico.

8.2. Training course

A quick and effective boost could be provided by intensive in-house short courses by teams of experienced expatriates, backed up by any local staff who have the right level of experience. Several organizations offer such courses, including my own base, the National College of Agricultural Engineering.

Three successful examples that I have been personally involved with are:

a) A 4-man team did a 2-week crash course in Sri Lanka on soil and water management for graduate officers of the Dept. of Agriculture.

b) Another 4-man team did a 3-week course in soil and water management for 20 graduate engineers of the Irrigation Division of Public Works Department of Iraq.

c) A 5-week course on soil conservation was held at NEAE for 27 soil conservation officers from Kenya, Tanzania, and Ethiopia, using 8 resident NEAE staff and 6 visiting lecturers.

Annex 1. Schedule of Known Runoff Plots and Stream Gauging Programs

A. Run-off Plots

1. Centre for Soil Research has small scale run-off and soil loss plots on 5 sites in Java and 2 in Sumatra. All include a bare fallow treatment and crop treatments appropriate to each region. The sites have varying length of record, some going back to a Belgian technical assistance project in the 1970's.

2. Brawijaya University, acting as agent for the Kali Brantas Project, has small plots on 2 sites in Kali Konto, measuring run-off and soil loss from potatoes and cabbage with and without terracing.

3. The UNDP/FAO project at Solo had a considerable range of plots of different sizes and different rainfall zones. Recording was maintained from about 1974 to 1976, and perhaps erratically since.

4. Citanduy II includes plans for run-off plots at several sites.

5. University of Gajah Mada (Dept. of soil Science) proposes to establish plots shortly.

6. In Cimanuk watershed, plots are installed at Campaga, and planned for the trials areas at Cipulus, Haurgeulis, Wanahayu, and Ciela.

B. Stream gauging sites

1. The UNDP/FAO project at Solo operated seven gauging weirs installed by a previous project and the program has been continued and extended by P3OAS in the Solo Watershed.

2. Citanduy I installed 2 weirs at Panawangan and 2 at Karangpucung.

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3. Citanduy II plans to install 6 more weirs.

4. Small watershed experiments were set up at Waspada in 1963 by what were at that time the Forest Research Institute, the Institute of Hydraulic Engineering (now DPMA), and the Bureau of Land Use Service (now Directorate of Land Use).

5. Stream gauging weirs are installed in Jratunseluna watershed, and many other watersheds, where consulting engineers have been working with the Ministry of Public Works, e.g., Citanduy, Brantas, Cimanuk and Cisanggarung.

6. Presumably DPMA at Bandung operates its own network of gauging sites.

7. The Hydraulic Research Institute (UK) is working with the Brantas Project on improved techniques for stream gauging and sediment rating on the Brantas at Karang Kates reservoir, and Selorejo reservoir.

C. Summary

There are almost certainly many more plots and gauging stations in addition to those listed. There should therefore be a good data base, but in fact it is widely dispersed, much of the data is of unknown (probably low) reliability and accuracy, and much of the data has not been analyzed. There is clearly an opportunity for a once-only serious compilation, study and analysis of all the available data in order to establish what steps are required to fill the gaps.

Annex 2. Outline of First Approximation of Land Suitability Classification

Developed by Department of Soil Science UGM

1. Crops separately considered
   - 1.1. Sawah rice (lowland or wetland rice)
   - 1.2. Annual upland, including upland rice (gogo)
   - 1.3. Grasses (pasture)
   - 1.4. Perennials (trees), subdivided into
     - 1.4.1. Need a certain period of dry months (for instance coffee)
     - 1.4.2. Dry period not required (for instance tea)

2. Land criteria and parameters:

   - 2.1. Climate
     - 2.1.1. Mean annual rainfall (mm)
     - 2.1.2. Mean number of wet months (monthly rainfall over 200 mm)
     - 2.1.3. Mean number of dry months (monthly rainfall below 100 mm)
     - 2.1.4. Mean annual air temperature (to accommodate highland and lowland crops). It may be approximated using the generalized relationship of $t = 26.3 - 0.6\ h$, where this air temperature in degrees Celcius, and h is altitude in hm (100m).

2.2. Land surface features:

2.2.1. Slope

2.2.2. Incidence of floods or inundations

2.2.3. Stoniness

2.2.4. Density of termite mounds - commonly reflect effective soil depth for biological activities, and impose hindrance to mechanized land clearing and soil cultivation.

2.3. Soil morphology and physics:

2.3.1. Predominant texture

2.3.2. Predominant structure

2.3.3. Consistence

2.3.4. Rockiness (degree and depth of concentration)

2.3.5. Concretions, particularly lime, ironstone, manganese (content and depth of concentration)

2.3.6. Effective depth and kind of limiting layer in terms of manageability

2.3.6.1. Manageable, for example ground water table, gley layer.

2.3.6.2. Not manageable, for example solid rock, contrasting layer of coarse sand or stones.

2.4. Soil chemistry:

2.4.1. pH in H_2O

2.4.2. pH in 1N KCl or K_2SO_4

2.4.3. EC (salinity)

2.4.4. Gleyzation (depth and intensity)

2.4.5. Mineralogy (mineral reserve)

3. Principles of evaluation:

3.1. Compensatory relationship among land criteria. For instance, the combination of a coarser textured soil with a more humid climate has the same rated value in terms of soil moisture management as the combination of a finer textured soil with a drier climate, provided that the other hydrological factors are the same (slope, relief, field position, etc.).

3.2. Possibility of technological intervention. For instance, a soil with a shallow effective depth limited by a manageable limiting layer is rated higher than when the limiting layer is not manageable.

3.3. Land is considered as a system, not as merely a grouping of elements. This means that the value or quality of land is determined by the land component which is the least responsive to compensation.

3.4. The basis of reference is the empirical skill of the average farmer in carrying out a sustainable process of production. Lands that possess the qualities to interact profitably to such a kind of skill are classified as currently suitable (R). This means that the farmer on such land can be left alone. This class of land has less than 10 percent of the total number of diagnostic parameters outside the "normal" range of workability according to the average farmer standard. If the land needs certain inputs which are generally not applied or not known by the average farmer, it is called conditionally suitable (TR). This class if further subdivided into three subclasses, according to the amount and variety of inputs required. The first subclass (TR_1) has 10-20 percent of the total number of diagnostic parameters outside the "normal" range of workability, while the subclass TR_2 has 20-50

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percent, and TR_3 has more than 50 percent discrepancies from normality. If there is just one submarginal property which is beyond manipulation, the land goes into the unsuitable class (TT). If manipulation is possible but presently not feasible in an economical sense, the land is classified as reserved land for eventual use in the future (C).

4. This classification system is intended for practical use with only a minimum of laboratory support. For adequate reliability, the field work can be done by surveyors with a limited knowledge about soil.

Annex 3. Comments on Watershed Visited

3.1. Citanduy

The two major projects are the Citanduy II run by P3RPDAS with USAID assistance and the Cigaru of PSLH - ITB. One small project working since three years ago in Jagabaya (Lengkong) is supported by Public Works with the provision of one field extension worker.

Citanduy II and Cigaru use so-called model farms (MF) as initial points of implementation intended to become in due time central points of impact to the surrounding farms. MFs are formed by grouping adjacent farms into land parcels of about 10 ha each. In Jagabaya a piece of land has been allocated by the village for a "petak pengalaman" (exercise plot), where farmers observe and learn to master the skill.

The MFs of Citanduy II are patterned after the Penawangan System of Citanduy I stressing on cropping systems, but reinforced with a soil conservation component that has been developed by the FAO Solo Project. Grasses are included in the cropping pattern for fodder as well as for the protection of terrace risers and lips. As livestock holding will be encouraged by the availability of better quality fodder, the cropping systems approach of Citanduy I ("Old Penawangan") has been advanced to a farming systems approach in Citanduy II ("New Penawangan").

The technical approach of Cigaru is similar to that of Citanduy II, except for the common waterways which are not included in the delivered package of Cigaru. In Cigaru coconut husks are also used for the protection of terrace risers, ditch banks and road cuts. Its difference with Citanduy II lays mainly in the basic idea of generating innovations. See table 1. The apparently adequate functioning of terraces in Cigaru suggests that waterways are not an essential component of every soil conservation package. The need will be determined by a number of physical factors, i.e., water intake rate (WIR) of the site, run

off percentage, frequency of rainfall, etc. The advantage of waterways depends on the effectiveness of the series of drop structures built along their course. Drop structures which easily collapse make waterways dangerous.

In the MF of Citanduy II, all drop structures are made of bamboo. After one year at the most the bamboo stalks show advanced degree of decomposition in need of replacement. The participating farmers are either not aware of the problem, or they assume that maintenance is the responsibility of the project. Although this is only one bit of evidence, it may raise some doubt about the effectiveness of MF or about the real intention of the participating farmers. If this is true, then the rate of replication today should be accepted with some reservation about the full attainability in post-project times.

In the Cigaru Area more positive results are evident as far as the probability of replication is concerned. While in the MF soil moisture management is done by mulching with rice straw, the farmers in the expansion area modify it by making alternate furrows and ridges at the otherwise smooth surface of the bench terraces. The furrows are meant to collect rain water (increasing infiltration.) This shows that the farmers have developed in themselves a kind of innovative ability, which is the key factor of adoption.

The apparently great success obtained by Citanduy II (and also Citanduy I) and Cigaru is to a substantial extent due to favorable climatic and soil conditions. The rainfall is rather well distributed, and the soils are quite deep and have good hydrological properties (infiltration, moisture retention, percolation.) Therefore, the results are not likely to be the same in other less favorable settings. In other words, the rate of replication may decrease with the increase in the expansion area, as more different land conditions will be met.

The Jagabaya Project is better positioned as far as representation of problem areas is concerned. The soils are inherently more susceptible

to erosion and they are less fertile. Water infiltration into the terraced soil is facilitated (thus runoff will be reduced) by digging a few short broad furrows in the terrace surface. No waterways are constructed and it seems that their absence do not weaken the conservation measures. Thus, some of the techniques applied are similar to Cigaru. Apparently the Jagabaya scheme is working notwithstanding that the subsidy is limited to the provision of one field extension worker only. Within three years the participation increases eight times in terms of farmers (25 in the initiation year to 200) and five times in terms of area (10 ha in the initiation year to 50 ha).

Not all excessive water has to be drained away through back sloping terraces and waterways. Part of it has to be retain to recharge soil moisture. Otherwise the success of erosion control will be set back seriously by an induced water deficit in the crops.

3.2. Yogyakarta

The two projects in Jogyakarta are the "Rangun Desa" (BD) of the BAPPEDA operating with IBRD assistance, and the regreening of P3RPDAS. The BD covers many aspects of rural development with a strong component of an integrated agricultural development in the uplands and hilly areas. The actions may imply more radical changes in farming systems. The P3RPDAS focusses on the rehabilitation of critical lands. The proper refunctioning of these lands determined the aptitude of the whole watershed for habitation and productive use.

Although at the end the result may be similar in terms of improved land capability and better living conditions, the framework of action of the two projects is different. The BD starts from the elemental parts (farming systems) to be eventually integrated into the macro system of watershed. The P3RPDAS first defines the total needs of the watershed for sustaining its production capacity and then traces the controlling elements that have to be manipulated.

Consequently, P3RPDAS is more concerned with land utilization types (LUT), while BD relies upon farming systems. The two projects should not be contradicted, as they are in fact complementary systems. The target areas comprise the Banjar Oyo and Hargotirto subwatersheds in Kulon Progo and the Kedung Poh subwatershed in Gunung Kidul. They represent the backward areas of Yogyakarta in terms of agriculture and wealth.

The farming systems approach of the BD shows promising results in terms of adaptability to local conditions and needs. The soil conservation and soil moisture management components, however, still need to be much improved, especially SMM. Insufficient account on these two cardinal components may cancel out the expected advantage of the introduced farming systems. All terrace risers are not protected. A substantial amount of eroded material come from there. In one place (ATDC of Nglipar) a rough calculation comes up with a rate of erosion from terrace risers of 1.5 mm/day during the rainy season.

The major aspects of SC and SMM that have to be elaborated further are:

a. How different measures and their combination relate to slope, soil type and depth, and climate.

b. SMM as a system to promote efficient use of rainfall.

c. Determine SC and SMM packages which are required to sustain a farming system which are appropriate for maintaining the habitability of the entire watershed.

The P3RPDAS project seems to be one sided in orientation. For example, in the area of Patuk it succeeded in establishing a so-called community forest intended to provide the people with a source of firewood or timber for earnings. The justification given for that was not convincing, either from the point of view of soil protection nor from its economic value. In fact, the soils and slopes in many parts of the area do not need such rigorous treatment as to put them under a permanent and dense vegetation cover.

The aim of SC and SMM at individual farms is not always compatible with what should be the aim at the watershed level. The work done on each farm is not necessarily based on the consideration of limiting the exported damage to lower lying farms.

In protecting the watershed as a whole, such considerations form the key to success. A multidimensional planning process is therefore imperative to reconcile as far as it is technically and economically possible those two different interests.

3.3. Solo

The visits included four demplots, one agro-forestry plot, and three check dams. In all demplots, soil moisture management is still neglected. For instance, in Mojogedang (Karanganyar), after seven consecutive rainless days the top 10 cm of the terraced soils were dry. The upland rice crop distinctly suffered from water deficit, meaning that the available moisture was probably already below the lower critical limit. As has been said previously, beautiful terraces from the point of view of erosion control will mean nothing if they are not treated properly to secure the availability of adequate soil moisture at least during one growing season.

The drop structures in waterways in Mojogedang are made of platy stones piled loosely in stacks. They are of course much more durable than bamboo stalks which are used in Citanduy, but those stone structures may pose a disguised danger. Through the gaps, water may back erode the soil unnoticed, finally causing the stones to collapse. Then the headward erosion continues at an accelerated speed. The higher the drop, the more pronounced the danger will be.

The apparent success in Mojogedang is not in the least due to the effect of the soil as it is the case in Citanduy II and Cigaru. The system still must go through a series of vigorous tests in less fortunate

areas before any claim of real success can be made. The demplot in Baleharjo (Sukodono) in quite unproductive land should in due time be able to tell us more about the system. The soil here is derived from the South Kendeng marls where soil formation is slow because the climate has a long dry season. The badly eroded soils are not the result of real strong erosion, as water is not much available for that, but it is more due to the retarded growth of the soil. So even moderate erosion can do harm. In such an area, it is not so much the control of erosion that counts, but it is the rate of soil formation that has to be promoted. This means that the soil should go through an initial cycle of reclamation first. The obvious solution to this is reforestation which has to fulfill three principle objectives:

(1) Deepen the effective depth of the soil,
(2) Increase the water retention capacity of the soil profile, and
(3) Build an A_1 horizon.

All the check dams that had been visited are in fact functioning as reservoirs (damming small rivers), or as a retention basin to store rain water. If this is the intended use of check dams, then the siting should be determined accordingly. This calls for, among other things, the establishment of a protection zone within the catchment area of the check dam in order to prevent the silting up of the reservoir behind the dam. As soil conservation for productive purposes is less demanding than when the purpose includes the protection of reservoirs, the existence of check dams for water storage requires more rigid criteria of protection. Consequently, there is less room for alternatives or for defining better use opportunities.

3.4. Jratunseluna

The places visited were the Lemah Ireng Demplot, a stream gauging station, the Andong reforestation project of 1976-77, and one check dam

in Ngargosari. The demplot in Lemah Ireng is not fully developed yet. The terraces are rather poorly constructed. As the area has long been known as one of the fruit growing centers, it might be advisable to develop the area into fruit orchards. Considering the soil and relief, this would be a better solution for the conservation of the productive capacity of the land than putting it under annual crops. Fruit orchards can be easily combined with livestock holding by utilizing the space between the trees for grass. The grass cover will form good protection against soil erosion.

Here again, the check dam of Ngargosari is fully functioning as a water retention basin to supply irrigation water to sawah fields below. It has been seeded with fish. From the fact that the downstream land of around 40 ha is presently fully utilized for sawah, it will then be illogical to assume that the check dam is only temporarily used for water storage and that its main function is still to trap eroded material. There is an urgent need to review the basic idea underlying the construction of check dams. In areas where the problem of water shortage is more serious and the problem associated with sediment transport can be satisfactorily handled by improved land use, check dams for water storage will be more appropriate. In fact, check dams as silt traps and flood control are only needed where normally runoff is excessive and sediment load is high. This happens in areas of high rainfall.

Stream gauging stations are intended also to collect water samples for water quality monitoring. The sample are sent to P3DAS together with the hydrometric measurements once every 15 days. It should be noted that without adding preservatives to the water samples, water analysis has to be finished within 72 hours from the time of sampling. Otherwise the results will be unreliable as water properties change during storage brought about by chemical and microbiological processes. There is also a technical prerequisite for long distance transportation of water samples. Any disturbance in the initial partial pressures of O_2 and CO_2 at sampling have to be kept at a minimum.

3.5. Brantas

The Kali Konto Project has been in operation for three years in the Perum Perhutani Area in the upper watershed of the Konto river, a tributary of the Brantas river. This upper watershed commands the Selorejo reservoir. The primary concern that led to the establishment of this project was the protection of the Perhutani forest against the ever increasing illegal cutting of trees by the villagers. As this objective can only be achieved through a change in land use in the agricultural lands bordering the forest area, a farming systems approach to farm lands becomes compulsory. Only from this point does the soil conservation element come into consideration. Intensive land use needs intensive care of the soil.

From the point of view of the soils, surface hydrology and geology, the Kali Konto area is unique for Indonesia. Therefore, the problems associated with this physical setting cannot be extrapolated to other areas. This project stands by itself.

Since soil conservation is understood as self-establishing in an economically sound farm system, there seems to be no intention to make soil conservation a pertinent subject of study. How a change in land use or farming systems affects the rate of soil erosion, how the reduction in illegal timber cutting relates to the decrease in sediment load of streams, are outside the conceptual framework of the project. Its central points of interest are "rural poverty" and "diminishing forest resources". It is a socio-economic project rather than a project dealing with watershed management.

In Gabes (Tulungrejo), in the uppermost part of the catchment area of the Brantas river, Brawijaya University operates an experimental plot for soil erosion. It is run under financial arrangements with the Brantas project of P.U. The on-going experiments focus on modifying the farmer's planting pattern of vegetables to reduce erosion. It seems that insufficient bugeting and lack of field technicians is responsible for the slackening of the work.

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TECHNICAL APPENDIX IV

LIVESTOCK DEVELOPMENT

by

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Doc. # 0835A

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Technical Report on Livestock Development

I. Introduction

The United States Agency for International Development (USAID) in collaboration with the World Bank and the Government of Indonesia requested an evaluation of the livestock aspects of the technology packages extended within the watershed projects of Citanduy and the National Regreening Program. The general objective of these programs is to increase the agricultural production while improving or at least maintaining the soil productivity by better soil and water management.

The usefulness of livestock products is not limited to the production of meat, milk and eggs, but also expressed in a number of other contributions to mankind (see Table 1). Furthermore, livestock plays a role in the transfer of income (or purchasing power) from high income urban areas to low income rural areas: a flow of urban wealth to the rural poor. Furthermore, livestock offers a way to utilize farm-labor with low opportunity cost such as that of young and elderly persons.

Demand predictions for livestock products indicate that a substantial increase in domestic supply is warranted. During the First and Second Five Year Development Plans (PELITA I & II) the annual increase of consumption of meat, egg, and milk was 4.9%, 19.8%, and 16.4%, respectively. The impact of this enormous increase of consumption has been challenging as the population of cattle, buffalo, and pig has actually decreased 0.54%, 2.17%, and 0.72% respectively per year. However, the poultry population has increased.

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Three alternatives of future anticipated consumption levels of livestock products may be suggested.

Alternative I : the consumption rate of meat, egg, and milk increases at 4.9%, 19.8%, and 16.4%, respectively. These are rates similar to those during PELITA I and II.

Alternative II : the consumption rate of meat, egg, and milk increases, respectively at 4.9%, 8.9%, and 9.5%. These rates ensure that in the year 2000 the nutritional standard of protein (5 gr protein/person/day) will be met.

Alternative III : the consumption rate of meat, egg, and milk increases at 2.34%, respectively. This is also the rate of population growth.

Alternative I and II is considered to be too high from the standpoint of purchasing power and the supply ability. Alternative III is considered to be most reasonable. Data in Table 2 show the composition of livestock population in the year 2000 for each alternative, compared to the composition in 1978. The data show the need to expand livestock production.

In most of Indonesia, livestock production systems are part of farming systems that also include crop production systems. Interacting components of livestock production with other farm activities need therefore to be taken into account. Such a farming systems approach does not imply that in many cases a final evaluation of a livestock production system is impossible without considering the farm as an unit. Within the scope or our reference, we limit our observations to the livestock enterprise, while emphasizing the links with other farming activities. The upland farming systems can be considered as consisting of three major enterprises, the food crops enterprise, the tree crops enterprise and the livestock enterprise. Sometimes it is useful to distinguish a fourth

subsystem, the cash crop enterprise. Links between the livestock enterprise the other enterprises are similar. The livestock enterprise uses the residues or by-products of the other enterprises as feed and turns it into money and manure, which again can be used as an important input for food crops as well as tree crops.

II. General impressions and recommendations

All the watershed project areas have a livestock component. It is based on the assumption that a policy of establishing and maintaining suitable vegetation cover on terrace banks achieves the dual purpose of stabilizing the structure and also providing animal feed. Sustained production of high quality forages can be achieved in three ways, i.e., by the cultivation of (1) grasses and weeds, (2) shrubs and (3) trees. Grasses and weeds are feed during rainy season when their supply is abundant. Shrubs which are more drought resistant can be used to supplement roughages during the transition period from the end of the rainy season to the end of the dry season when the supply of grasses and weeds rapidly decreases. Trees are mostly drought resistant so that they can be pruned to obtain fodder in the dry season. Shrubs and trees, if they are legumes, can also supplement low quality roughages such as rice straw and sugar cane top. Grasses and weeds that grow in fertilized crop land are usually good quality roughage containing protein not less than 10% on dry matter basis. Planting improved grasses and legumes on the risers and lip of terraces is a promising possibility. However, further research into the possible negative effects on crop production is desired.

The project authorities are to be commended for the procurement and distribution of various high yielding grass. Presently, only the Citanduy project has an animal complement implemented. As the animals are not monitored, it is difficult to assess their performance. However, there are indication that their productivity is comparable with that of the upland area of West Java in general, i.e., about one surviving lamb per ewe per year. This is far below the genetic potential of these animals,

and only about half of the reproduction achieved by commercial sheep farmers in the Garut area. It seems that the cause of the low reproduction is due to the number of parturitions per ewe per year and mortality losses rather than the size of litters. Too many lambs die (at about 20%) and too many ewes do not lamb during an entire one-year period (maybe as many as 30% of the adult females). Other livestock species have similar problems in achieving a high profitability.

It is clear that the introduction of high yielding grasses offers a great opportunity for livestock husbandry. In upland farming systems the feeding method is cut-and-carry. The high yielding grasses require less time for feed collection so that a higher return to the labor input is obtained. If, in addition to lower labor requirements for feed collection, the reproduction rate of the livestock population could be increased by improved management practices, the chances of spontaneous adoption of the high yielding grasses will increase. Indeed, the productivity of grasses is derived from livestock productivity. The feasibility of maintaining suitable vegetation on terrace banks is therefore mainly dependent on the productivity of the animals for which these grasses or shrubs are used. This is generally understood because at most of the project sites, the distribution of animals is an integrated part of the technology package.

However, merely the utilization of grasses on slopes and banks are too narrow an approach to the livestock aspects of erosion management. As the fundamental cause of erosion is one of "over-use" of land because of population pressures and lack of alternative labor use, the development of the livestock sector in upland areas <u>in general</u> deserves attention. The contribution of livestock to the total income of upland farmers in West Java averages between 20 and 30%. In Central and East Java this figure is probably higher as livestock population and livestock density data indicate an even more important role. For farmers with minimal landholdings, livestock offers maybe the best employment opportunity. The size of livestock holding is, although, a reflection of the farmers'

wealth, not dependent on the size of his landholdings. Rather than solely emphasizing food production in upland areas of low soil fertility, the possibility of livestock development as a first source of income should be seriously explored.

Field observations and the existing data show that livestock is the logical substitute for land. Inverse relationship between the size of land holding and the size of livestock ownership strongly support the role of livestock as a substitute for crop land. Positive correlation between population density and livestock density reveals that they are quite compatible in numbers of ways.

Closer scrutiny to micro level indicates that for the village people the livestock are inseparable means to generate cash, to accumulate capital, to produce manure to sustain crop production, to work as draft animals to prepare crop land, and last but not least as security against farming failures.

Livestock raising is not only for obtaining additional income but is also essential for sustainable and productive upland farming. On the other hand successful livestock keeping depends on the agricultural wastes and weeds from the food crops and estate crops land and fodder and grasses from forest land. This interdependency in a mutual symbiosis should be kept in mind if conservation as well as the productivity is to be achieved in watershed management.

Livestock feeds are derived demand, which also means that the degree of the economic role of the livestock will increase the appreciation and their willingness to cultivate grasses and fodder trees.

Presently, the watershed projects focus on implementation rather than research. There are, however, still many unknowns. Interaction and trade-offs between the three main enterprises of the upland farming systems (food crops, tree crops and livestock) are seldomly investigated.

Examples of trade-offs are grasses, shrubs or trees on boundaries of terraces versus solely food crops cultivation, the harvesting of cassava and tree leaves versus maximum root crops, fruit or wood yield, the use of crop residues directly for green manure or first for feed, etc. The lack of knowledge is a serious constraint to the effectiveness of agricultural research as well as extension. Before introducing new technology packages on demonstration sites, integrated applied research should be conducted under conditions similar to those of the farmers socio-economic and physical environment. As animals are an important capital asset to the farmer, it is mandatory that recommendations are always pre-tested. In this respect the pre-testing of Brachiaria species for feed is urgent as these grass species have sometimes negative side effects. In the same vein, the addition of animals to demonstration plots is recommended. The performance of these animals should then be carefully monitored.

The field laboratory also could serve as a place for the screening of grass, shrubs and tree species. Presently the selection of grasses is based on yield production and ability to control erosion. Other important criteria such as palatability and digestibility are neglected. Another input aspect is the timely delivery of the feed supply. The provision of animal feed during the dry season is one of the most serious constraints for several reasons: (1) the maximum size of flock livestock is determined by the ability to supply feed during dry season, (2) the fluctuation of production can be reduced if fluctuation of feed supply is minimized, (3) marketing problems are reduced if these is less fluctuating, and (4) a more efficient use of resources is accomplished if the surplus roughages during the rainy season can be used during dry season. The problem of dry season feed can be solved by increasing the village reserve as well as by importing feed from outside. Feed reserve in the form of "lumbung hidup" (live storage), that is by trees and shrubs, is cheap and effective. Roughages can also be stored as hay and silage. Hay is preferred over silage because dried roughage is already widely known, while silage making is more expensive and needs more facilities.

Agricultural waste products such as peanut fodder, sweet potato vine, corn fodder and cassava leaves are good quality roughages which have been widely used. Increasing the production of these roughages without decreasing the main products, and without significantly increasing the cost, is an attractive alternative to be explored.

Sugar cane tops and rice straw are potential low quality roughages. Processing of these roughages into pellet is not yet economically justified. Fermentation of rice straw has not been scientifically proven to be beneficial. Acid and alkaline treatment is not technically as well as economically, viable. Utilization of tree roughages for beef cattle and buffaloes is especially appropriate as provision for drought feeding.

The distribution of animals in the projects (mainly small ruminants) is based on the so called "gaduhan" credit system. Under this system, female animals are distributed on credit while part of the offspring is used as pay back. Such a sharing agreement is common in all villages of Java as well as in other part of Indonesia. Animals are lent by owners to neighbors, relatives or friends in return for a share in the offspring. The specific conditions regarding the number of lambs/calves to be returned, and the time of pay-off differs from location to location. Before launching a new "gaduhan" program, it would be useful to investigate and document local existing contract arrangements among livestock keepers. It might be easily adapted to the needs of the project. The "gaduhan" system offers an excellent opportunity for animal distribution, especially when the credit and repayment conditions are carefully spelled out. These are presently vague. These conditions do not have to be universal but can be adopted to local needs. It is recommended that the credit for animals is used as an incentive for farmers to follow recommendations. These recommendations should again be location specific and not be limited to the planting of improved grasses. Also recommendations concerning other aspects of livestock management should be formulated (see the above observation regarding the productivity of the animals).

It was observed that at all project sites, even those where the livestock component was already implemented, the livestock management expertise among the implementing agencies was very limited if not non-existent. It is limited to the planting and growing of grasses only. The performance of the animals is not monitored. Mortality causes are not investigated. Also the institutional linkages with the Dinas Peternakan are very weak. This has not only the disadvantage of missing the technical services of the Dinas Peternakan but also opportunities to link up with national livestock program such as PUSP, PUTP and RCP (See Appendix I) are being lost. The Dinas Peternakan can also assist in animal disease control and advise on the selection of breeds.

To improve and to maintain the herd quality, the following are the breeding management techniques that can be considered as guidance:

1. Dairy Cattle - Artificial insemination is highly recommended for up grading programs. This technology is already socially acceptable, economically and technically feasible. The capacity of frozen semen production is sufficient to meet the need. The dairy cooperatives could provide inseminators at their own cost. There is no doubt about the suitability of Frisian Holstein breed.

2. Beef cattle & buffaloes - Both natural mating and artificial insemination could be done, depending on the availability of facilities and constraints at each sites. For natural mating, the method of distributing selected bulls can still be suggested. The Ongole and Brahman are suggested breeds since they are easily up graded to dairy cattle which are the future type of cattle to be extensively developed in densely populated Java.

3. Sheep and Goats - Artificial insemination is not operational. To increase the conception rate, it is imperative that each holder have his own ram in the confined flock. In most areas the fat tail sheep is preferred, especially in the drier areas.

4. No recommendation is suggested to improve Kampung chicken through breeding.

Efficiency of production very much depends on the ability to control the external and internal parasites and pathogens under farm conditions. In principle, the government, through the Livestock Service, provides free of charge services to traditional livestock producers to control livestock diseases particularly those caused by contagious pathogens. However, the budget is limited, while shortage of field workers is quite serious. To cope with the problems, several solutions are being tried or proposed:

1) PUSKESWAN (Animal Health Center): unit of task force at the kecamatan level.
2) INPRES Dokter Hewan (Presidential Decree to employ veterinarian at the kecamatan level).
3) Paramedic education (to provide paramedics at the kecamatan level).

Those are long term efforts which very much depend on the availability of budget, the method and procedure being developed, and the consistency of the program.

The dairy cooperatives have been successful in extending their services to their members. They employ veterinarians and paramedics to serve the members. Their success stems from two factors: 1) dairy cattle generate higher cash income and 2) the cooperative is an effective economic institution.

The following considerations are important:

1. The control of foot and mouth disease, haemorhagic septicaemia, surra, anaplasmosis, and babesiosis will depend on the service of Dinas Peternakan.

2. Brucellosis, mastitis, and other dairy cattle diseases could be tackled by dairy cooperatives.

3. The control of gastrointestinal parasites (Neoascaris vitulorum, nematode, and liver flukes), and external parasites (scabies) will depend on the ability of farmers to provide cash and help from local farmers organizations.
4. Newcastle Disease is the most prevalent disease that wipes out kampung chickens almost every year. The radical approach of control and the incorporation of local vaccinators are considered promising.
5. Most of the livestock credit systems (PUTP, PUSP) have budget allocations for disease control. However, their effectiveness needs field improvement.

The general focus of the projects is on goats and sheep rather than other species. The advantages of small animals, are among others, their divisibility, the rapid turn-over of capital and their marketability. However, other livestock species such as poultry and cattle each have their own advantages. Depending on the comparative advantage of each project area in terms of farmer objectives, input requirements, productivity, marketability and income equity, each of the species should be assessed.

Kampung chicken are important sources of cash for farmers. Compared to other species of livestock, they offer the most feasible source of animal protein. Since they are raised as scavengers the control of Newcastle Disease is considered to be the most effective single action that will increase the potential and productivity of kampung chicken.

Beef cattle is preferred over small ruminants if there is need for work animals for land tillage. The most popular method of beef cattle raising is the cow and calf method. However, fattening of feeder cattle through absolute confinement is adopted if the requirement of manure is critical. In more humid areas and especially irrigated land, buffaloes are also kept although gradually replaced by cattle. Large ruminants facilitate accumulation of capital which is required whenever the farmers need high cash to buy new land, to build house or to have a wedding party.

Dairy cattle are multipurpose animals. They generate significant daily cash, produce manure and also represent capital formation. Milk marketing is not critical anymore and has been well managed by dairy cooperatives in cooperation with milk factories. Among ruminants, dairy cattle are responsive to intensification in feeding, breeding and disease control. Dairy cattle can be considered as pull factor for the development of cultivated improved grasses and legumes. Dairy cattle are also the least dependent on local carrying capacity because they could be fed imported feeds, especially concentrate.

All those classes of livestock should not be considered as mutually exclusive. In many cases, the combination is the most appropriate in fulfilling farmers' needs and in creating a more even distribution of livestock ownership among different economic strata of farmers.

Another serious aspect deserving investigation is the issue of ownership. Public land and forest land are areas presently used as feed resources. The planting of high yielding grasses or shrubs in these areas is possible if aspects of ownership and use can be solved. Many shrubs and tree species are multipurpose plants which produce good quality fodder in addition to other products such as fuelwood or building material and erosion control. Leucaena leucocephala, Albizzia falcataria, Glyricidia species are considered promising plants to be developed not only on forest and other public land, but on private land as well. Special consideration should be given to the repercussions of the introduction of high yielding species on the availability of fodder for landless farmers. Field grasses generally are considered a public good (as weeds). They can be cut by anyone. Presently, field grasses amount to respectively 70-80% of the diet of small ruminants in upland farming systems during the wet season and 40-50% during the dry season. However, improved grass varieties are owned by the landowner and/or the person planting the grasses. Attention should be given to the availability of the improved grasses to landless farmers. Arrangements by which landless farmers are allowed to cut high yielding grasses in return for manure seems a way to fully use rural labor

resources while preventing the selling of manure by landless livestock holders outside the area.

The livestock marketing for most livestock is dominated by a group of specialized traders (blantik) (see for example Figure 1). On the one hand, their existence implies a weak bargaining position of the small farmer. On the other hand, around many markets, local trade seems competitive. The types of contract between middlemen and farmer offers the latter a choice between a number of different contracts. The bargaining process between farmer and middlemen generally centers around the credit arrangements. The greater the cash needs of the farmer, the lower the price.

In Citanduy, one of the project where the livestock component is implemented, there are only a limited number of markets. Farmers at a number of locations (for example in Panawangan) are handicapped by a fairly long distance to the market. The livestock population (small ruminant) in Panawangan in 1981 was already more than 18,000 head. Assuming 100% reproduction per female adult, 50% female adults in total population, 10% home consumption and 5% for stock expansion, market volume is estimated to be about 7,700 head per year. This amounts to about 140 head per week and is certainly a volume large enough to justify the establishment of a local market.

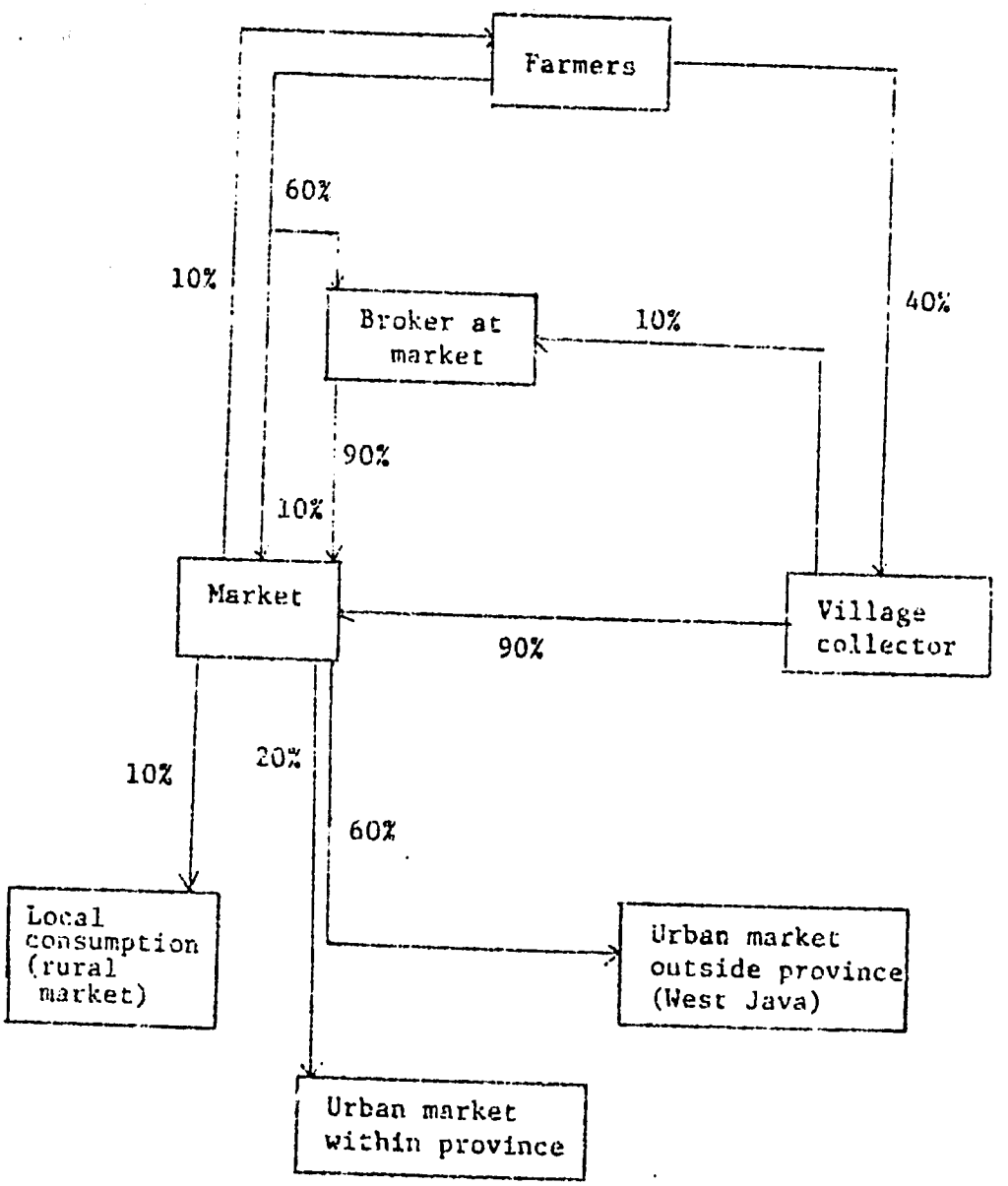

Figure 1. The market structure for small ruminants at three large markets in Central Java (Ampel, Ambarawa and Margorejo).

Source: Sabrani *et al*.

From the livestock development point of view, four types of agro ecosystems are identified:

1. Wet rice
2. Upland crop (palawija)
3. Vegetable/horticulture
4. Dry marginal land

In the areas dominated by wet rice fields, beef cattle and buffaloes are the main livestock to be raised as a work animal. If the climate is drier, the cattle density is higher because of the availability of grazing ground during the fallow period. These areas could be developed as sources of feeder cattle to be fattened in upland areas. The contribution of livestock as source of income is higher. Kampung chicken, duck and small ruminants are also raised because of their comparative advantage.

Upland farming systems need more livestock manure. In the Desa Pojok, Kecamatan Mojogedang and Kabupaten Karanganyar, farmers apply up to 5 tons per ha of upland crops. It is a costly input since 5 tons of manure is worths Rp.50,000.-. The main objective of raising ruminants is therefore to produce manure. The need of animal power is only secondary although it may generate Rp.1,500 per pair for 4 hours work. In this type of area small ruminants are increasingly important. Dairy cattle, if marketing of milk is established, may flourish, as in Boyolali.

In the higher elevations, with vegetables (cabbage, onion, potatoes) and corn as primary crops, dairy cattle find their best place for development. Dairy centers (Pangalengan, Lembang, Pujon, Nangkajajar) are located in this type of area. Maximization of the collection of manure is done through fattening of feeder cattle in completely confined method. In Boyolali the income from cattle fattening is quite significant, around Rp.25,000,-/head/month. Small ruminants are widely kept and are a very attractive alternative. In those areas, the manure is very valuable (Rp.15,-/kg). Import of manure from other areas is not unusual.

In the dry areas with low soil fertility, such as Gunung Kidul, Gunung Kendeng, and Trenggalek the yield of food crops and even tree crops is quite marginal. The following examples illustrate the situation:

Case 1. Desa Ngargosari, Kecamatan Suberlawang (Kendeng Mountains), Upper Jratunseluna. The land can not support even subsistence needs. The farmers go to other areas as farm labors. Livestock offer an attractive employment opportunity. However, not enough cattle are available. The share arrangement is one-third of the offspring for the operator (in other areas, one-half of the offspring plus one-half of the additional value of the growing cow). Sonokeling trees grow very well and have been pruned to produce dried animal feed where a family could earn Rp.500,-/day (10 kg of dried ground feed). A check dam in this village is useful for drinking water for livestock.

Case 2. Kecamatan Klego, Kabupaten Boyolali, KPH Tlawah. Area of marginal land. Livestock provides significant income and is a leading commodity in this area. An elderly farmer could earn Rp.400,-/day from raising kampung chicken and sheep. This is significant income since a farm laborer may earn only Rp.500/day, working from 7:00 to 16:00.

In these types of areas, combination of forestry and animal husbandry seem quite beneficial. The development of forest and forage will benefit both the local farmers and the soil conservation objective. Dried ground forage (from leucaena, and other fodder trees) has been produced substantially even to the extent of being exported from such forest and forage development activities.

III. Strategies of Livestock Development in the Framework of Watershed Management

1. Livestock as Substitute for Land

In the Upper Solo Watershed there is a negative correlation between size of landholding and the size of livestock holding. This phenomenon demonstrates that livestock offers employment opportunities especially for smallholders. The contribution of livestock to the total income of upland farmers ranges from 20-50%. That is why merely the establishment of grasses on slopes and banks of terraces is too narrow an approach to the livestock aspects of watershed management. As the fundamental cause of erosion is one of "over-use" of land because of population pressures and lack of alternative labor, the development of the livestock sector in upland areas deserves attention.

2. Higher Priority of Livestock Development Should be Given to Low Income Farmers and Farmers Using Marginal Land

Dictated by so many constraints (capital, technology, skill, knowledge, and resources) poor farmers are unable to avoid high erosion in using the land. Crop intensity is higher with minimum effort to maintin soil fertility and to control erosion. If they still rely on such minimal land holding as their source of income, the deterioration of the soil is an inevitable process. In such pressing conditions, livestock could provide possible alternatives to alleviate pressure on land.

In most marginal lands, food crops and even tree crops are very unproductive. Crops can not even support subsistence needs. Most of the land is barren and erodable and promotes high surface runoff. Observations in the field reveal that livestock plays a significant role as a main source of income. Development of fodder trees also offers a promising way for the farmers to earn money from selling dried ground fodder.

3. Increasing the Productivity and Economic Role of Livestock to Stimulate Planting of Grasses and Fodder Trees

The cultivation of high yielding grasses has not been adopted spontaneously by farmers surrounding the demonstration areas. Experiences in many areas in the past have clearly shown that the success of introduction of new improved grasses depends largely on the economic viability of the respective livestock and not the reverse. The problem is how to develop a productive and economically profitable livestock industry. The planting of improved grasses and fodder trees will follow.

4. Maximizing Internal Processes of The Farming System

Livestock have a strong hold in the farming system of smallholders because of synergistic interdependent interaction with food crops, cash crops, and tree crops. Livestock produce manure to maintain the fertility of cropland and also provide traction to prepare land for cultivation, while the crops supply feed for the livestock. By increasing these internal processes we can increase the efficiency of the farming and the fulfilment of the farmers' needs.

5. Closer Cooperation Between Projects and Directorate General of Livestock Services

At most sites, collaboration with the Livestock Services (Dinas Peternakan) can be further developed. Besides providing technical assistance, coordination with the activities of the Dinas Peternakan provides extra opportunities as project efforts might be linked to existing livestock programs such as PUSP, PUTP, RCP, and BANPRES (see definitions in Appendix I following).

Table 1.
Livestock Contributions to People

Food:	meat, milk, eggs
Fiber and Skins:	wook, hair, hides, and pelts
Traction:	power for crop production, irrigation pumping, threshing, and transport
Animal Wastes:	fertilizer, heating fuel, methane gas production, feed, construction material
Storage/Savings:	storage of food supply or capital and seasonal excess of feeds
Weed Control:	biological control of brush, plants, and weeds along roadsides and waterways
Cultural/Religious:	security and self-esteem-revered symbols
Sports/Recreation:	competition, exhibition, hunting, and companion animals

Source: Winrock International

Table 2.
Composition of Livestock Population in The Year 2000 for Each Alternatives Compared to 1978 (in million)

Species	Population			
	1978	Each Alternative in the 2000		
		I	II	III
Cattle	6.4	14.3*	14.3*	8.1
Buffalo	2.3	5.5	5.5	3.1
Goat & Sheep	11.7	55.4	55.4	31.4
Pig	2.6	5.2	5.2	3.0
Poultry		857.3	862.3	631.0
(Kamp.Chicken)	(96.1)	(428.0)	(428.0)	(428.0)
(Ducks)	(14.1)	(78.2)	(78.2)	(78.2)
(Layer)	(2.9)	(1,148)	(124.7)	(48.3)
(Broiler)	( )	(**)	(231.4)	(76.5)

Note:
* Including dairy cattle 8.3 million; 1.9 million and 443 thousand for Alternative I, II, III, respectively
** Already over supplied by chicken meat from layers.

Appendix I

A. PUSP

1. Pengembangan Usaha Sapi Perah (PUSP) (Dairy Cattle Business Development)

a. Definition: Government program to promote domestic milk production towards milk self supporting.

b. Objective :

- short term: to stimulate the growth of domestic milk production
- long term: self supporting in milk production

c. Desired impact:

- increasing productivity
- increasing population
- increasing income of dairy farmer
- creation of job opportunities
- improvement in nutrition
- saving of foreign exchange

d. Participation:

- smallholders who already own 2 - 10 heads of lactating cows and need technical assistance, capital, and handling and processing of milk
- priority is given to traditional dairy cattle farmers and small holder

e. Desired location:

- technically appropriate
- no significant problem in milk marketing
- accessible to the field workers of BRI Unit Desa
- could use the available package
- dairy cooperative is a prerequisite

f. Criteria of participants:

- smallholding dairy farmers
- local inhabitant
- already own cows with the minimum number as specified by project
- experience in raising dairy of cattle at least 2 years
- no credit debt
- has collateral
- member of dairy cooperative or desire to be a member
- accepts all technical rules of PUSP

g. Package of credit:

This is Kredit KIK (Kredit Investasi Kecil = small investment credit)

- interest rate 10.5% per year
- period: 7 year
- grace period: 12 months
- each package: 2 heads of heifers
- range of package: 1 - 5 packages

Components and value of package in 1979

- imported heifers 2 heads.....	Rp.	906,000.-
- barn and equipment.....	Rp.	80,000.-
- concentrate for the first 3 months...	Rp.	50,000.-
- mortality insurance.....	Rp.	6,000.-
- sterility insurance.....	Rp.	15,000.-
- insurance payment for ASKRINDO.....	Rp.	35,334.-
- roughages/laborers etc.....	Rp.	3,666.-
Total.....	Rp.	1,000,000.-

h. Repayment schedule

After 1 year grace period repayment is done by delivering a predetermined amount of milk to the Milk Collecting Center Managed by a cooperative.

B. Panca Usaha Ternak Potong (PUTP)

1. Definition: extension activities facilitated through matching production input (breeding stock, feeds, medicines) and credit (with low interest rate). Make the farms accessible to production inputs, general resources, and financial resources.

Moving from traditional to more commercial through:

a. providing for low interest credit (soft loan);
b. more intensive extension through the establishment of farmer contact and farmers groups;
c. make cattle feed more available through the nearest local market;
d. make improved grasses and fertilizer more available;
e. make medicine more available through health centers and increased vaccination;
f. facilitating of marketing.

2. Criteria of participant:
- at least one year of experience in keeping cattle (not necessarily owning the cattle)
- traditional farmer
- permanent address
- already has barn or has land to build barn
- owns grassland or has ability to obtain feed
- willing to participate in training and to cooperate
- no debt and has only one other credit from BRI
- has collateral worth the value of the credit

Package of Credit

a. One package consists of:
   - 1 head of cattle.....Rp.

- planting of improved grass.....Rp. 4,000.-
- barn/composting facilities.....Rp. 3,600.-
- animal health.....Rp. 1,000.-
- insurance.....Rp. 1,400.-

b. Range of package : 1 - 3 packages

c. Period of credit : 3 years

d. Type of credit : advance credit (Persekot credit, or Rekening koran)

e. Repayment schedule: 6 times (every 6 months)

f. Collateral : asset with equal value as credit

PUTP Bibit

1. Component of credit:
   - 5 heads of heifers.....Rp. 250 - 500,000.-
   - barn and equipment.....Rp. 36,350.-
   - concentrate.....Rp. 36,000.-
   - animal health.....Rp. 14,000.-
   - labor, A.I. etc.....Rp. 10,000.-

2. Characteristics of credit:
   - KIK
   - grace period 3 years
   - interest rate 10.5%

C. Rural Credit Project (RCP)

1. Farming business needs long term small investment credit
2. Financing bank : World Band/IDA
3. Bases:

   Development Credit Agreement.....GOI & IDA 23/6-'78

   Project Agreement.....BRI & IDA

   IDA Credit No. 827 - IND.

4. Objective:
   - small holder development through long term S.I.C.
   - to develop the ability of BRI in the management of small rural credit
5. Livestock species:
   breeding cattle, work cattle, buffaloes, sheep and goat
6. Annual Lending Program (ALP)
   Kanca - Kanda - Kanbes
7. Criteria for selecting livestock species:
   - potential, its development will improve the economic condition of the area, income of the farmers, job opportunities
   - no problem of marketing
   - sufficient participant at least 50 creditor/Kabupaten
   - period of credit: 5 - 15 years
   - fulfill the requirements of Kanca (Branch Office)
   - PPL and other supporting facilities
8. Criteria for participants:
   - has experience in raising livestock
   - weak enterpreneur and indigenous
   - good mental attitude
   - no debt from BRI
   - no similar credit from other bodies
   - has facilities for raising livestock
   - willing to obey guidance from the Dinas Peternakan
9. Type of credit: KIK massal
   - interest rate: 10.5% per year
   - period of credit: 5 - 15 years
   - member of package: - cattle, buffalo & pig: 1 - 2 units
     - goat/sheep : 1 - 8 units
   - collateral: the livestock itself and other asset
10. Component of credit:
   - various, depends on the condition of each area & farmer
   - main component: livestock, animal health & breeding

- if AI service is available, bull component is eliminated
- preposition if cows : bull = 10 : 1

Most complete component.

11. Repayment:

- based on cash flow budget.

PN-AAT-809

COMPOSITE REPORT
OF THE WATERSHED ASSESSMENT TEAM

assembled by the Government of Indonesia and USAID
between March 28 and May 7, 1983

WITH TECHNICAL REPORTS IN THE DISCIPLINES OF:
WATERSHED MANAGEMENT, FARMING SYSTEMS, SOIL AND
WATER CONSERVATION, LIVESTOCK, FORESTRY AND TREE CROPS,
ECONOMIC EVALUATION, HUMAN RESOURCES DEVELOPMENT,
and INSTITUTIONAL DEVELOPMENT

V O L U M E III
(APPENDIX V - VIII)

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TECHNICAL APPENDIX V

TREE CROP MANAGEMENT

by

ACHMAD SUMITRO

Doc. #2750A

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Technical Report on Farm Tree Crop Management for Watershed Development

I. Introductory background

1. Appreciation of tree crops for lumber or firewood

Unlike fruit trees and other estate crops, trees planted for wood crops are the factories and at the same time the products. When the products (lumber and firewood) are harvested, the factories are destroyed. This production process requires a somewhat different management approach which is commonly called forestry. The nature of the products harvested, however, is actually the same as the fruits produced from the trees annually. The annual production of trees for lumber or firewood is the "annual growth" per tree or per hectare of trees planted. Wood harvest can be in the form of cutting the oldest trees of an all-ages stand planted on one site, or on different blocks by each age group. Every year the trees, in total, can produce the same amount of wood products, continuously just as the fruit trees.

An example is taken from a demplot in Modjogedang, Upper Solo watershed. The 40 Albizia trees per hectare (various ages) grown on that land can produce wood from 5 trees cut annually at 8 years of age. Wood volume of each tree is about 0.5 m^3 of timber, so that the total harvest is 2.5 m^3 per hectare per year. The standing tree at age 8 years can be sold at current market price of Rp. 15,000 per m^3 or Rp. 37,500 per hectare annually. If the owner of the land increases the number of trees, say to 200 per hectare (10 x 5 m spacing), theoretically the annual net income will be also 5 times as much (Rp. 187,500 per

hectare), which is comparable with the income from fruit trees or even food crops. This example indicates that in terms of annual cash earning ability, tree crops for the production of lumber and firewood can perform equally with tree crops for fruits or food.

2. Tree Utilization Consideration

The function of the plantation is to provide either products such as food, fodder, and wood, or services such as soil stabilization and improvement, shelter and shade. Any successful tree species can fulfill at least three purposes, because:

- all trees produce wood and all wood can be burnt as fuel, an important but often neglected need of rural people;

- all trees produce roots and these roots which bind the soil are beneficial in reducing soil erosion and generally improving the percolation of water;

- all trees produce leaf litter and this litter which returns nutrient rich organic matter to the soil is essential for soil regeneration.

For a wider utility consideration, a tree with multiple functions can serve the farmer better than a tree with only a single or dual purposes. This means that a tree species that can produce a variety of products, such as fruits, fodder, resin, bark, lumber and firewood is more desirable than a tree that yields only lumber.

In some cases, however, a diversity of single purpose trees on one area is more efficient and more acceptable than a single species plantation of a multipurpose species which may be vulnerable to pest or disease hazard and therefore financially more risky.

Diverse species mix may then be assessed according to the special function of each species producing goods and services. In terms of land-use efficiency, the diversification of the plant species can be arranged to optimize the utilization of growing space both horizontally and vertically; for example, the upper storey may be reserved for big trees producing lumber or fruits, the middle storey, for fodder, fruits and branches for firewood, and the understorey for food crops and grass. This kind of species combination management, is commonly called agro-forestry or other similar names and appears to be the farming system which can best serve the production (income) objectives of the upland farmer as well as environmental protection.

3. Farmers' motivation versus national interest

Clearly, watershed management under existing conditions of high population pressure reveals that immediate return or production of subsistence food crops is very much desired by and, indeed, necessary for some rural people. Therefore, in the selection of tree species for on-farm planting, the multipurpose tree species is more compatible with farmers' interests. Backed by adequate financial support from the central government, the planting of trees for environmental protection has gained a wide national interest and social support. In practice, however, this tree planting program has been also subject to local social constraints. The conflict of private and social interests is a very serious problem to which solutions must be found. The fact is that every locality has a different set of physical and social conditions. Legitimate solutions should be realistically and flexibly adjusted to local situations in order to enlist local people's interest and participation.

Where farmers are completely dependent on their small area of steeply sloping land, having no alternative cropland or employment opportunity, it is unrealistic to ask farmers to cover their land with trees leaving no space for food crops, or to wait for some years until the tree crop is

ready to harvest. On the other hand, where the land is already severely degraded (down to the "C" soil horizon) and is owned by better-off farmers who have alternative sources of income, tree planting will be an attractive proposition as the wood is readily marketable and the return high.

II. Technical and Economic Feasibility

1. Choice of tree species

From observation of the fields around project areas visited, the tree species for wood crops commonly grown or planted on steep slopes, in descending importance are:

1. *Albizia falcata*
2. Bamboo
3. *Acacia auriculiformis*
4. *Glyricidia maculata*
5. *Leucaena glauca*
6. Teak

Tree species most often planted for fruits crops, primarily in home gardens are:

1. Coconut
2. Cloves
3. Petai (*Parkia* sp.)
4. Bread fruit (*Arthocarpus* sp.)
5. Banana

Tree species offered by the Regreening program in the model farms, mostly *Leucaena* sp. and *Acacia auriculiformis* have been chosen primarily on the basis of seed availability.

The species choice made by the farmers depend on their familiarity, such as teak, even though it is a slow growing species; availability of market, such as Albizia sp. for packaging industry; and physical adaptability on poor soil, such as Glyricidia maculata for industrial firewood (e.g., for the lime factories) and fodder.

In this report, two prevailing species for wood crops are presented for brief economic analysis, namely, Glyricidia maculata and Albizia falcata.

2. Some economic aspects of Glyricidia maculata plantation on private lands.

This report is based on a study by a graduate student supervised by the writer on a village located at Kecamatan Adjibarang in the western part of Central Java (east of the Citanduy basin).

The total area of the village "tree farm" is about 167 hectares comprising one-tenth to two hectare lots of land, mostly critical land. The Glyricidia plantation was initiated by the kepala desa from a small demplot under a local program about 25 years ago.

The opportunity cost of labor inputs on critical land has been become too expensive for intensive use, and thus tree plantation on such land on the area is increasing.

Land preparation and planting require 7.5 mandays and subsequently 3.5 mandays per hectare required for maintenance. The cost of planting and replanting material is about Rp.30,000 per hectare (1 m X 1 m spacing). However, it would be much less if the farmers could obtain this material from their own land.

With the first harvest in the fourth year, the greatest cost to the poor farmer is the "waiting cost" over the three years. Generally,

however, it can be compensated by income derived from working at "marginal job" in another place, for example, collecting sand in the river.

The plantation is managed under a coppice system. After three years the trees are cut to 40 cm above the ground and the sprouts or young branches produced each year are harvested every year at the end of the dry season.

The yield from the first cut is around 40 m^3 (stacked volume) per hectare, from the second cut, about 70 m^3 per hectare and from the third cut and so on it is approximately 80 m^3 per hectare. The wood is sold by the owners generally on a stumpage (standing stock) basis, and the established market price is currently Rp.2,500 per m^3 (stacked volume).

At this price, an established (i.e., after 3 years of age) Glyricidia plantation per hectare can generate net income of about Rp.2,500 X 80 = Rp. 200,000 annually. Or it turns expectation value of the land use into Rp. 200,000 / 0.1 = Rp. 2.000,000,- with 10% discount rate. This is an attractive undertaking, especially on land with limited production alternatives.

In addition to the income received from selling industrial firewood, the farmer obtains residual material such as small branches and leaves which can be used for home consumption. Intangible benefits derived include improvement of the soil condition, self-created employment in the rural areas and support for downstream industries with a regular energy supply.

3. Some economic assessment of Albizia falcata plantation.

Albizia falcata is a species of known performance and suitability in the upland of Java. It has been recognized by the rural upland people as

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a fast-growing species, good for lumber, with a ready market at any time in any quantity. In addition it improves soil conditions, and its foliage is palatable for livestock, being especially useful as supplementary forage in the dry season.

With sparse foliage and ample light penetration to the ground level, this species allows farmers to grow food crops, grass or other smaller fruit trees beneath the stand. The significance of this under-planting depends on the number of Albizia trees planted per hectare.

The wood production for lumber (sawlogs) and firewood can be estimated by using a standard yield forecast of Albizia on Java (published by the Forest Research Institute), assuming the land is planted with trees alone. Since from a financial point of view the farmers cannot wait for a very long period of time before harvesting this crop, a rotation of 8 years on the lowest site class is recommended.

A tentative yield forecast per hectare for Albizia falcataria, on Site Class II.

Harvested Volume

			Harvested Volume		Income Stream:	
Age (yrs.)	No. of Stems	Average Diameter (cm)	Firewood M_3/Ha	Sawlogs M_3/Ha	Firewood Rp.2,500 per M_3	Sawlogs at Rp.15,000 per M_3
2	1075	5.2	-	-	-	-
3	800	10.4	7	-	17,500	-
4	595	14.8	15	-	37,500	-
5	440	18.7	25	2	62,500	30,000
6	330	22.0	35	10	87,500	150,000
7	250	25.5	40	18	100,000	370,000
8	200	26.4	100	80	250,000	1,200,000

The cost of plantation establishment in the upland of several major species is more or less the same. The cost of seedlings is about Rp.10 each.

The full cost can be calculated approximately as follows:

- Site preparation, planting	Rp.25,000/Ha.
- Tree seedlings	Rp.25,000/Ha.
- Erosion control	Rp.10,000/Ha.
- Contingencies 10%	Rp. 6,000/Ha.
Total:	Rp.66,000/Ha.

With those numbers at hand, an arithmetic calculation indicates an economic rate of return of 24.25% (land rent and overhead costs are excluded).

It has been mentioned that the number of trees could be reduced to allow food crops or grass to be grown beneath the trees, but this should be done only with additional inputs for soil protection structures. With a reduced number of trees, it must be noted that the stream of income from the trees is reduced proportionately.

TECHNICAL APPENDIX VI

ECONOMICS

by

R. BERNSTEN & R. SINAGA

Doc. # 2735A

TECHNICAL REPORT: ECONOMICS

I. Introduction

Over the past decade, the Government of Indonesia, partially assisted by FAO, World Bank and USAID, has initiated major activities to stabilize the upper watersheds of Java. These efforts have grown out of a recognition that unless immediate actions are taken to control erosion, irreversable damage will occur that will alter the fundamental nature of Indonesian agriculture.

Based on available information, field visits and discussions with staff involved in these projects, we attempt to comment on

- the economic viability of the technology that has been extended through the projects
- opportunities for generating non-farm employment in the upland watersheds
- private enterprise opportunities
- the role of subsidies to secure adoption
- credit needs of the target groups, and
- policies and activities that could complement soil and water conservation efforts.

Based on the above analyses, recommendations are proposed.

II. Watershed Technology

To address watershed deterioration, several complementary interventions are proposed, including check dams; a combination of bench terracing, intensive food crop and forage/livestock production on slopes

of 50% or less, and the establishment of fuelwood, cash tree crop, and forage/livestock systems on slopes greater than 50%. Together these activities represent a comprehensive farming systems approach to learning how to better manage watershed resources.

A. Check dams

1. Description

In selected subwatersheds of a few hundred hectares, check dams have been built. The main function of these structures are flood control and the provision of an impounded area for the precipitation of suspended soil particles. Secondary functions include short term irrigation of small downstream areas, provision of a water supply for people and livestock, fish production, and recreation.

2. Costs and Benefits.

These checkdams are budgeted not to exceed Rp., 150,000/ha of upstream watershed. Once constructed, maintenance costs are minimal. Direct costs are primarily for local labor (60%) which is paid the prevailing wage rate, and material (40%) obtained at the site (except cement). Personnel at sites visited reported that construction costs from Rp.20-30 million and required 12,000 - 15,000 mandays of labor. Compensation is paid to owners of the land flooded by the dam at a rate of Rp. 75/m^2. After the check dam silts up, the land is returned to the original owner.

Off-site benefits going to downstream residents include reduction in flooding and reduction in the rate of siltation in major dams, irrigation canals, and farmers' fields. On the site, the dams visited irrigated 10-15 ha. downstream, reduced drought risk in the wet season and permitted a second crop in the dry season. Individuals at the sites suggested that after the dams silted up, the effect of the dams in

elevating the water table would facilitate wet season and early dry season irrigation of downstream areas.

3. Assessment

The short life expectancy of some of the dams visited (5 years or less) indicates the magnitude of the erosion problem. During this period the check dams do serve to facilitate flood control and reduce siltation of the lowland irrigation infrastructure. Hence, these dams serve as a stop gap solution until more permanent interventions can be established. Yet, at no site visited where a check dams had been constructed had major terracing and/or regreening activities been initiated that could be expected to either extend the useful life of the dam or provide adequate soil stabilization by the time the dam was projected to silt up.

Certain subwatersheds upstream from the dams visited were more susceptible to erosion than others, due to soil structure, slope, production activities and extent of degradation. Yet, the intensity of interventions being applied to the watershed did not appear to vary significantly between sites visited.

While site staff provided approximate estimates of costs, it did not appear that empirical ex post studies are being undertaken to assess the benefits accrued, including the value of increased income and employment generation due to the availability of water for irrigation, animal production and fishing.

4. Recommendations

- Consider closely coordinating check dam construction and upstream watershed stabilization so that erosion is significantly reduced by the time the dam is fully silted up.

- For a sample of check dams, monitor direct benefits generated so that costs and benefits can be estimated. Analysis should be directed toward identifying factors associated with higher B/C ratios and this information used to guide future site selection.

B. Terracing on 50% slope or less

1. Description

In the upper watershed areas with 50% slope or less, the primary intervention to stablize the soil is the bench terrace. After establishment, food crops are planted on the horizontal surface of the terrace and grasses on the riser and lip to support livestock intensification. Originally tested in the FAO Solo Watershed project, this technology has been applied in the PORPDAS dem farms, Citanduy I and II and the Yogyakarta Rural Development Project.

2. Costs and Benefits

The cost of bench terracing and associated structures is largely a function of the slope of the hillside to be terraced. Estimates of labor requirements/ha suggest a significant manpower input is needed, ranging from about 500-1800 MD/ha depending on the slope (Table 1). Some projects paid the farmer to construct the terrace and others did not. Yet, even if the farmer is not paid, he must forgo opportunities to earn a daily wage. At full (Rp. 700/md) and 50% opportunity costs of labor, these manpower requirements imply construction costs of Rp. 263,000 to Rp. 1,283,000/ha. Costs of planting material, tools and fertilizer required to build and establish a crop on the terrace in year 1 average Rp. 70,000/ha (Table 2). Total labor and material costs would range (based on Citanduy II data) from Rp. 1,293,000 to Rp. 349,000, depending on slope and assumed labor costs (Tabel 4). While maintenance requirements are reported to be minimal and may be considered as a normal

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part of land preparation, waterways and drop structures will require yearly maintenance. Consequently, building bench terraces requires a significant investment of time and money.

The benefits from bench terracing accrue on-site to the land owner/user and off-site to downstream residents. On-site, terracing reduces erosion and associated fertility decline -- permitting continued land use. Terracing in itself does not increase yields, but reduces future yield losses. In fact, yields may decline in the first year or two after construction if the sub-soil is disturbed. Downstream benefits include reduced flooding and siltation in irrigation dams, canals, and irrigated rice fields. Thus, a significant portion of the benefits of terracing are off-site and not captured by the farmer who is expected to build the terrace.

3. Assessment

From the farmers' perspective, the real cost of terracing will depend on off-farm and non-farm labor opportunities when the terrace is to be built. Family labor is the principal resource for most of the poor farmers in the target area. If off-farm employment is available, the cost of terracing would equal the value of labor income lost. Thus, the farmer's economic status will determine his ability to bear the cost of forgoing income-earning opportunities to invest his labor for a future income gain.

In addition to the farmers' implicit cost of building terraces, the absolute labor requirements may be a significant constraint. The labor for constructing the terraces is generally assumed to be provided by the farmer during the dry season. For example, let us assume the engineering labor estimates are accurate, that the work should be done during a four month season, and that each farmer owns only 0.5 ha of land. Under these circumstances, a single farmer could provide a maximum of 100 MD/dry season - compared to the terracing requirements of from

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approximately 350 (low slope) to 800 (steep slopes) MD/0.5 ha parcel. Alternatively, during a 100 working day period a farmer could only terrace 0.14 ha of low slope and 0.06 ha of steep slope.

Finally, to be effective terracing must be carried out over a mini-watershed, typically 10 ha or more of contiguous land farmed by 20-30 individuals. All of the farmers in the 10 ha area must participate or excessive run-off from the unterraced parcels will damage the newly constructed terraces. It will be difficult to motivate group action, especially if the group includes tenants and near landless.

The above considerations suggest that even if terracing is technically sound and economically viable, adoption will be limited to households with available cash to hire additional labor, those with more than one adult male member to supply labor, and/or wealthier households that can afford to forgo seeking wage employment during the dry season. If the farmer operates a large parcel, needs to attend to personal activities and/or must earn wage income to support his family, it will be extremely difficult for him to self-finance construction through his own labor contribution. Over the many mini-watersheds that need to be terraced in Java, it is highly probable that many farmers will find it extremely difficult to participate, but without widespread participation the success of the terracing effort is threatened.

4. Recommendations

- At several sites, such as the expansion area in Citanduy II, some self-financed terrace construction has occurred. In order to understand potential labor and financial constraints to terrace construction, adoption studies should be initiated immediately. These studies should select a random sample of dem farm adopters, expansion area adopters and non-adopters. Data should be collected on environmental and socio-economic factors hypothesized to influence adoption such as slope,

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length of the dry season, farm size, family labor resources, farmer's age, proximity to demonstration farm, tenure status, financial ability to invest in terracing, off-farm work pattern, and similar dimensions. Analysis of this data should focus on identifying differences between adopters and non-adopters to provide insights into potential constraints to adoption and necessary interventions to relax these contraints.

- Information derived from adopter vs. non-adopter comparison should be used to determine subsidy/credit levels required to enable various types of farmers to adopt terracing.

- Data should be collected on actual labor requirements/ha for terracing at various slopes. This will provide an empirical basis for estimating the area of terraces farmers can be expected to construct during a single dry season.

- Data needs to be collected on off-farm employment opportunities to determine the income lost by farmers building terraces and the burden that forgoing this employment is likely to place on them.

C. Improved Cropping Patterns

1. Description

Once bench terraces are built, farmers are expected to adopt improved cropping pattern that gives higher profits and resource productivity, compared to the pre-bench terrace situation. The sources of the increased potentials are improved varieties, higher population densities, higher input levels (fertilizer, insecticide) and the arrangement of plants into rows. Benefits that can be captured through the adoption of the improved cropping patterns on bench terraced land is based on several proven technical considerations:

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a. Yield are increased since:

- fertilizer provides nutrients relatively absent in the upland soils, especially on continually cultivated traditional terraces, resulting in a strong yield response.

- improved varieties are more responsive to fertilizer than traditional cultivors.

- terracing increases fertilizer efficiency by reducing the rate and quantity of surface water run off and fertilizer loss.

b. Labor productivity is increased by:

- arranging crops into intercropped rows which reduces labor requirement for weeding and harvesting.

- increasing planting densities which reduces weed growth and weeding labor needs.

c. Productivity of capital is increased by:

- crop arrangement which permits the differential application of fertilizer and insecticides to each crop at rates and growth stages when response will be maximized.

d. Intensity of land use is increased by:

- introducing inter, relay and sequential cropping patterns that permit more crops to be grown per year.

e. Risk associated with price and production failure is reduced by:

- introducing a greater number of income streams, generated from an increased mix of crop enterprises.

- planting and harvesting crops throughout the year.

The ultimate objectives of these strategies are to increase employment by increasing the total demand for labor throughout the year, raise the "implicit" wage the farmer earns by employing his own labor on his own farm, and increasing total net income per year. If productivity is sufficiently high, this reduces farmers dependence on off-farm and non-farm employment to reduces rural migration to urban areas.

2. Cost and benefits

Estimates of costs and returns to the improved cropping patterns must be based on actual on-farm trials and or/ demonstrations conducted over several years in the target areas. In addition, the data must be objectively collected and analyzed correctly to provide credible results. The following analysis is based on limited available data from watershed projects that meets these minimal standards.

In the following economic analysis we attempt to assess the attractiveness of the new cropping technology to the farmer by estimating its impact an yearly labor demand, the implicit wage rate and total net income. He can increase his income by working more days/year, seeking jobs that give a higher wage/day or a combination of the above. The change (%) in total income due to the new technology is computed as:

$$\frac{\text{MD/year/ha employed by new pattern}}{\text{MD/year/ha employed by old pattern pattern}} \times \frac{\text{Wage rate/day earned in new pattern}}{\text{Wage rate/day earned in old}} = \frac{\text{net income/year/ha earned in new pattern}}{\text{net income/year/ha earned in old pattern}}$$

In this analysis, we do not include a charge for land or depreciation for terrace construction.

a. Upper Solo River Basin Project

The FAO/GOI Upper Solo River Basin project ran from July 1973 to March 1977. The terminal economic report (Gauchon, 1976) includes a section in which the results of the improved cropping pattern trials are analyzed. A sample of traditional farmers were surveyed and net returns estimated to represent without project productivity. With project benefits were estimated by the agronomy staff for year 1 and year 10 (full benefits) from experimental data. This production data (Table 4) is adjusted to reflect approximate current prices so that the economic analysis is comparable to more recent studies.

Results in Table 5 suggest that the improved practices more than double labor demand/ha on severely eroded slopes and increase labor requirements by 27% on the moderately eroded land. The implicit daily wage the farmer earns for himself by adopting the technology is about three times the pre adoption level. Net farm income - the consequence of both more days worked per year and a higher wage/day - ranged from 3.5 to 8.3 time the without project level, on severe and moderately eroded slopes respectively.

b. Jogyakarta Rural Development Project

The World Bank funded Jogyakarta Rural Development Project was started in 1980 and is ongoing. Under guidance of a well trained Indonesian economist and expatriate consultant, a strong economic analysis unit has been establish. Input output data is collected by personel working in the three field sites. The data base includes results from (1) researcher assisted farms on which improved cropping patterns A, B, and C are tested on plots of 1000 m^2 (2) demonstration farms in which farmers plant all of the 10 ha contiguous area to a single

improved pattern which they jointly select (3) farmers' fields outside the project area against which the introduced patterns are compared. The number of respondents of each type are shown in Table 6.

Table 7 shows input used and outputs produced. At all sites the assisted farmers applied significantly higher input levels, although Dem Area cooperators tended to use lower material input applications rates on their field than the researcher testing patterns A, B, and C in 1000 m2 plots. Yields reported appear to be quite high. For example, in Banjar Oyo the peanut crop produced 3.5t/ha in pattern C.

Economic analysis focuses on a comparision of the most productive assisted pattern (C), the Dem Area pattern and the farmers' traditional pattern. Analysis shows that, compared to the farmers' pattern that absorbed 122 MD/ha/year, the introduced pattern increased employment by about 25% in the Dem Area and 75% in Pattern C (Table 8). Compared to the average implicit wage rate of Rp. 3,855 for the farmers pattern, Pattern C and the Dem Area earned more than twice this level (Table 9). While the farmers' pattern gives a net income of Rp. 480,699, in the Dem Area and in Pattern C net income/year is 4-5 times higher (Table 10). While these results are extremely impressive, they are significantly greater than at other project sites and are quite variable between the three sites in Jogyakarta. Consequently, they must be accepted with caution.

c. Citanduy

The GOI/USAID Citanduy II project was initiated in 1981. To date about 10 model farms have been established. To estimate the before situation, participants in the 10 ha model farms were interviewed to recall pre project inputs and outputs. To estimate the impact of the introduced patterns, the Dem farm cooperators are interviewed throughout the year and crop cuts are made at harvest. Data from only one model farm was available in worksheet form and is summarized in Table 11. The

improved pattern makes possible triple cropping. As shown in Table 12-14, for the farmer who grew only one crop before development, the improved pattern tripled the labor requirements, tripled the daily wage and increased net income ninefold. For the farmer who grew two crops before development, the improved pattern increased labor demand by 35%, doubled the wage rate earned, and increased net income by two and one-half times.

d. P3RPDAS

At each of the demonstration farms maintained by P3RPDAS, basic input output data is collected. Field staff reported they are provided basic instructions on how to collect and analyze this data. Field staff provided worksheets from eight sites which was used to develop Tables 15-17.

These results suggest that on the average the introduced pattern doubles total labor requirements from a pre development level of 168 MD/ha to a post-development level of about 375 MD/ha (Table 15). The implicit wage rate rose by two and one-half times from Rp. 474/MD to about Rp. 1,200/MD (Table 16). Total net income increased five to six times from a pre-development level of Rp. 64,000/ha to a post-development level of over Rp. 320,000 (Table 17).

3. Assessment

The results reviewed indicate that compared to the farmers' traditional patterns, the introduced patterns have a capacity to absorb 2-3 times as much labor/ha/year, generated 2-3 times as high a daily wage and provide a net income 5-6 times above the farmers' previous crop income. As farmers become more familiar with the new technology, the soil quality is improved through crop residue management, the researchers and farmers are able to fine tune recommended practices, and still better varieties are identified, we would expect these results to be even more favorable.

On the other hand, our analysis covered only a small sample of the demonstration farms that have been established. In addition, even within our small sample, considerable variability in results occurred. Consequently, while these results are encouraging, continued attention must be directed at evaluating on-farm cropping trials and demonstrations to guide future implementation activities.

All of the data presented was obtained from model or demonstration farms in which participants were generally provided free inputs, including planting material, fertilizer and insecticides. It is likely that once farmers have to pay for these inputs, they will apply lower levels and obtain lower yields.

Finally, inputs and credit is not readily available at most sites. Unless inputs are physically available and production credit is provided, many farmers may be unable to adopt this technology.

4. Recommendations

- At all sites, monitoring and evaluation activities must be strengthened so that project staff have available information that they can use to evaluate the introduced technology and guide decision making.

- Basic environmental data must be collected and used to group together similar sites for pooled analysis. This will reduce the variability in results and increase the power of monitoring data for developing recommendations for homogenous agro-climatic areas.

D. Livestock Component

1. Description

After establishing bench terraces, grasses are planted on the lips and risers to prevent erosion. Grasses planted at sites visited include

Brachiaria brizantha, Pennisentum purpureum, and Sitaria spliacalata. Depending on the site, various animal types are to be introduced to utilize the addition supply of grass, including sheep, goats and cattle.

2. Costs and Benefits

The cost of establishing a grass cover on the terrace is approximately Rp. 45,000 for material and 2-5 MD/ha of labor, if 20% of the hectare is in terrace risers and lips. A mature female sheep/goat costs about Rp. 40-45,000.

The major variable input into small ruminant production is labor. Owning these animals provides a opportunity for the household to self employ family labor, often child labor with a low opportunity cost. Typically, livestock forage needs are provided by men or boys who cut grass along the roadways and on other public land and carry it back to the pens in which the animals are confined. To feed small ruminants, the household must spend 1 hour/animal/day in the wet season and 2 hours/animal/day in the dry season. Consequently, flock size seldom excedes 4-8 animals/household. Establishing grass intensively on the terraces greatly reduces the time required to harvest daily food requirement. This enables the household to either raise a greater number of animals with the same labor input or raise the same number of animals with perhaps only 20% of the labor input required under the traditional extensive cut and carry system. Hence, the grass/livestock enterprise can be expected to increase labor productivity and the implicit wage earned from ruminant production by 2-3 times. Furthermore, livestock provide farmers with an additional income stream, reducing vulnerability to crop failure. At the same time, livestock provide a mechanism by which farmers can accumulate capital. Whenever the occasion arises, this asset can be sold to meet family consumption and investment needs.

3. Assessment

The introduction of livestock is intended to encourage the farmers to maintain a grass cover on the terrace as required for land stabilization, in addition to increasing farm income. Local animal breeds are to be used, along with grasses widely grown in Indonesia. The only "new" technology is the planting of grasses on the terraces. While this is not technically complex to introduce, farmers seemed to prefer bunch grasses, compared to running grass that give better erosion control. Initial establishment may be difficult and require replanting if a dry period follows sowing.

To date, several of the projects have not yet implemented a livestock credit program and/or have been unable to make animal stock available at the sites. If livestock is not made available early after the grass cover is established, farmers will have no incentive to maintain a forage cover crop.

Traditionally, grass has been a public good available to anyone wishing to cut it. With the introduction of a profitable livestock component, the economic value of grass will increase and possibly result in the exclusion of individuals-particularly the landless-from cutting grass on private land.

Livestock productivity in Java is relatively low, partly due to poor nutrition and inadequate breeding management. While the new grasses and leguminous fodder trees may partially reduce nutritional constraints, significant opportunities exist for increasing overall productivity through applied research. After first identifying the field constraints to higher productivity, an applied research program needs to be established to test technologies for breaking these bottlenecks-thereby increasing the profitability of the livestock enterprise and farmers' interest in adopting the terracing technology.

4. Recommendations

- Mixes of running and bunch grasses should be evaluated on the risers and lips of bench terraces as such a combination may be more acceptable to farmers than sole planting of recommended running grasses.

- Credit programs must be established immediately so farmers will be able to utilize the terrace grass, once it is established.

- Applied research must be initiated to identify constraints to higher livestock productivity and test interventions for breaking these constraints.

- A sample of farmers receiving livestock on credit must be monitored to identify problems encountered, the need for modifying the recommended technology, and to determine the economic returns obtained.

E. Development on slopes greater than 50%

1. Description

On slopes greater than 50%, farmers are encouraged to take the land out of annual food crop production and plant tree crops for cash income such as clove and citrus, firewood for home consumption and sale (Albizzia falcata), fodder trees to supply animal feed (leucaena spp.) and grass for livestock under the canopy. Tree seedlings and livestock are to be made available to participating farmers.

2. Costs and benefits

The costs of establishing tree crops/grass is dependent on the type of tree planted and the spacing. The long run returns to tree crops such

as cloves and citrus are significantly greater than food crops, once they reach maturity. For example, a clove plantation with trees planted at a rate of 250 seedlings/ha gives an annual gross return of over Rp. 1.5 million/ha.

3. Assessment

A significant advantage of tree crop establishment is that unlike bench terracing, it can be done by an individual farmer acting independently. In addition, establishment is divisible in the sense that each year he can gradually expand the size of his plantation. Furthermore, the proposed trees are widely grown throughout the area, so the technology is tested and known to local farmers.

The main constraint to tree plantation establishment is the long payback period during which the farmer receives no income from the land. Consequently, farmers with limited alternative income sources or no other land base continue to grow food crops on steep slopes. In the tidal swamps of South Kalimantan, farmers have solved this dilemma by planting coconut trees on mounds in rice fields, enabling them to grow food crops until the coconuts are in full production after 10 years. A similar strategy is practiced in Citanduy where upland food crops and economic trees are intercropped. Although not optional, a similar strategy may be appropriate throughout the upper watersheds. Ideally, a mix of trees should be planted that can be harvested or produce fruit at different times to spread income flows throughout the year.

Another major constraint to tree crop establishment is land tenure. It appears that poor tenants sometimes cultivate the steep slopes owned by absentee landlords. These farmers have little interest in tree crops since their right to harvest the crop is insecure. Provision of credit for land purchase by tenants could reduce this constraint.

If tree crops/grasses are to be established on the steep slopes, long term production credit will be required to enable farmers to finance

the necessary inputs, including fertilizer, trees, grasses, and livestock. In addition, long term subsistence credit could be provided to compensate farmers for short term reductions in food crop income until the cash crops come into production. Repayment schedules for both production and subsistence credit should be calculated to coincide with the maturity of the cash crop enterprises.

4. Recommendations

- Credit should be provided to tenant farmers to enable them to purchase steep slope land which would create an economic incentive for them to establish tree crops.

- Credit should be provided to cover input costs and subsistence food requirements to enable farmers to establish tree/grass/livestock enterprises on the steep slopes.

- Credit repayment schedules should be developed to coincide with the income generating capacity of the newly established enterprises.

F. Evaluation Research

An extremely large amount of money is currently being spent to implement the recommended upper watershed technology. All of the ongoing on-farm activities are built on the assumption that with the existing knowledge about soil conservation, crop production, and animal husbandry, packages of technology can be designed for extension to farmers. Once demonstrated, farmers will see that these packages are financially attractive and adopt them. Consequently, there is minimal emphasis on research with primary attention given to demonstrations. We agree that there is adequate knowledge to proceed, but see major constraints to widespread adoption.

Given the high labor requirements of bench terracing, it is difficult to imagine how a majority of farmers - especially the poorer ones - will be able to self-finance construction. Even if the total package is financially attractive, the poor majority living at a subsistence living standard would suffer considerable hardship forgoing alternative cash or kind daily employment to invest labor over the 3-4 month dry season to reap benefits that will not be fully captured until some years in the future.

Terraces observed varied in technical quality from excellent to poor. Reports suggest that even on well terraced land, soil erosion is considerable during the first year before grass is established. Factors such as soil type, slope, rainfall, quality of technical supervision, degree of local political support, cohesion in the farmer group and resource characteristics of cooperating farmers probably explains much of this variability.

In these watershed projects, stabilizing soil is a primary objective. To obtain the farmers' cooperation, new technology is introduced that will make it financially attractive to adopt and continue to employ soil conservation practices. Farmers' willingness to adopt new technology will depend on the increased profitability of both the introduced food crop package and the forage/animal system which utilizes grass and forage trees planted on the lip of the riser and terrace face. In this model, farmers' interest in terracing is a derived demand highly dependent on the feasibility and financial viability of crop and livestock production. If these enterprises are not as or more profitable than alternative income opportunities, the farmers will have little or no interest in maintaining the terraces, resulting in serious erosion and utimately degradation of the terrace system and watershed. In other words, if any one of these interdependent components is missing, it is less likely that project goal will be realized.

To date, there have been significant breakdowns in the delivery of planting materials, establishment of credit, availability of livestock

and establishment of a strong crop and livestock research component. If adoption is to proceed, these organizational constraints must be resolved.

While some spontaneous adoption has occurred at Citanduy II, we know nothing about the characteristics of the adopters and the degree to which we can expect others to follow this path. There is considerable variability both between major project visited and within sites at each project in term of stage of implementation, emphasis on research, staff expertise, budget resources, environmental conditions, robustness of the interventions, and data available to assess the technology packages. Consequently, as we move forward, we must acknowledge the fact that we must learn as much as possible from our initial experiences. When dealing with so many unknowns, a strategy of sequential tinkering is required. We intervene in a complex system, observe what happens, and base future action on what we have learned through this incremental process.

In order to assess program impact and have confidence in our analysis, several conditions should be met. An evaluation design must be used that permits a valid comparison of the before situation and the after program impact, in which major threats to validity are controlled. Ideally, respondents must be randomly drawn from the population at a site and randomly assigned to the control and experimental group. Appropriate data must be collected from each group before, during and after the interventions are introduced. In addition, the data must be systematically collected at an acceptable standard of accuracy to insure reliability.

The projects reviewed met this standard to varying degrees. Major areas of concern observed in one or more projects included:

(1) Non-random selection of cooperators, including the selection of participants based on such criteria as nearness to the road,

(2) Absence of before project data,

(3) Absence of a comparable control group against which the cooperators experience could be compared.

(4) The short period over which data had been collected, compounded by a severe drought which resulted in widespread crop and tree/grass establishment failure,

(5) Reporting of yields based on small crop cuts taken on small parcels (0.1 ha) of land and converted to per hectare yields,

(6) Reporting of crop yields on a per hectare basis without discounting for the 15-30% of the land taken out of food crop production as a consequence of terrace construction,

(7) Minimal characterization of site variables (physical and socio-economic) that would provide insights into the transferability of the packages across sites.

In all of the projects observed, the staff's capacity to continually assess project impact must be strengthened. Strategies for evaluating impact must be planned into the projects from the beginning so that appropriate data is collected throughout the life of the projects. Emphasis should not only be placed on evaluating economic parameters, but also systematically evaluating the institutional support system components, including extension, credit, research and project management, so that weak components are strengthened immediately.

Finally, these projects proport to following the farming systems approach. While technology package are designed for all components in a farming system-soil conservation, crops, forage, livestock and trees-this alone does not constitute a farming systems approach. Explicit in the farming system approach is the acknowledgment that to develop technology

that meets farmers' needs and which will be adopted by them, the technicians and research staff must meaningfully involve farmers in identifying their own needs and evaluating initial technology interventions. This implies that rigid technology packages cannot be prescribed by technicians. Rather recommendations must be developed with a range of options from which farmers can select in accordance with their own needs and preferences.

III. Off-Farm Employment

In the upland watersheds, agricultural activities are the principle source of employment at the present time and can be expected to remain so for the indefinite future.

The major thrust of the upper watershed development projects is to reduce soil erosion and increase the productivity of land based agriculture. This is an important priority, but must be complemented by additional employment generation activities. First, most villages have a population of landless households ranging from a few percent to perhaps 30%. These households are by far the poorest in the upland community and will not be assisted by a land based development effort. Second, in the long run land based development may actually adversely affect the landless population, both relatively and absolutely. Currently, landless livestock producers have a traditional right to harvest grass growing on both public and private land. The introduction of high yielding grasses and productivity increasing livestock management practices can be expected to make livestock production more profitable. As a result of the increased profit potential, land formerly available to the landless is likely to be reclaimed - as in Kali Konto where dairy cattle enterprises using improved grasses have been established. Third, it is well documented that the forest area in Java decreases yearly as poor people (especially the landless) move up to the hillsides to plant food crops in the forest and gather wood. If alternative income generating opportunities are not developed, the forests will eventually disappear.

Finally, as the population increases in the upper watershed, the labor intensity of agricultural production will increase. While the introduction and refining of available technology can be expected to increase labor productivity in the short run, we must anticipate diminishing marginal returns to a gradually increasing man-to-land ratio. For these reasons, a permanent solution to watershed stabilization will not be realized unless resources are also allocated to increasing non-farm employment opportunities. The land based watershed activities can provide a breathing period during which a more comprehensive strategy can be designed and implemented.

In the short run, major opportunities for increasing non-farm employment lies in public works projects, such as feeder roads, bridges and checkdams. These projects will also provide a base for continued development. First, road and bridge construction will strengthen the transportation infrastructure which will facilitate the movement of agricultural inputs into and products out of areas that are presently quite isolated. Second, improved transportation will reduce shipping costs, making agricultural outputs from the watershed more competative with the more developed lowland areas. Third, the infusion of capital as wage payments would increase the savings and investment capacity of participants, making them more capable of adopting new agricultural technology.

In the longer run, non-farm employment projects must be planned in relation to other watershed development activities. First, in anticipation of increasing food crop production agricultural product processing activities should be established, including cassava and soybean processing. Second, as fuel wood trees mature and the fuelwood offtake increases, charcoal production may be feasible. Third, wood product based cottage industries such as furniture making could add value to forest trees harvested. Finally, there may be opportunities to develop small manufacturing industries for producing agricultural tools and similar products.

Presently the upper watershed areas are at a comparative disadvantage in the production of almost all goods and services except the processing of agro-forestry products - due to higher transportation costs and the outmigration of the most skilled manpower resource. Consequently, without significant government intervention directed at firm establishment, manpower training, transportation, and marketing that could offset these natural disadvantages, non-farm employment is unlikely to increase significantly.

IV. Private Enterprise Opportunities

A major constraint to watershed development is the complexity of the planning process that is designed to deliver a wide mix of inputs to participating farmers at a given point in time. To date delays in the delivery of improved food crop seeds, grass seed, fertilizer and animal stock have seriously constrained implementation.

There are several reasons for exploring opportunities to divorce the provision of technical advice from the provision of inputs. First, scarce technical manpower should be freed of administrative responsibilities associated with procurement to enable them to advise the maximum number of farmers. Second, costs to the farmer recipients can be reduced if he is permitted to directly procure inputs such as livestock, accelerating farmer acceptance.

Third, centralized planning for input procurement and delivery require information about future demand that places a significant burden on the administrative system to do in a timely fashion. Fourth, the development of private input supply source can contribute to the general objective of strengthening the economic viability of increasing community and the employment. Finally, an input delivery system controlled by individual entrepreneurs or a cooperative is more likely to make available product that reflect farmers' needs. In contrast, since a public procurement system has a built in demand for its output through

the planned program, it is likely to provide inputs, varieties, and brands that are not consistent with the farmers' perception of their own needs.

For example, the multiplication of improved food crop varieties (corn, peanut and soybean), grasses and tree seddlings could be organized around dem/model farms. These cooperators -- as individuals or as a farmer group - could be provided an initial small stock of registered seed to grow under recommended spacing and fertility levels to give maximum production. The harvest could be graded and stored by the producers under specified conditions. PPL's could conduct germination tests to insure a minimum standard of viability and designate these individuals as authorized seed sources. Neighboring farmers could then buy seed from these source at a premium price set to compensate the seed producers for their extra effort. A similar mechanism could be established for the production of grass and tree seedlings. In these systems, the role of the public institution is still important, but limited to technical advice to the seed producers, quality control, and communicating to potential buyers the local sources of improved seed.

Inputs such as fertilizer and pesticides are successfully marketed through cooperatives in the lowland. In transmigration areas "spontaneous" fertilizer dealers have developed in response to local demand before official channels were established. Until viable cooperatives are developed in the upper watershed areas, it may be appropriate to promote the establishment of private dealerships.

V. Subsidies and Credit

A. Subsidies

There are several valid reasons to grant subsidies to encourage the adoption of conservation practices. First, the benefits derived from implementing these practices are captured not only on-site by the

adopter, but also off-site by others who do not share in paying the cost. In the upper watershed case, a significant share of anticipated benefits go to downstream residents in the form of flood control, reduction in dam/canal siltation, and reduced damage to estuaries. In effect, if the upland farmer does not receive a subsidy, he is actually subsidizing the lowland population that capture the off-site benefits. Second, conservation benefits generally have a long payback period. Thus they are partly captured by the farmer, and partly by future generations. For these reasons, subsidies are provided to reduce the actual cost to the farmer so that he is able and willing to adopt them. The subsidy is established at a level that makes it profitable for him to implement a practice that, without a subsidy, would only be profitable from a societal point of view. Third, subsidies may also be granted on equity grounds to redress historical patterns that have resulted in significant differences in welfare between groups. Residents in the upper watersheds have been largely bypassed by the development process which has focussed on building social and physical infrastructure to serve the needs of lowland populations.

From the governments' perspective, subsidies must be set at the minimum level required to obtain adoption so that available resources are leveraged to stimulate adoption over the largest possible area. Currently, several models are being tested that have relied on different levels of subsidization:

1. <u>P3RPDAS Demonstration Farm Approach</u>

Farmers on a contiguous land area of not more than 10 ha are provided about Rp. 290,000/ha in year 1, with Rp. 50,000/ha for waterways construction and the rest for inputs like fertilizer, planting material, insecticides and bench terrace construction. In the second year the subsidy falls to Rp. 113,000 for livestock purchase and in the third year to Rp. 25,000/year. About Rp. 50,000 is provided to farmers outside the Dem farms who adopt the new technology.

2. Citanduy II approach

Farmers in the 10 ha demonstration area are partly subsidized to build bench terraces and waterways (Rp. 100,000/ha). Free inputs are provided such as seed, fertilizer and insecticide. Cooperators are provided free of cost small ruminants after 70% of the terrace face and lip are established in grass. Using the model farm as a base, extension staff reach out to neighboring farmers to encourage them to adopt the technology package. In the expansion area, farmers with contiguous holdings (mini-watersheds) are organized into groups, provided technical assistance in laying out contours, and are expected to construct the bench terraces using their own labor. Waterways and drop structure are constructed at the expence of the project. After completing their terrace, grass is provided free of cost to vegetate the risers and lips. During the first year, improved food crop seeds and material inputs (fertilizer and insecticide) are provided free. In later years farmers are expected to purchase material inputs and credit is made available for livestock purchase.

3. Jogyakarta Rural Development Project

In the Jogyakarta model, a higher level of subsidization for terrace construction is provided to Dem Area participants, estimated at 50% of the cost of terracing (Rp. 300,000/ha). In addition, inputs are provided to program participants such as fertilizer, insecticide, and planting materials.

All of the projects observed are only a few years into implementation. Typically, the model or demonstration farms have been established for only a year. In some instances, inputs such as grass and improved food crop seeds were not provided and livestock not available. Furthermore the several sites differed significantly in terms of soil type and other agro-climate factors.

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A key indicator of the success of a subsidy strategy is adoption by farmers. For most of these efforts, there is minimal information available that documents the adoption process outside demo farms that can be used to judge the quality of terrace construction, cropping patterns actually grown and productivity. Consequently, it is difficult to conclude that one model has proven more effective than another in facilitating adoption at a lower cost/ha.

We feel the major component in the package of technology that may require direct subsidization is terrace construction. While it is sometimes argued that farmers will not maintain terraces that are financed publically, we believe that past failure by farmers to maintain publically constructed terraces has been due to the unavailability of inputs, credit and technology that gave an attractive return. As a result, there was no adequate incentive to maintain the terraces.

Consequently, a flexible subsidy policy is recommended that takes into account the initial response of farmers to a modest level of subsidization and takes into consideration the differences in the quality of the land resource and probable increase in productive capacity as a result of terracing. For example, a higher level of subsidization may be required in areas with poor soils such as in Jogyakarta than in Citanduy. If cash subsidies are provided they should be channeled to farmer groups who would be responsible for constructing the terraces on their own land in order to insure quality and provide a direct benefit to these cooperators.

B. Credit

As many farmers in the upper watersheds are at the subsistence income level, they are not able to generate the savings needed to purchase recommended inputs for cash. At many of the sites visited, credit channels have not yet been established to serve the needs of small farmers. Consequently, adoption of the recommended practices may have

een slowed. To enable farmers to adopt the improved technology, credit ill be required.

In Indonesia, small farmer credit is generally tied to a specific ackage of inputs for specific crops such as the Bimas program. The pper watershed development program takes a farming systems approach and ncludes new technology for a diverse set of enterprises, each requiring ifferent inputs. In addition, credit needs can be expected to vary from armer to farmer. Consequently, credit should be made available not for pecific inputs or packages, but to finance the inputs and enterprises he farmer feels are most suited to his needs.

In the upper watershed, many of the poorest residents with the reatest need for credit have no land which could be used as collateral or loans. If collateral were required, these residents would be ypassed. Yet, by combining the available family labor resources with apital, the productivity of their labor could be significantly ncreased. In order to meet the needs of this population, it will be ecessary to provide non-collateral loans. To guarantee repayment, these oans should be provided to farmer groups which are responsible for eeing that each member meets his obligation.

Initial results from demonstration farms suggest that the introduced echnology will increase farmers' income, making adoption financially ttractive. Consequently, it should not be necessary to subsidize redit, but only to make it available to clients at a fair market rate. armer's willingness to borrow and invest in the new technology will in act be a test of the economic viability of the recommended practices.

There is a need to develop a credit system that is permanent and not ssociated with a specific project. Otherwise, when the project ends, armers will lose access to much needed capital. Efforts must be made to annel credit through existing financial institutions, and encourage ese institutions to increase the capacity to serve farmers in the mote villages throughout the watershed.

Repayment schedules should be established so that loans come due soon after a return on the investment is realized. For example, loans used for annual crops should be paid after harvest. Loans for tree crop establishment should be longer term and take into account the fact that income will not be generated for several years.

Table 1:
Labor requirements and cost/ha at various project sites and slope ranges

Site	Slope %	md/ha	Total Cost (Rp. 000) at wage rates/MD: Rp. 700	Rp. 350
Upper Solo[a]	5 - 30	750	525	263
	30 - 50	1520	1140	570
Citanduy II[b]	10 - 15	789	551	275
	45 - 50	1742	1219	610
Jogyakarta[c]	10 - 20	845	592	296
	40 - 50	1833	1283	642

Source:
a) Gauchon, 1976, Some Aspect of Watershed Management Economics, Solo p. 60
b) Project staff (typed data)
c) Jogyakarta Rural Development Project, Working Paper C-5, Appendix I, p. 2

Table 2:
Estimated material costs for terrace development

Site	Slope	Cost (Rp/ha)
Citanduy II[a]	N.A.	74,000
Jogyakarta[b]	25 %	69,500

[a] Citanduy II, Appendix 3, p. 24
[b] Jogyakarta Rural Development Project Working Paper C-5 Appendix 2, p. 1

Table 3:
Estimated cost (Rp./ha) of bench terracing at various slopes and labor costs, late 1970's

Slope	Opportunity cost of labor	
	Full	50%
Low	Rp. 625,000	Rp. 349,000
Steep	Rp. 1,293,000	Rp. 684,000

Note: Derived from Table 1 and 2

Table 4:
Results from the introduction of improved crop production practices on bench terraced land in the Upper Solo Watershed, 500 m and below (per hectare).

Parameter	Erosion Status			
	Severe		Moderate	
	Development Stage		Development Stage	
	Pre	Post (First year)	Pre	Post (First year)
Labor				
total (MD)	147	330	383	487
hired (MD)	4	100	94	184
draft (days)	4.2	4.7	5.3	5.8
Planting material				
upland rice (kg)	6.4	12	17	17
maize (kg)	0.2	0.7	0.9	3
groundnuts (kg)	6.2	25	31.5	55.5
soybeans (kg)	0.7	1.5	0	0
Manure (t)	1.1	1.2	2	2.2
Chemical Fertilizer				
urea (kg)	3.3	177	56	187
TSP (kg)	0.5	184	28	192
Insecticide (l)	0.1	0.1	0.4	0.4
Yield				
upland rice (kg)	40	400	325	1,125
maize (kg)	1.5	30	15	200
groundnuts (kg)	60	275	400	1,025
soybeans (kg)	2	15	0	0
cassava (kg)	650	3,525	1,300	6,225

Source: Gauchon, 1976, Some Aspects of Watershed Management Economic, Solo.

Table 5:
Impact of introducing improved crop production practices on bench terraced land in the Upper Solo Watershed project, 500 m and below, 1981 (adjusted)[a]

Parameter	Erosion Status					
	Severe			Moderate		
	Pre-bench terrace value	Index of changes Pre	Index of changes Post	Pre-bench terrace value	Index of change Pre	Index of change Post
Labor intensity (md/ha/year)	147	100	224	387	100	127
Wage rate (Rp./md)	231 [b]	100	370	556	100	278
Net income (Rp./ha/yr)	33,957 [c]	100	830	215,172	100	353

[a] Estimated current (1981) prices are applied to the project input and output values: fertilizer (Rp.90/kg), insecticides (Rp. 2,000/l), rice (Rp. 150/kg), maize (Rp. 100/kg), groundnuts (Rp. 300/kg), cassava (Rp. 50/kg), soybeans (Rp. 250/kg).

[b] Wage rate calculated as gross returns minus material costs divided by total labor input.

[c] Net income calculated as labor intensity times wage rate.

Source: Computed data in Gauchon, 1976, Some Aspects of Watershed Management Economics, Solo.

Table 6 :
Distribution of cooperators, Jogyakarta Project
1981 - 1982

Site	Assisted[a] and growing pattern:			Unassisted and growing:	
	A	B	C	Dem Area	Farmer's pattern
Kedung Poh	4	4	4	18	12
Hargotirto	2	0	2	9	6
Banjar Oyo	8	0	2	9	6
Total	8	4	8	36	24

[a] Bench Terraced land

Source: Technical Development Cell, Agricultural Component, 1982, Consultant's Report on Agricultural Economics, Jogyakarta Rural Development Project.

Table 7:
Input use in cropping patterns grown in Jogyakarta Rural Development Project, 1981 - 1982

Site/factor	Assisted and growing Pattern: A	B	C	Dem Area	Unassisted and growing: Farmers' pattern
Kedung Po					
Major inputs:					
total labor (md/ha)	442	448	111	149	122
manure (t/ha)	0	0	0	0	4.4
urea (kg/ha)	250	250	200	275	71
TSP (kg/ha)	200	200	200	125	77
Outputs:					
rice (t/ha)	2.8	2.9	-	3.2	2.4
corn (t/ha)	1.8	1.7	1.1	1.8	1.1
peanut (t/ha)	0.8	-	1.1	0.8	0.6
cassava (t/ha)	9.2	7.3	7.9	8.1	5.6
soybean (t/ha)	-	0.6	0.6	-	-
Hargotirto					
Major inputs:					
total labor (md/ha)	501	-	399	234	152
manure (t/ha)	0	-	0	0	3.1
urea (kg/ha)	250	-	200	275	115
TSP (kg/ha)	200	-	200	125	44
Outputs:					
rice (md/ha)	1.3	-	-	-	-
corn (t/ha)	1.0	-	0.8	1.4	-
peanuts (t/ha)	0.4	-	1.4	0.8	-
cassava (t/ha)	7.1	-	8.4	6.0	1.8
Banjar Oyo					
Major inputs:					
total labor (md/ha)	320	-	220	128	126
manure (t/ha)	0	-	0	0	1.7
urea (kg/ha)	250	-	200	275	190
TSP (kg/ha)	200	-	2--	125	88
Outputs:					
rice (t/ha)	3.4	-	-	-	-
corn (t/ha)	0.7	-	0.6	0	1.2
peanuts (t/ha)	1.9	-	3.5	0.9	1.4
cassava (t/ha)	4.2	-	5.0	6.0	1.0

Source: Technical Development Cell, Agricultural Component, 1983, Consultants' Report on Agricultural Economics, Jogyakarta Rural Development Project.

Table 8:
Impact of introduced cropping pattern on labor intensity, Jogyakarta Rural Development Project, 1981 - 1982

Site	Labor use in farmers' pattern (md/ha/year)	Index of change: Comparison of patterns		
		Farmers'	C	Dem Area
Kedung Poh	122	100	91	122
Hargo Tirto	152	100	263	154
Banjar Oyo	126	100	175	102
Average	133	100	176	126

Source: Calculated from data in Technical Development Cell, Agricultural Component, 1983, Consultants' Report on Agricultural Economics, Jogyakarta Rural Development Project.

Table 9
Impact of introduced cropping pattern on wage rate, Jogyakarta Rural Development Project, 1981 - 1982

Site	Wage rate with farmers' pattern (Rp/md)	Index of change: Comparison of patterns		
		Farmers'	C	Dem Area
Kedung Poh	6,902	100	123	125
Hargo Tirto	473	100	429	576
Banjar Oyo	4,191	100	136	86
Average	3,855	100	229	262

Source: Calculated from data in Technical Development Cell, Agricultural Component, 1983, Consultants' Report on Agricultural Economics, Jogyakarta Rural Development Project.

Table 10

Impact of introduced cropping patterns on net income, Jogyakarta Rural Development Project, 1981 - 1982

Site	Net/Income from farmers' pattern (Rp./ha/yr)	Index of change: Comparison of patterns		
		Farmers'	C	Dem Area
Kedung Poh	842,044	100	112	153
Harge Tirto	71,896	100	1,128	887
Banjar Oyo	528,066	100	238	88
Average	480,669	100	493	376

Source: Calculated from data in Technical Development Cell, Agricultural Component, 1983, Consultants' Report on Agricultural Economics, Jogyakarta Rural Development Project.

Table 11:
Analysis of cropping patterns before and after model farm development, Kegiatan, Citanduy II, 1981-82

Parameter	Before			After		
	Monoculture	Polyculture		Polyculture		
		First crop	Second crop	First crop	Second crop	Third crop
Selected Inputs						
Total labor (md/ha)	123	170	130	170	128	108
urea (kg/ha)	0	100	100	200	200	50
TSP (kg/ha)	0	0	50	100	100	35
NPK (kg/ha)	0	100	50	0	0	0
manure (t/ha	2.8	0.7	0	2.0	2.0	1.0
Yields						
rice (t/ha)	-	2.1	-	2.0		
corn (ears/ha)	-	1500	1500	5000	5000	-
peanut (t/ha)	-	-	0.7	-	1.0	-
cassava (t/ha)	6.0	-	0.5	-	-	-
wijen (kg/ha)	-	10	-	-	-	-
pumpkin (pieces)	-	100		-	-	-
grass (t/ha)	-	-	-	1.5	1.5	1.5
kacang tunggak (t/ha)	-	-	-	-	0.4	1.2
egg plant (pieces)	-	-	-		100	-

Source: Model farm worksheet provided by project staff.

Table 12:
Impact of introduced cropping pattern on labor intensity before and after model farm development, Kegitians, Citanduy II, 1981 - 1982

Type of pattern	Before Model Farm labor intensity (md/ha/yr)	Index of Change: Comparison of before to after model farm	
		Before	After
monoculture	125	100	325
polyculture	300	100	135

Source: Model farm data records provided by project staff.

Table 13:
Impact of introducedcropping pattern on wage rate before and after model farm development Kegitians, Citanduy II, 1981 - 1982

Type of pattern	Before Dem Farm wage rate (Rp/md)	Index Change: Comparison of before to after model farm	
		Before	After
monoculture	690	100	282
polyculture	1,056	100	184

Source: Model farm data records provided by project staff.

Table 14:
Impact of introducedcropping pattern on net income before and after model farm development
Kegitians, Citanduy II, 1981 - 1982

Type of pattern	Before Dem Farm net income (Rp./ha/yr)	Index of Change: Comparison of before to after model farm	
		Before	After
monoculture	86,250	100	917
polyculture	316,800	100	248

Source: Model farm data records provided by project staff.

Table 15
Impact of introduced cropping patterns on labor intensity, Jratunseluna, P3RPDAS Dem Farms, 1980/81 and 1981/82

Site	Plot area (ha)	Pre Dem Farm Labor intensity (md/ha/yr)[a]	Index of Change: Comparison of Pre to Post Dem Farm Situation		
			Pre	Year 1	Year 2
Ngargosari	5.5	51	100	153	-
Lemahirang	4.4	269	100	114	-
Karang Gatok	8.0	155	100	226	-
Jlorem	7.0	301	100	216	-
Bagor	4.9	127	100	280	175
Ketapang	6.0	107	100	467	425
Kayen	7.5	251	100	108	98
Watugede	5.2	80	100	216	207
Average	6.8	168	100	223	226

[a]Computed as total labor/dem farm (md) divided by area of dem farm (ha)

Source: Dem farm data records provided by site staff.

Table 16
Impact of introduced cropping patterns wage rate, Jratunseluna, P3KPDAS Dem Farms, 1980/81 and 1981/82

Site	Pre Dem Farm Wage Rate (Rp/md)[a]	Index of Change: Comparison of Pre to Post Dem Farm Situation		
		Pre	Year 1	Year 2
Ngargosari	672	100	143	-
Lemahirang	402	100	200	-
Karang Gatok	466	100	210	-
Jlarem	238	100	466	-
Bagor	495	100	230	210
Ketapang	405	100	233	375
Kayen	179	100	288	333
Watugede	933	100	82	101
Average	474	100	259	255

[a]Computed as net returns (Rp/ha) divided by total labor input (md/ha)

Source: Dem farm data records provided by site staff.

Table 17
Impact of introduced cropping patterns on net farm income; Jratunseluna, P3RPDAS Dem Farms, 1980/81 and 1981/82

Site	Pre Dem Farm Farm labor Income (Rp./ha/yr)[a]	Index of Change: Comparison of Pre to Post Dem Farm Situation		
		Pre	Year 1	Year 2
Ngargosari	34,272	100	219	-
Lamahirang	108,138	100	228	-
Kerang Gatok	72,230	100	475	-
Jlarem	71,638	100	1,007	-
Bagor	62,865	100	644	368
Ketapang	43,335	100	1,088	1,594
Kayen	44,929	100	311	326
Watugede	74,640	100	177	209
Average	64,006	100	509	624

[a]Computed as days of labor (md/ha) times daily wage rate (Rp./md)

Source: Dem farm data records provided by site staff.

TECHNICAL APPENDIX VII

HUMAN RESOURCES DEVELOPMENT

by

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Doc. # 0314A

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TECHNICAL REPORT

HUMAN RESOURCES DEVELOPMENT

1. Introduction

Background

Since 1969, the Government of Indonesia has placed increasing importance on the problem of rapid degradation of its natural resource base. As population pressures have increased, deforestation of upland areas has taken place and forests have been replaced by annual crops. These crops are often grown with relatively little attention to soil and water conservation practices. The change in land use has resulted in rapid increases in soil erosion, siltation of stream and irrigation canals, flooding during rainy seasons, and drought during dry periods. As erosion has become more severe, productivity of the land has decreased while population pressures continue to increase, creating an increasingly rapid cycle of degradation.

The foregoing is an oversimplification of a very complex problem. However, it is sufficient to show that a wide range of social, economic and technical factors are involved in the improvement of watersheds. The manpower needed to develop and execute programs required to improve the existing situation must also represent a wide range of knowledge, experience and skills.

Objectives

Planning to meet the requirements for trained personnel for watershed management and upland development involves four main areas. First, qualitative, or the content of training and the ability of trained people

to perform the duties required of them. Second, quantitative, or the numbers required by level of training and by broad subject matter area. Third, utilization of trained personnel, or the factors which influence their effective use and their capacity to carry out the functions assigned to them. Fourth, all of these aspects should then be brought together in the appropriate manpower strategy necessary to meet the overall government policies for watershed management and upland development within a specified period of time.

The Human Resources Assessment Team

Two members of the Team were assigned to study manpower and training. This sub-team adjusted its schedule of work to include visits to training institutions and extension centers not visited by the whole team. It also participated in most of the meetings and field visits by the Team with watershed program personnel in order to obtain information and to evaluate manpower needs for these programs.

2. Qualifications of Human Resources

The work force in the watersheds visited is made up of the rural population and the staff of line agencies and special projects. Those playing key roles in the development and implementation of watershed improvement activities are the farm family, key farmers, village extensionists, extension supervisors, extension specialists, researchers, program planners, administrators and support personnel.

The Farm Family

The ability of farmers and their families to understand the consequences of present practices on their land and their future livelihood, their willingness to make changes in the face of the risks involved in the adoption of new practices, and their skills to implement new practices are a major concern of training programs. In a democratic

society, the farmer is the key to the success of any program aimed at changing agricultural practices. Thus, the farm family must be the focal point of manpower training for watershed development programs in Indonesia.

The average farmer in the watershed areas visited is literate but has only 3 years of formal education. The level of education of his wife is likely to be somewhat lower. However, they are intelligent and have well developed skills in traditional farming systems as evidenced by their well kept farm plots, gardens and homes. The farmers and farmers wives interviewed exhibited positive attitudes toward education and cooperation in community activities, and were willing to experiment with new farming practices which they felt would improve their income. Thus, they are receptive to training and have the capacity to learn new skills and to adapt them to existing conditions. Their limited resources, however, makes risk taking difficult and may limit their interest in new practices.

Farm parents are interested in providing higher levels of education for their children than they have themselves. The rapidly expanding primary and secondary school systems make it possible for farm children to complete at least 6 years of formal training. Approximately 50% receive secondary school education.

Key Farmers

In order to deal more effectively with the large number of farm families in a program area, extensionists have established a practice of working with key farmers who, in turn, work with a farm group. The key farmers also facilitate the process of "feed back" of farmers' problems into the system.

The criteria for selection of key farmers is as follows:

1. They must be actively engaged in farming.
2. They must have adopted new, recommended practices.

3. They must be willing to disseminate information regarding new practices to other farmers.
4. They must have a farmer group.

Although these farmers have similar educational background to their neighbors, they have leadership qualities and experience which make them valuable assets in the promotion of new practices.

This system has worked well in the promotion of programs such as the mass guidance program for irrigated rice. Although there are undoubtedly instances in which key farmers are selected by criteria other than those listed above, these cases appear to be the exception rather than the rule in the project areas visited. As might be expected, the key farmers interviewed by the team generally had larger land holdings than other members of the group and often held some other position of authority such as village head.

The Village Extension Workers

The village level extension worker is perhaps the most important agent for change in existing and projected programs for watershed development. There are 2 types of extensionists who work on the watershed projects at this level. They are:

1. The PPL-field extensionists for rice, secondary crops and horticulture mass guidance (BIMAS).
2. The PLP-the field worker of the greening project. These workers are usually assigned to extension activities but may also be assigned to other field tasks.

These field extension workers are graduates of agricultural high schools and their background varies only in terms of special training courses taken and their experience. In general the PPL have been in service longer and have had more supplemental training. However, most of

their field experience has been with irrigated rice and secondary crops. The training of the PLP, on the other hand, has been oriented toward greening project targets. The basic role of the PPL as defined by AAETE is as follows:

1. To disseminate useful agricultural information,
2. To recommend more profitable farming practices,
3. To teach improved agricultural knowledge and skills,
4. To assist farmers to participate in development programs which will provide credit, supplies, processing, and marketing facilities, and
5. To develop auto-activity of farm families to achieve higher standard of living.

The role of field extension workers for watershed projects vary from those stated above only in terms of the limits placed on them by their specific assignment.

The PPL-PLP face three major problems in fulfilling their roles. The first problem relates to the fact that their training has not adequately prepared them for their tasks in watershed development. There are three types of high schools which train field extension workers. They are:

1. SPP-Negeri - National agricultural development high schools under the Ministry of Agriculture.
2. SPP-Daerah - Provincial agricultural high schools with guidance (curriculum approval) by the Ministry of Agriculture.
3. SLTA-P - Vocational agriculture high schools under the Ministry of Education (national only).

The curriculum of the SPPs, with the exception of the marine fisheries schools (SUPM) and the two forestry schools (SKMA) which have specialized curricula, has been designed to provide a polyvalent

(multidisciplinary) type orientation. Twenty eight percent of the teaching time remains flexible for the introduction of a specialized bias. This bias is either directed toward inland fisheries (two schools), animal husbandry (five schools), or crop production (in the remaining schools). Overall the curriculum consists of 34% general education and 66% technical subjects, the proportion of lecture and practical period is 49% and 51% respectively. The SLTA-P of the Ministry of Education are oriented more toward a specialized job market and do not provide the polyvalent type orientation.

Most field extension workers are graduates of the SPP. In spite of the polyvalent training offered in these schools, the workers themselves and others identified the following basic deficiencies related to their specific assignments:

1. Extension and adult teaching methods,
2. Upland mixed farming systems,
3. Soil and water conservation technologies.

In-service training is provided primarily by In-Service Training Centers (ISTC/BLPP, BLK, BKPI) and by project level supervisors and specialists at Rural Extension Centers (REC). There are 19 In-Service Training Centers which provide learning in the following topics:

Topics	%Time 1980/81
Orientation Training	22.7 %
Basic Training	0 %
Skill Upgrading	48.0 %
Refresher Training	17.3 %
Advanced Training	0 %
Promotional Training	12.0 %

The training program for watershed development projects are more specific. For Citanduy, for example, the training program to be provided by the centers includes:

1. First year of assignment
   a. Orientation to job assignment — 3 weeks
   b. Basic Extension Training — 1 month
   c. Community development — 2 weeks

2. After 1 year on assignment
   a. Special Extension Technology — 2 weeks
   b. Integrated Farming Technology — 2 weeks
   c. Special Farming Technologies — 2 weeks

Such a program, if and when it is provided to all field extensionists, should go a long way towards overcoming their technical deficiencies.

On the job training is also being provided to field extensionists through training programs at the REC and on demplots and model farms. Agricultural Information Centers (AIC's) were set up to assist in training activities as well as to provide support services. There are 11 Regional Agricultural Information Centers and 1 National Agricultural Information Center, covering the 27 provinces, which means that one Regional AIC has to cover more than one province.

The functions of AIC are:

1. Gather, select, and organize information from various sources such as research institutions, universities, libraries, government and private institutions, farm businesses and the rural people.

2. Prepare extension material in a form suitable for printing and audiovisual purposes, and suitable to the target audiences.

3. Distribute extension materials as smoothly as possible to all units who are working in extension or who supervise extension activities.

4. To collect, analyze, and interpret data as regards the effectiveness and efficiency of the information materials that have been distributed.

5. Assist in the training activities and work together with the extension.

Since 1982/83, the AICs have related their system more closely with the extension programs run by the REC's. For this reason, the AIC has also assisted with conducting on-farm trials and of developing agricultural extension methods. The limited numbers of AICs and the fact that their programs are new means that they have not yet had full impact on raising the quality of field extensionists working in watershed areas.

Although the basic resources are available to provide the necessary training, there needs to be a greater focus by training units on relevant field problems. A number of "field laboratories" where the learning experience involving field extensionists and the farmer can be a continual one should be developed.

The second problem, which is related to the first, is the difficulty the field extensionist has in identifying specific factors which limit agricultural productivity and in reporting these factors back into the system to bring about change. There is a tendency to accept a package of practices without question. In the areas visited, some crops were growing well while others were obviously limited by low levels of soil fertility, yet fertilizer recommendations were the same. Field staff did not think it strange, nor could they explain, the results of trials in which dryland rice yields were reported at over 4000 kg/Ha while peanut yields in the same area were 250 kg/Ha. Though one can not expect the extensionist to be a specialist in all areas, they should be trained to be more observant and analytical in their evaluation of program results and farmers needs. The field "laboratories" mentioned above should be helpful in improving these skills.

The third problem which the field extension workers face is their youth. Many of them have been appointed to their tasks within the past 5 years and some of the more experienced ones have moved up in the hierarchy to higher levels. Consequently, as a group, they are young and relatively inexperienced. Although this problem cannot be completely resolved by training, improving social awareness and skills in working with farm groups would help. It should also be recognized that as farmers become better educated, there will be a need to raise the academic level of field extensionist. Diploma (So) level program should be developed to fill this need.

The field extensionists interviewed had very positive attitudes, were eager to do their job well, and recognized the need for improving their capacity to work effectively with farmers. They present an important resource for the future development of watershed projects.

The Extension Supervision (REC level)

The Rural Extension Center (REC/BPP) is the primary administrative unit from which field extension services are provided with supervision by the middle level extension workers (PPM's). Generally there are 2 types of middle level extensionist who work at this level. They are:

1. The PPM-extension supervisor for BIMAS.
2. The PMP-extension supervisor for the watershed project.

The PPMs at the REC level are generally appointed from senior field extension workers and are graduates of agricultural high schools. A few are graduates of agricultural academies or universities. Their roles are defined by AAETE are as follows:

1. To develop agricultural extension programs at REC level.
2. To guide and supervise the activities of field extension workers.
3. To manage training and demonstration farms.

4. To evaluate the implementation of extension programs and give recommendations for improvement.
5. To manage the REC as a whole which comprises the building, land, facilities, and agricultural extension activities.

Although the primary role of the PPM is not to act as specialists, they should be able to provide some support to the field level technicians because of their experience and additional training in short courses and in service seminars or workshops.

The following basic deficiencies are faced by PPM's in carrying out their duties.

1. Basic techniques of management and supervision.
2. Agricultural extension programming.
3. Evaluation of extension programs.
4. Upland farming systems.
5. Watershed management.

In service training and upgrading of professional qualification are needed. The ISTC's and AIC's have programs to help overcome these deficiences. For example the Citanduy Project is planning the following program to be offered by the ISTC within the first year of assignment.

1. Extension Program Development (1 month).
2. Supervisory training (2 weeks).
3. Water Management at the farm level (2 weeks).

These programs should help to overcome technical difficulties of the PPM but consideration should also be given to raising levels of academic training for these staff to the Sarjana (S_1) level as the general educational level of field workers improves.

In-service training and upgrading of professional qualifications are needed and are being planned to overcome these deficiencies. These

activities will be discussed in a later section. The REC visited had active programs in progress and the PPM's were doing good work in spite of deficiences which they also recognized.

The Extension Specialist (Project Level)

The extension specialists working in the watershed area include the following:

1. The PPS-extension specialist for BIMAS and for agricultural services.
2. P3RPDAS PPS - heads of sub-centers.

The extensionist at this level usually has an Ir or equivalent and a few have graduate degrees. The basic responsibilities of the PPS are:

1. To bridge research activities and farming practices.
2. To backstop field extensionists by means of material and methodology improvement.
3. To backstop program development, implementation and evaluation at the REC level.
4. Assist the head of the agricultural services in developing agricultural programs.

These specialists are relatively well trained in their specific discipline but have some deficiences in knowledge and skills needed to fulfill their tasks in the watershed programs. These are:

1. Watershed management principles involving integrations of disciplines in upland mixed farming systems.
2. Extensions program development and evaluation.
3. Field demonstration or action research.

Although it is not expected that extension specialists should become researchers, they should have closer contact with research programs and

work with researchers in developing effective field demonstrations which show a variety of practices. Both in-service and academic programs are to improve the capacity of PPS to carry out their tasks. Training programs beeing projected include:

1.	Orientation to job assignment	(2 weeks)
2.	Extension methods	(2 weeks)
3.	Watershed management	(3 weeks)
4.	Special professional training	(1 month)
5.	Trainer training	-

In general these programs especially watershed management, appear to be too short and too all-"inclusive" for a specialist. It is difficult to see how 8 subjects including terrace constructions techniquas, land survey and mapping, basics of hydrology, etc. could be covered in more than an introductory way in 3 weeks. At this level a greater degree of specialization is required. Further academic training is also needed for staff at this level.

Other problems faced by extension specialist are that frequently critical disciplines are not represented on the specialist staff or if it is represented the support is provided from other programs which demand almost all the specialist's time. This problem will be discussed in more detail under the section on institutional constraints.

Planning and Technical Staff (Project Level)

The professional staff required to provide analytical, planning and technical support for watershed projects include such areas as watershed planning, conservation engineering, survey and mapping, and nursery supervisors. Disciplinary support is provided by specialist staff. Most of these staff have Ir degree and a few have graduate level degrees.

Indications were that the greatest need in this area is the development of analytical skills needed to adequately evaluate existing

resources and to develop integrated plans for watershed development. In some instance, improved technical skills such as soil and water engineering, economic and social sciences and land survey were limited. The upper Solo watershed had benefited from an intensive training program in these areas under FAO Solo I.

Both in-service and academic training activities are being used to upgrade staff in these positions. Not enough emphasis is being given to this area of training.

Researchers (Project Level)

Research is being conducted in the watershed areas by on-going programs of the Agency for Agricultural Research and Development, by AARD staff seconded to watershed development projects and by national and international contractors. The largest research group specifically assigned to carry on watershed research is P3DAS in the Upper Solo Watershed. However, this group appeared to be underutilized. The major problem with research activities relates to lack of facilities, staff, and institutional support needed to focus research on local problems.

Administrative Staff

Other important groups relating to the further development of watersheds are policy makers and heads of administrative units. It is essential the Camat, Bupati and other officials be given intensive training on watershed development problems to acquaint them with the program, to orient them toward development processes, and to win their understanding and support.

3. Manpower Requirements

Development programs and educational institutions in Indonesia are growing rapidly, thus the data base for projecting manpower demand and

supply is constantly shifting. Past experience has shown that manpower projections are often outdated before they are published. However, it is important to establish estimates of needs and potential supplies of manpower for programs which are to expand as rapidly as is upper watershed development.

Manpower Demand

In order to make projections for technical and professional manpower demands for upper watershed development, a few basic assumptions are made:

1. That 35 priority watersheds will be developed to at least the present level of the Citanduy project by 1989/90.

2. That an "average" watershed will be represented by 500,000 heads of household.

3. That the ratio of professional staff to technical staff to farmers needed to implement the program is as follows:

Ratio	Number for One Watershed	
PPS/PPM = 1/10	10 PPSx10 = 100 -	PPM
PPM/PPL = 1/5	100x5 = 500 -	PPL
PPL/Key Farmer = 1/10	500x10 = 5000-	KF
Key Farmer/Progressive Farmers 1/20	5000/20 = 10,000 -	PF
Progressive Farmers/Late adoptors 1/5	10,000x5 = 500,000	HH

4. That with each unit of this size there would be a need for 100 Technicians to work as research assistants, nursery operators and check dam technicians.

5. That 8 headquarters professional would be required.

6. That an average of 5 research staff would be needed.

The total requirements of technical and professional staff for the entire programs at the project level would be:

1. Technician SPP level		
a. 500 x 35	= 17,500	PPL-Field extensionists
b. 100 x 35	= 3,500	PPM-Extension Supervisor
c. 100 x 35	= 3,500	PPL-Technicians
Total	= 24,500	
2. Professional Ir level		
a. 10 x 35	= 350	PPS-Extension specialists
b. 5 x 35	= 175	Research workers
c. 8 x 35	= 280	Headquarters Professionals
Total	= 805	

The ratio of PPL to farm families used in these estimates are lower than those used for BIMAS rice projects because of the greater complexity of upland mixed cropping systems. However, the ratio is still very high at 1/1000. Actually, it is more practical to think in terms of 1 PPL to 200 farm families who participate in the farm groups. This provides direct contact with 20% of the total population. Others would be reached primarily through mass media and through contact with progressive farmers. However, this would mean that the systems for supplying inputs i.e., seeds, fertilizer, credit, etc. would need to be very well developed to meet the requirements of the larger group.

Qualification and Training Requirements

This subject has been covered in some detail in an earlier section but is reviewed in relation to type of training and numbers.

Following is a listing of numbers by position and level of training.

Position	Polyvalent + ISTC	Diploma + ISTC	Sarjana + ISTC	Graduate Degree
Field Ext. Worker	17,500	3,500	---	---
Field Technician	3,500	1,000	---	---
Ext. Supervisor	2,500	2,500	1,000	---
Ext. Specialist	---	---	350	100
Headquarters Professional	---	---	280	100
Researcher	---	---	175	100
Total	23,500	7,000	905	300

The above numbers are based on an assumption that all staff will be given the basic pre-service and in-service training required at present and that approximately 20% in each category will be upgraded to the next level.

The field extension workers would continue to receive polyvalent or general training to enable them to work with farmers on a wide range of problems. The implications of this are that assistance for resolving specific problems must come from a good program of support from the specialist staff supplemented by support from the Agriculture Information Center (AIC). Field technicians who operate nurseries, serve at check dams, etc., would not necessarily be required to be polyvalent. They would be required to have specialized training related to their assignment. Extension supervisors need polyvalent training plus supervisory and management skills.

At least the following types of training would be represented in the professional level staff.

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Extension Specialist	Headquarters Professional	Researcher
Extension and Training	Watershed Planning	Cropping Systems
Upland cropping systems	Conservation Engineer	Soil/Water Engineering
Soil and Water Cons.	Surveying/Mapping	Animal Science
Animal Science	Numerical Supervisor	Farm Management
Forestry	Rural Sociology	Forestry
Farm Management		
Estate Crops		
Fisheries		

In some areas more than one person would be assigned to make up the full complement of staff and there would be a significant amount of interchange among headquarter, extension and research staff.

Potential Supply of Staff

Technical - A recent report *)indicated that middle-level technical manpower would be in short supply through the mid-1980s and that standards of agricultural technicians need to be raised. The report has stimulated the government to undertake additional studies to ascertain the magnitude of effective demand for agricultural technicians.

Based on 1980/81 data, the operating SPP schools totalled 91 of which 19 were national, 51 were local government (provincial or district) and 21 private. The total enrollment in the system was 22,465. A further six national S.P.P. are coming into stream and in addition it is expected that a small annual increase in private schools (accredited by the AAETE) will occur. Future enrollment will thus rise by an additional 2,880 places coming from the 2nd Agricultural Education and Training Project (No. 1692 - IND), plus an incremental growth of approximately 720 places from accrediting additional private and local government schools. A projected future enrollment of 30,500 is thus indicated for 1988/89.

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*) Indonesia: Technical and Professional Manpower in Agriculture, Report 3249-IND, IBRD, August 1981

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Teachers are divided into two basic types, part time and full time. Part time teachers are of value to the system as they help in many cases to strengthen linkages between the other Directorates General of the Ministry and the AAETE and also in ensuring that course content relates closely to actual field practice. Based on 1980/81 data, the national schools had 182 full time teachers and 233 part time teachers while the remainder of the schools employed 587 full time teachers and 812 part time teachers. The teacher pupil ratio based on full time teachers was 1:24 in the national schools and 1:31 in the non-national. The qualifications of teachers in the national schools are high with 35% having Sarjana degrees and 43% Sarjana Muda, but in the other schools the qualification level is lower with 14% only having Sarjana degrees and 50% Sarjana Muda. In both cases the remainder of the teachers have had only a basic grades 10-12 secondary education, usually within the SPP system.

Through the resources provided by the 1st and 2nd Agricultural Education and Training Project, the national SPPs are now operating at a quality margin considerably above the majority of the non-national schools. This quality margin is the result of better facilities in terms of science laboratories, school farm development, equipment, and better teaching aids. The quality margin can be quantified through an examination of the relative output efficiency of the two components of the S.P.P. system. In 1980/81, the pass rate at graduation was 98% in the national schools as against 78% in the non-national schools.

As on a numerical basis total enrollment in national schools was 4,371 against 18,094 in the non-national schools, this low graduation rate in non-National schools has serious consequences in terms of the output of the overall system. One strategy to improve the quality and internal efficiency of SPPs is to continue and extend the assistance to selected individual provincial SPPs in the form of teacher training and practical facilities and equipment.

In addition to the programs mentioned above the Asian Development Bank is presently studying the possibility of providing support to the

further development of high schools, including teacher training, and to the further development of Polytechnic (Diploma) programs.

Based on the above mentioned improvements, revised World Bank estimates show only a 3% gap on a total demand for 146,300 middle level technicians by the end of Pelita IV. These projections included large increases for several agricultural service areas which will play a major role in future watershed development. Data is as follows:

Service	1980/81	1988/84	% increase
Forestry	9,900	31,760	320%
Estate Crops	16,200	39,470	240%
Livestock	6,900	14,030	200%
Food Crops	22,500	37,440	166%

The total increase projected for these areas between 80/81 and 88/89 is 39,200 compared with the calculation of 17,000 additional middle level technicians needed for the watershed development program.

Diploma programs were initiated in 1980 and have already grown to an estimated number of 2000 in training at the present time. Since these programs are developed largely "on demand", it is likely that the annual production of these programs will approach 5000 per year by 1988/89, provided demand is high enough and planned facilities and teacher training support are available.

In summary, it appears that the supply of middle level and upper middle level technicians will be limited by the end of Pelita IV but that the needs of high priority programs can be met.

Professional level - The 52 agro-complex faculties in Indonesia have been growing at an accelerated rate. The Sarjana level (S_1) student body has been growing at a rate of 23%/year over the past decade and the universities are projecting continuing growth rates of 8-10%

annum. The output by 1988/89 could easily exceed 10,000/year. Graduate programs are also growing rapidly, expanding from fewer than 100 students in 1975 to over 1000 in 1982/83.

It is also significant to note that in addition to the traditional curricula being offered in the universities, a substantial expansion of offerings are taking place. For example, IPB is proposing to initiate an agricultural extension curriculum by 1984. This would train extensionists as opposed to agronomists with a course in extension, etc. Also more emphasis is being given to multidisciplinary curricula, and graduate activities in such areas of environmental studies and farming systems.

World Bank estimates show a positive balance in the supply of professional level graduate. However, these projections do not reflect the substantial level of upgrading of positions which is likely to take place in the next decade. The conclusion is that emphasis must continue to be given to higher agricultural education if demands for professional level manpower are to be met but that, as with technical manpower, the needs of priority programs will be met.

In-Service Training - As curricula in agricultural high schools and universities are adjusted to more adequately meet needs for technical training, the work of the ISTC's and AIC's can be concentrated on upgrading and field level training. There are 19 ISTC's (BLPPs) covering non-specialised agricultural in-service training. In addition there are 5 centers specializing in fisheries (BKPIs), 6 centers for forestry training (BLKs), and 2 centers for animal husbandry. The capacity of the existing centers is as follows:

BLPP	1,500 (including Ciawi and two animal husbandy ISTCs)
BLK	540
BKPI	360
	2,400 places

The training is carried out on a daily basis with each day being made up of 9 sessions of 45 minutes each for five days a week plus 6 sessions of 40 minutes each on Friday. The weekly total sessions is thus 51. Each center operates for 40 weeks in the year allowing for 240 training days per center. The total through-put capacity of existing centers is thus 2,400 X 240 per annum or 576,000 trainee/days. In 1980/81 seven new centers of 109,200 trainee days were not in function (under construction) so that the existing capacity was 576,000 - 109,200 =466,800 trainee days. In comparison, in 1980/81 the through-put totalled 350,092 trainee days. The effective efficiency of the overall system was thus 350,092: 466,800 = 75%, which demonstrates a high level of management efficiency within the system.

Regarding the type of training given in 1980/81, in general agriculture 28 different topics were covered for a total of 4,035 participants; forestry, 34 different topics and 2,772 participants; fisheries, 10 topics and 804 participants, and at the national center (Ciawi), 13 topics and 544 participants. The total number of participants in the in-service system during 1980/81 was 8155 against an estimated total staff of 74,600, or in broad terms, one person out of nine received some form of in-service training during the year, with an average course duration of 52 days. Thus the capacity of the training system is sufficient to provide each member of the Ministry of Agriculture with 6 days of training per annum.

The Agricultural Information Centers are also valuable in-service training units. As was pointed out earlier, they not only assist in preparing extension information and materials for use in teaching and mass media activities, but also assist in training at the REC and in field demonstrations. An information center has an officer in charge. Under the AIC are a group of extension specialists and administrative support personnel. The number of existing subject matter specialists (SMS) totals 42 persons, some of them having master's degrees in education, and the rest either university or academy graduates, an

average of 4 SMS in each AIC. Based on their educational background, their respective specialization can be determined. There are 12 kinds of specializations, e.g., Agronomy, Horticulture, Fresh Water Fish Culture, Animal Husbandry, Poultry Management, Veterinary, Farm Mechanics, National Resource Conservation, Agricultural Economics, Post Harvest, Home Economics, and Fishing Facilities.

Each center every year has a projected average output of 10 folders/leaflets, 6 posters, 6 brochures, 4 bulletins, 10 series of slide and still photo albums, and 15 recordings for rural broadcasting. The extension materials produced by AIC are disseminated throughout their working areas which include the various agricultural services, the various research institutions from which they gather the information, the SPPs, the ISTCs, and agricultural extension workers.

In view of the important role the AIC can play in providing direct support to the field extension staff and the potential for developing more effective programms using mass media, these units need to be expanded to at least one per province if they are to provide the level of support needed. Both the ISTC and AIC are needed to maintain in-service training requirements.

Organizational Constraints to Effective Use of Manpower

Although other members of the team were responsible for studying institutional arrangements, the sub-team for human resources considered some problems which relate to effective manpower use.

Distribution of Effort

During the past two decades government policy has determined that major emphasis be given to the development of lowland agriculture, primarily rice. As a consequence, programs, staff, and facilities have concentrated in the lowland areas. The fruits of these efforts are

evident in the increased production of rice. In spite of the great progress which has been made in these areas, a large agricultural support system is still needed. Thus, it is unlikely that emphasis will be shifted from these areas but it should be expanded to include the upland areas. Improved management of these areas is important not only to the upland farmer but also to the lowland farmer who shares in the consequences of upland degradation.

In order to show the present imbalance in personnel assigned to upland and lowland areas the following data from the Citanduy Watershed will serve as an example.

Kabupaten	BIMAS PPM	P3RPDAS PPM	BIMAS PPL	P3RPDAS PLP
Tasikmalaya	20	2	96	9
Majalengka	20	-	117	-
Kuningan	12	1	75	5
Cilacap	20	4	80	20
Ciamis	32	5	145	25
	104	12	513	59

These data show a ratio of BIMAS to P3RPDAS staff of approximately 9:1. Although some of the BIMAS staff are working on upland agriculture, it is estimated that at least 90% of them work in lowland agriculture.

Another related problem is that the REC's are most frequently located in areas where they serve lowland agriculture more effectively than they do upland agriculture. This problem was raised in every watershed area visited by the team.

Coordination of Extension at the REC Level

Coordination of extension programs at the REC level is extremely important. This is the level at which programs directed toward the farm

community are either integrated in a unified system of mutually supporting activities or are presented to the community as a bewildering array of separate activities. The fact that personnel working at this level represent a wide range of agricultural services and projects, different sources of funding and different lines of command, would indicate that coordination at this level will be difficult.

The distribution of field level personnel among agricultural services and P3RPDAS in Citanduy indicates a large and diverse effort on the part of government in this area. The distribution is as follows:

Agencies	Number of PPL
Food Crops	222
Forestry	117
Small Holders	64
Livestock	13
Fisheries	16
P3RPDAS (PLP)	59

The problem of coordination is further complicated by the fact that 3 coordinating bodies with supervisory responsibilities exist at this level, they are the REC with PPM supervisory staff, the P3RPDAS sub-center with PINLAK, and the UDKP under the Camat. There is a possibility that this problem will be accentuated when the P3RPDAS falls under a separate Ministry from the Agricultural Services.

In practice, coordination of extension activities by the REC appears to be strongest but the degree of coordination is quite variable. The REC's visited in Gunung Kidul and Citanduy seemed to be functioning quite well. In other areas they seemed to play a limited role. Since only a few Rural Extension Centres were visited, this observation is subject to considerable error. However, one thing is certain, coordination of project implementation at this level is extremely important. Since this is the level which involves the largest number of people and is the level

at which the farmer and project interact a strong, a well organized coordinating unit which can backstop the staff in the center is needed.

The Agency for Agricultural Education, Training, and Extension (AAETE) of the Ministry of Agriculture was established under Presidential Decree No. 44/45 in 1974. The Agency is charged with the formulation of policies and plans for coordination of agricultural education, training, and extension and to implement programs in liaison with the various Directorates General of the Ministry of Agriculture. According to this decree, AAETE should exercise a coordinating role between the existing services and special projects at the Rural Extension Centers. The fact that AAETE also has a strong base for supporting extension activities through training (ISTC) and information services (AIC) would support this approach.

Effective use of personnel and mutual support of programs would be strengthened by a unified program of extension which could be effective across service and project lines.

In order for such a system to function effectively, there is also a need to establish a functional career program in extension. In spite of the important role that extension plays in the implementation of agricultural programs, there is no formal career program for extension. As a result, it is more difficult to get qualified persons to enter this activity, and there is a significant drain of extensionists into other services. A strong career program which provided improved uniformity, professional identity, and stability would do much to improve the effectiveness of extension work.

Field Support to the PPL

Most of PPL have, or will have, general or polyvalent training. In view of the fact that they must deal with farmers on a wide range of subjects, this type of training is most useful. However, it means that

he must depend on others to backstop him on special problems. The present structure places specialized help at the kabupaten level where the specialist has to backstop up to 50 PPL spread over a large area (based on the ratio of 1 PPS/10 PPM and 1 PPM/5 PPL). Actually, if there were 5 PPS representing 5 disciplines, then each PPSs would have to respond to problems in his discipline experienced by 250 PPLs. This represents a weak link in the chain.

Organization of Training Programs

Several institutions and agencies are involved in training technical and professional manpower. These include national agricultural high schools, provincial agricultural high schools, the ISTC's, the AIC's, project staff, and universities. Although each institution fills a defined slot in the training program, all study programs and the appropriate relationships between them are not studied and adjusted often enough to take the needs of new programs into consideration. Consequently, field workers may have to take technical training as an in-service activity when it should have been given in his pre-service program. Adjustment in the program would permit him to spend his time in-service more effectively, concentrating on field activities as opposed to classroom training. A system for coordinating these activities is important.

In addition to the coordination of programs of instruction there is a need to organize activities in schools to increase their contact with field activities of watershed development projects. The agricultural high schools have little or no contact with upper watershed activities while they receive considerable exposure to lowland agriculture through direct visits and through contact with teachers who work part time in the Agricultural Services.

Universities have developed some activities, most notably those of the Environmental Studies Centers, which are directly tied to watershed

projects through the Ministry for Environment. However, these activities involve only a small part of the Universities' applicable expertise. As the professional staff of watershed projects are provided with opportunities for graduate studies, a program of fellowships and research support should be developed to involve them and their professors in research activities in cooperation with the research agencies in the field. Such programs are already being used by the Ministry of Agriculture in other areas. The output of such activities would be training, research, and improvement (increased relevance) of curricula of the University.

5. Recommendations

In order to meet the demand for manpower for watershed development programs, the following recommendations are made.

1. Technical Level Manpower

   a. The government's three point strategy to accelerate teacher training, strengthen and consolidate agricultural high schools, and develop post secondary diploma programs should be implemented.

   b. The curricula for the agricultural high schools should be adjusted to give more attention to the needs of field personnel in watershed development. This should place greater emphasis on:

      1) Upland mixed farming systems.
      2) Basic soil and water conservation.
      3) Agricultural extension methodology.

   c. Field and classroom contact between P3RPDAS staff and agricultural high school students should be increased through class visits to watershed areas and the use of P3RPDAS staff as guest lecturers.

d. Diploma(So) curricula should be developed to meet the needs for upgrading polyvalent extensionists in such areas as:

1) Upland mixed farmer systems.
2) Rural communications.
3) Extension methodology.

2. Professional Level Manpower

a. The Ministry of Education's efforts to expand and improve the system of higher agricultural education in Indonesia, which places emphasis on staff and facility improvement, the development of a system of unified curricula, improvement in terms of efficiency and increased enrollment, should be continued.

b. Curricula of sarjana level programs should be strengthened in such areas as soil and water conservation, agricultural and extension education, rural communications, upland farming systems, and community nutrition and family resources, in addition to traditional disciplinary areas.

c. The graduate level programs should be more directly involved in training staff of watershed development projects and in broader participation in research and public service activities through their centers for Environmental Sciences, Community Development, Economic Research, and Farming Systems.

3. In-Service Training

a. Plans to strengthen Agricultural Training Centers and to expand Agricultural Information Centers to put at least one AIC in each province should be implemented.

4. Organizational Considerations

a. A coordinated effort should be made to expand programs of watershed development. This would include not only the expansion

of P3RPDAS activities but also the activities of the agricultural services such as the secondary crop improvement program of the Directorate General for Food Crops.

b. An effective means for developing and implementing unified extension programs at the "working community" level should be developed. The team recommends that strong consideration be given to using the Rural Extension Center as the point of coordination and that AAETE's role in coordinating activities at this level be strengthened.

c. Consideration should be given to providing technical staff with specialized training to assist extension specialists in improving support to PPL-PLPs.

d. A technical coordinating committee, made up of representatives of high schools, projects or services, training centers, and universities and chaired by AAETE, should be appointed to develop an effective unified system of instruction for field personnel.

TECHNICAL APPENDIX VIII

INSTITUTIONAL DEVELOPMENT

comprising

I. BENEFICIARIES PARTICIPATION

by M.P.S. TJONDRONEGORO

and

II. INSTITUTIONAL ARRANGEMENTS

by D. KING assisted by D. KORTEN

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APPENDIX VIII-1

TECHNICAL REPORT: BENEFICIARY PARTICIPATION

by M.P.S. Tjondronegoro

A. Assumptions

One of the basic assumptions made in this report is an acknowledgement of the undeniable implication of beneficiary participation in the Pancasila State ideology as well as in the basic policy guidelines (Garis Besar Haluan Negara) of the current Pelita III as well as the forthcoming Pelita IV. Thus, beneficiary or popular participation in specific project areas has been desirable not only for ethical and moral reasons, but also for functional, utilitarian reasons.

Experiences of over three decades in Indonesia as well as other developing countries have clearly indicated that without participatory processes which involve the poor majority in the design and implementation of development policies, such policies are unlikely to achieve their declared goals. As a consequence, the poor majority are unlikely to benefit from them in any substantial way.

Thus, beneficiary participation appears not only as an ideal but also as a necessity in terms of organized struggle of the poor for more favourable terms of incorporation and for improvement in livelihood prospects. To avoid fostering the term beneficiary or popular participation as the current catchword, or maintaining research as merely bureaucratic operation, more direct involvement of the beneficiaries is crucial, at the very least to provide the necessary information required for planning .

In any given project or program the beneficiaries are far from being a homogeneous group of farmers. At the implementation stage, the various sub-categories of farmers need to be properly identified in order to enable a more differential and, therefore, appropriate design and application of improved technology.

B. Village Level

In Indonesia the "farmer based" or "participatory" approach practiced in many rural programs has been based on the assumption that the village is the most viable and effective social unit. From past research findings and experiences in project implementation, this assumption has been called into question. Although the villages are still the most viable administrative units, sociologically they have become in many instances more class divided and even exploitative than is often admitted.

Many case studies and surveys on the green revolution, nutrition, family planning, irrigation and community development, have concluded that the sub-village units, i.e., dukuhs, kampongs or hamlets, have greater viability. Experiences of the PSL-ITB in Cigaru and of the FAO-2 project in Gunung Kidul (SW1 and SW3) seem to underline the above conclusions.

For future project design it seems to be more important to pose and answer such questions as: (a) what are the existing rural units of settlement through which popular participation can be achieved; (b) which settlement units are not in themselves class divided and exploitative, and (c) what legitimacy do these rural units have for defending or advancing customary rights and livelihood or for staking a claim to fair shares in technological advance?

The majority of rural projects trying to reach the beneficiaries at the grasroots level in Indonesia have been using bureaucratic methods. Indeed, unless created in the near future there are few alternatives,

since voluntary farmer's associations of some size at village or lower levels have been non-existent for the past 15 years or so.

On the one hand, clause no. 19 of Law No. 4 of 1982 on the Basic Provisions for the Management of the Living Environment seems to open wider opportunities for non-governmental organizations to participate in government financed and sponsored development programs and projects. On the other hand, Law No. 5 of 1979 on Village Administration forms the basis for strengthening village bureaucracy.

There are also other ways to stimulate beneficiary participation. For instance, the growth of local functional or interest groups under guidance of involved non-formal leaders could be stimulated and such groups could be given representation in the LKMD, now often chaired by the village headman. If the LKMD is to function as a democratic institution at village level it may well be advised to make the villagers more familiar with a bi-pillor leadership structure so that dialogues about needs and interests of all the community will be facilitated. The present monolithic leadership structure at the village level seems to discourage rather than promote community dialogue.

No doubt the low levels of education, as well as widespread ignorance of new technological inputs, call for very intensive education, training and extension by "motivators" rather than by extension workers who are often perceived as government officials. Group leaders selected on the basis of their field performance and access to LKMD could form a better alternative.

It is a generally agreed that a whole array of existing 'curricula' for training courses and formal education for PPLs, PLPs, PLRs, etc. should be reviewed and accommodated with the future needs of strengthening a watershed management agency at micro-level, i.e., localities (see Technical Report on Human Resources). Extension and training in the field may be directed to farmer beneficiaries on the

basis of a common settlement unit such as RK (Rukun Kampung) or RT (Rukun Tetangga), or on the basis of adjacent landholdings somewhat distant from their homes. For extension purposes, the location of a demonstration plot closer to the farmers' landholding, preferably on farmers' fields, may be more effective as it would involve them as direct cooperators.

C. Bridging the Gap

So far the planning activities of P3RPDAS have been carried out at BAPPEDA I level with a few examples also at BAPPEDA II levels, e.g., DAS Citanduy. Although P3RPDAS also gathers information at grassroots level through LKMD and the village headmen, a strong impression was left that the beneficiaries themselves have little stake in the planning process, or in the process of implementing plans.

The distance or 'gap' between kabupaten and village level given the slow-moving bureaucratic mills is often a great handicap to quick problem solving at the micro-level where the beneficiaries are directly involved. Success or failure of a project often is determined by the inability to synchronise actions and/or human interventions.

The above recurring phenomenon in project implementation has given rise to complaints such as: "the implementation of target-driven projects, frequently with a simultaneous introduction of new technologies, is top-down (instructional) channels, rather than following social process". In contrast, it may be recalled that the FAO I (Samin Watershed Project) of the early 1970s and the Cigaru (upland terracing) project form salient alternatives to standardized top-down approaches.

To bridge the 'gap' between the higher level BAPPEDA's and the 'micro locality', thoughts have been given to the possibility of activating a kecamatan level coordinating agency for village development known as the Unit Daerah Kerja Pembangunan (UDKP). Such UDKPs have been dormat almost since their inception in the early 1970s (Pelita II), suffering from a lack of technical personnel, funds and the necessary 'extent of autonomy'.

If a better alternative within the given administrative structure is anticipated, however, the role of kecamatans needs to be enhanced and brought closer to the micro-locality. It is at this level also that the P3RPDAS should be communicating most intensively with a number of aides of the Camat (mantri), not only for information gathering necessary to planning, but also for actual supervision in implementation.

D. Project Status and Bureaucracy

Precisely because in the past rural development projects have come with considerable inputs and subsidies from the government, the perception among farmers and villagers has emerged of an open-handed and lavish 'father state'. Apart from the fact that project status carries fringe benefits for the bureaucratic apparatus, a more serious consequence is that operations cease with the termination of the project. In other words, project management has not become institutionalized and the bureaucratic apparatus is not sufficiently prepared to routinize operations as well as funding in the post-project period.

The above problems present additional reasons to involve beneficiaries from the very beginning of project management. While speedy institutionalization at the beneficiary level suggests itself as the best alternative to bureaucratic project management, external subsidies should be kept to the minimum necessary. Where such subsidies are unavoidable, for instance in many critical areas (e.g., terracing in Gunung Kidul and Kulon Progo, or in the Solo watershed), a rule should be imposed to give priority to subsidies or rewards in kind rather than in cash. Fortunately this practice is gaining popularity in the day-to-day operations by Pemdas as well as P3RPDAS. The weak point here is that the bureaucracy must exert supervision and control over quality, both of work and of subsidies in kind.

The idea of stimulating consultations at the BPP kecamatan level is strongly supported. It could even perform a more useful function if also

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farmer beneficiary groups could join such consultations so as to make the BPPs an open forum for extension workers and group representatives.

In addition, LKMDs should increasingly involve interest group participation and representation, thus balancing more formal institutions such as the pamong desa and kecamatan level agencies. Intensified education and effective extension could and should strengthen LKMDs over time.

E. Coordinator and Beneficiary Participation

In the current watershed management projects, there exists ambiguity in the sense that the planning, guiding and supervising P3RPDAS has limited command over the funds for implementation which are channelled through the Governor. The question arises which agency is the factual coordinator; from on the spot interviews with farmers it appeared that the beneficiaries have come to understand the project as a P3RPDAS undertaking.

If in the near future the structure of management will be under the direct coordination of the Ministry of Forestry, the question may be raised to what extent other Ministries such as Public Works, Home Affairs, Population and Environment, and Agriculture can be coordinated. Experiences with BIMAS and Transmigration indicate that such a national level coordination should find a common umbrella under a Presidential Decree. The relative weakness of a new-born Ministry, however, suggests that operations may be less effective than they have been as a project.

In the administrative structure of Indonesia, autonomy has been allocated to provinces and kabupatens, which implies that they are sole coordinators in their respective regions. Even national programs from Jakarta have to be accounted for by both the administrative levels above. Moreover, regional development, of which watershed development is a part, falls under the Department of Home Affairs. In the longer term

perspective, particularly when programs and projects cease as such and become routine operations, Home Affairs and the Pemda, although in coordination with sectoral agencies, will still be held responsible. This vital consideration therefore suggests that coordination should be in the hands of Pemdas and Bappedas.

Given the special requirements for micro-locality management and the distance between kabupatens and the beneficiaries at sub-village level, it is suggested that kecamatan level agencies should be gradually activated, strengthened and presumably equipped with a greater degree of competence. Meanwhile, every effort should be made to activate and strengthen LKMDs as perhaps the key vehicle for more direct participation of farmers and sub-village institutions.

Often the organizational structure underlying the Bimas program in the country has been used as a successful example of top-down management. However, there have been a significant number of comments as to the high price that the country is paying for maintaining that management. The argument has run against creating another such structure, which the country could hardly afford. The "beneficiary participation" approach, relatively less structured but requiring higher quality personnel, well-motivated and devoted, presents itself as the most desirable alternative "mode of rural development".

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TECHNICAL REPORT:
INSTITUTIONAL ARRANGEMENTS
by D. King assisted by D. Korten

The basic institutional issue in any development effort is to achieve a suitable fit between the institutional requirements of the tasks to be performed and the institutional structures through which those tasks must be accomplished. This presents a particularly challenging problem in the area of watershed development because the task is so complex and far reaching and presents demands to which few existing institutional structures are designed to respond. Available experience and theory suggest that the basic approach must involve achieving highly sensitive micro-level adaptations to local soil and water conditions which are possible to achieve only at the lowest operational level--specifically the level of the farmer, group of farmers on a single hydrological unit, and the village. Since integration must take place around the specific characteristics of the local micro-environment, decision makers at higher levels cannot deal with the amount of variety involved. Unlike monoculture cropping system, such as rice, where the range of input choices are limited, the range of technical packages and associated input choices for upland agriculture farming systems are much broader and must be tailored to fit the particular agro-climatic, social, and institutional environment in which they are being introduced. Given the range of choices involved, it is simply not feasible to manage upland agriculture programs in a centralized manner. A decentralized management structure which places responsibility and authority at the appropriate lower levels of government is the only practical way of managing the diverse conditions and specific needs of the upland areas in each watershed.

The second principle which should govern institutional arrangements for watershed development flows logically from the justification for decentralized management. If the responsibility for watershed development is most appropriately placed at provincial or lower levels of government, officials at those levels need to be vested with sufficient authority, including effective budgetary control, to ensure the unified and coordinated management of the various human technical and financial resources that are required for successful introduction of improved practices. The resources required for watershed development (e.g. research skills, extension, and credit) reside within several technical, line ministries. All of these resources must be mobilized and allocated in an integrated manner if a sustainable process of upland development and watershed conservation is to be achieved. The magnitude and severity of upland degradation together with the pressing need for unified management for effective conservation interventions in uplands requires giving serious attention to strengthening the management capacity of local governments.

The final principle essential to successful execution of a watershed development program is budget and credit systems that are sufficiently flexible to accommodate inevitable variation found in any effort to introduce technology in diverse agro-climatic zones and to farmers with varying income levels, sources of employment and attitudes toward risks.

Decentralization, unified, interagency management and flexible budgetary and credit systems are thus desirable goals in and of themselves, and they can also be viewed as dimensions of variation on which three existing projects can be assessed.

I. DECENTRALIZATION

A. The National Regreening and Reforestation Program (INPRES)

A program to rehabilitate critical lands begun in the late 1960's by the Department of Agriculture provided for replanting of forest lands (reforestation) and a 33% subsidy of the cost for treatment of private land (greening). This "Program for Safe-guarding Forest, Land, and Water" continued in Repelita I with minor changes which gave greater responsibility and budget control to the local level.

In 1974, with the beginning of Repelita II, the program became the Reforestation and Greening Program, with funding for implementation provided as assistance to the regional governments under Presidential Instruction (INPRES). Guidance for implementation was provided through a joint decree of six Ministers: Home Affairs, Finance, Agriculture, Public Works, the Minister of State for Development Supervision and Environment and the Coordinating Minister for Economic Affairs/Chairman of BAPPENAS. A joint instruction issued by the Ministers of Home Affairs and Agriculture provided more detailed guidance.

Under the joint decrees and instructions, responsibilities for reforestation and greening are assigned to the provincial and district (kabupaten) levels of government. The Governor (as chief representative of the central government), is responsible for supervision of the program and implementation of reforestation. The District Chief (as representative of the central government and head of the second level autonomous region) is responsible for supervision of the program and implementation of greening. In addition, an organization (P3RPDAS) was established, under the Directorate General of Forestry, for planning, guidance, and evaluation of the program on behalf of the central government with operations in the provinces and districts. (See Figure 1)

There is a fundamental division in this program between the institutional structure for planning, supervision and evaluation, on the one hand, and the structure for implementation on the other. Planning and supervision are managed through a single directorate of the Ministry of Agriculture (MOA) and its field offices (P3RPDAS) in 35 watersheds.* These functions are financed directly by the national budget (APBN) through the regular proposal-authorization (DIP) process. Staff are paid by and responsible to the central directorate or its representative in each watershed. The head of each P3RPDAS manages field operations and controls financial allocations (pimpro). The central government determines the level of effort in each watershed, uses to which funds may be put and the procedures and activities permissable under the program which are standardized on a national basis, i.e. identical in every watershed regardless of their particular characteristics and needs. Once an operational plan has been prepared in consultation with local officials, changes in location of activities and in allocations of funds among activities require permits all the way up the administrative hierarchy. Monitoring consists of periodic reporting of financial disbursements and progress toward physical targets. Evaluation of the impact of the program during the third five year plan (Repelita III) is being conducted by the same central directorate that is responsible for planning and supervising the program.

Once the central directorate has agreed to the operational plans, funds flow to the district governments' budgets (APBD) and they implement the plans under the technical supervision of P3RPDAS. The Program designates the chief of the district agriculture office (or other technical official of similar level) as general Program manager (pimpro)

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* In late April 1983 this directorate was elevated in status to a Directorate General and moved into a new Ministry of Forestry. It was expected at the time of writing that the field offices would be moved as well.

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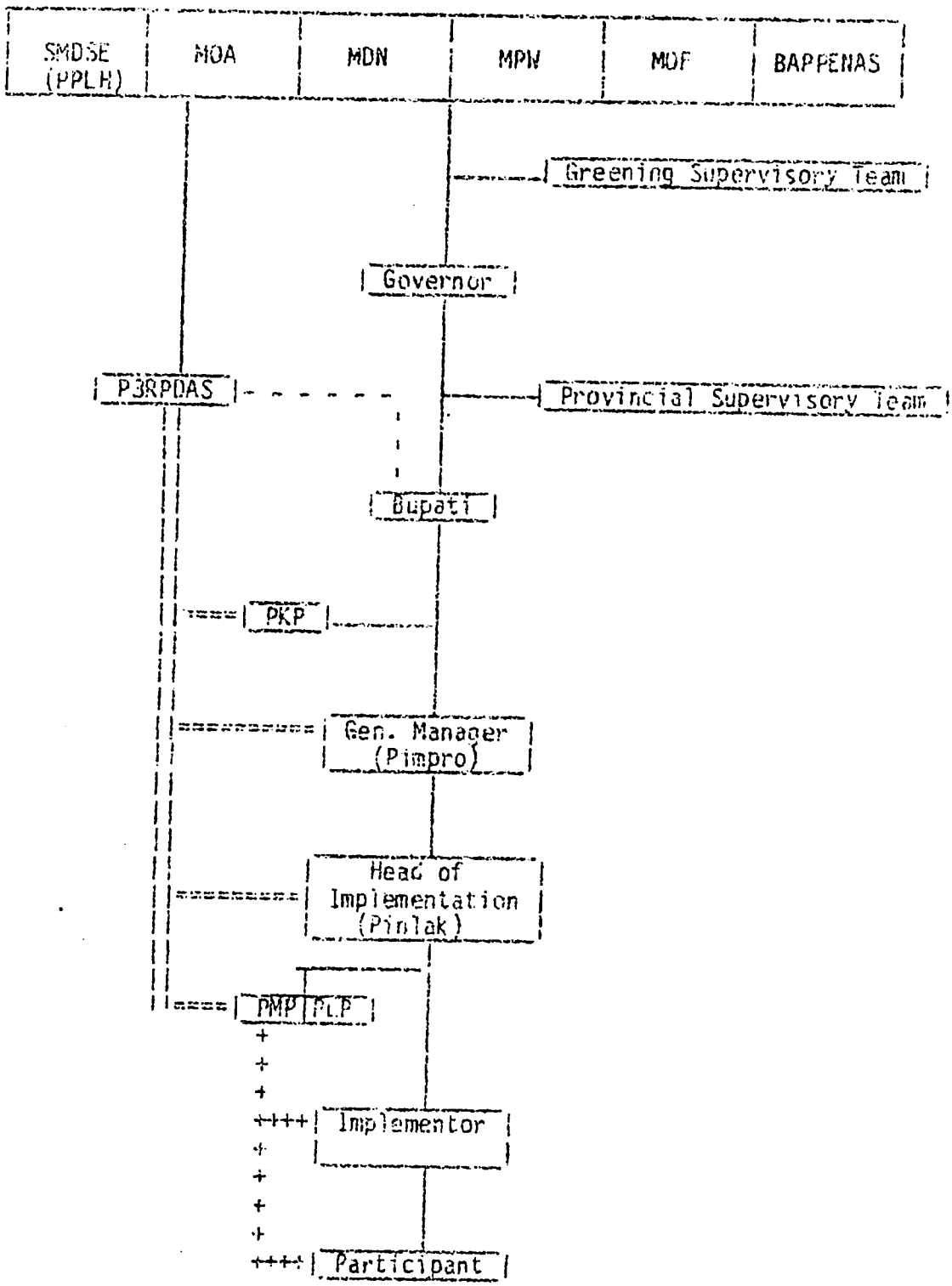
FIGURE NO. 1

OFFICIAL ORGANIZATIONAL CHART OF NATIONAL (INPRES) REGREENING PROJECT DURING REPELITA III



————	Command
========	Technical Assistance and Guidance
- - - -	Consultation
+++++++	Technical Assistance and Extension

Source: Bantuan Penghijauan dan Reboasasi, Tahun 1981/1982

and places responsibility for daily operations with a subdistrict agriculture official. These procedures may be changed with the move of the Program into the new Ministry of Forestry.

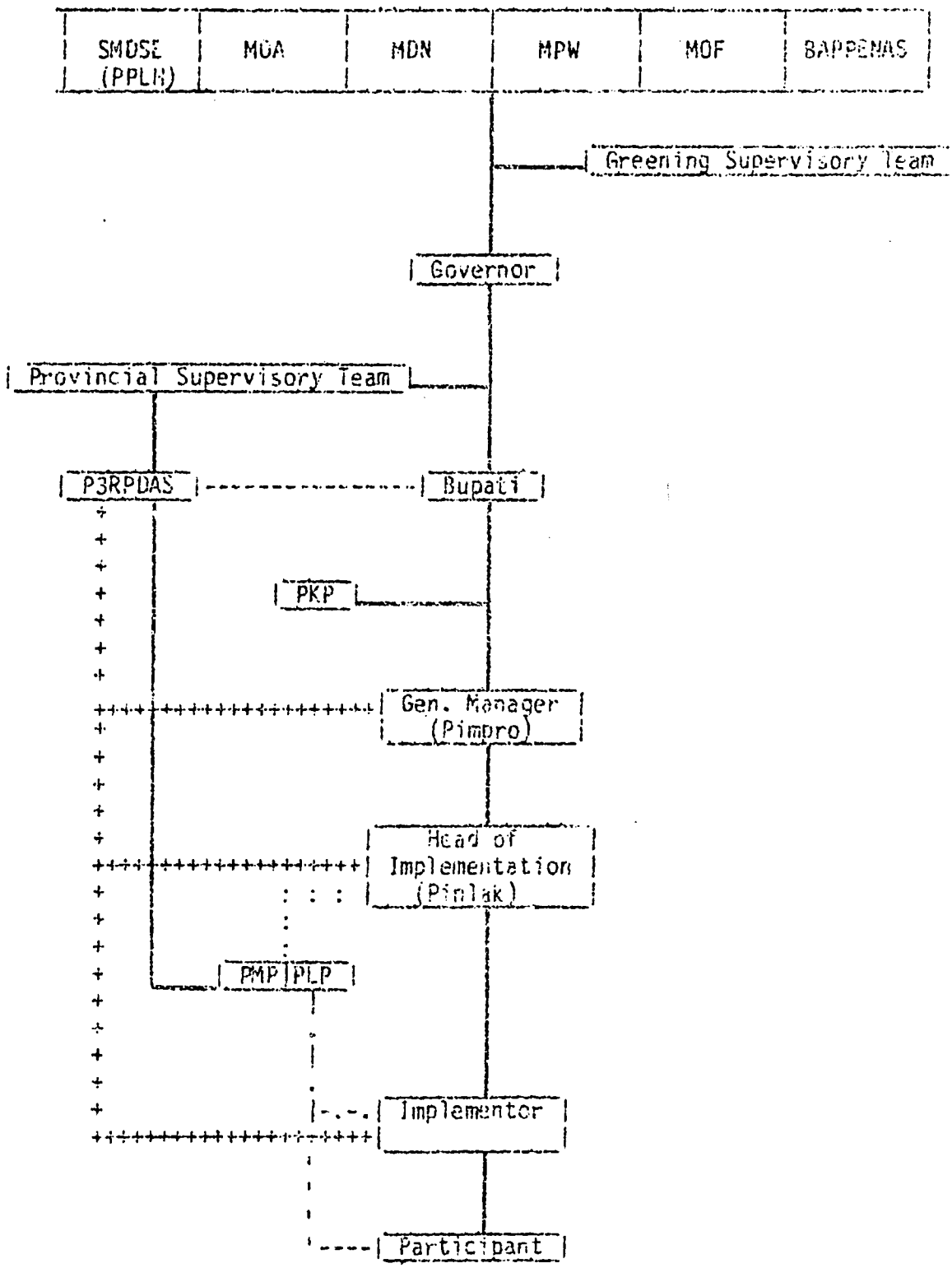
An organizational chart (see Figure 2) used in a field presentation suggests that lines of authority are unclear or differ in several ways from those in Figure 1. Figure 2 shows P3RPDAS under the administrative authority of the Regreening Supervisory Team on behalf of the provincial government. It may also be noted that P3RPDAS has an administrative or command function over the regreening extension workers in addition to the technical-guidance function specified on the official organizational chart (Figure 1). This better reflects the actual situation, because most extension works are not tenured civil servants (pegawai proyek) and they are under the administrative supervision of P3RPDAS. Thus, in reality the 6,000 field workers hired under the Program are accountable to P3RPDAS and the central directorate. Yet other field workers (food crops, livestock, etc.) are administratively under the agricultural agency of local government (Dinas Pertanian) and coordinated by the Rural Extension Centers (BPP). The integrated farming systems approach needed in upper watershed management requires that all field workers be placed under the administrative control of local government and the BPP.

B. The Citanduy II Project

The Project has three components. Development of irrigation services is the responsibility of the Directorate of Rivers in the Directorate General of Water Resources Development, Department of Public Works, and implementation is carried out on behalf of the central government by a Project Office located in the Citanduy Basin. The largest component is focused on upper watershed development. Seven directorate general level agencies of the MOA are involved and implementation is primarily the responsibility of the local agriculture services in the Basin's five districts. By decree of the Minister of Agriculture, the functions of the P3RPDAS were widened and its head designated as MOA Project manager

FIGURE NO. 2

ORGANIZATIONAL CHART OF NATIONAL
REGREENING AS VIEWED BY A P3RPDAS



————	Command
+++++++	Technical Assistance and Guidance
- - - -	Consultation
-.-.-.-	Technical Assistance and Extension
: : : :	Coordination

(pimpro). The decree established a multidisciplinary project organization, the Watershed Management Development Center (WMDC), with upper level staff seconded from the involved MOA agencies, and made the team leader directly responsibile to the Minister. The decree gave the WMDC responsibility for planning, guidance and monitoring of all agricultural development activity in the Basin (i.e., food crops, estate crops, livestock, research, etc.) and responsibility for implementing training, extension and field trials.

Figure 3 portrays the organization chart according to the formal decree. Figure 4, a chart prepared by the WMDC, presents a contrasting perception of the organizational arrangements. Note on Figure 4 that agriculture development activities in the Basin are perceived, except for Regreening, to be the responsibility of the central MOA agencies and their line offices (Dinas) in the Basin. No relationship is depicted with provincial and district government, even though they are vested under the Project with responsibilities for model farms, access roads, and expansion of upper watershed activities. The discrepancies between the two charts reflects the reality of the situation; the WMDC still lacks the authority intended by the Minister's decree and coordination with local government occurs on an informal, ad hoc basis.

A separate but related problem is that some Directorates General of the MOA have delegated more authority than others over Project activities to their representatives in the WMDC. Some have discretion over funds, others do not. Moreover, a key Project activity, model farms, in practice has been subject and subordinate to Regreening Program standards. There is a tendency to apply standard Pangawangan or Regreening Program packages of techniques rather than to discover and test new techniques and treatments.

The most decentralized activities in the Project are those being planned and implemented by local government. The current credit implementation plan calls for a vertically integrated structure that utilizes two Provincial Development Banks (BPD) as primary lending

pr 2

FIGURE NO. 3

ORGANIZATIONAL CHART FOR UPPER WATERSHED DEVELOPMENT OF DAS-CITANDUY

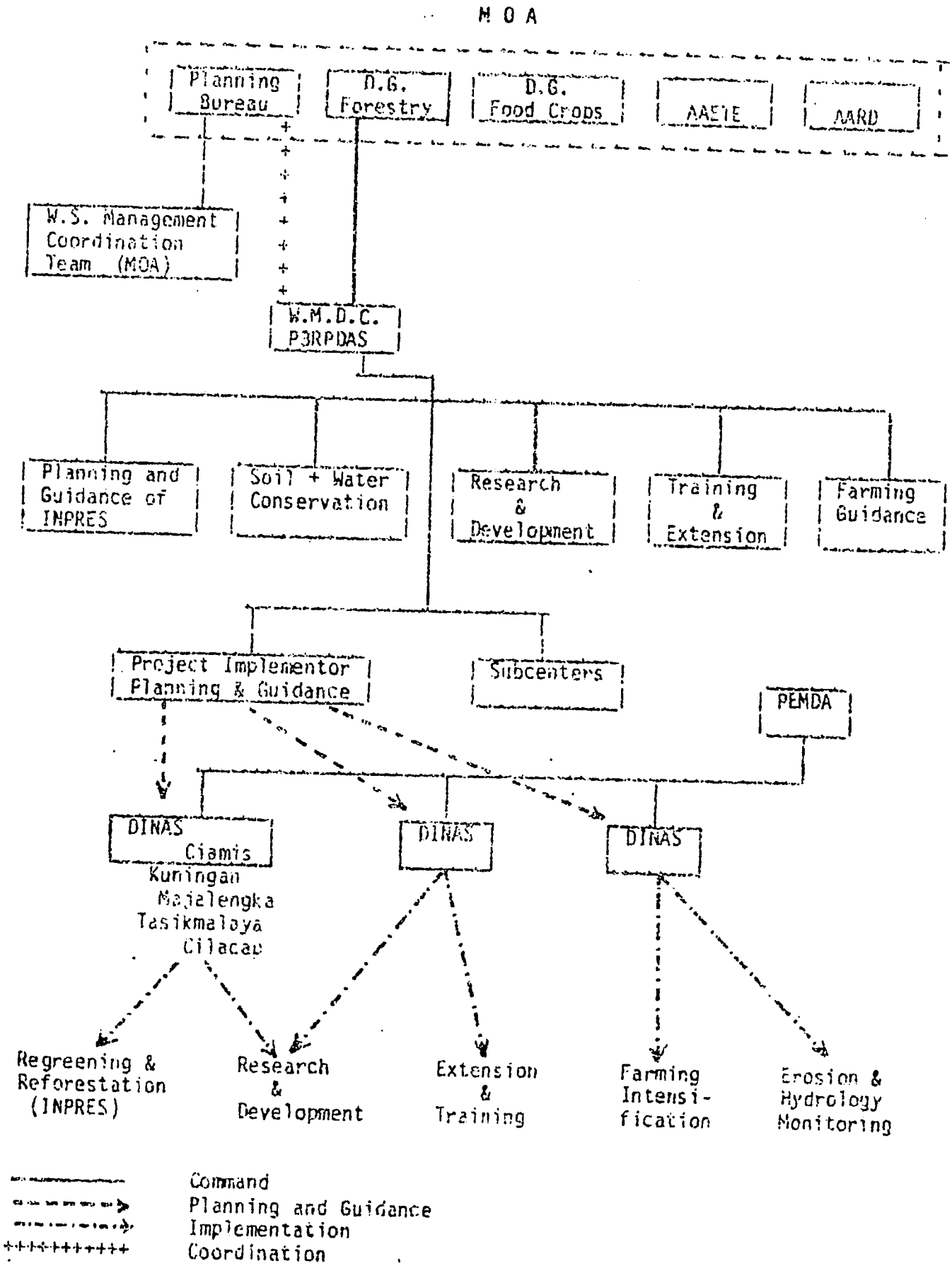
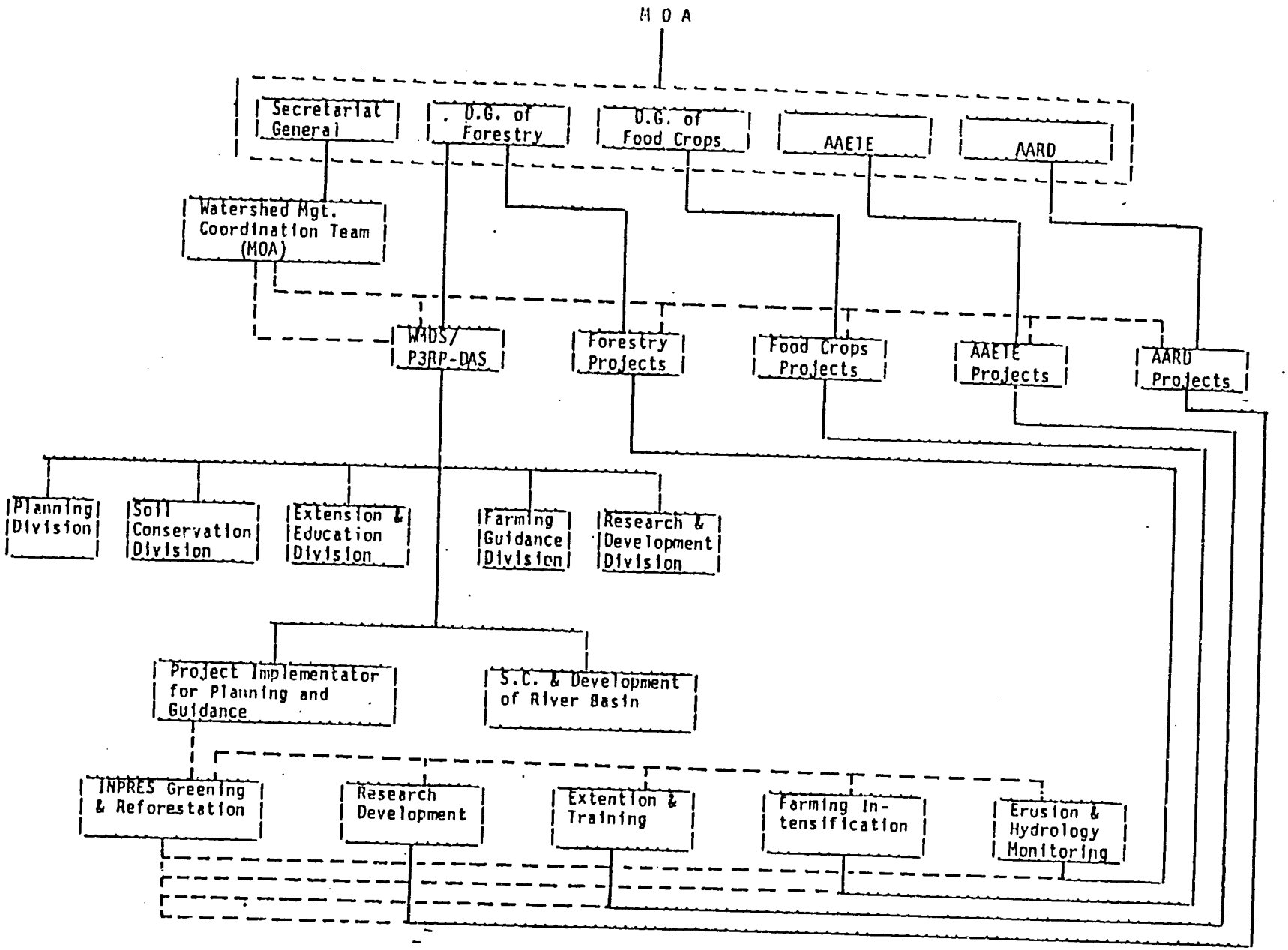


FIGURE NO. 4
STRUCTURE & ORGANIZATION
OF THE DEVELOPMENT OF CITANDUY RIVER BASIN



Command
Technical Assistance and Guidance

Source: P3RPDAS Citanduy-Cisanggarung

institutions and sixty-nine rural banks (BKPP, BKK) as secondary lending institutions. One type of activity, called local initiative subprojects, is planned and implemented by district-level Planning Boards (BAPPEDA) under the supervision of those at the provincial level. In general, however, lines of communication, authority and responsibility between project leaders from the provincial government and district-level officials are not yet clearly defined.

C. Jogyakarta Rural Development Project

This Project is under the planning and management of the Provincial Planning Board (BAPPEDA I). Funding is accomplished through a grant to the province (INPRES DATI-I) and budgets are approved by the Director General of Regional Development, Department of Home Affairs. Planning and management processes were specified in great detail in the Project design by outside consultants. Little decentralization has occurred below the provincial level, the need for which is obviated somewhat by the small size of the province which has the status of a special district. Despite considerable expertise in the Agriculture Technical Development Centers, their staff are virtually uninvolved in forward planning and budgeting. An attempt is underway this year, the fourth year of the Project, to establish guidance and management units at the district level. Presumably planning will remain at the provincial level.

The three projects thus reflect some variation on the dimension of decentralization. In both the National Regreening Project and Project Citanduy authority over broad policies, planning, and funding, remains with the central government and its field officers. Lower levels of government are given responsibility for implementing projects and monitoring and reporting on their implementation. In the Jogya Project, on the other hand, virtually full authority has been devolved to the provincial level.

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II. UNIFIED, INTERAGENCY MANAGEMENT

A second dimension of variation among the several watershed development projects is the extent to which inter- and intra-agency cooperation has been achieved at both the national and local level.

A. The National Regreening and Reforestation Program

As noted earlier, planning, guidance and evaluation of the Project occurs through a single directorate general of the MOA but implementation is the responsibility of the provincial and district governments. To facilitate inter-departmental coordination in policy matters, a Supervisory Team (Team Pembina Pusat) composed of representatives of six ministries has been established at the national level. The team has a secretariat composed of full time staff from the Directorate General of Forestry (Agriculture), Directorate General of Water Resources Development (Public Works) and Directorate General of Regional Development (Home Affair). Inter-agency Supervisory Teams are also established at the provincial level. These are headed by the chairmen of BAPPEDA and the heads of the Provincial Development Bureau serve as secretary. Members of the Team include representatives of Agriculture (Kanwil), Finance (Kanwil), Directorate General of Forestry (P3RPDAS) and the provincial agencies of agriculture, finance, agrarian affairs, estates, livestock, public works, and Bank Rakyat Indonesia. Because the Governor is required to submit quarterly reports on the Project, the Team usually meets every three months. The work of the provincial Team is carried out by a full time secretary (PKP) responsible to the governor. However, this official has no authority to create an interdisciplinary staff or to manage implementation.

In its planning function, the P3RPDAS staff are instructed to "pay attention or obtain technical aid" (memperhatikan atau mendapat bantuan teknis) from BAPPEDA, local office of agrarian affairs, public works, and technical agricultural agencies (dinas). The generality of this

instruction plus the fact that many forms need to be signed by the general manager and the operational manager, both of whom are usually from a single agency (Dinas Perhanian) means that other sectoral agencies often have little awareness of local regreening activities. The degree of BAPPEDA involvement depends largely on the Bupati, whose stamp is needed in order to make many of the documents official. Typically the BAPPEDAs serve as the "post office"; they receive already well formulated plans from P3RPDAS and Project leaders and pass them along to the next higher level.

The attachment of the Program to a narrowly specialized agency, the Directorate General of Forestry for purposes of planning and supervision has resulted in a narrow view of watershed management, i.e., that it consists only of those activities mandated in Program Instructions. In those few places where a more integrated approach has occurred, it has happened coincidently due to unusual BPPs or general managers. Another overall weakness of the Program is the lack of formal agreements with the applied research program (P3DAS) and linkages between P3DAS and the P3RPDAS centers so that P3DAS's technical knowledge has been underutilized.

An important issue has been introduced by a decision to to use the watershed as the basic geographical unit for development planning and to assign planning responsibility to the P3RPDAS Centers--which are responsible to a central directorate and have little accountability to either province or district governments. In addition to centralizing the planning process, such organizational separation of planning responsibility from responsibility for implementation means that neither the province/district nor the P3RPDAS can be held accountable for results. This organizational separation also results in the dispersion of limited skilled manpower between BAPPEDA and P3RPDAS which have overlapping and essentially competing jurisdictions. The implications of this decision are likely to become more significant with time, as the Directorate General of Reforestation and Land Rehabilitation, Ministry of Forestry, believes that it has a responsibility in its role as

administrator of the P3RPDAS Centers to assume increasing responsibility for overall development planning and coordination in all watershed areas of the country, with the exception of the urban centers. Since the jurisdictions of province/district and P3RPDAS do not coincide and the nature of the authority relationship between the two is unclear this involves an awkward overlapping of responsibility which could seriously weaken the watershed development effort, as well as efforts to develop the province and district as effective locally responsive mechanisms for area development planning and management. The watershed is a useful concept for planning, but it should be utilized within a regional development framework, which is the responsibility of province/district.

It has been suggested that in fact the conflict is more apparent than real because the BAPPEDAs are responsible for macro-planning while the P3RPDAS is responsible for more operational planning. This would imply that the P3RPDAS functions as a subordinate staff unit of the corresponding BAPPEDA. Yet the P3RPDAS Centers appear in fact to perceive themselves as having the superior role and are accountable to the Ministry of Forestry, rather than to the province/district.

The logic of organizing developmental activities on a watershed basis becomes less compelling than it first appears. Indeed it could not be established that there are any functions presently performed by the P3RPDAS Centers which could not as well be performed on a provincial or district basis. Their present functions are limited largely to doing locational planning for the placement of check dams and demonstration farms. Present decision rules call for basing these choices primarily on the location of critical lands. These can be identified as readily on a provincial/district as on a watershed basis.

Those functions which must by their nature be performed on a watershed rather than a kabupatan or provincial basis are relatively few. First there are decisions relating to the allocation of water--specifically allocation of water rights between different uses and users, a provincial function currently. Second is the management of

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water distribution within a given irrigation system, a function of Public Works and/or Agriculture. Third, there are activities relating to the monitoring of stream flows and sedimention patterns throughout a watershed, a function at least partially performed currently by Public Works. None of these are present functions of the P3RPDAS, nor is it likely that they will become such.

The critical concern should be with seeing that whatever unit is responsible for territorial or area based planning has the necessary capacity and commitment to effectively address soil and water conservation requirements from an ecological systems perspective. In the majority of instances where a subwatershed falls predominantly within one district (kabupaten) or sub-district (kecamatan) this can be accomplished without compromise either to the administrative jurisdiction or to the logic of the watershed as a hydrologic unit. The point is that the assignment of responsibility for planning to a separate organizational unit whose jurisdiction falls midway between district and province, and occasionally across two provinces, is unlikely to improve the quality of the planning choices made until such point as the underlying analysis is based on substantially more sophisticated metholologies than will be practicable to apply within the foreseeable future.

With regard to the question of capacity to coordinate across sectors, it must be recognized that the P3RPDAS Centers are instruments of a functional ministry, the newly created Ministry of Forestry. Efforts by one functional ministry to coordinate another are seldom successful in any setting. Invariably, where one such ministry is assigned responsibility for a coordinating a multi-sectoral effort, that effort becomes de facto a single sector undertaking. While the conversion of the Directorate General for Forestry to a separate Ministry would appear to increase its overall authority, it in fact may substantially weaken its ability to perform the necessarily integrative role in watershed development, since it no longer has direct call on critical resources controlled by the Ministry of Agriculture. A tendency may be anticipated for the new Ministry to begin duplicating many of the research and

extension capabilities of the Ministry of Agriculture in order to compensate for this loss of access.

The above considerations suggest that between the choice of the administrative unit and the watershed as the basic unit of organization, the arguments in favor of the administrative unit are the more compelling. Many of the present difficulties and ambiguities could be resolved and a stronger basis established for effective ecologically sound land and water resource development by integrating the existing P3RPDAS Centers into the provincial or kabupaten structure and making them accountable to the BAPPEDAs. This would concentrate limited human resources and create a basis for decentralized locally responsive planning, while achieving a closer integration of planning and implementing responsibilities. The scarce staff resources dispersed across individual centers in the 11 Java watersheds identified by the Ministry of Forestry could provide a very substantial planning resource within the provinces. The BAPPEDAs would then be in a much stronger position to facilitate a coordinated effort across functional ministries in support of unified soil and water management programs within each province.

Provinces and districts presently vary significantly in their technical and managerial capacities. This presents a major barrier to effective action on the watershed problem. But bypassing them to set up an alternative and to some extent competing capability will likely only delay effective action. The institutional development resources so consumed should be directed instead to strengthening and supporting these essential units in their roles as planning and coordination bodies.

B. Project Citanduy-II

Planning documents indicate that unified management was a major issue during Project negotiation and that the final organizational arrangements differed substantially from those preferred by USAID. Two concepts were generally maintained during planning discussions: (1) that there should

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be a single plan for the Basin and a coordination of budget requests in conformance with that plan, while leaving budget control and responsibilities with the appropriate agencies, and (2) that while one implementating agency would be the lead agency and the others in supporting roles, project inputs should be provided for all participating agencies. As the Project was being planned and negotiated, some changes took place within the GOI that affected the Project. The National Regreening Program was changed to include model farms much like those planned under the Project. With this change, the key model farm activity came under existing, Regreening Program arrangements, i.e. implementation by local government with planning and technical support from a separate and different agency (P3RPDAS). The subsequent effect on the Project has been to complicate management of model farm activities. Changes were also made within the Directorate of Reforestation and Land Rehabilitation, MOA. National headquarters for watershed management was moved from the Watershed Management Development Center in Solo to a new subdirectorate with offices in Bogor. P3RPDAS responsibility for support to local governments in the Regreening program was under a separate subdirectorate. The effect of this change on the Project has been to make intra-agency (MOA) cooperation more difficult by increasing the autonomy of one subsector Directorate General. Now the reorganization that elevates the subdirectorate and moves it out of the MOA increases its authonomy further and will likely compound the diffeculty of interagency cooperation.

Whatever the concepts for unified management during the planning phase of the Project, they are imperfectly reflected in current organizational arrangements. The funding of Project activities under multiple budgets - perhaps an unintended outcome of the decision to leave budget control and responsibilities with appropriate agencies - has been a major handicap to unified management. There are 24 distinct budgets for funding the 16 activities in the upper watershed development component alone. Eleven of the 16 activities are funded by a single budget, three are funded by two budgets, one activity is funded by three budgets and one by four budgets. Only five of the 24 budgets (21%) for

IPY 82/83 were submitted to the Basin Coordinating Committee (TKW) for review; all 5 were under the supervision of Ministry of Home Affairs and were APBD INTRES funds. The remaining Project budgets, involving APBN funds, were planned, approved, and disbursed on routine, line-agency basis. Where these budgets dealt with model farms, agriculture extension teams, agriculture staff increases, and some training activities, they were not specific to Project Citanduy so Project managers had no means of identifying that portion intended for the Project.

As a consequence of this financial fragmentation and lack of comprehensive budgetary review by a single Project body, management is dispersed among individual project chiefs and their respective line agencies. Rather than one lead and several supporting agencies as was considered in planning discussions, the final form of the Project carefully balances the roles of three implementing ministeries. Each ministry has a lead role in one component, and a secondary or no role in other components. Project specific coordinating teams are established at two levels by joint decree of the three ministers. The National Coordinating Committee for Development of Citanduy Watershed (TKP) is composed as follows:

Chairperson:	BAPPENAS, Head of Bureau of Agriculture and Irrigation
Deputy Chairperson:	Home Affairs, Director of District Development Guidance
Secretary:	1. Public Works, Director of Rivers 2. Agriculture, Director of Reforestation and Land Rehabilitation (now part of MOF)
Members:	1. Public Works, Director of Irrigation Program Guidance 2. Public Works, Head of Bureau of Planning 3. Home Affairs, Head of Education and Training Agency 4. Agriculture, Head of Bureau of Planning 5. Agriculture, Director of Food Crops Program Guidance 6. Agriculture, Secretary of AAETE/BPLPP 7. Finance, Director of Budgetary Administration 8. Health, Director of Hygiene and Sanitation

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9. BAPPENAS, Head of Bureau of Natural Resources and Environment
10. Population and Environment, Assistant I of the Minister

The team has the duty of "coordinating planning and formulation of Citanduy watershed regional development program". The decree was accompanied by letters of approval from the Minister of State for Administrative Reform and the Minister of State for Development Supervision and Environment. As noted by the latter in his letter, this national level committee was considered an interim arrangement until a structure with nationwide applicability is established. While USAID insisted on a structure as a condition of the loan and set a time limit, the structure itself was worked out internally by the GOI agencies involved.

Nearly one year later a secretariat of the National Committee was established by decision of the Director General for Regional Development, Home Affairs. It is composed of "representatives of Home Affairs, Public Works, and Agriculture whose composition is as included in an attachment to this decision". The attachment lists eight persons by name and departmental affiliation. Chairpersons I and II are from Home Affairs and Agriculture, respectively, and their appointment appears to confirm and officially recognize their substantial roles in operational management of the Project ever since its beginning.

These organizational structures appear to be reasonably effective in facilitating communication and dealing with administrative bottlenecks at the national level. Some Project staff stationed in the Basin feel that the Secretariat is too involved in operational management and thus reinforcing of centralized management.

Another coordinating committee (TKW) was established at the Basin level by joint ministerial decree. It is chaired by the chairman of the two provincial BAPPEDA, in rotation. The chiefs of the Public Works and Agriculture (WMDC) Project offices are designated secretaries of the

Committee. Heads of involved provincial and district offices are designated members. Thirty people make up the entire Committee, although attendance at the six meetings of the Committee so far has averaged about one hundred. The meetings have provided a forum for presenting the Citanduy programs and for general discussions.

There is widespread dissatisfaction with the operation of the Committee. Achievement of Committee objectives is not apparent. It has very limited authority. Its potential ability to persuade agencies to coordinate is limited by lack of control over funds and the lack of a program that focuses on this possibility. Financial aspects of the operation of the Committee are not clearly spelled out. The attendance is too large and often a given agency is represented by different personnel from one meeting to the next. Problems related to the Project that arose between Ciamis (West Java) and Cilacap (Central Java) were solved through BAPPEDA-I, rather than through the Committee. An agreement by some Committtee members to establish a permanent secretariat reflects members' concern about the Committee's operation.

The Department of Home Affairs (BANGDA) and local governments have responsibility for the Local Development Planning and Management component of the Project and they share responsibility with the WMDC for the Upper Watershed Development component. Inter-agency management in these components has been problematic. Contrary to the expectations of Project designers, BANGDA and BAPPEDAs have not well coordinated their planning, budgeting and allocations with the WMDC and technical agencies (dinas). This was clearly evident from the delays in providing funds for the expansion area farmers in the IFY 82/83 season. General implementation guidelines for the Local Development component have been issued by BANGDA, but they are couched in very general terms and need to be supplemented with district-level implementation procedures. These are being worked out slowly, a process handicapped by the absence of full-time soil and water management coordinators. That role has been given to the already overloaded BAPPEDA chairmen, most of whom cannot give it the attention it requires. Implementation procedures are a

necessary prerequisite to improved coordination between local governments and the WMDC. Since the Bupati already appoints a special greening officer (PKP) to his staff (Biro Perekonomian), a question arises about division of resonsibilities between the PKP and the soil and water management coordinator. Clearly more unified management is needed at the district -level.

C. Jogyakarta Rural Development Project

BAPPEDA-I has the key role of overall Project coordination, detailed forward planning and securing coordination among the different components. A Project Coordination Unit has been established within BAPPEDA's evaluation and coordination division. The Unit, in collaboration with component managers and heads of implementating agencies, prepares consolidated annual project work programs and related budgets for approval by the Governor prior to their submission to the Directorate of Regional Development in the Ministry of Home Affairs. The Chief of BAPPEDA, on behalf of the Governor, establishes guidelines for coordination among implementing agencies and has authority for final decisions in those cases where agreement between implementing agencies cannot be achieved in the regular coordinating meetings. There seems to be good integration between Project activities and basic responsibilities of each (sectoral) agency. Coordination with the National Regreening Program is facilitated by one official who doubles as head of BAPPEDA's Social Economic Division and head of P3RPDAS Gunung Kidul. This structure appears to have been effective at coordination. Most administrative and procedural problems were solved within the first two years of the Project. The effectiveness of the organizational arrangements seems related to several factors unique to Jogya as well. The Chairman of BAPPEDA is the son of the vice-governor, the Paku Alam; and thus he commands authority by virtue of lineage as well as position. The relative small size of the province and the physical proximity of planners and managers also facilitates coordination.

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Several deficiencies may also be noted. Since the agricultural demonstration plots under Project auspices were initiated prior to the addition of similar activity to the National Regreening Program, there has been little communication and cooperation between field personnel even though they are engaged in very similar activities. Lessons being learned on the Projects demplots are reported to BAPPEDA, whereas those being learned on Regreening demplots (UPSA) are reported up a different channel to the Directorate of Reforestation and Land Rehabilitation, MOA. Having the head of a BAPPEDA division double as head of P3RPDAS has been insufficient means of enriching the planning process with sufficient technical knowledge of soil and water conservation. Project staff who traveled to Citanduy were impressed with the attachment of a technical assistance unit directly to the WMDC; their suggestion for a similar unit attached to BAPPEDA, Jogya indicates that coordination with the agricultural agencies in particular could be improved.

Once again considerable variation has been noted in existing projects on the dimensions of unified management. The attachment of the planning and supervisory functions of the Regreening program to a narrowly specialized functional agency whose jurisdiction does not coincide with administrative boundaries, is an obstacle to effective unified management. Project Citanduy shows the difficulty of unified management when financing is fragmented and responsibility for operational coordination is heavily vested in teams external to the regular government structure. Unified management is most evident in the Jogya Project where management responsibilities clearly located and are authoritatively exercised by the regional government through BAPPEDA, which is vested by Law Np.5/1974 and President Instruction 27/1980 with authority to plan, coordinate, and manage development within the region.

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III. FLEXIBLE BUDGETARY and CREDIT SYSTEMS

Flexibility in budgetary and credit systems is required to enable local decision-makers to respond to the inevitable variations found in any effort to introduce technology to varying agro-climatic zones and to farmers with varying income levels and attitudes toward risks. This is a third another goal of watershed management, means to beneficiary participation, and dimension of variation on which existing projects can be assessed.

A. National Regreening and Reforestation Program

This program has little budgetary flexibility and does not include credit for activities related to the program. Instructions applicable nation-wide regarding twelve permissable uses of Program funds are issued annually in Bantuan Penghijauan dan Reboasasi. These instructions include itemized, kabupaten budgetary allocations based on plans submitted the previous year. A theme that runs through the instructions is that regreening funds are only partially adequate for the job and that provinces, kabupatens and local people must mobilize and apply added resources and effort to solve the problems. If funds are in excess of what is needed to accomplish planned activities, the Bupati allocates them to regreening expansion activities after obtaining the advice of BAPPEDA and P3RPDAS. If funds are excessive as a result of diminished or cancelled plans, however, they can only be used after obtaining agreement all the way up the hierarchy to the Ministerial level.

B. Project Citanduy

Although the Project has a significant credit component ($5 million), it has not yet reached the implementation stage. Assessment can thus only be made of budgetary flexibility. The attachment of several Project activities to the Regreening Program has subjected those activities to the same budgetary regulations and process. Since the Regreening Program

is based on a joint decree of six (now seven) ministers, they would also have to agree to any changes or locality specific flexibility, which is practically impossible. The reader will also recall the discussion above on financial fragmentation and consequent problems for unified management. The fact that on the average two different agencies are involved in every Project activity, each with its own budgetary channel, has also had a negative effect on budgetary flexibility. Managers at the Project level have too little authority over funds channeled through the cental government budget (APBN) and these funds are occasionally insufficient. Funds channeled through regional government budget (APBD) are adequate but frequently late. When one activity is funded from multiple sources, budgetary flexibility is more difficult because it requires so much coordination and synchronization. Despite the fact that a large portion of Project funds were placed in contingency items on which the donor, USAID, has placed few restrictions, their use has been inhibited by lack of submission of timely and cogent plans to USAID.

Flexibility is apparent in the local initiative subprojects which are managed by and funded through regional government (BAPPEDA). Total IFY 1983/84 allocations for these subprojects exceeded by 26 percent the amount planned in the Project proposal. Procedures for structuring some flexibility into the regular budgetary process with regard to local initiative sub-projects have been adopted. However, the planning process moves painfully slow due to multiple entities (5 districts, 2 provinces), the complexity of the process within each, and the lack of an adequate administrative linkage between provincial and district BAPPEDAs.

C. Jogyakarta Rural Development Project

The Project is funded through a consolidated budget (DIPDA) that is prepared by BAPPEDA-I and authorized by BANGDA and BAPPENAS. Small changes have been made after authorization with agreement from BANGDA. Apparently only certain activities are fundable with the IDA loan and the proportion of loan funding must be 63% on an annual basis, creating some plannning difficulties for BAPPEDA who would prefer to achieve that

proportion on a life-of-the-project basis. Some administrative difficulties have resulted from two disbursement channels, one for IDA funds and another for the counterpart funds which are taken from INPRES DATI-I. The provincial treasury has very limited capacity for pre-financing if disbursement is delayed or funds are needed for unanticipated and hence unbudgeted supporting activities.

The Project has no credit component, although regular GOI credit programs are more easily coordinated with Project activities because of BAPPEDA's role in planning and coordinating both Project and regular programs. The Project has provided small blocks grants of about $150 to 111 sub-village units (dukuh). These funds are managed by the LKMD and are supposed to provide capital for productive activities not fundable under other government programs.

In conclusion, the assessment of the institutional arrangements of three projects finds that three desirable management principles are best exemplified in the Yogyakarta Rural Development Project. Management and financial authority are clearly located in the provincial BAPPEDA, thus decentralized to the provincial level. BAPPEDA effectively coordinates agencies involved in implementation through the Agriculture TEchnical Development Centers because it has effective control of the entire budget. However, because of the special characteristics of the province, doubts remain about the generalizability of the Project's institutional arrangements.

With the exception of the Citanduy Watershed Project no institutionalized credit system for financing conservation and productivity increasing upland technologies in presently envisioned or in place. The absence an institutionalized credit program for upland farmers constitutes a major constraint to successful diffusion of upland conservation and productivity increasing technology.

In the absence of an institutionally decentralized credit system it is hard to envision how the technology, now being demonstrated (through

direct subsidization) by the National Regreening Program on over 700 sites, can be systematically disseminated to surrounding farmers. The investment and working capital requirements for adopting improved conservation and productivity increasing technologies are well beyond the means of the vast majority of upland farmers (see Technical Report on Economic Condition).

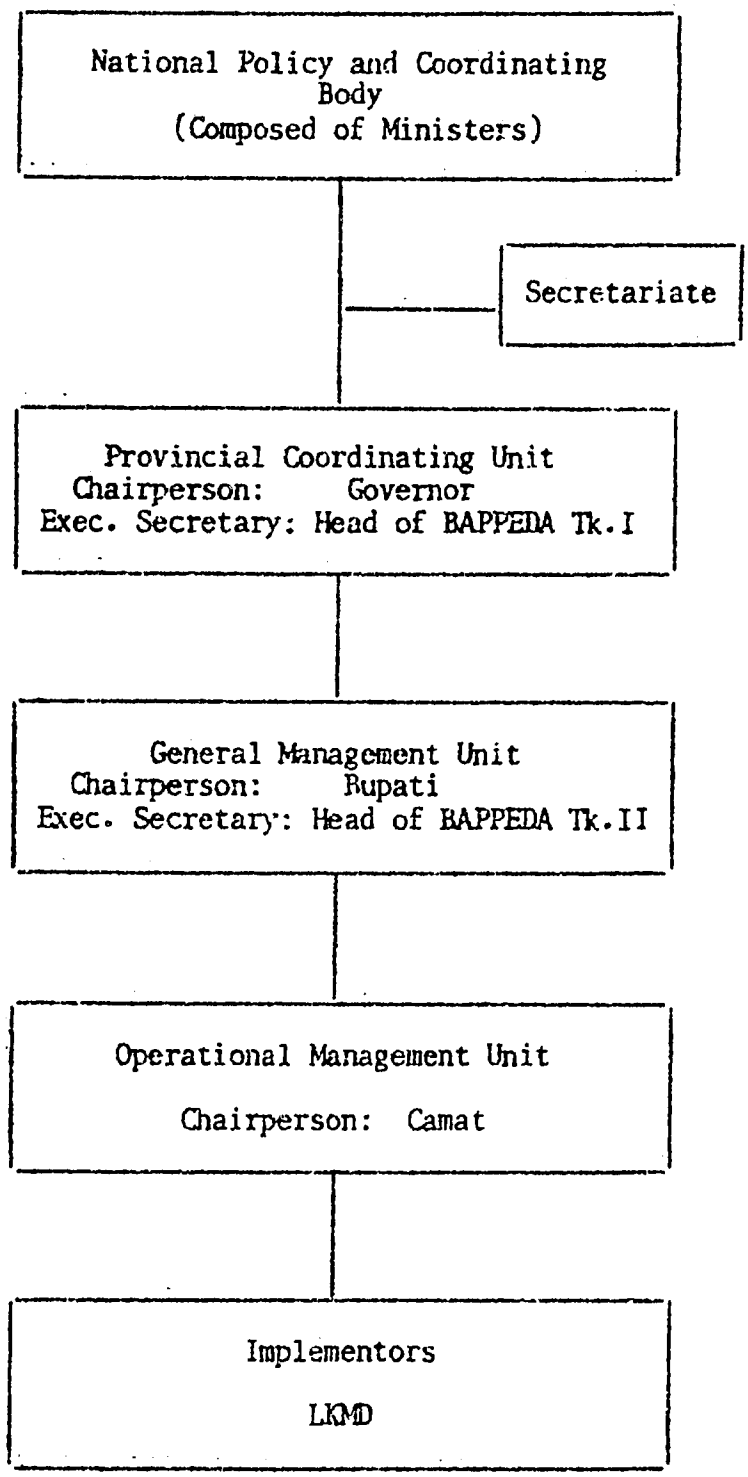
IV. RECOMMENDATIONS

A. Province, district (kabupaten) and subdistrict (kecamatan) should be re-emphasized as the fundamental units for the organization of upper watershed management in both planning and implementation. An alternative, organizing by watershed, is conceptually attractive. Yet there are no functions presently being performed in the National Regreening Program or in the upper watershed component of Project Citanduy that could not be performed equally well on a provincial or district basis. The assignment of responsibility for planning to a separate unit based on the watershed is unlikely to improve the quality of planning choices, at least for the foreseeable future.

B. Coordination of watershed management activities should be strengthened through a Presidential decree (KEPPRES) that would establish special coordinating bodies at the national, provincial, district, and subdistrict levels. This is needed to further specify the policy of decentralized but unified management mandated in Law No. 5/1974 and Presidential Instruction 27/1980 because it would authorize operational management lower than the kabupaten or at the sub-district (kecamatan) level and mandate an inter-agency approach to watershed development at all levels of government. See Figure No. 5. The coordinating bodies that now exist at the national and provincial levels under the National Regreening Program might be utilized, provided they are vested with sufficient authority. Such bodies should be established at lower levels as well and would be strengthened at all levels by the proposed decree.

Figure No. 5

Bodies for Coordination of
Watershed Development Based on Presidential Decision



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The decree should vest the proposed supervisory bodies at the provincial and district levels with sufficient authority to insure unified management of watershed development interventions within their jurisdiction, including control over all budget resources, i.e., resources traditionally allocated to technical line agencies.

C. Watershed development programs require financial arrangements different from most of those currently in use. The necessity of a farming system approach and the nature of the task which involves adaptations to conditions at the lowest operational level, imply that a watershed program should neither be structured like most INPRES programs nor utilize multiple funding sources such as in Project Citanduy. Most of the INPRES program designs (DATI-I and DATI-II excepted) give too little discretion and initiative to the local level in allocating funds to particular projects, locations and items within given types of expenditure. Multiple funding channels as in Project Citanduy have several adverse results: lack of synchronization in arrival of financial authorizations (DIPs) means late deliveries of inputs/services and occasional postponement of activities for an entire season; there is no way of ensuring that the development and operational costs of a function are comprehensively covered; no one is encouraged to feel an overall sense of responsibility for a particular function when so many agencies ar contributing to its running; and, above all, unified management is ineffective if not impossible without financial control.

D. A decentralized system or rural financial institutions should be established to support the investment and working capital requirements of upland farmers.

Every effort should be made to utilize existing rural credit institutions such as the Badan Kredit Kecamatan in Central Java, the Bank Karya Produksi Desa in West Java and the Bank Desa in East Java. These decentralized, local financial institutions supported by the respective Provincial Development Banks (BPD) represents appropriate institutional mechanisms for the delivery of credit to upland farm communities. These

rural financial institutions are considered appropriate because they fall under the direct supervision of the provincial government and the provincial development banks and, therefore, should be more capable than national banking institutions, in developing flexible credit programs responsive to specific agro-climatic, social and environmental conditions unique to each watershed. The credit package should not be standardized but should be offered in the form of a general line of credit, leaving it to the farmer to determine both the size of the loan and the specific inputs to be financed. Eligibility for borrowing would be determined, in part, by the recommendation of the local extension worker and the village head that the prospective farmer borrower has been made aware of the upland technology package appropriate to his area and that he is prepared to test all, or appropriate elements of, the technology packages. Interest rates should be established at a sufficiently high level to ensure that the rural lending institutions can cover all cost, including generation of adequate reserves to write off bad debts. The credit program now being put in place to support the Citanduy Watershed Project should be carefully examined as possible model for broader replication.

E. At the present time there are three interagency watershed management coordination teams at the central level. These are the Regreening Supervisory Team (INPRES Tim Pembina Pusat), the National Watershed Commission (Pokja Lola DAS), and the Citanduy Central Coordinating Team. These should be consolidated and institutionalized according to No. B above.

F. In order to avoid duplication and inefficient use of resources, attention should be given to clear definition of roles and mechanisms for coordination between the Sub-directorate of Soil and Water Conservation, Directorate of Farming Expansion (Perluasan Areal), MOA and the Directorate of Soil Conservation, D.G. of Reforestation and Land Rehabilitation, MOF.

G. Field workers under the technical guidance of the D.G.'s in MOA and the D.G.'s in MOF should be placed fully under the administrative

supervision of local government and instructed by their respective D.G. to integrate their activities, one specialty/commodity-focus with all others, in order that each extension center (BPP) can provide integrated extension and training services, especially toward upland farmers.

H. Soil and water conservation requires giving attention also to aspects beyond the technical solutions within the realm of agriculture and forestry. An effective national program must be oriented toward prevention in addition to the rehabilitation of critical lands (see Technical Report on Soil and Water Conservation). Otherwise critical lands will expand faster than rehabilitation can occur. There are at least two institutional implications:

1. A promotion and awareness program should be launched nation-wide for purposes of increasing public awareness and understanding of soil and water conservation. The information, strategy and techniques used in National Family Planning Program could provide a useful model. The LKMD should play a major role in such a program, with supporting roles by the UNDP and the district information office (PUSPENMAS).

2. National legislation and polices should establish the parameters within which natural resources are to be utilized and managed and should indicate the general directions of responsive programming by the various sectoral ministries. Laws already enacted in this area include:

Law No.5/1960 on Basic Agrarian Regulations
Law No.5/1967 on Basic Forestry Regulations
Law No.11/1974 Water Resources Development
Law No.4/1982 on Basic Environmental Regulations

All of these laws need better enforcement. Law No.4/1982 needs to be completed with implementing regulations. Also, the formation and application of basic conservation and erosion control rules and guidelines by central and provincial planning agencies could have a major impact.